Knowledge Organisers
Summer Term – Year 9

ORMISTON SWB ACADEMY

Name: _____

Please remember:
- It is to be kept inside your knowledge organiser book
- It is to be brought into school every day

Regular retrieval throughout a scheme of learning (daily, weekly and monthly) has been proven to **reduce the rate of forgetting**, supporting you to **retain more** in long term memory- making assessments/ exams way easier! The challenge for you as a student is to make sure you use your knowledge organiser for each subject properly to help you to know more and remember more over time. We've created this walk through to support you in using your knowledge organiser- for more support speak to your subject teachers.

Using your Knowledge Organiser

1	2	3	4	5
Look	**Cover**	**Write**	**Check**	**Repeat**
Start with a **small section of knowledge** that you want to remember e.*g Henry VIII's wives in History*. Read through this section of the knowledge organiser (a couple of times if it helps)	Now **cover up this section** of your knowledge organiser with a post it note or scrap paper.	**Self quiz- what can you remember** and rewrite? Make sure you do this without looking back at your knowledge organiser.	**Remove the post it and check for accuracy**- did you get the key terminology? Was it spelt correctly? Was the order correct? If you drew a diagram, how much of this did you get correct? Most importantly- what did you miss out?	After a short break away from your knowledge organiser repeat the look, cover, write, check **until you can recall all of the facts correctly without prompts.** This process can be used for any new knowledge that you want to acquire. It is good idea to do this on a regular basis, once a week.

Strategy 1- Look, cover, write, check – A really simple but effective way to use your knowledge organiser. Focus on a specific area of your knowledge organiser.

1	2	3	4	5
Focus	**Big ideas**	**Explain it**	**Link it**	**Record it**
Make it manageable by selecting an area of your KO where your learning is not secure. Don't waste time going off something you can already do!	Pick out the main points or the **big ideas** in this section.	**Explain what you know** about the main points (this could be written or shared verbally – a friend, a family member.	Now, see **how it links to other areas** within the subject. *E.g Eating meat – causes global warming. Cows produce methane which is a greenhouse gas.*	**Write down as many 'think it, link it' ideas** as you can in your book. See if you can beat others in you class!

Strategy 2- Think it, link it – Great for connecting the big ideas in your subject. How does 'x' relate to 'y'. What are the key factors which make an equation/ experiment/ process work? Challenge yourself to see how many links you can make!

1	2	3	4	5
Select topic	**Prepare quiz**	**Answer it**	**Self check**	**Repeat**
Decide **which area you want to be quizzed** on (this might build up over time)	Get someone else to **prepare 10 random questions** on that topic to challenge you.	**Set a time limit** (depending on the number of questions) and answer the questions without looking at your KO.	Now look at your KO to **self check**- make a note of your score. Celebrate your successes and make a note of anything you missed or got incorrect.	**Return to this section** in 2/3 weeks- see if you can improve your score! Re-do those questions that you missed or got incorrect.

Strategy 3- Knowledge quiz – You might try this after a few weeks of using your knowledge organiser. Get someone to set you 10 questions using your knowledge organiser. These could be spellings, key words, processes, equations etc to see how much you can remember! Record your score and see if you can beat your personal best each half term!

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73	Engineering
74 – 75	Food Technology
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86 – 87	Sport

Step 1: Read the question: what is the steer (a)?

Step 2: Where can you find the steer (a) in the poem?
- Start with the title
- Beginning/middle/end
- ONLY things that link to the steer (a) or focus.

Step 3: Link your methods or ideas
- 1 overarching thesis (d) statement that addresses the steer (a).
- 3 supporting ideas or methods.
- HA language and structure
- LA language.

Step 4: Explode the effects of these three methods OR ideas in the poem.

Step 5: Structure this in three paragraphs.
- Idea, meaning, method (language and /or structure), connotations (words), effect (on a reader), alternative (b) interpretations (c) and secondary reference.

In 'On Aging', how does the poet present the speaker's attitude **to growing old**? (24 marks)

On Aging

Thesis:
The speaker does not want to be judged or stereotyped as an old person.

When you see me sitting quietly,
Like a sack left on the shelf,
Don't think I need your chattering.
I'm listening to myself.
Hold! Stop! **Don't pity me!**
Hold! **Stop your sympathy!**
Understanding if you got it,
Otherwise I'll do without it!
When my bones are stiff and aching,
And my feet won't climb the stair,
I will only ask one favour:
Don't bring me no rocking chair.
When you see me walking, stumbling,
Don't study and get it wrong.
'Cause tired don't mean lazy
And every goodbye ain't gone.
I'm the same person I was back **then**,
A little less hair, a little less **chin**,
A lot less lungs and much less **wind**.
But ain't I lucky I can still breathe **in**.

Maya Angelou

This simile (f) is outlining that that the speaker is completely still, implying that they are content with their surroundings and is at peace with their life.

The imperative (g) illuminates the speaker's heightened emotion and natural impulse to reject prejudice (l) and demonstrate her lack of vulnerability (m)

The ABCB rhyming structure (h) conveys how the speaker has accepted how they are evolving (j) as a person but at the same time rejecting the stereotype (e) of being an old person.

	Key terms	Definition
A	Steer	Direction/focus of the question.
B	Alternative	Another option or possibility
C	Interpretations	Explaining the meaning of something.
D	Thesis	Statement or theory as an argument to be proved.
E	Stereotyped	An oversimplified image/idea of a person or thing.
F	Simile	A language feature as a method of comparison ('as' or 'like').
G	Imperative	A sentence structure involving a command or warning.
H	Cyclical Structure	The conditions are the same at the end as they are at the beginning.
I	Inevitable	Certain to happen; unavoidable.
J	Evolution	The way things develop.
K	Simultaneously	At the same time.
L	Prejudicial	An idea/opinion formed before reviewing evidence or experience
M	Vulnerable	Being at risk of physical or emotional harm.
N	Speaker	The voice or narrator of the poem.

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Things to consider before writing

✓ Plan your answer.

✓ Underline the **audience (a), purpose (b) and style (c)** the task/question.

✓ Use the "Overview" to plan your paragraphs.

✓ 5 minute checking SPaG, including paragraphing.

Top Tips

✓ Consider the following first:
what do you **already know** about the topic?

✓ What is your **opinion** on the topic?

✓ What would others' opinion be? What is the **effect on others or society**?

Letter
Dear Sir/Madam or name • Addresses • Date • Paragraphs • Yours sincerely if named /faithfully if 'sir or madam'.

Speech
• Clear address to audience • Use rhetorical (g) devices throughout
• Use of direct address like "you/we" to include audience.

Article
• Subheadings
• Introductory paragraph
• convince reader of your viewpoint.

Leaflet
• Clear/apt/original title
• Organisational devices such as inventive subheadings
• Bullet points.

Essay
• Clear introduction responding to statement.
• Has three paragraphs with evidence.
• Conclusion paragraph.

The 'Writing for a purpose' question.

You will produce a written text for a specified **audience (a), purpose (b) and style (c)**.

Example question:

" A local MP has recently said that 'the biggest issue for youths today is getting a job'.

Style (c)   Purpose (b)   Audience (a)
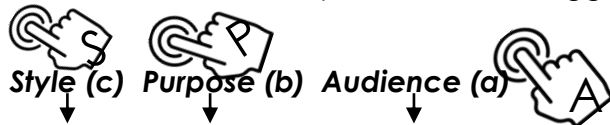
Write a <u>speech</u> <u>persuading</u> <u>your school</u> of the things you need to learn to get a good job.

Overview of each paragraph

P1: Describe a dystopia (d). Create the imagery (e) of a negative future. For the "Example Question", where schools have not prepared young people for jobs and there is lots of unemployment.

P2: Outline your purpose (b). Explain why you are writing or speaking. For the "Example Question", that schools need to change/not change to adapt to the job market.

P3: Main argument - personal response. What do you think about the statement?

P4: Branch out – societal impact - make it universal. How will this impact on the local community/country/world? For the "Example Question", what will it be like if there is mass unemployment?

P5: Describe a utopia (f). What will life be like if they listen to your speech or read your article? For the "Example Question", what will life be like if everyone is trained for the right jobs?

	Topic	Audience	Purpose	Style
	The subject the writing is about.	Who the writing is aimed at.	The reason why the writing has been completed.	The genre or style of the piece of writing.

	Key terms	Definition
A	Audience	This is who you are aiming your writing towards.
B	Purpose	This is why you are writing. Is it to instyle, persuade, advise etc.
C	Style	This is what your writing will be in the design of i.e. a letter, speech, article, leaflet, blog etc.
D	Dystopia	A negative world where people are often scared or sad.
E	Imagery	Creating an image or scene for the reader/listener.
F	Utopia	A perfect world where everyone is content.
G	Rhetorical	Speech features and devices to persuade an audience.
H	Distinguished	Successful and deserving of respect
J	Discriminated	Treat differently because of something about them. Often negatively.

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Year 9 – English – Writing for Change

Our Carbon Footprint

CO₂ Technology has made life a lot easier. However, along with the ease, there is a problem which is being added to each and every day.

Every time we use electricity from non-renewable sources, we release carbon into the air which traps heat and raises the temperature of the world.

Greta Thunberg famously refused to go back to school until climate change was taken seriously in Sweden.

Why is this important? Well, in short, the hotter the world's temperature, the more ice melts from North and South Poles, the more water is in our oceans and the more land is under water.

Notable person: Greta Thunberg

Gender in the Media

Media, television, radio, newspapers and now social media, has generally had more men than women working in it.

Media companies often seem to favour men as they get older, too. While men are said to look distinguished (h) as they get older, women are seen as not looking as good as when they were younger.

Emma Watson, who played Hermoine in Harry Potter, has been a big advocate of gender equality in the 'He for She' campaign.

Why is this important? Equal opportunities is the corner stone of a fair society. If we don't stand up for equality for all, people cannot complain when they are unfairly treated later.

Notable person: Emma Watson

Knife Crime

It only takes a second to change or destroy a life. There are lots of dangers out there without people taking knives onto the streets of the UK.

Quite often, carrying knives can be because of peer pressure and a gang mentality. If you're not carrying a knife, you cannot stab anyone.

One of the most famous cases was Damilola Taylor who was killed with a bottle when he was just ten-years-old.

In the West Midlands, offences involving knives rose by 500 cases to 3,649 in 2019.

Notable person: Damilola Taylor

Homelessness

Could you imagine sleeping on the streets? Rain is pouring down, the cold biting at your fingers and toes and being in constant fear of someone abusing you while you sleep?

A lot of people do. In 2019, there were 23,715 recorded homeless people in the West Midlands.

That's a 64% increase on 2016. Newsreader Alastair Stewart OBE is a famous supporter of Crisis, the homeless charity. Often, homeless people can be ex-soldiers or people who fall on hard times and can't recover.

Why is it important? Homeless people tend to die age 47. That's 30 years less than non-homeless people in the UK

Notable person: Alastair Stewart OBE

Key vocabulary to learn

Crucial/ imperative	Important to success	Monumental	Of great importance or size.
Promote/ advocate	To support and help progress	Unity	Working together.
Wholehearted/ vehement	Full or strong and forceful support	Epidemic	A widespread disease.
Abhorrent/ deplorable/ despicable	Actions which inspire hate or disgust.	Disproportionate	A difference in size, degree or circumstance.
Improve/ rectify/ transform	To develop or make better	Revolution	An overthrowing of normal life.

Key skills:
You should:
Ensure the writing has a point of view which is clear.

You should:
Use varied and accurate sentence structures.

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Completing a Two-Way Table:

Two-way tables are used to link two variables (two different categories).

They look like this:

$29 - 17 = 12$

	Left-handed	Right-handed	Total
Boys	17		35
Girls	12	23	35
Total	29		70

$12 + 23 = 35$

We can add or subtract to calculate the missing values using the TOTAL column/row to inform our calculations.
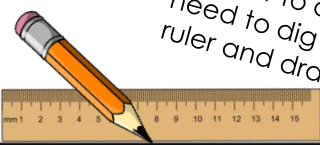
Forming a Two-Way Table:

Sometimes we have to draw our own two-way table (but the sneaky examiner might not tell us) in order to solve a problem.

In order to answer this you will need to dig out your pencil and ruler and draw a table.

150 students in Years 10 and 11 visit a school canteen.

Some students have packed lunches.
Some students have a cooked lunch.

56 out of the 89 students who have packed lunch are in Year 10.
There are 72 Year 11 students.

Work out how many Year 10 students have a cooked lunch.

	Packed	Cooked	Total
Year 10	56		
Year 11			72
Total	89		150

Step 1: Identify variables (what are your two categories?)
Step 2: Draw table with labeled rows and columns
Step 3: Put the numbers from the question into the correct space in the table
Step 4: Use 'Completing a Two-Way Table' above to complete your table
Step 5: Select (and write down) the correct piece of information to answer the original question.

Keyword/Skill	Definition/Tips
Frequency	The number of a specific thing or value.
Probability	The chance of something happening.
Table	A table is a data structure that organizes information into rows and columns
Addition	The process of joining together amounts
Subtraction	The process of removing an amount from an original amount.
Total	The combined amount when all of the amounts in the questions are added.
Two-way	A table that represents two categories of data that are related in some way.

Other Topics/Units this could appear in:
- Probability
- Dual bar charts
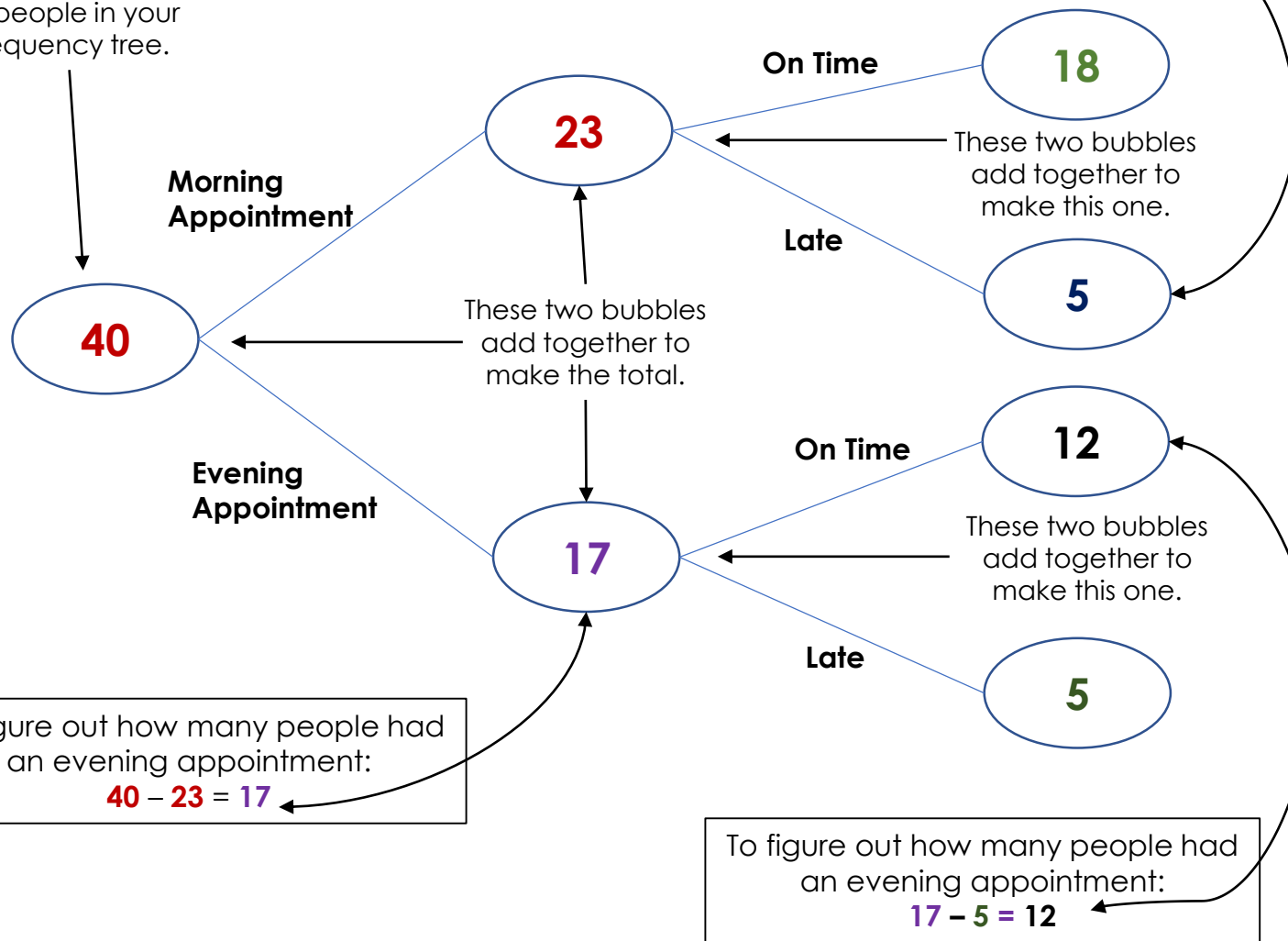- Relative frequency

Exams!
- In an exam you will get the first mark for correctly calculating any missing cell value.
- This type of question can be non calculator so make sure you write down the column addition and arithmetic you are doing.

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Completing Frequency Trees

Over one week, 40 patients visit a dentist. The frequency tree shows some information.

This is the **total** amount of people in your frequency tree.

To figure out how many people were late to the morning appointment:

23 – **18** = **5**

Morning Appointment

These two bubbles add together to make this one.

These two bubbles add together to make the total.

Evening Appointment

On Time

Late

On Time

Late

These two bubbles add together to make this one.

To figure out how many people had an evening appointment:

40 – **23** = **17**

To figure out how many people had an evening appointment:

17 – **5** = **12**

Keyword/Skill	Definition/Tips
Frequency	The number of a specific thing or value.
Probability	The chance of something happening.
Dependent	Two or more events that are related and influenced by each other. The events' outcomes are connected and do not occur without the other.
Independent	Two or more events occur without influencing each other. The events' outcomes occur separately from each other..
Tree diagram	A diagram representing the events and outcome of a situation or problem.
Outcomes	The possible results of an event.
Branch	A branch is a line on a tree diagram. It connects outcomes and represents how an event can have more than one outcome.

Other Topics/Units this could appear in:
- Probability
- Dual bar charts
- Relative frequency

Exams!
- In an exam you will get the first mark for correctly calculating any value in the tree diagram.
- How the question is worded is really important when calculating the probability. If it says the probability of 'a female playing tennis' is different to 'a student who is female and plays tennis'. The first requires the probability out of the total females, where as the second requires the probability out of the total number of male and females.

Crossover Unit 3 - Venn Diagrams

A Venn diagram is a tool used to sort data into groups. If the data is in both groups it is placed in the overlap of the circles (the intersection). Venn diagrams can be used to calculate probability.

Example

In a class of 30 students, 7 are in the choir, 5 are in the school band and 2 students are in the choir and the band. A student is chosen at random from the class. Find the probability that:

a) The student is not in the band.

b) The student is not in the choir nor in the band.

There are 2 students who are in both

There are 5 in the school band but we already have 2 so $5 - 2 = 3$

There are 7 in the choir but we already have 2 so $7 - 2 = 5$

There are 30 students overall but we already have $3 + 2 + 5 = 10$ so $30 - 10 = 20$ that are in neither.
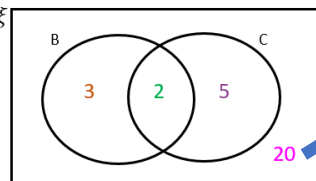
Example

In a class of 30 students, 7 are in the choir, 5 are in the school band and 2 students are in the choir and the band. A student is chosen at random from the class. Find the probability that:

a) **The student is not in the band.**

b) **The student is not in the choir nor in the band.**

This is everything that doesn't involve the band:
$$\frac{5 + 20}{30} = \frac{25}{30}$$

This can't be in the band or the choir: $= \frac{20}{30}$
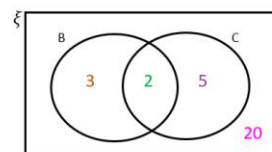
Draw a Venn diagram ξ numbers 1 to 20
Set A = multiples of 3
Set B = Odd numbers

Hint!
Write out all the numbers from 1 to 20 to make sure they all appear in the Venn diagram, cross out once you have used them.
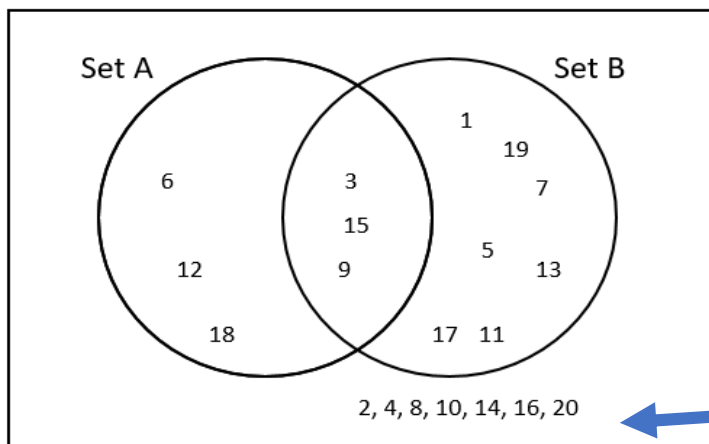
What is the probability of a number being a multiple of 3 and an odd number?

Look at the intersection, where the circles overlap. 3 numbers out of 20, so $\frac{3}{20}$ is the probability.
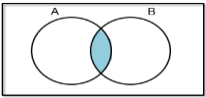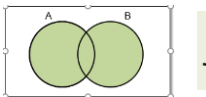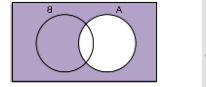
Other Topics/Units this could appear in:
- Product of prime factors
- Multiples in context
- Probability
- A-level statistics

Exams!
When drawing Venn diagrams remember to:
- Label the circles
- Place anything that is not included in any of the sets outside of the circles, like these numbers in this example

Keyword/Skill	Definition/Tips
Venn Diagram	The relationship between a group of different things.
Set	A collection of objects named elements
Empty set	It has no elements and is written as ∅.
Universal Set	A universal set has all the elements and is written as ξ.
Intersection	This is where two sets overlap $A \cap B$ This means **A and B**.
Union	This is two or more sets together. $A \cup B$ This means **A or B**.
Compliment	This is the region that is not included. A' This means **not A**.
Probability	The chance of an event happening.
P(A)	This means probability of event A
P (A')	This means probability of NOT A.
Independent	If an outcome is independent, the outcome of one does not affect the other.
Dependent	When an event can be affected by the outcome of another.
Mutually Exclusive.	Mutually exclusive events can not happen at the same time. (E.G. Rolling a 1 and rolling a 3 with one roll of a dice.)
Conditional Probability	When one event has happened which has an affect on another. (If a blue bead has already been picked and not replaced, what would be the probability of picking a blue bead now?).
Percentage	Percentage questions must add up to 100. Use this to check your answer.

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Any number can be written as a **product of prime factors**. It is also called **Prime Factorisation** or **Prime Factor Decomposition.**

We use a factor tree method to do this:

EXAMPLE: Express 420 as a product of prime factors.

So $420 = 2 \times 2 \times 3 \times 5 \times 7$
$= 2^2 \times 3 \times 5 \times 7$
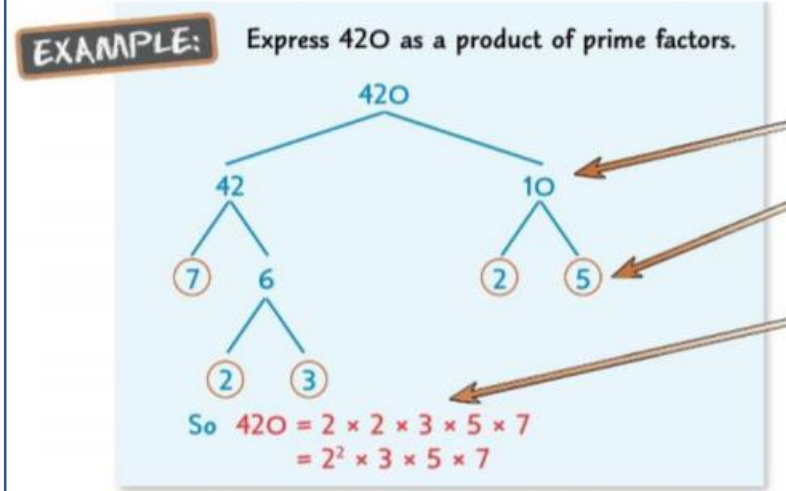
1) Start with the number at the top and split it into **factors** as shown.
2) Then do the same with factors you have written.
3) If the number is a **prime number** put a circle around it.
4) Keep going until you can't go any further (i.e. you are just left with prime numbers)
5) Write these prime numbers out as a **product**.
6) If there is more than one of the same factor, you can write them as powers (**index form**).

No matter what numbers you choose for each step, you'll find the product of primes is exactly the same!

Keyword/Skill	Definition/Tips
Product	Means multiply
Prime number	A number that has exactly two **factors**
Factor	An integer that divides the number exactly leaving no remainder
Multiples	Multiples of 4 is anything in the 4 times table E.g. 4, 8, 12, 16, 20, 24, 28, …
Index Form	Writing numbers in terms of powers E.g. $6 \times 6 \times 6 \times 6 = 6^4$ <- This is in index form
Prime Factor	A **factor** of a number that is also a **prime number**
Prime Factor Decomposition /Prime Factorisation	To write a number as a **product** of **prime numbers** Every number has a unique **prime factorisation**
Highest Common Factor (HCF)	The highest number that can be divided exactly into each of two or more numbers.
Lowest Common Multiple (LCM)	The lowest quantity that is a multiple of two or more given quantities.

Highest Common Factor

To find the highest common factor of two numbers, you need the biggest number that is a factor of the two (or more) numbers stated.

Ex1: Find the HCF of 36 and 12
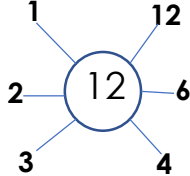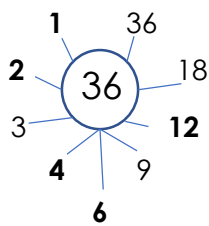
As you can see: 1, 2, 3, 4, 6 and 12 are all common factors.
We want the **highest common factor** which in this case is 12
Ans: HCF of 12 and 36 = 12

Lowest Common Multiple

To find the lowest common multiple you need to list the multiples of two (or more) numbers and see which number appears in both first.

Ex1: Find the LCM of 4 and 6
First list the multiples of 4 and 6

Multiples of 4: 4, 8, **12**, 16, 20, **24**, 28, 32, …
Multiples of 6: 6, **12**, 18, **24**, 30, …

As you can see: 12 and 24 are common multiples
We want the **lowest common multiple** which in this case is 12
Ans: LCM of 4 and 6 = 12

Other Topics/Units this could appear in:
• Factorising
• Use of Calculator
• Algebraic Proof

Exams!
• In an exam you will get the first mark for correctly listing 5 correct factors or multiples of one of the numbers, then a second mark for listing 5 correct factors or multiples for the second number. So try and do that if you are unsure how to go any further.

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We can also use the product of primes to figure out the HCF & LCM of two numbers:
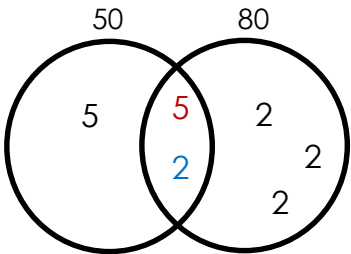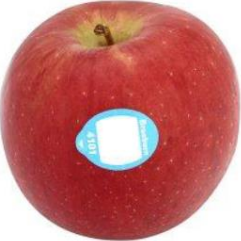
<u>Example</u>: What is the HCF and LCM of 50 and 80?

Step 1 - Find the product of prime factors for 50 and 80.

50

10   5

5   2

$50 = 2 \times 5 \times 5$

80

10   8

5   2   4   2

2   2
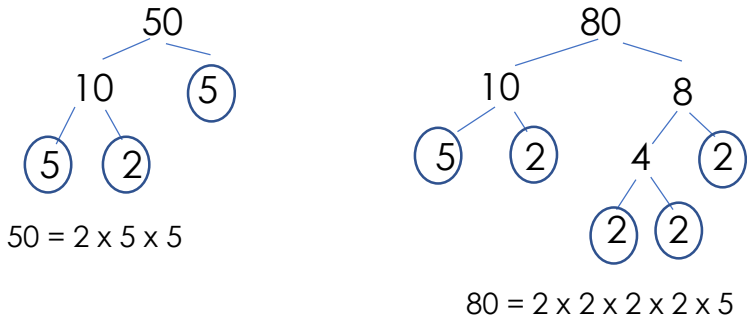
$80 = 2 \times 2 \times 2 \times 2 \times 5$

Step 2 - Put the prime factors of 50 and 80 into a Venn Diagram (you can use **Crossover Unit 3 – Venn Diagrams** knowledge organiser to help)

$50 = 2 \times 5 \times 5$ $80 = 2 \times 2 \times 2 \times 2 \times 5$

50   80

5   5   2
    2   2
        2

Numbers common to both 50 and 80 go in the middle…

Multiply the middle numbers to find the **HCF**

HCF→ $2 \times 5 = $ **10**

Multiply <u>**all**</u> of the numbers in the Venn Diagram to find the **LCM**

→ $5 \times 5 \times 2 \times 2 \times 2 \times 2 = $ **400**

<u>Multiples in Context:</u>

How to …

Matt and Dan cycle around a cycle track.

Each lap Matt cycles takes him 50 seconds.

Each lap Dan cycles takes him 80 seconds.

Dan and Matt start cycling at the same time at the start line. Work out how many laps they will have each cycled when they are next at the start line together.

There are a couple of ways of solving this type of question - less mistakes are made by listing multiple

Matt - 50,100,150,200,250,300,350,400, 450, 500, 550…..

Dan - 80,160,240,320, 400

I can stop here as its in both lists

So Matt and Dan will be at the start when they have both been cycling for 400 s… thats not what the question asked for….

….count the 'multiples of 50' and 'multiples of 80'….

Matt __8__ laps

Dan __5__ laps

(3)

Keyword/Skill	Definition/Tips
Product	Means multiply
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Factor	An integer that divides the number exactly leaving no remainder
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Index Form	Writing numbers in terms of powers E.g. $6 \times 6 \times 6 \times 6 = 6^4$ <- This is in index form
Prime Factor	A **factor** of a number that is also a **prime number**
Prime Factor Decomposition /Prime Factorisation	To write a number as a **product** of **prime numbers** Every number has a unique **prime factorisation**
Highest Common Factor (HCF)	The highest number that can be divided exactly into each of two or more numbers.
Lowest Common Multiple (LCM)	The lowest quantity that is a multiple of two or more given quantities.

<u>Other Topics/Units this could appear in:</u>
- Factorising
- Use of Calculator
- Algebraic Proof

<u>Exams!</u>
- In an exam you will get the first mark for correctly listing 5 correct factors or multiples of one of the numbers, then a second mark for listing 5 correct factors or multiples for the second number. So try and do that if you are unsure how to go any further.

11

Crossover Unit 6 & 7 – Best Buys & Exchange Rates

Best Buys: Work out how much money **one item** costs. The best value is the **cheapest**.

A	B
1.2kg for £3.89	700g for £2.14

1.2kg = £3.89
÷ 1200 { 1200g = 389p } ÷ 1200
1g = 0.32p

÷ 700 { 700g = 214p } ÷ 700
1g = 0.31p

Offer B is the best value.

Step 1 - For offer A, Convert 1.2kg to grams by multiplying by 1000 so that we have both offers in grams.

Step 2 - If 1200g of Apples costs 389p (or £3.89) we can work out 1g by dividing the grams and the money by 1200.

Step 3 - For offer B, If 700g costs 214p (or £2.14) we can work out 1g by dividing the grams and the money by 700.

Step 4 - See which is the lowest cost per gram and that is the best value.

Note: If you leave the money in £'s, for offer A, 1g = £0.0032 and for offer B, 1g = £0.0031. The answer is still the same. Offer B is cheapest.

Eg2. Which is better value?

SHAMPOO

TRESCO Supermarket Sells 500ml bottles for £1.60
Special Offer 3 for price of 2

ASDER Supermarket sells 300ml bottles for £1.50
Special offer buy one get one free

TRESCO:
x 3 { 500ml = £1.60 } x 3
÷ 1500 { 1500ml = £3.20 } ÷ 1500
1ml = £0.0021

ASDER:
x 2 { 300ml = £1.50 }
÷ 600 { 600ml = £1.50 } ÷ 600
1ml = £0.0025

TRESCO is the best value

Step 1 - At Tresco, the offer is 3 bottles of 500ml for the price of 2 bottles. Therefore 3 x 500ml costs 2 x £1.60

Step 2 – So if 1500ml of Shampoo costs £3.20, we can work out 1ml by dividing the ml and the money by 1500.

Step 3 - At ASDER, the offer is buy 1 and get 1 free. Therefore we get 2 x 300ml for 1 x £1.50

Step 4 - If 600ml costs £1.50 we can work out the cost of 1ml by dividing the ml and the money by 600.

Step 5 – Now see which is the lowest cost per ml of shampoo and that is the best value. – In this example TRESCO is the cheapest/best value.

Keyword/Skill	Definition/Tips
Best Buy	The cheapest price per item/unit OR the highest number of units/price .
Direct Proportion	2 variables change at the same rate
Unitary Method	Finding the cost of a single unit OR finding the amount of units per eg. £1
Exchange Rate	The price of one currency in terms of another currency. Eg. £1 = $1.25 For each pound I have to spend I can buy $1.25
Multiply	Repeated addition.
Divide	To split into equal parts or groups.
Changing Format	If the rate is given in the format (for instance) $1 = £0.85 Divide both numbers by 0.85 to get the exchange rate in the format £1 = $1.18

Other Topics/Units this could appear in:

- Direct and Inverse Proportion
- Similarity
- Mensuration
- Fractions and Percentages

Crossover Unit 6 & 7 – Best Buys & Exchange Rates

Exchange Rates: One currency can be exchanged for another currency by calculations using exchange rates.

Example 1

John went to Paris on holiday. He changed £1450 into Euros at Manchester Airport before his flight to Paris. The exchange rate at the airport was £1 = €1.14. On the holiday he spent €1355. On his return to England he changed his remaining euros back into pounds. Work out how much he returned to England with. Give your answer in pounds to the nearest penny.

£1 = €1.14

£1450 = 1450 x 1.14 = €1653

€1653 - €1355 = €298

298 ÷ 1.14 = £261.4035……

= £261.40 (nearest penny)

Step 1 - For EVERY pound John receives he gets €1.14. Therefore, for £2 he gets 2 x €1.14, for £3 he gets 3 x €1.14 etc so for £1450 he gets 1450 x €1.14 = €1653

Step 2 - On holiday in Benidorm he spends € 1355 so the next thing we do is subtract 1355 from 1653 which is €298

Step 3 - When we changed from pounds to euros we used multiplication, so to convert back from euros to pounds we do the inverse of multiplication ie. division.

Therefore the calculation is 298 ÷ 1.14 = £261.4035 which is £261.40 to the nearest penny

Note: When the exchange rate is given as
£1 = "other currency" then
GBP ⟶ Other currency x exchange rate
GBP ⟵ Other currency ÷ exchange rate
Otherwise: Reverse the operations. See eg2.

Example 2

Elaine is going to New York. She wants to change £500 into US Dollars. The exchange rate in the UK is £1 = $1.26 and the exchange rate in New York is $1 = £0.81. In which country is she best changing her money? Explain your answer.

UK : 500 x 1.26 = $630

US (New York) : 500 ÷ 0.81 = $617.28

She should change her money in the UK because she will get more dollars.

Step 1 - If Elaine changes her money in the UK, for every
£1 she gets $1.26
£2 she gets 2 x $1.26
£3 she gets 3 x $1.26 etc

so for £500 she gets 500 x $1.26 = $630

Step 2 - If Elaine changes her money in New York, even though she is changing pounds to dollars the calculation is "divided by the exchange rate" because the exchange rate in New York is given as $1 = £0.81

Exams!
- As you can see, these questions are all about money, so make sure in an exam you use the correct units, e.g £ or $ etc.
- You also need to make sure all of your answers are rounded to 2.d.p, as money is always in this form.

Keyword/Skill	Definition/Tips
Best Buy	The cheapest price per item/unit OR the highest number of units/price .
Direct Proportion	2 variables change at the same rate
Unitary Method	Finding the cost of a single unit OR finding the amount of units per eg. £1
Exchange Rate	The price of one currency in terms of another currency. Eg. £1 = $1.25 For each pound I have to spend I can buy $1.25
Multiply	Repeated addition
Divide	To split into equal parts or groups
Changing Format	If the rate is given in the format (for instance) $1 = £0.85 Divide both numbers by 0.85 to get the exchange rate in the format £1 = $1.18

Other Topics/Units this could appear in:

- Drawing and Interpreting tables and graphs
- Expressions and substitution into simple formulae

Rounding – Decimal Places

- You need to be able to round a number to a given number of **decimal places.**

$$3.248$$

3 is the units digit.

2 is worth 2 <u>tenths</u>, and is the **first** decimal place.

4 is worth 4 <u>hundredths</u>, and is the **second** decimal place.

8 is worth 8 <u>thousandths</u>, and is the **third** decimal place.

You will sometimes see "decimal place" shortened to "d.p."

3.248 rounded to 1 d.p.

$$3.248 \qquad 3.2|48 \rightarrow 3.2$$

1st dp
3.2

Look at the next digit.
4 stays down - stay at 3.2.

3248 rounded to 2 d.p.

$$3.248 \qquad 3.24|8 \rightarrow 3.25$$

2nd dp
3.24

Look at the next digit.
8 rounds up - go to 3.25

Rounding- Significant Figures

- You need to be able to round a number to a given number of **significant figures.**

$$0.0004300$$

Zeros after the decimal NOT SIGNIFICANT before non zero numbers

All non zero numbers are significant

Zeros after non zero numbers in a decimal are significant

Example 1
Round 524 to **one** significant figure.
Check 1st significant digit value = 500
Round to the nearest 100 = 500

Example 2
Round 0.006832 to **two** significant figures.
Check 2nd significant digit value = 8/10,000 (8 ten thousandths)
Round to the nearest 10,000th = 0.0068

Error Intervals
You need to be able to use inequality notation to specify error intervals.
Example:
0.3 has been rounded to 1 decimal place. Write the error interval.
0.2 is the decimal place below 0.3 and 0.4 is the decimal place above 0.4.
My lower bound is halfway between 0.2 & 0.3
My upper bound is halfway between 0.3 & 0.4

| 0.2 | | 0.3 | | 0.4 |
| 0.25 | | | 0.35 | |
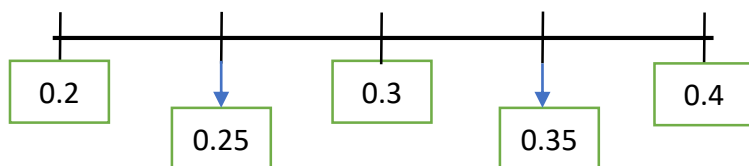
Therefore, my error interval = $0.25 \leq x < 0.35$

Exams!
- Rounding to decimal places and significant figures can appear as 1 mark questions.
- You may be asked to round an answer at the end of a 3, 4, 5 mark question.
- A 'bog standard' error interval question (as shown) will be worth 2 marks.

Keyword/Skill	Definition/tip
Integer	A whole number - can be positive or negative or zero.
Number	Describes a quantity or value. Can be a word or figure or symbol.
Digit	A symbol used to show a number.
Decimal	A number system based on the number 10
Decimal place	The position of a digit to the right of a decimal point.
Significant Figure	Numbers beginning with the left non zero digit OR beginning with the first non zero digit after the decimal point if there are zero digits.
Rounding	Change a number to a more convenient but less accurate value.
Inequality	'Not equal to' Inequality symbols ≠ not equal to, ≥ greater than or equal to, ≤ less than or equal to, > greater than, < less than, = equal to.
Error interval	A range of values that could be taken before rounding/truncating.

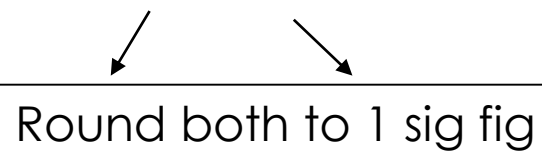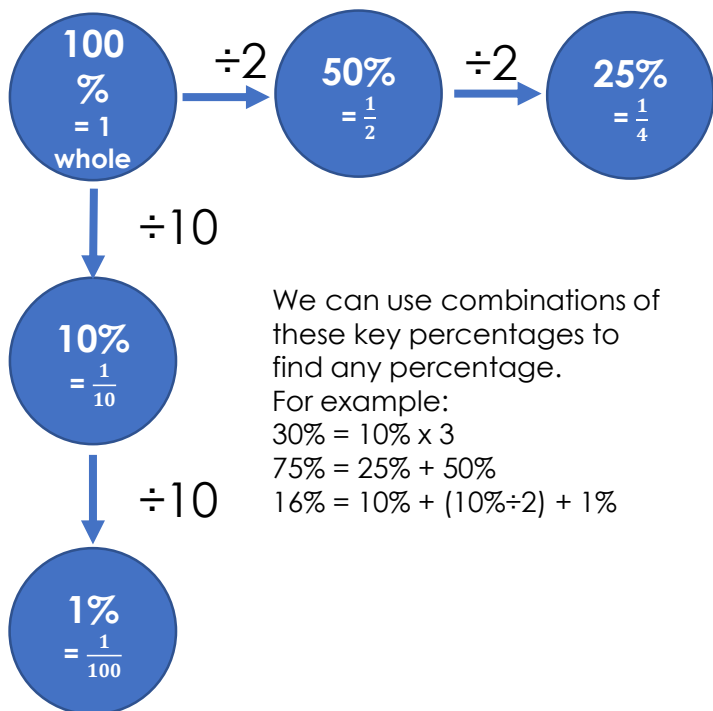Other topics/Units this could appear in:
- Upper and lower bounds

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Estimation

You need to be able to estimate answers to calculations by rounding to 1 significant figure or an appropriate level of rounding.

Example 1
Estimate the value of 2.9 x 403

Round both to 1 sig fig

2.9 rounds to 3
403 rounds to 400

3 x 400 = 1200

Example 2
Bob buys 72 packets of crisps at 19p each.
Estimate the total cost.

72 = 70
19 = 20p
70 x 20 = 1400p = £14.00

Round both to 1 sig fig

Example 3
You will need to be able to say whether an answer is an overestimate or an underestimate.

a) Paul organised an event for charity.
Each ticket cost £19.95.
Paul sold 395 tickets.
Paul paid costs of £6000.
Work out an estimate for how much money Paul gave to charity. (3)

Round to 1 sig fig

£19.95 = £20
395 = 400
20 x 400 = £8000
Take away costs = 8000 – 6000 = 2000
= £2000

b) Is your answer to part (a) an overestimate or an underestimate? Give a reason.

My answer is an overestimate because I have rounded both £19.95 and 395 up, therefore £8000 is more than the actual amount and £2000 is more than the actual amount given to charity.

Keyword/Skill	Definition/tip
Decimal place	The position of a digit to the right of a decimal point.
Significant Figure	Numbers beginning with the left non zero digit OR beginning with the first non zero digit after the decimal point if there are zero digits.
Rounding	Change a number to a more convenient but less accurate value.
Estimation/ estimate	To make an approximate or rough calculation based on rounding.

Other topics/Units this could appear in:
Surface area and volume
Sampling

Exams!
- Estimation questions can appear on calculator papers but often will be found **on non-calculator** paper
- You will gain no marks if you work out the exact answer
- You must include the rounded values in your working
- You will gain a mark for correctly rounding in a 3 mark question

15

ORMISTON SWB ACADEMY

1. Percentage of an Amount (without a calculator)

100% = 1 whole

÷2 → **50%** = $\frac{1}{2}$

÷2 → **25%** = $\frac{1}{4}$

÷10

10% = $\frac{1}{10}$

÷10

1% = $\frac{1}{100}$

We can use combinations of these key percentages to find any percentage.
For example:
30% = 10% x 3
75% = 25% + 50%
16% = 10% + (10%÷2) + 1%

Example 1:
Find 25% of £120
To find 25% you divide by 2 then divide by 2 again (or ÷ 4)
£120 ÷ 4 = £30
So, 25% of £120 is £30

Example 2:
Find 60% of 300kg
To get 60% we can use 50%+10%
To find 50% you divide by 2
So 50% = 150kg
To find 10% you divide by 10
So 10% = 30kg
Therefore 60% of 300kg = 180kg

2. Percentage increase/decrease (without a calculator)

Firstly, find the percentage of the given amount.
Then you add or subtract this amount depending on whether you are increasing or decreasing.

Example 1
Increase $80 by 50%

50% of $80 = $40
Then **add** this onto the starting amount

$80 + $40 = $120

Example 2
Decrease 500g by 3%

1% of 500g = 5g
3% of 500g = 5g x 3 = 15g
Then **subtract** this from the starting amount

500g – 15g = 485g

3. Percentage of an Amount (with a calculator)

Here we can use **percentage multipliers**.
First of all you need to find the decimal equivalent of the percentage you need.

50%	=	0.5
75%	=	0.75
30%	=	0.3
2%	=	0.02

You need to use these decimals as percentage multipliers.
Example
Find 48% of £250
48% = 0.48 (this is the percentage multiplier)
250 x 0.48 = 120
So, 48% of £250 is £120

4. Percentage Increase/Decrease (with a calculator)

Here we can also use **percentage multipliers.**

Increasing Example
Increase 480 by 16%.
Every amount starts at 100%. If I want to **increase** by 16%, this would go up to 116%.
So I need my multiplier to be the decimal equivalent of 116%
116% = 1.16
So to increase 480 by 16%
480 x 1.16 = 556.8

Decreasing Example
Decrease 725 by 26%.
Every amount starts at 100%. If I want to **decrease** by 26% this would go down to 74%. (100 – 26 = 74)
So I need my multiplier to be the decimal equivalent of 74%.
74% = 0.74
So to **decrease** 725 by 26%
725 x 0.74 = 536.5

Keyword/Skill	Definition/Tips
Percentage	A number out of 100. Symbol %
Fraction	Any part of a group, number or whole. They are written as one number over another.
Decimal	A number with a decimal point in it. It can be positive or negative. 3746.374
Equivalent	Having the same value or amount.
Increase	To get larger in size or number.
Decrease	To get smaller in size or number.
Profit	This occurs when an item is sold for more than it cost to buy. It is the difference between the amount earned and the amount spent.
Loss	This occurs when an item is sold for less than it cost to buy.
Interest	Money paid regularly at a particular rate. Usually on bank accounts or loans.
Percentage multiplier	The number you multiply a quantity by to find a percentage or increase/decrease it by a percentage.
Simple Interest	Interest calculated as a percentage of the original amount.
Compound Interest	Interest paid on the original amount and the accumulated interest.
Decay/ Depreciation	The decrease in the value or amount of something over time. (Car prices are a common example)
Growth/ Appreciation	The increase in the value or amount of something over time. (House prices are a common example)

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5. Interest, Growth and Decay

Simple Interest (Growth)	A £200 loan earns 15% **simple** interest over 5 years. How much will be owed at the end of the 5 years? Work out 15% of £200 = £30 £30 x 5 years = £150 £200 + £150 = £350
Compound Interest (Growth)	A £200 loan earns 15% **compound** interest over 5 years. How much will be owed at the end of the 5 years? Here you need to use percentage multipliers. To **increase** by 15% five times (for each of the 5 years) you would multiply by 1.15 five times. A quick way of writing this is by using indices. £200 x 1.15^5 = £402.27
Compound Depreciation (Decay)	A car was brought for £12,000. It depreciates in value by 20% per year. How much will the car be worth after 3 years? Here you need to use percentage multipliers. To **decrease** by 20% three times (for each of the 3 years) you would multiply by 0.8 three times. A quick way of writing this is by using indices. £12,000 x 0.8^3 = £6,144

6. Reverse Percentages

Reverse percentages help us to calculate the **original** price or value of something, when we only know the price or value after the increase or decrease has taken place.

Before we do this, it is important we know that 100% represents the whole amount or the full price of something. So if something is increased by 20%, the amount we have now is worth 120%. If something is reduced by 5%, the amount we have is now worth 95%.

Non – Calculator This could come up on a non-calculator paper, but they will usually give you nice numbers that will divide easily like the example here.	A shop has a 20% off sale. A shirt is now worth £24. What was the original price? So, £24 represents 80% of the value of the shirt 80% + 20% = 100% £24 + £6 = £30
Calculator On a calculator paper, the numbers are likely to be more difficult, so you will need to use percentage multipliers.	Some money has been put into a bank account with an interest rate of 4%. After a year, the total amount of money in the account was £291.20. How much money was invested? £291.20 ÷ 1.04 = £280
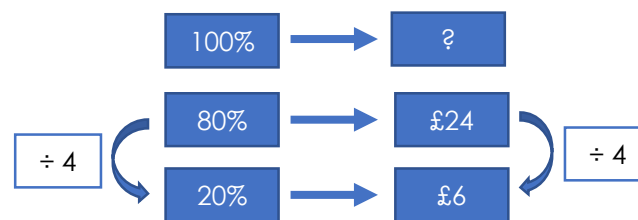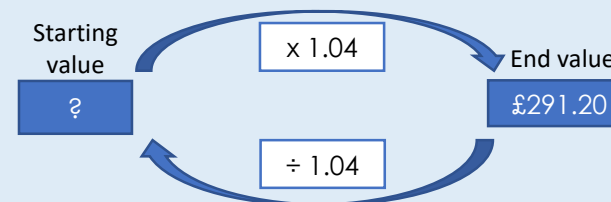
Sometimes, the phrase 'per annum' is used. This means the same as 'per year'. Annum is the Latin word for year.

Exams!
- A lot of these questions will involve money. Remember money should always be rounded to 2d.p.

Other Topics/Units this could appear in:

- Direct and inverse proportion
- Ratio
- A-level Units

1. Calculators

- You will need to make sure that you are familiar with the keys on the calculator

fraction button

cubed

squared

square root

negative

brackets

Press shift first*

*root

*cube root
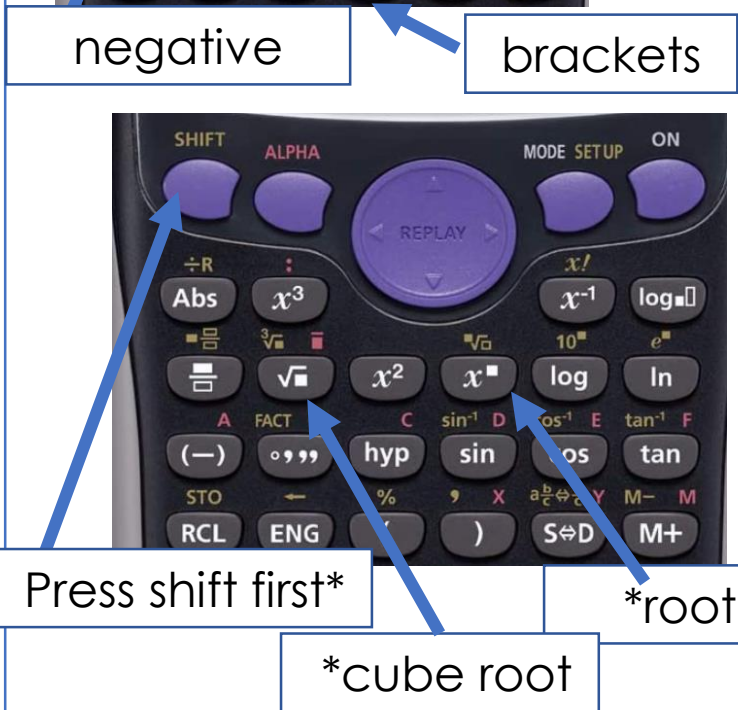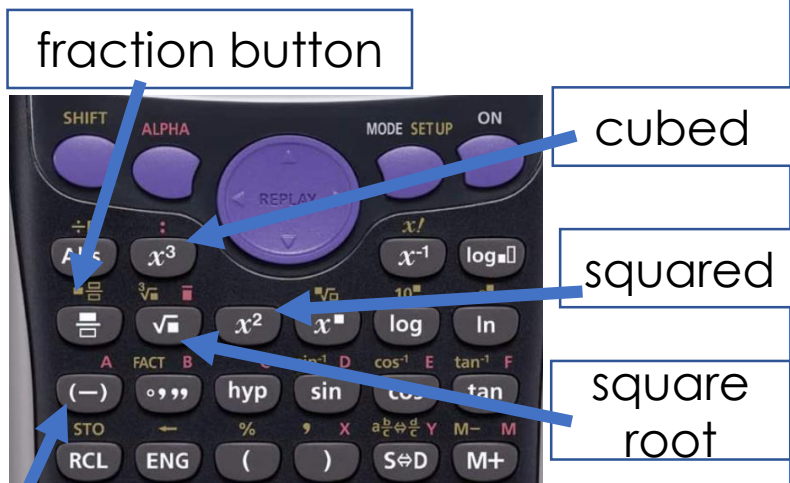
2. Calculations

- Use the buttons to correctly enter the calculations.

Example 1

Work out the reciprocal of 1.25

Reciprocal means $\dfrac{1}{n}$ so enter $\dfrac{1}{1.25} = 0.8$

So the final answer is: 0.8

Example 2

Use your calculator to work out: $\dfrac{\sqrt{7056}}{0.35 \times 12.8}$

Use the cursor to move down

Write down all of the figures of your display

So the final answer is: 18.75

Example 3

Work out the value of: $\dfrac{\sqrt{30}}{2.5^2} = 0.876356092$

Give your answer to 3 decimal places

So the final answer is: 0.876

Substitution in calculations

- This is where you substitute (replace) a letter with a number.
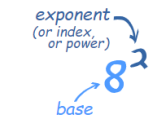
Example 1

x = 0.7   work out the value of $\dfrac{(x+1)^2}{2x}$

Write down all of the figures on your display

So enter $\dfrac{(0.7+1)^2}{2 \times 0.7} = 2.06428571$
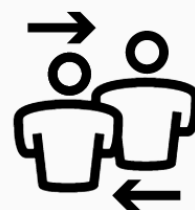
Keyword/Skill	Definition/Tips
Powers	The power (or exponent) of a number says how many times to use the number in a multiplication. Example $8^2 = 8 \times 8 = 64$
Square Root	A square root of a number is a value that, when multiplied by itself, gives the number.
Root	*The root of a number x is another number, which when multiplied by itself a given number of times, equals x.* **For example, the third root (also called the cube root) of 64 is 4, because if you multiply three fours together you get 64:**
Brackets	Symbols used in pairs to group things together
Square	The result of multiplying an integer by itself
Cube	The result of using a whole number in a multiplication three times.
Order of operations (BIDMAS)	The **order** you should do calculations in. **'Brackets, Indices, Division, Multiplication, Addition and Subtraction'.**
Reciprocal	The reciprocal of a number is: 1 divided by the number

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FRACTIONS

Recognising Fractions

Numerator
How many equal parts of a number are needed

$$\frac{3}{8}$$

Denominator
How many equal parts are there altogether

Simplifying Fractions

You will need to simplify your answers after you have added, subtracted, multiplied or divided your fraction. Here's a reminder how:

- To simplify a fraction you need to find a common factor of the **numerator** and the **denominator.**

- Ex: Simplify: $\frac{18}{30}$ A common factor of 18 and 30 would be 6. So I need to divide 18 and 30 by 6

- $18 \div 6 = 3$ and $30 \div 6 = 5$, therefore my simplified fraction is $\frac{3}{5}$

Keyword/Skill	Definition/Tips
Numerator	How many parts of a whole. The top number in a fraction.
Denominator	How many parts the whole is split into. The bottom number in a fraction.
Improper Fraction	A fraction where the **numerator** is bigger than the **denominator**
Mixed Number	A number made from an integer and a fraction
Reciprocal	One of two numbers that multiply to make 1. e.g. the reciprocal of 2 is $\frac{1}{2}$ because $2 \times \frac{1}{2} = 1$
Multiplicative Inverse	Another way of describing reciprocal
Conversion	To change our fraction into something else (decimal or percentage)
Equivalent Fractions	Two or more fractions that are equal in value
Common Denominator	When two or more fractions have the same denominator

Fractions of Amounts

Zaki's mum buys 20 sweets and gives Zaki $\frac{1}{4}$ of them.
How many sweets does Zaki get?

I am splitting 20 into four parts as it is $\frac{1}{4}$ of the sweets.

20

$20 \div 4 = 5$
That means each part is worth 5

5	5	5	5
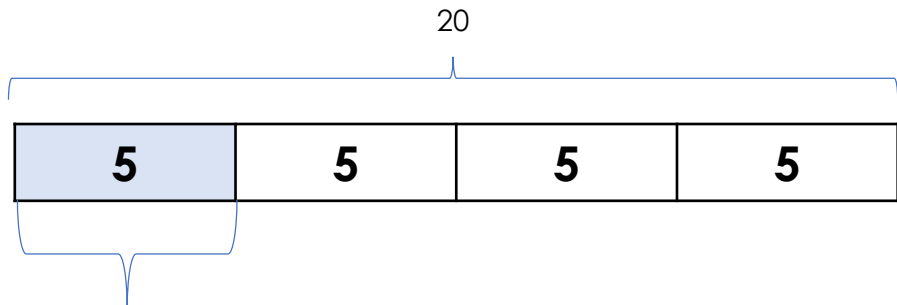
As it is $\frac{1}{4}$ I only need one of these parts

So Zaki gets 5 sweets.

Gurpreet & Mitch share 35 sweets.

Gurpreet gets $\frac{3}{5}$ of them.

I am splitting 35 into five parts.

35

$35 \div 5 = 7$
That means each part is worth 7

7	7	7	7	7
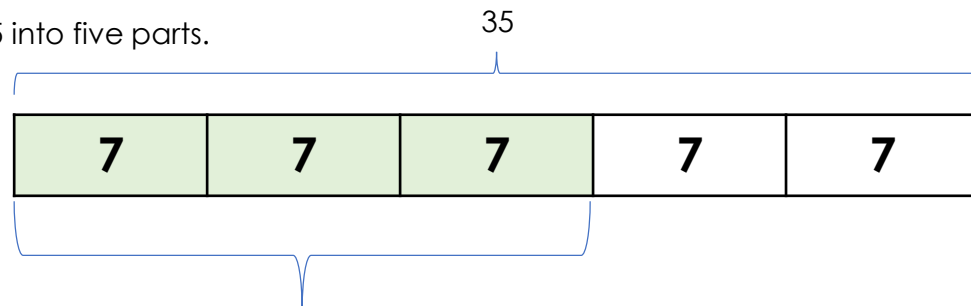
As it is $\frac{3}{5}$ I need three parts so this is $7 \times 3 = 21$

So Gurpreet gets 21 sweets.

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Multiplying Fractions

To multiply fractions together, we simply multiply the numerators and then multiply the denominators.

Don't forget to simplify your answer

$$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12} = \frac{1}{2}$$

Dividing Fractions

$\frac{6}{7} \div \frac{3}{5}$ can be expressed as $\frac{6}{7}$ is $\frac{3}{5}$ of something?

$$\frac{6}{7}$$
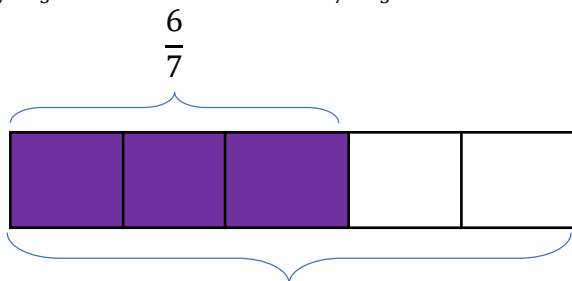
We need to figure out what one part of the bar model is worth. We can do that by doing $\frac{6}{7} \div 3$ which equals $\frac{2}{7}$

This means one part of the bar model is worth $\frac{2}{7}$.

To find the answer to $\frac{6}{7} \div \frac{3}{5}$ we want to know what the whole bar is worth.
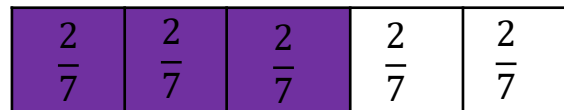
We have 5 lots of $\frac{2}{7}$ which equals $\frac{10}{7}$.

Therefore the answer to $\frac{6}{7} \div \frac{3}{5} = \frac{10}{7}$

Keyword/Skill	Definition/Tips
Numerator	How many parts of a whole. The top number in a fraction.
Denominator	How many parts the whole is split into. The bottom number in a fraction.
Improper Fraction	A fraction where the **numerator** is bigger than the **denominator**
Mixed Number	A number made from an integer and a fraction
Reciprocal	One of two numbers that multiply to make 1. e.g. the reciprocal of 2 is $\frac{1}{2}$ because $2 \times \frac{1}{2} = 1$
Multiplicative Inverse	Another way of describing reciprocal
Conversion	To change our fraction into something else (decimal or percentage)
Equivalent Fractions	Two or more fractions that are equal in value
Common Denominator	When two or more fractions have the same denominator

Other Topics/Units this could come up in:

- Fraction Calculations
- Recurring Fractions
- Surds including Rationalising

Adding and Subtracting Fractions

To add or subtract fractions we must first make the denominators the same. We do this by using equivalent fractions and common denominators. Once the denominators are equal we simply add or subtract the numerators (keeping the denominators the same)

$\frac{1}{6} + \frac{4}{9}$ The common denominator will be 18

$$\frac{1}{6} = \frac{3}{18} \qquad \frac{4}{9} = \frac{8}{18} \qquad \frac{1}{6} + \frac{4}{9} = \frac{3}{18} + \frac{8}{18} = \frac{11}{18}$$

$\frac{5}{7} - \frac{1}{3}$ The common denominator will be 21

$$\frac{5}{7} = \frac{15}{21} \qquad \frac{1}{3} = \frac{7}{21} \qquad \frac{5}{7} - \frac{1}{3} = \frac{15}{21} - \frac{7}{21} = \frac{12}{21}$$

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Representing a ratio

"For every 5 boys there are 3 girls".

This is the "whole" – boys and girls together

This represents the 5 boys   This represents the 3 girls

5:3

Double Number Line

This represents the 5 boys

This is the "whole" – boys and girls together

This represents the 3 girls
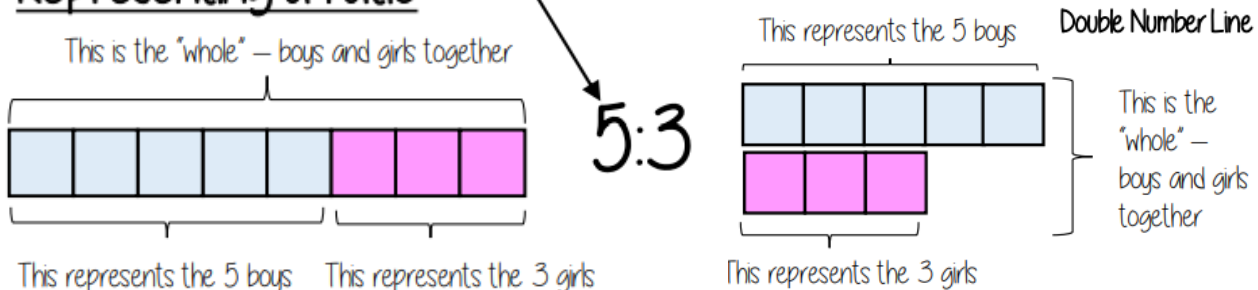
Units are important:

When using a ratio – all parts should be in the same units

Useful Conversions

mm $\xrightarrow{\times 10}$ cm $\xrightarrow{\times 100}$ m $\xrightarrow{\times 1000}$ km
$\xleftarrow{\div 10}$ $\xleftarrow{\div 100}$ $\xleftarrow{\div 1000}$

g $\xleftarrow{\div 1000}$ kg $\xrightarrow{\times 1000}$

ml $\xrightarrow{\times 1000}$ L $\xleftarrow{\div 1000}$

Order is Important

"For every dog there are 2 cats"

Dogs: Cats

1:2

The ratio has to be written in the same order as the information is given

e.g. 2:1 would represent 2 dogs for every 1 cat ✗
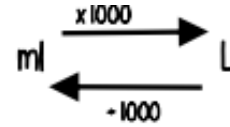
Simplifying a ratio

Cancel down the ratio to its lowest form

"For every 6 days of rain there are 4 days of sun"

6:4

÷ by 2 ↓

rain   sun

3:2
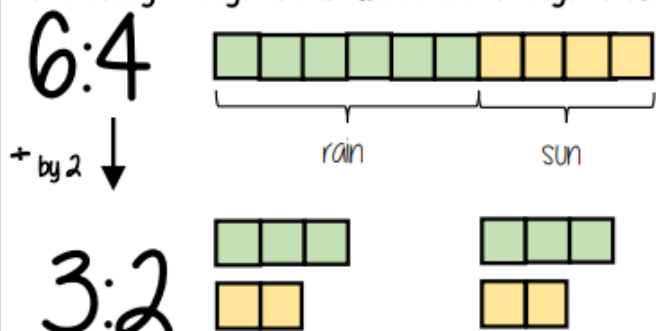
Find the biggest common factor that goes into all parts of the ratio

For **6** and **4** the biggest factor (number that multiples into them is **2**)

"For every 3 days of rain there are 2 days of sun" – when this happens twice the ratio becomes 6:4.

Ratio 1:n (or n:1)

This is asking you to cancel down until the part indicated represents 1.

Show the ratio 4:20 in the ratio of 1:n

The question states that **this part has to be 1 unit** Therefore **Divide by 4**

4 : 20

1 : 5

This side has to be divided by 4 too – to keep in **proportion**

H the n part does not have to be an integer for this type of question

Keyword/Skill	Definition/Tips
Ratio	Ratio compares the size of **one part** to **another part**. Written using the ':' symbol. 3 : 1
Proportion	Proportion compares the size of **one part** to the size of the **whole**. In a class with 13 boys and 9 girls, the proportion of boys is $\frac{13}{22}$ and the proportion of girls is $\frac{9}{22}$
Share	Split or divide.
Parts	One cube in the bar model represents one part
direct proportion	As one amount increases, another amount increases at the same rate
inverse proportion	when one value **decreases** at the same rate that the other increases.
Best Buys	The product which is the best value for money/cheapest

Other Topics/Units this could appear in:

• Direct and inverse proportion

21

ORMISTON SWB ACADEMY

Sharing a whole into a given ratio

James and Lucy share £350 in the ratio 3:4.
Work out how much each person earns

Model the Question

James : Lucy

3 : 4
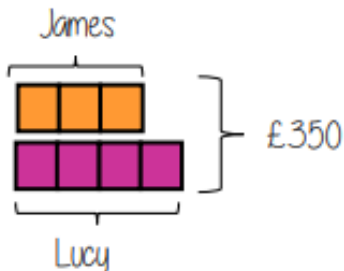
James
Lucy
} £350

Find the value of one part

Whole: £350
7 parts to share between
(3 James, 4 Lucy)

£350 ÷ 7 = £50

☐ = one part
= £50

Put back into the question

James : Lucy

(×50) 3 : 4 (×50)

£150 : £200

James = 3 × £50 = £150

50 50 50
50 50 50 50
} £350

Lucy = 4 × £50 = £200
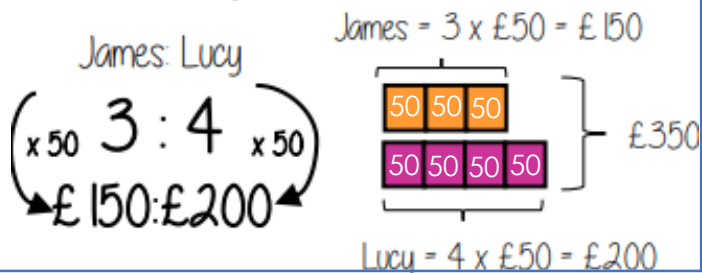
Other Topics/Units this could appear in:

• Direct and inverse proportion

Finding a value given 1:n (or n:1)

Inside a box are blue and red pens in the ratio 5:1.
If there are 10 red pens how many blue pens are there?

Model the Question

Blue : Red

5 : 1

Blue pens
Red pens

One unit = 10 pens

☐ = one part = 10 pens
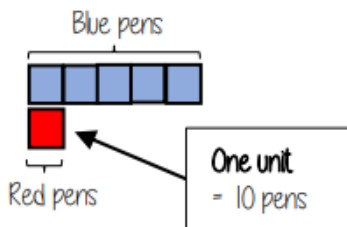
Put back into the question

Blue : Red

(×10) 5 : 1 (×10)

50 : 10

Blue pens = 5 × 10 = 50 pens
Red pens = 1 × 10 = 10 pens

There are 50 Blue Pens

Ratio as a fraction

Trees : Flowers

3 : 7

Trees
Flowers
Ratio
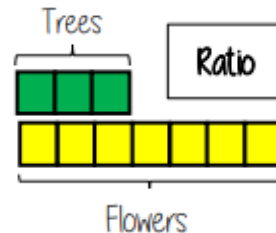
There are **3** parts for trees

Fraction

$$\frac{\text{Number of parts of in group}}{\text{Total number of parts}} = \frac{3}{10}$$

Tree parts **3** + Flower parts **7** = **10**

Proportion – Using Recipes

This is very applicable to real life! It's all about adjusting ingredients in a recipe!

Here are the ingredients needed to make 16 gingerbread men.

Ingredients to make **16** gingerbread men

160 g flour   80g
40 g ginger   20g
110 g butter   55g
30 g sugar   15g

Hamish wants to make 24 gingerbread men. Work out how much of each of the ingredients he needs.

24 = 16 + 8

Find how much of each ingredient he needs for 8 gingerbread men (divide everything by 2!) and add that to your original recipe

80 + 160   240   g flour
20 + 40   60   g ginger
110 + 55   165   g butter
15 + 30   45   g sugar

Keyword/Skill	Definition/Tips
Ratio	Ratio compares the size of **one part** to **another part**. Written using the ':' symbol. 3 : 1
Proportion	Proportion compares the size of **one part** to the size of the **whole**.
Share	Split or divide.
Parts	One cube in the bar model represents one part
Direct proportion	As one amount increases, another amount increases at the same rate
Inverse proportion	When one value **decreases** at the same rate that the other increases.
Best Buys	The product which is the best value for money/cheapest

Standard Form

Keyword/Skill	Definition/Tips
Decimal Numbers	The numbers we use in everyday life are decimal numbers, because they are based on 10 digits (0,1,2,3,4,5,6,7,8 and 9)
Standard Form	A way of writing very large numbers or very small numbers using a number between 1 and 10, multiplied by a power of 10.
Power	The number of times a base number is multiplied by itself.
Index	A small number placed on the upper-right of a base number to inform how many times to multiply by itself.

Converting Small Numbers into Standard Form

3×10^4 Is a number written in standard index form.

Write 3×10^4 as an ordinary number.

3×10^4 can be written as:

$3 \times 10^4 = 3 \times 10 \times 10 \times 10 \times 10$

$= 3 \times 10,000$

$= 30,000$

Converting Large Numbers into Standard Form

Write $15,000,000$ in standard index form.

$15,000,000$ can be written as:

$15,000,000 = 1.5 \times 10,000,000$

$= 1.5 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

$= 1.5 \times 10^7$

What is Standard Form?

Always between 1 and 10 (not including 10)

$1.9 \times 10^7 = 19000000$

Standard index form is also known as standard form. A number is said to be written in standard form when it is written as $A \times 10^n$, where
• A is a number greater than or equal to **1**, but strictly less than **10**, and
• **n** tells us how many places to move the decimal point.

Standard Index Form

$10^3 = 1,000$
$10^2 = 100$
$10^1 = 10$
$10^0 = 1$
$10^{-1} = 0.1$
$10^{-2} = 0.01$
$10^{-3} = 0.001$

Adding and Subtracting in Standard Form

In order to add and subtract numbers in standard index form, you need to convert them into ordinary numbers, do the calculation, and then change them back (if you want the answer in standard form).

$4.5 \times 10^4 + 6.45 \times 10^5$
$= 45,000 + 645,000$
$= 690,000$
$= 6.9 \times 10^5$

$(4.7 \times 10^5) - (3.2 \times 10^4)$
$= 470,000 - 32,000$
$= 438,000$
$= 4.38 \times 10^5$

Multiplying and Dividing in Standard Form

• To multiply powers – you add: $10^5 \times 10^3 = 10^8$

$(2 \times 10^3) \times (3 \times 10^6) = 2 \times 3 \times 10^3 \times 10^6$
$= 6 \times 10^9$

• To divide powers – you subtract: $10^5 \div 10^3 = 10^2$

$(6 \times 10^6) \div (2 \times 10^2) = \dfrac{(6 \times 10^6)}{(2 \times 10^2)}$
$= \dfrac{6}{2} \times \dfrac{10^5}{10^3} = 3 \times 10^2$
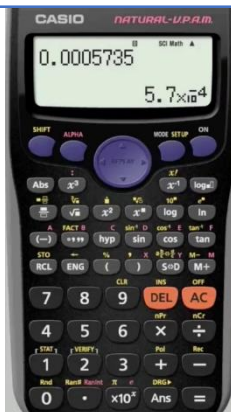
The Calculator Guide

Change numbers to standard form

Write the number 0.0005735 in standard form to two significant figures.

Press SHIFT, the SET UP, then press 7 for SCI mode.

Change the number of significant figures to 2.

Input the number 0.0005735 and press =.

The answer of 5.7 x 10⁻⁴ is displayed.

Other Topics/Units this could appear in:
• Sequences
• Use of Calculator
• Estimation

23

Multiplication Law

$$a^m \times a^n = a^{m+n}$$

Ex1: $5^4 \times 5^9 = 5^{4+9} = 5^{13}$

Ex2: $3a^5 \times 4a^6 = 3 \times 4 \times a^{5+6} = 12a^{11}$

Division Law

$$a^m \div a^n = a^{m-n}$$

Ex1: $8^{12} \div 8^7 = 8^{12-7} = 8^5$

Ex2: $12a^{18} \div 6a^{10} = (12 \div 6) \times (a^{18-10}) = 2a^8$

Brackets Law

$$(a^m)^n = a^{m \times n}$$

Ex1: $(10^2)^4 = 10^{2 \times 4} = 10^8$

Ex2: $(5a^8)^2 = 5^2 \times a^{8 \times 2} = 25a^{16}$

Power of Zero

Anything to the power of zero is equal to 1.

$$a^0 = 1 \qquad 8^0 = 1 \qquad 129487893^0 = 1$$

Powers of 10

$10^6 = 1,000,000$

$10^5 = 100,000$

$10^4 = 10,000$

$10^3 = 1,000$

$10^2 = 100$

$10^1 = 10$
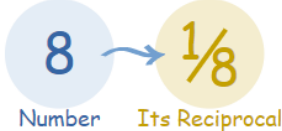
$10^0 = 1$

$10^{-1} = 0.1$

$10^{-2} = 0.01$

$10^{-3} = 0.001$

$10^{-4} = 0.0001$

Keyword/Skill	Definition/Tips
Indices	Powers e.g. 6^3, 10^5, x^4
Reciprocal	The reciprocal of a number is: 1 divided by the number.
Index Form	Writing numbers in terms of powers E.g. $6 \times 6 \times 6 \times 6 = 6^4$ <- This is in index form
Index Laws	A collection of rules we use for simplifying expressions
Notation	A system of symbols used to represent something
Standard Index Form	A shorthand way of writing numbers (usually very large or very small numbers)
Powers of 10	A power of 10 is any of the integer powers of the number 10

Other Topics/Units this could appear in:

- Negative & Fractional Index Laws
- Surds including rationalising
- Algebraic Fractions
- Algebraic Proof
- Standard Form
- Expanding & Simplifying
- A-Level – Core – Algebra & Functions

Expanding Single Brackets

When you are expanding brackets you need to multiply all the terms inside the bracket by the term on the outside.
The grid method is useful when we are expanding brackets.

Example: Expand $3(a + 4)$

$3(a + 4)$

x	a	+ 4
3	3a	12

= **3a + 12**

Example: Expand $y(3y - 5)$

$y(3y - 5)$

x	3y	- 5
y	$3y^2$	- 5y

= **3y² - 5y**

Expanding Pairs of Single Brackets

Example: Expand & Simplify $4(a - 2) + 3(2a + 5)$

Expand each bracket separately and then simplify your answer:

$4(a - 2)$

x	a	- 2
4	4a	- 8

4a – 8

$3(2a + 5)$

x	6a	+ 5
3	6a	15

6a + 15

Then simplify: 4a – 8 + 6a + 15 = **10a + 7**

Factorising Expressions

Factorising is the opposite of expanding. You factorise an expression by first finding the highest common factor of the terms in the expression. This goes outside of the brackets. Divide each term by the highest common factor to find the new terms inside the brackets.

Example: Factorise $10x - 15$

HCF of 10x and 15 is 5. $10x ÷ 5 = 2x$
$15 ÷ 5 = 3$

= **5(2x – 3)**

The highest common factor is not always a number. Sometimes it is a letter!

Example: Factorise $x^2 + 5x$

The HCF of $x^2 + 5x$ is x. $x^2 ÷ x = x$
$5x ÷ x = 5$

= **x(x + 5)**

Exams!
- Check your answer by expanding it, you should get the expression from the question.

Keyword/Skill	Definition/Tips
Expression	One or a group of symbols representing a number or a value. Can contain numbers, variables & operations
Variable	A symbol for a number we do not know yet
Simplify	To reduce an expression to the smallest number of terms.
Expand	To multiply out terms to remove the brackets () (Opposite of **factorise**)
Coefficient	A number used to multiply a variable. Coefficient — 4, Variable — x in $4x$
Factor	An integer that divides the number exactly leaving no remainder
Factorise	Write an expression as a product of its factors. (Opposite of **expanding**)
Power/Index	The number of times a number is multiplied by itself. E.g. 10^3 <-This means multiply 10 by itself 3 times -> 10 x 10 x 10
Quadratic	An expression where the highest power is 2 Ex: x^2
Term	A single number or a variable
Highest Common Factor (HCF)	The highest number or variable that divides exactly into two or more numbers or variables

Other Topics/Units this could appear in:
- Forming and Solving Equations
- Quadratics
- Expanding & Factorising (Working Above)
- Algebraic Fractions
- Algebraic Proof
- Simultaneous Equations

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Expanding Double Brackets

When expanding double brackets, we can still use the grid method to help us. You will also need to simplify your answer at the end

Ex1: Expand (a + 4)(a + 5)

(a + 4)(a + 5)

x	a	+ 4
a	a^2	4a
+5	5a	20

= a^2 + 4a + 5a + 20

= **a^2 + 9a + 20**

Make sure you are careful when you are simplifying your answer when negatives are involved.

Ex2: Expand (y + 3)(y − 6)

(a + 4)(a + 5)

x	y	-6
y	y^2	-6y
+3	3y	-18

= y^2 – 6y + 3y -18

= **y^2 – 3y - 18**

If you need any help with simplifying expressions, you can look back at the '**Working Towards Unit 6 – Expressions & Substitution**

Factorising into Double Brackets

Factorising into double brackets will always involve quadratic expressions.

Ex1: Factorise x^2 + 5x + 6

When factorising into double brackets, you need to find two numbers that add together to make 5 and multiply to get 6.

$$x^2 + 5x + 6$$

__ x __ = 6
__ + __ = 5

List the factors of 6 and see which ones add to make 5.

1, 6   2, 3

Out of these pairs, 2 and 3 add together to make 5.

2 x 3 = 6
2 + 3 = 5

Once you have these numbers, you put them into double brackets.
The first term of each bracket is whatever the variable is in the question because you need them to multiply to make x^2 (if the variable is x).
In this example it is x.

(x + 2)(x + 3)

Keyword/Skill	Definition/Tips
Expression	One or a group of symbols representing a number or a value. Can contain numbers, variables & operations
Variable	A symbol for a number we do not know yet
Simplify	To remove unnecessary terms and numbers
Expand	To multiply out terms to remove the brackets () (Opposite of **factorise**)
Coefficient	A number used to multiply a variable
Factor	An integer that divides the number exactly leaving no remainder
Factorise	Write an expression as a product of its factors. (Opposite of **expanding**)
Power/Index	The number of times a number is multiplied by itself. E.g. 10^3 <-This means multiply 10 by itself 3 times -> 10 x 10 x 10
Quadratic	An expression where the highest power is 2 Ex: x^2
Term	A single number or a variable
Highest Common Factor (HCF)	The highest number or variable that divides exactly into two or more numbers or variables

Coefficient   Variable

4x

Other Topics/Units this could appear in:
- Forming and Solving Equations
- Quadratics
- Expanding & Factorising (Working Above)
- Algebraic Fractions
- Algebraic Proof
- Simultaneous Equations

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When we are solving equations, you need to figure out the value of the variable in the equation

Variable

$$4x - 7 = 5$$

You need to carry out the inverse operations to find the value of the variable.

Remember whatever operation you do to one side of the equals sign, you must do the same to the other to keep it balanced. Think of it like a set of scales:
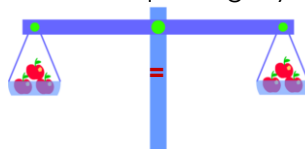
If I remove one apple from the left side, to keep it balanced I must do the same to the right side!
We need to think like this when we solve equations.

Keyword/Skill	Definition/Tips
Expression	One or a group of symbols representing a number or a value. Can contain numbers, variables & operations
Equation	Statement using an equals sign, to show two **expressions** are equal. $$4x - 7 = 5$$ Terms
Variable	A symbol for a number we do not know yet
Operations	The four basic operations in maths: addition, subtraction, multiplication & division
Inverse Operations	The **operation** that reverses the effect of another operation. **Addition & subtraction are inverse operations** **Multiplication & division are inverse operations**
Simplify	To remove unnecessary terms and numbers
Formula	A rule or fact written using mathematical symbols
Solve	To find the answer/value of something
Rearranging Formulae	Use inverse operations on both sides of the formula until you find the expression/equation for the letter you need.
'Subject of'	A certain variable needs to be by itself on one side of the equal sign Example: x = 4y + 10 x is the subject of this formula

One – Step Equations
These are equations where you only need to do one inverse operation to solve the equations:

Ex1

$y + 14 = 20$
 -14   -14
$y \quad = 6$

Ex2

$x - 120 = 80$
 +120   +120
$x \qquad = 200$

Ex3

$3n = 12$
÷3   ÷3

$n = 4$

Ex4

$\frac{k}{2} = 16$
x2   x2

$k = 32$

Two – Step Equations
These are equations where you need to do two inverse operations to solve the equations:

Ex1

$4x - 3 = 25$
   +3   +3
$4x = 28$
   ÷4   ÷4
$x = 7$

Ex2

$\frac{y}{5} + 6 = 14$
   -6   -6
$\frac{y}{5} = 8$
   x5   x5
$y = 40$

Expanding and Solving Equations
You will also need to use skills you have already learnt to solve some equations. (If you need help expanding brackets look back at the **Crossover Unit 19 – Expand & Simplify** knowledge organiser).

Ex1

$3(x + 4) = 27$
Expand the brackets first
$3x + 12 = 27$
   -12   -12
$3x = 15$
   ÷3   ÷3
$x = 5$

Other Topics/Units this could appear in:
- Forming and Solving Equations
- Expanding and Factorising
- Simultaneous Equations
- Algebraic Fractions
- Algebraic Proof
- Rearranging Equations

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Crossover Unit 21 & 22– Solving Equations & 'Subject of'

Keyword/Skill	Definition/Tips
Expression	One or a group of symbols representing a number or a value. Can contain numbers, variables & operations
Equation	Statement using an equals sign, to show two **expressions** are equal. $4x - 7 = 5$
Function	A mathematical relationship between two values
Operations	The four basic operations in maths: addition, subtraction, multiplication & division
Inverse Operations	The **operation** that reverses the effect of another operation. **Addition & subtraction are inverse operations** **Multiplication & division are inverse operations**
Simplify	To remove unnecessary terms and numbers
Formula	A rule or fact written using mathematical symbols
Solve	To find the answer/value of something
Rearranging Formulae	Use inverse operations on both sides of the formula until you find the expression/equation for the letter you need.
'Subject of'	A certain variable needs to be by itself on one side of the equal sign Example: x = 4y + 10 x is the subject of this formula

Equations With an Unknown Variable on Both Sides

Sometimes equations may have variables on each side of the equals sign. There is one extra step you need to do before you apply the same method for solving two-step equations.
The extra step is whichever side has the smaller unknown variable, subtract that from both sides of the equation. You can then continue with the same method of using the inverse operations to solve the equation

Ex1
$$8x + 12 = 5x + 30$$
Here we will subtract $5x$ from both sides as $5x$ is the smaller variable

$$8x + 12 = 5x + 30$$
-5x   -5x

$$3x + 12 = 30$$
-12   -12
$$3x = 18$$
÷3   ÷3
$$x = 6$$

Making the 'Subject of' (Rearranging Formulae)

In these types of questions, it will ask you to make a certain variable the 'subject of' the equation or formula. What this means is you need to use the solving equation method to isolate the variable it is asking for:

Ex1 Make y the subject of this formula:
$$y + 81 = x + 100$$
-81   -81
Here y is the variable we want to isolate (have by itself on one side of the equals sign).
$$y = x + 19$$

Ex2 Make x the subject of this formula:
$$C = 4x + 5y$$
-5y   -5y
$$C - 5y = 4x$$
÷4   ÷4
When you are dividing an expression, just write it as a fraction
$$\frac{C-5y}{4} = x$$

Other Topics/Units this could appear in:
- Forming and Solving Equations
- Expanding and Factorising
- Simultaneous Equations
- Algebraic Fractions
- Algebraic Proof
- Rearranging Equations

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Crossover Unit 23 - Averages

Calculating the Mean

The mean is the most commonly used measure of average. The mean is the total amount split evenly.

For example take this data set:
10. 12. 4. 2
I can represent this as a bar model:

10	12	4	2

28
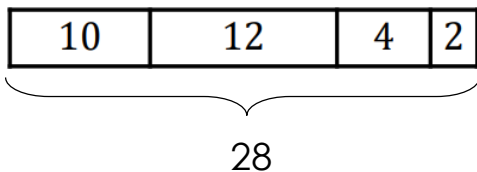
The total is 28. I then want to split this amount evenly into how many values there are. In this case I need to split 28 into 4 even values.

7	7	7	7

28
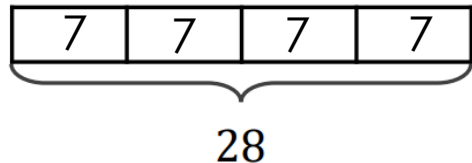
Therefore the mean is 7!

You can also find missing values from data sets when given the mean.

Example:
Three children have a mean of 150cm.
Two children have a height of 155cm and 158 cm.
What is the height of the third child?

I can draw a bar model to help me out:

450cm

150 cm	150 cm	150 cm
155 cm	158 cm	? cm
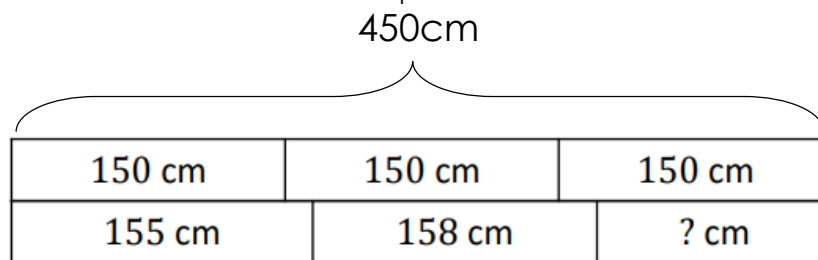
I can see that the total would be 450cm so I can figure out the missing total:
155cm + 158cm = 313cm   450cm – 313cm = **137cm**

Calculating the Median

- If you place a set of numbers in order, the median number is the middle one.
  10 12 13 15 16 23 26

  15 is the middle number so it is the median.

- If there are two middle numbers the median is the mean of this
  10 12 13 15   16 17 23 26
  Here you need to find the number in the middle of 15 and 16:
  15 + 16 = 31   31÷ 2 = 15
  Therefore, 15.5 is the median.

Calculating the mode

- The mode is the value that occurs most often

Example:

1,3,3,4,7,8

The number 3 occurs the most so the mode is 3.

Calculating the Range

The range is the difference between the highest and lowest values in a set of numbers

Find the range of:

23, 27, 40, 18, 25

The largest value is 40 and the smallest value is 23.
40 – 23 = 17

Keyword/Skill	Definition/Tips
Discrete	Discrete data can only have a finite or limited number of possible values
Continuous	Continuous data can have an infinite number of possible values within a selected range
Quantitative	Quantitative data that can be counted (discrete), quantitative date that can be measured (continuous)
Qualitative	Information that describes something
Average	A calculated 'central value' of a set of numbers
Mean	The mean amount is the total amount split evenly
Median	Place the numbers in value order and then find the middle number. When there are two numbers in the middle we average them.
Mode	The number which appears most often in a set of numbers
Range	The difference between the highest and lowest values
Frequency	How often something happens.
Table	Information (such as numbers and descriptions) arranged in rows and columns.
Data	A collection of facts, such as numbers, words, measurements, observations or even just descriptions of things.
Proportion	A part, share, or number considered in comparative relation to a whole.
Univariate Data	Univariate means "one variable" (one type of data).

Other Topics/Units this could appear in:

- Averages
- Averages from Tables
- Sampling
- Histograms

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Crossover Unit 24 – Averages From a Table

Finding the mode from a table

- The mode is the value that occurs most often.
- The mode is the only average that can have no value, one value or more than one value.
- When finding the mode, it helps to order the numbers first.

In this frequency table, the mode is the value with the highest frequency:

Shoe size	5	6	7	8	9
Frequency	2	5	11	4	1

The modal size is 7 because more people wear size 7 than any other size.

Finding the modal class from a grouped frequency table

The following table shows the weights of children in a class.

Mass (m) kg	Frequency
$30 \leq m < 40$	7
$40 \leq m < 50$	6
$50 \leq m < 60$	8
$60 \leq m < 70$	4

The modal class is the class that has the highest frequency. In this case the modal class is:

$$50 \leq m < 60$$

Total Frequency

score	frequency
1	19
2	18
3	12
4	19
5	9
6	23

Andy throws a dice in an investigation. How would you work out the total number of times he has thrown the dice?

100

You can work out the **total frequency** by adding up each frequency.

Finding the median from a Table

The table below shows the average number of hours a group of 200 students spend watching TV per week to the nearest hour.

hours	frequency	cumulative frequency
0	8	8
1	16	24
2	33	57
3	75	132
4	44	176
5	8	184
6	16	200

The 105.5th value which is the **median** would be in this category.

To work out the median value, first work out the **cumulative frequency column**.

- There are 200 data items, so **the median** must lie between items 100 and 101

$$\text{Median} = \frac{n+1}{2} \qquad \text{Median} = \frac{200+1}{2} = \frac{201}{2} = 105.5$$

The median value would be the **105.5th value** in the table. Then use this to help you to work out where this data would lie using the **cumulative frequency column**

Calculating the Mean from a Table

- The **mean** is found by adding up all the numbers and dividing by how many numbers there are.

To find the mean in this example, the total number of goals must be found and then divided by the number of games.

Number of Goals (x)	Frequency (f)	fx
0	2	0 x 2 = 0
1	2	1 x 2 = 2
2	5	2 x 5 = 10
3	1	3 x 1 = 3
Total	10	15

Total number of football games

Total number of goals.

- From the table, we can see that for 2 games, no goals were scored. This makes a grand total of zero goals so far.
- The rest of the total amount of goals can be worked out in this way, by multiplying goals **(x)** by the frequency **(f).** Call this column **fx** (f multiplied by x)

The total number of goals is 15. There were 10 football games so
15 ÷ 10 = 1.5
The mean number of goals is 1.5 goals per game.

Remember to divide fx by the total of the frequencies, not by the amount of different items of data – the correct answer here is $\frac{15}{10}$ not $\frac{15}{4}$

x	f	fx
1	15	15
2	27	54
3	8	24
4	5	20
TOTALS:	**55**	**113**

Further Example

The table shows the number of parking spaces per house in a street. Work out the **mean number of spaces**

Mean = $\frac{113}{55}$ = **2.05...**

Finding the Range
The **range** is the **difference between the highest and lowest values** in a set of numbers.
<- Using this table as an example:
The highest value is 4 and the lowest value is 1. Range = 4 – 1 = 3
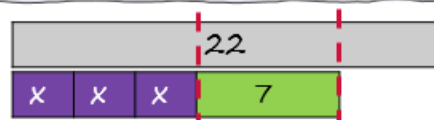
Keyword/Skill	Definition/Tips
Sample	A selection taken from a larger group 'the population' that will let you find out things about a larger group.
Population	The whole group being studied
Stem and Leaf	A plot where each data value is split into a 'leaf' and a 'stem'. 'Stem' values are listed down and 'leaf' values are listed next to them.
Pie Chart	Graph using a divided circle where each section represents part of the total.
Estimate	To make an approximate or rough calculation often based on rounding.
Primary	Primary data is data that is collected by a data researchers from first hand sources.
Secondary	Secondary data is data gathered from studies, surveys or experiments run by other people or for other research.
Interval	An interval is between two points of values. An interval may or may not include start and end points.
Survey	To gather information by individual samples so we can learn about the whole thing.
Sort	To arrange or group in a special way (such as by size, type or alphabetically).
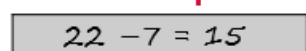
Other Topics/Units this could come up in:

- Averages
- Mode, median, range and mean
- Cumulative frequency

31
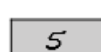
Solving Inequalities

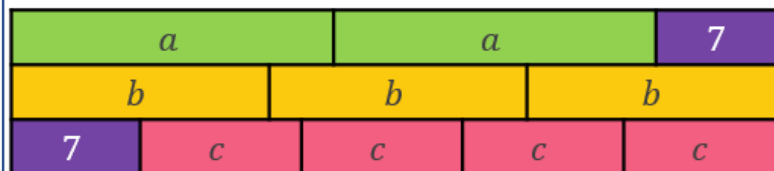Solving an inequality means finding the range of values that **satisfy** the inequality.
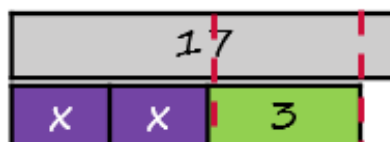
$3x + 7 < 22$

$3x < 15$

$22 - 7 = 15$

$x < 5$

We can also use bar models to form new inequalities.

e.g. $2b < 2a$
           $4c + 7 = 2a + 7$
           $3b > 4c$

$2x + 3 < 17$

$17 - 3 = 14$

$2x < 14$

$x < 7$

$2x + 3 < x + 17$

$2x < x + 14$

$x < 14$

We can use bar models to represent the size of each side of the inequality. This allows us to see how much bigger/smaller one side is compared to the other. It also allows us to make changes to both sides in order to solve the inequality.

Keyword/Skill	Definition/Tips
Product	Means multiply
Prime number	A number that has exactly two **factors**
Integer	Whole number including 0 and negative numbers. No fractions or decimals.
Inequality	Compares two values showing if one is less than, greater than or not equal to each other.
Greater than	One number is BIGGER than another number.
Less than	One number is SMALLER than another number.
Equal to	Two things have the SAME value.
Equation	Says that two things are equal. (1 + 1 = 2).
Satisfy	A value that solves an equation. E.g. $2x + 1 = 9$ x =4 so x=4 satisfies the equation.
Variable	A symbol for a number we don't know yet, usually a letter.
Coefficient	A number used to multiply a variable. E.g. $6y = 6 \times y$. y is the variable and 6 is the coefficient.
Inverse	Opposite of (i.e. x and ÷, + and -)
Solve	Find all of the values that satisfy the inequality.

Inequality Symbols

Equality and Inequality

larger > smaller
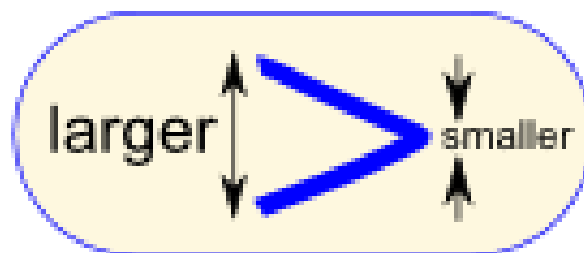
= equal

≠ not equal

> greater than

≥ greater than or equal

< less than

≤ less than or equal

Examples:

x < 5   means x is less than 5

p ≥ 100   means p is greater than or equal to 100

y > -2   means y is greater than -2

Other Topics/Units this could appear in:

- Numbers, powers, roots, decimals and rounding
- Expressions and substituting into a formula
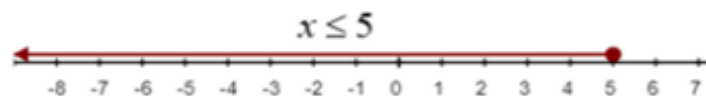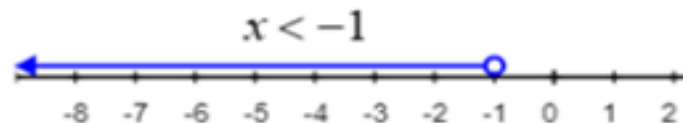- Expand and simplify
- Solving equations

Keyword/Skill	Definition/Tips
Integer	Whole number including 0 and negative numbers. No fractions or decimals.
Inequality	Compares two values showing if one is less than, greater than or not equal to each other.
Greater than	One number is BIGGER than another number.
Less than	One number is SMALLER than another number.
Equal to	Two things have the SAME value.
Equation	Says that two things are equal. (1 + 1 = 2).
Satisfy	A value that solves an equation. E.g. $2x + 1 = 9$ $x = 4$ so $x=4$ satisfies the equation.
Variable	A symbol for a number we don't know yet, usually a letter.
Coefficient	A number used to multiply a variable. E.g. $6y = 6 \times y$. y is the variable and 6 is the coefficient.
Inverse	Opposite of (i.e. x and ÷, + and -)
Solve	Find all of the values that satisfy the inequality.

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Inequalities Symbols on a Number Line

Symbol	Circle	Direction of Arrow
<	Open ○	Left
>	Open ○	Right
≤	Closed ●	Left
≥	Closed ●	Right

We use open and/or closed circles to represent inequalities on a number line. A closed circle means that the number **is** included in the represented group of values. An open circle means that the number **is not** included in the represented group of values.

Examples:

$x > 5$

$x < -1$

$x \geq 3$

$x \leq 5$

Keyword/Skill	Definition/Tips
Integer	Whole number including 0 and negative numbers. No fractions or decimals.
Inequality	Compares two values showing if one is less than, greater than or not equal to each other.
Greater than	One number is BIGGER than another number.
Less than	One number is SMALLER than another number.
Equal to	Two things have the SAME value.
Equation	Says that two things are equal. (1 + 1 = 2).
Satisfy	A value that solves an equation. E.g. 2x + 1 = 9 x = 4 so x=4 satisfies the equation.
Variable	A symbol for a number we don't know yet, usually a letter.
Coefficient	A number used to multiply a variable. E.g. 6y = 6 x y . y is the variable and 6 is the coefficient.
Inverse	Opposite of (i.e. x and ÷, + and -)
Solve	Find all of the values that satisfy the inequality.

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Frequency Diagrams

Frequency Diagrams

A **frequency diagram**, often called a line graph or a frequency polygon, shows the frequencies for different groups of data.

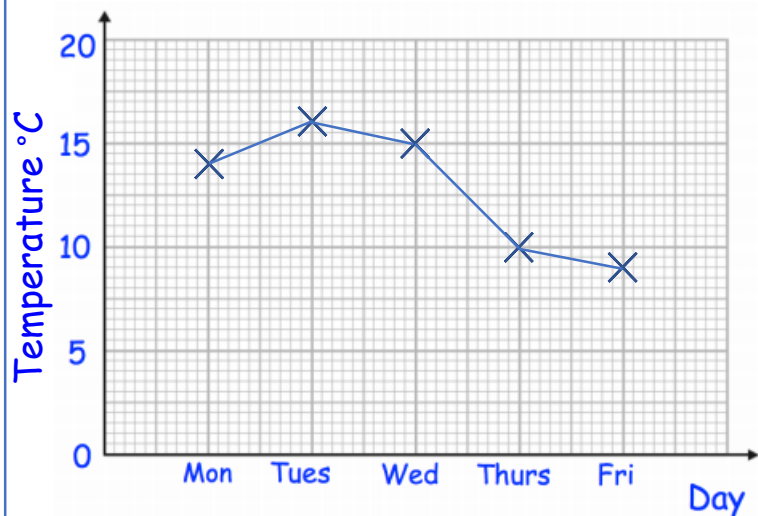### Line Graphs (for discrete data)
Example
The table below shows the average temperature in Belfast each day.

	Belfast
Monday	14°C
Tuesday	16°C
Wednesday	15°C
Thursday	10°C
Friday	9°C

The line graph below shows the results of the table.

A point has been plotted at the correct frequency for each day. And the points are joined with straight lines.

Frequency Polygons (for continuous grouped data)
Example
The table gives information about the distances thrown, in metres, at a school sports day.

Time (seconds)	Frequency
$0 < d \leq 2$	5
$2 < d \leq 4$	10
$4 < d \leq 6$	21
$6 < d \leq 8$	18
$8 < d \leq 10$	1

The line graph below shows the results of the table.

A point has been plotted at the correct frequency for each day, above the **midpoint of each group**. And the points are joined with straight lines.
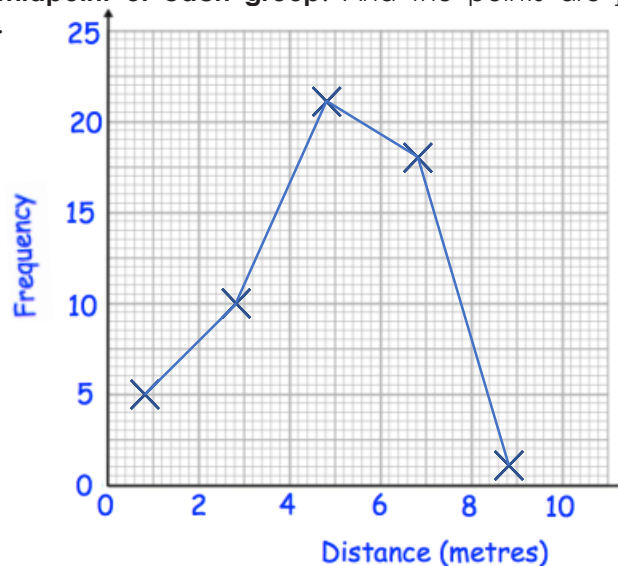
Keyword/Skill	Definition/Tips
Discrete	Discrete data can only have a finite or limited number of possible values.
Continuous	Continuous data can have an infinite number of possible values within a selected range.
Qualitative	Data categories like food, clothes and hobbies.
Quantitative	Data that can be counted or measured.
Data	Collection of information.
Sample	Section of a whole group.
Population	Whole set of individuals, items or data from which a statistical sample is drawn.
Frequency	The number of times an item appears in a set of data.

Exams!
When drawing line graph or frequency polygon you must draw straight lines between the points. Not curved lines.
A polygon is a shape with straight edges, so your graph needs straight edges too.
You **do not** join the first and last point together

Other Topics/Units this could appear in:

- Probability
- Probability Trees
- Cumulative Frequency & Box Plots
- Histograms
- Representations of Data

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Scatter Graph

A scatter graph is a diagram where points are plotted to show the relationship (correlation) between two variables.

The value of one variable is shown along the x-axis and the values of the second variable is shown on the y-axis.
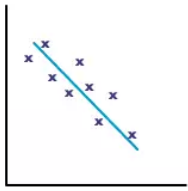
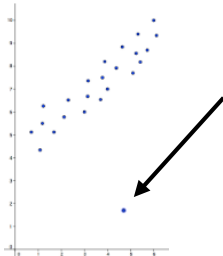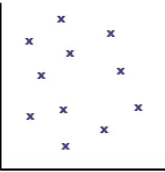The scatter graph to the right shows the temperature compared with the number of ice-creams sold.
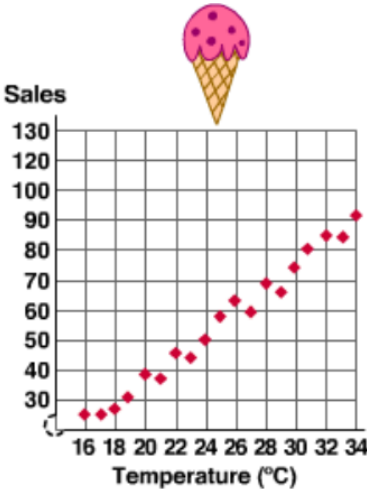
Positive Correlation
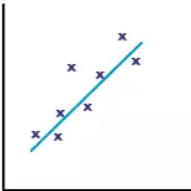
Negative Correlation

No Correlation

Outlier

Time – series graph

Time series graphs show data fluctuations over time and are used to predict trends, cycles and seasonality.

Example

The time series graph below shows the amount of money invested by a company between 2005 and 2014.
The general trend of the graph is an increase in the amount of money invested over time.
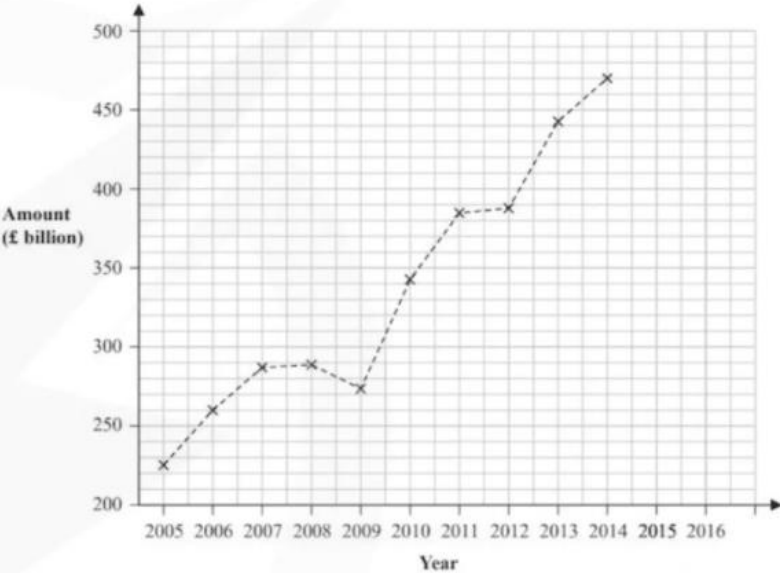
Keyword/Skill	Definition/tip
Scatter graph	A diagram with points plotted to show a relationship between two variables.
Variable	A quantity that can change or vary, taking on different values.
Line of best fit	A straight line that best represents the data on a scatter graph.
Correlation	A relationship between two or more things.
Positive correlation	Both variables increase or both variables decrease.
Negative correlation	One variable increases and the other decreases or vice versa.
No correlation	There is no relationship between the two variables.
Outlier	A value that lies outside most other values.
Time-Series	A line graph of repeated measurements taken over regular time intervals.
Trend	A direction in which something is changing.

Other topics/Units this could appear in:

- Coordinate Geometry
- A-Level Statistics - Correlation

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Exams!
- When interpreting scatter graphs always refer to what the graph is showing. For example "it has positive correlation so the hotter it is the more ice creams that are sold"

Exams!
- Once all points have been plotted, ALWAYS draw a line of best fit. (Scatter graph)
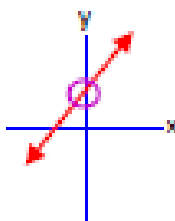- Use line of best fit to estimate answers.

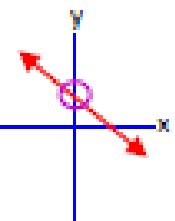$$y = mx + c$$

Gradient   y-intercept

When gradient is positive.   When gradient is negative

Parallel Lines have the SAME gradient.

y = 2x + 1
y = 2x -3

How to find the gradient of a line.

$$gradient = \frac{change\ in\ y}{change\ in\ x} = \frac{4}{2} = 2$$
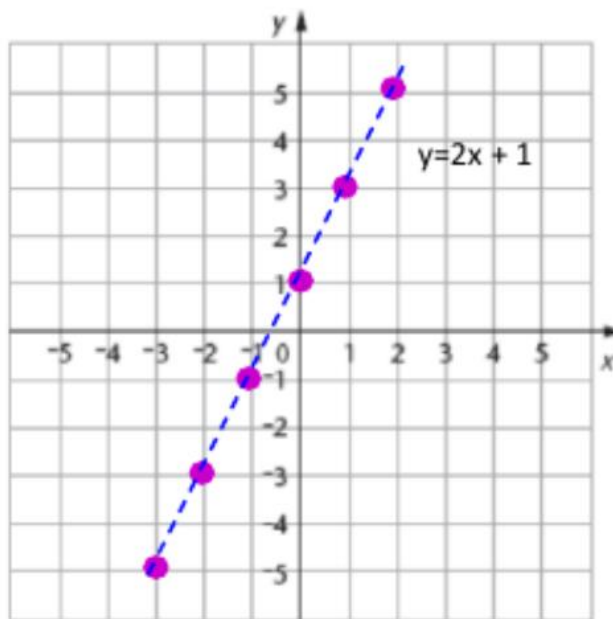
4 units up

2 units across

How to complete a table and plot a straight line graph.

1) Complete the table by substituting the x values into the equation y = 2x + 1.
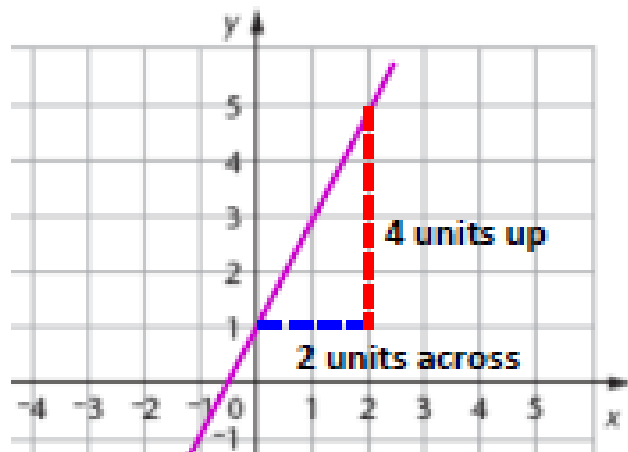*(This will give you the corresponding y values)*

X	-3	-2	-1	0	1	2
y	-5	-3	-1	1	3	5

2) Plot the co-ordinates: (2, 5) (1, 3) (0, 3) (-1, -1) (-2, -3) (-3, -5)

y=2x + 1

Keyword/Skill	Definition/Tips
Linear	A graph that makes a straight line. Often written in the form y = mx + c
Graph	A drawing or diagram used to show information.
Distance	A measurement of how far.
Time	Minutes, Seconds, Hours, Days, Weeks, Months etc.
Coordinate	Shown as a pair (2, 4) to show a position on a set of axes.
Quadrant	Any of the 4 areas created by the x and y axes.
Real-Life Graphs	A graph that shows events of real life – distance and time.
Gradient	How steep a line is.
Y-Intercept	Where the line crosses y-axis
Function	A mathematical relationship between two values.
Solution	A value that makes an equation true.
Parallel	When two lines are always the same distance apart and never meet.

Other Topics/Units this could appear in:

- Coordinate Geometry
A-Level – Core:
- Algebra & Functions
- Coordinate Geometry in the xy plane
A Level – Statistics:
- Correlation

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$ax^2 + bx + c$

c = **y-intercept** (where the graph CUTS the Y axis)

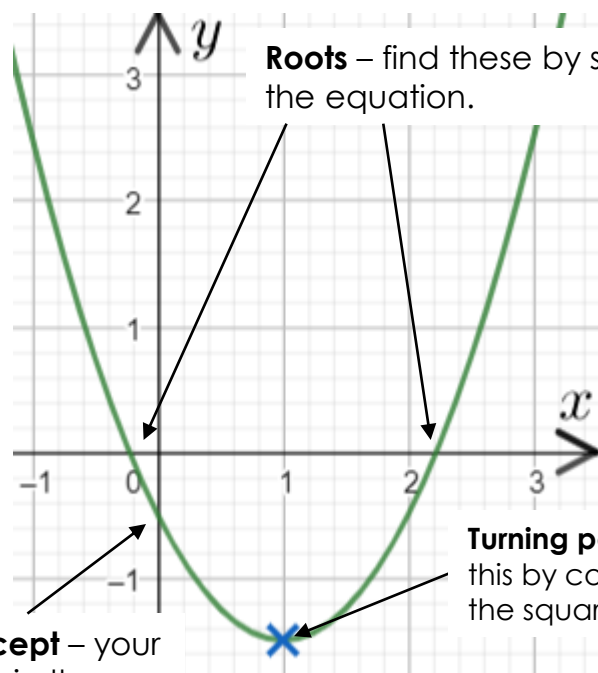A quadratic graph is called a parabola.

They are symmetrical.

When **a** is positive

When **a** is negative

Features of a Quadratic Graph

Roots – find these by solving the equation.

Turning point – find this by completing the square.

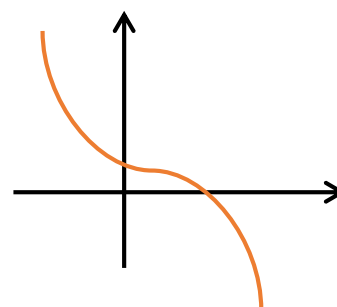**y-intercept** – your c value in the equation

Other Graphs you Need to Know:

Cubic: $ax^3 + bx^2 + cx + d$
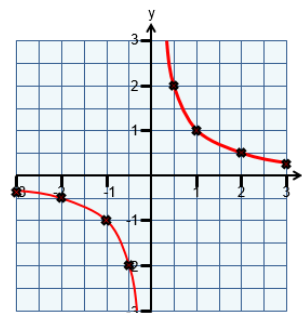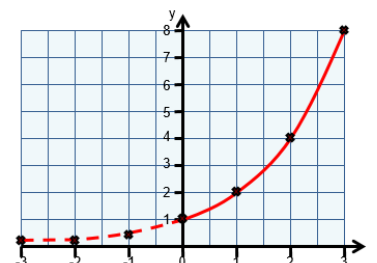
When **a** is positive
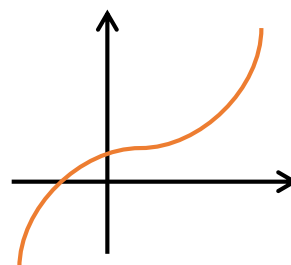
When **a** is negative

Reciprocal: $y = \frac{1}{x}$

Exponential: $y = 2^x$

| Keyword/Skill	Definition/Tips
Quadratic	An equation that has an x^2 as the highest power.
Function	A mathematical relationship between two values.
Solve	To find a value that makes an equation true.
Expand	To multiply out one or more sets of brackets.
Factorise	To put the expression back into brackets.
Simplify	To make an expression easier by expanding or factorizing.
Graph	A drawing or diagram used to show information.
Curve	A line that is not straight
Coefficient	A number which multiples a variable…..2 is the coefficient of x in 2x.
Cubic	An equation that has an x^3 as the highest power.

Other Topics/Units this could appear in:

- Graphs of Trig Functions
- Using Graphs of Circles, Cubes and Quadratics
- Gradient and Area Under Graphs

A-Level – Core:
- Algebra & Functions

38

Crossover Unit 31 – Coordinate Geometry

The Four Quadrants.

When plotting coordinates, (x,y), x represents how far along the x-axis (left or right) the point is, and y represent how far along the y-axis (up or down) the point is. See the co-ordinates labelled below.

A (4,7)

(-6,-3) B
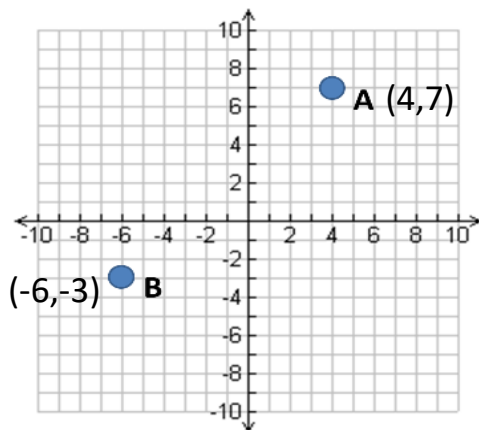
How to Find the Midpoint of a Line Segment

Add the x coordinates and divide by 2.
Add the y coordinates and divide by 2.

Example:

Find the midpoint between (2, 1) and (6, 9)

$$\frac{2+6}{2} = 4 \quad \text{and} \quad \frac{1+9}{2} = 5$$

So the midpoint is (4, 5).

Finding the Equation of a Line

The general equation of a line looks like this: **y = mx + c**

Gradient   y-intercept

Example:
Find the equation of the line:

Gradient = $\frac{change\ in\ y}{change\ in\ x}$

Gradient = $\frac{4}{2} = 2$

y = 2x + c
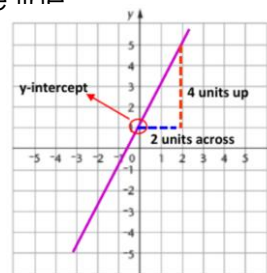
The y-intercept is where the line crosses the y-axis, you can see this from the graph. Therefore the equation is:
y = 2x + 1

You may not be given the graph but instead get two points from the line.

Example:
A line passes through the points (4, 7) and (8, 19). Find the equation of the line.

Gradient = $\frac{change\ in\ y}{change\ in\ x}$

Gradient = $\frac{19-7}{8-4} = \frac{12}{4} = 3$ y = 3x + c

Then substitute in one of the points to find the value of c
Sub (4, 7): 7 = 3(4) + c
7 = 12 + c
c = -5

So the equation is: y = 3x - 5

Using the Gradient of a Line.

The gradient of a line is how steep it is.

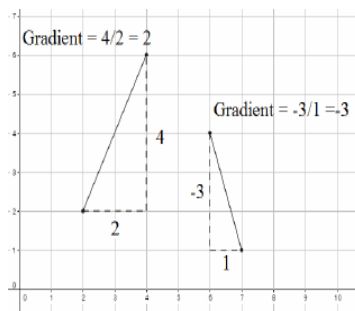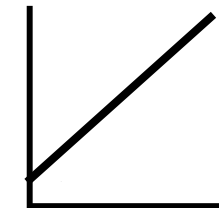Gradient = $\frac{change\ in\ y}{change\ in\ x}$

The gradient can be positive (going up) or negative (going down).

In the equation $y = 2x + 5$, the gradient is 2.
In the equation $y = -3x - 10$, the gradient is -3.

If two lines are parallel, they will have the SAME gradient.
Example:
$y = 2x + 5$ and $y = 2x - 6$ are parallel because they both have a gradient of 2

Keyword/Skill	Definition/Tips
Linear	A graph that makes a straight line. Often written in the form y = mx + c
Graph	A drawing or diagram used to show information.
Coordinate	Shown as a pair (2, 4) to show a position on a set of axes.
Quadrant	Any of the 4 areas created by the x and y axes.
Gradient	How steep a line is.
Y-Intercept	Where the line crosses the y-axis
Function	A mathematical relationship between two values.
Solution	A value that makes an equation true.
Parallel	When two lines are always the same distance apart and never meet.
Midpoint	The point that is exactly mid way between to given points.

Other Topics/Units this could appear in:

- Coordinate Geometry
A-Level – Core:
- Coordinate Geometry in the xy plane

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Speed

Speed is a compound measurement combining **distance** and **time**

Example
A car travels **120 miles** in **2 hours and 30 minutes**. Calculate the average **speed** of the car in **mph**.

The units of **speed** are **miles per hour** so the **distance** must be in **miles** and the **time** must be in **hours**.
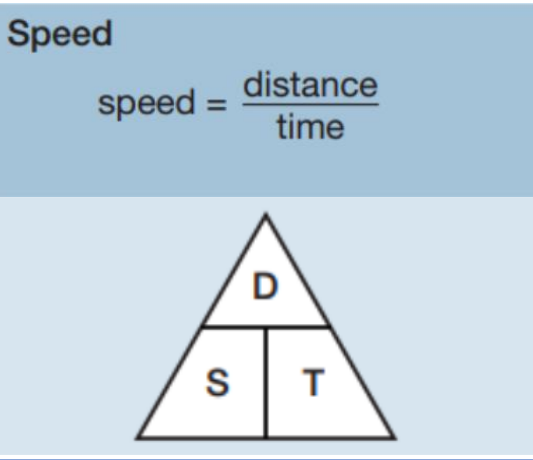
Distance = 120 miles
Time = 2.5 hours

$$Speed = \frac{Distance}{Time}$$

$$Speed = \frac{120}{2.5}$$

$$Speed = 48mph$$

The formula triangles can be used to help rearrange this equation to calculate distance or time.

Speed

$$speed = \frac{distance}{time}$$

Density

Density is a compound measurement combining **mass** and **volume**

Example
The **mass** of a metal block is **1.2kg** its **volume** is **40cm³**. Calculate the **density** of the metal in **g/cm³**.

The units of **density** are **g/cm³** so the **mass** must be in **grams** and the **volume** must be in **cm³**.
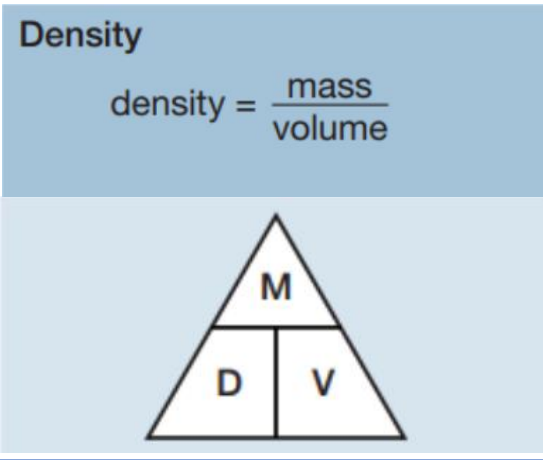
Mass = 1200 grams
Volume = 40cm³

$$Density = \frac{Mass}{Volume}$$

$$Density = \frac{1200}{40}$$

$$Density = 30 \, g/cm^3$$

The formula triangles can be used to help rearrange this equation to calculate mass or volume.

Density

$$density = \frac{mass}{volume}$$

Pressure

Pressure is a compound measurement combining **force** and **area**

Example
Find the **pressure** exerted by a **force** of **240 Newtons** on an area of **3000cm²**. Give your answer in **N/m²**.

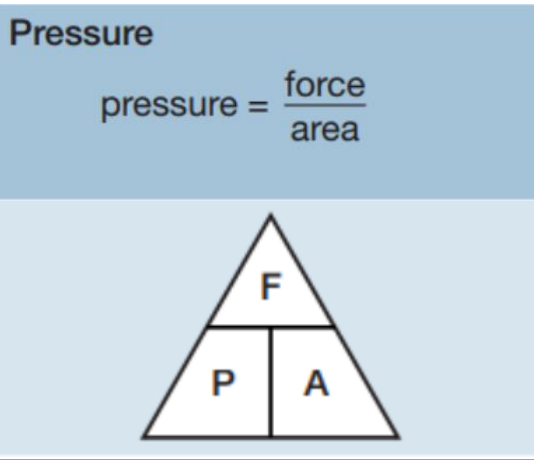The units of **pressure** are **N/m²** so the **force** must be in **Newtons** and the **area** must be in **m²**.

Force = 240 Newtons
Area = 0.3m²

$$Pressure = \frac{Force}{Area}$$

$$Pressure = \frac{240}{0.3}$$

$$Density = 800 \, N/m^2$$

The formula triangles can be used to help rearrange this equation to calculate force or area.

Pressure

$$pressure = \frac{force}{area}$$

Keyword/Skill	Definition/Tips
Speed	How fast something is moving.
Distance	A measurement of how far something travels.
Time	Time is the ongoing sequence of events taking place. The past, present and future.
Density	A measure of how much matter is in a certain volume.
Mass	A measure of how much matter is in an object.
Volume	The amount of 3-dimensional space something takes up.
Pressure	Pressure is the force per unit area. The pressure exerted by a solid object onto another solid surface is the weight of the object divided by the area of the object's surface.
Force	A push or pull that acts upon an object .
Area	the amount of space taken up by a 2D shape or surface
Compound Measure	Compound measures are ones that involve two other measures of different types; examples include measuring speed in metres per second, or defining density as mass divided by volume.

Exams!
- You need to knows these formulae off by heart.
- You will get marks for substituting the values given in the question into the correct formula.

Other Topics/Units this could appear in:
- Coordinate Geometry
- Real-Life Graphs
- Mechanics

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Real Life Graphs

| Keyword/Skill	Definition/Tips
Linear	Relating to a line; in a straight direction.
Graph	A drawing or a diagram to record information.
Distance	The length between two points or objects.
Time	Continuum of past to present to future.
Coordinate	Shown as pairs of letters and/or numbers to show position on a coordinate plane or map.
Quadrant	Any quarter divided by an x and y axis.
Gradient	How steep a line is.
Intercept	To cross over one another or overlap.
Function	A mathematical relationship between two values.
Solution	Solving a problem.
Parallel	Always the same distance apart and never touching.

Real Life Graphs

All real-life graphs can be used to estimate or read-off values. The actual meaning of the values will depend on the labels and units shown on each axis.

Sometimes:

- **the gradient of the line or curve has a particular meaning.**

- **The y-intercept (where the graph crosses the vertical axis) has a particular meaning**

- **The area has a particular meaning**

This graph shows the cost of petrol. It shows that 20 litres will cost £23 or £15 will buy 13 litres.
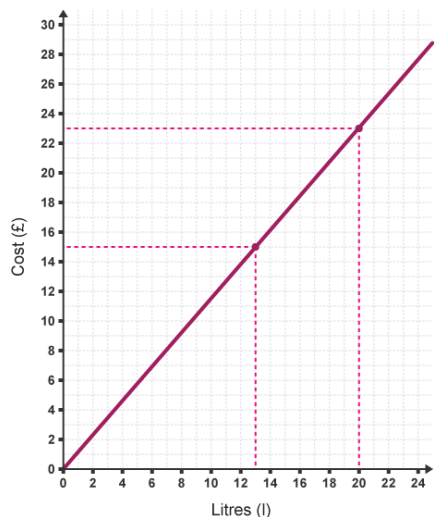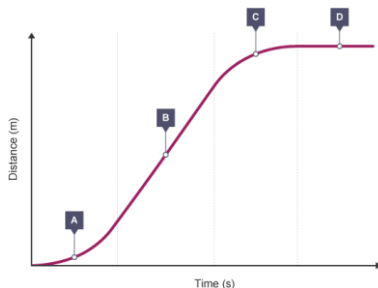
Distance – Time Graphs

A horizontal line on a **distance-time graph** shows that the object is **stationary** (not moving because the distance does not change)
A sloping line on a distance-time graph shows that the object is moving.
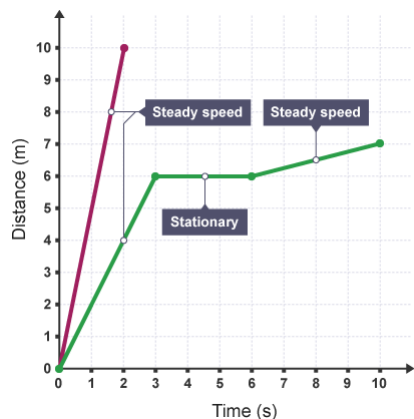
If the speed of an object changes, it will be **accelerating** or decelerating.
This can be shown as a curved line on a distance-time graph.

Speed – Time Graphs

A velocity-time graph shows the speed and direction an object travels over a specific period of time. Velocity-time graphs are also called speed-time graphs.
The vertical axis of a velocity-time graph is the velocity of the object. The horizontal axis is the time from the start.
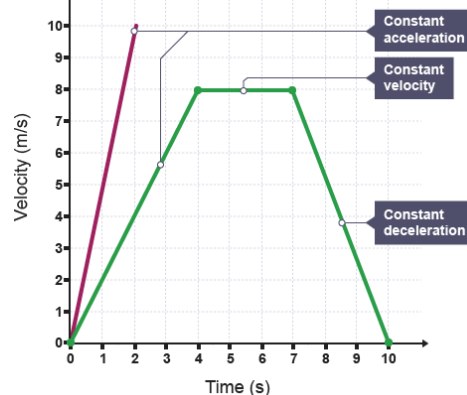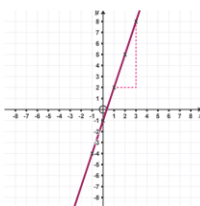
Gradient of a straight line

The gradient of a straight line describes the slope or steepness of the line.

$$Gradient = \frac{change\ in\ y}{change\ in\ x}$$

To determine the gradient of a line:
- *choose any two points on the line*
- *draw a right-angled triangle from one to the other, using the line as the hypotenuse*
- *determine the height and width of the triangle*
- *gradient = height ÷ width*

The triangle goes from 2 to 8 on the y-axis, so has a height of 6. It goes from 1 to 3 on the x-axis, so has a width of 2.

$$Gradient = \frac{6}{2} = 3$$

Trends

A trend is a pattern in a set of results displayed in a graph.

Upward Trend
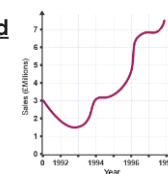
Downward Trend
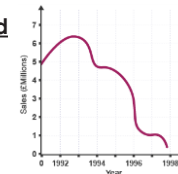
Other Topics/Units this could appear in:

- Drawing and Interpreting tables/charts
- Straight line graphs
- Graphs of trig functions
- Gradient & Area under graphs
- Mechanics

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PYTHAGORAS

Pythagoras' Theorem: $a^2 + b^2 = c^2$ Where c is the hypotenuse.
a and b can be either of the two shorter sides.

$$a^2 + b^2 = c^2$$

You can use the theorem to calculate the length of the hypotenuse (the longest side)

You can rearrange the theorem to calculate the length of the shorter sides

$3^2 + 4^2 = 5^2$

$9 + 16 = 25$

$$a^2 + b^2 = c^2$$

$$a^2 = c^2 - b^2$$

OR

$$b^2 = c^2 - b^2$$

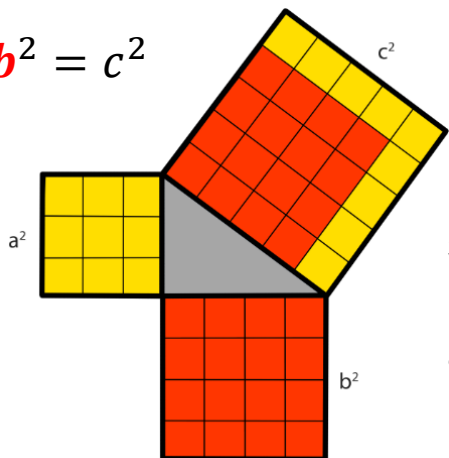| Keyword/Skill	Definition/Tips
Pythagoras	A Greek mathematician. He is famous for proving a theorem about the right-angle triangle.
Pythagoras' Theorem	In a right-angled triangle the square of the long side (**hypotenuse**) is equal to the sum of the squares of the other two sides.
Hypotenuse	The longest side of a right-angled triangle. It is always opposite the right angle.
Adjacent & Opposite	Adjacent side – Next to the marked angle. Opposite side – Opposite the marked angle
Trigonometry	Trigonometry is the study of triangles: their angles, lengths and more.
Trigonometric Ratios/Functions	The special measurements of a right-angled triangle: **Sin**/Sine **Cos**/Cosine **Tan**/Tangent
Inverse Trig Functions	You use these when calculating angles: $Sin^{-1}(x)$ $Cos^{-1}(x)$ $Tan^{-1}(x)$
Sin/Sine	The ratio of the length of the **opposite** side to the length of the **hypotenuse**
Cos/Cosine	The ratio of the length of the **adjacent** side to the length of the **hypotenuse**
Tan/Tangent	The ratio of the length of the **opposite** side to the length of the **adjacent** side

Example of calculating the hypotenuse:

Calculate the value of x:
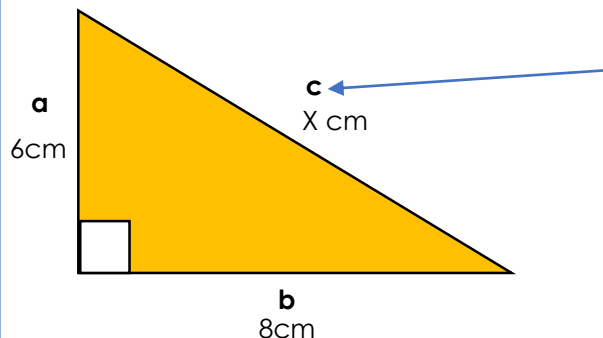
Label the sides of your triangle with a, b and c.
The hypotenuse must be labelled c.
The other sides can be labelled a and b (it doesn't matter which way round these are).

Example of calculating the shorter sides:

Calculate the value of the missing side:

Substitute the lengths you have into this formula:

$6^2 + 8^2 = c^2$ ⟵ $a^2 + b^2 = c^2$

$36 + 64 = 100$

$100 = c^2$ ⟹ $\sqrt{100} = c$ ⟹ $10cm = c$

Don't forget, this is c^2. We want to calculate c so we need to square root!
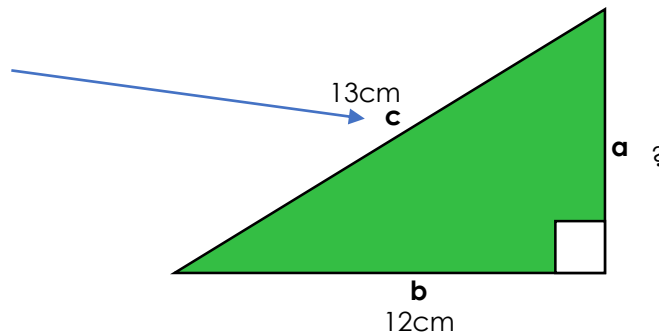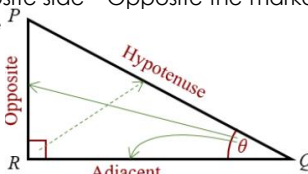
Substitute the lengths you have into this formula:

$a^2 = 13^2 - 12^2$ ⟵ $a^2 = c^2 - b^2$

$a^2 = 169 - 144$

$a^2 = 25$ ⟹ $a = \sqrt{25}$ ⟹ $a = 5cm$

Don't forget, this is a^2. We want to calculate a so we need to square root!

Other Topics/Units this could appear in:
- Graphs of trigonometric functions.
- Further trigonometry.
- Appears throughout A-Level in the Core and Mechanics Units

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Crossover Unit 34 – Pythagoras & Trigonometry

Trig Ratios

Sin **SOH** **Cos** **CAH** **Tan** **TOA**

Sin: O / Sin° / H
Cos: A / Cos° / H
Tan: O / Tan° / A

$$\sin(\emptyset) = \frac{opposite}{hypotenuse} \qquad \cos(\emptyset) = \frac{adjacent}{hypotenuse} \qquad \tan(\emptyset) = \frac{opposite}{adjacent}$$
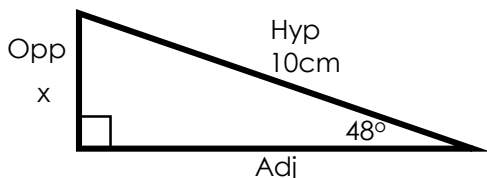
When you are calculating angles it will involve the inverse trig functions:

$$Sin^{-1}(x) \qquad\qquad Cos^{-1}(x) \qquad\qquad Tan^{-1}(x)$$

TRIGONOMETRY

Your first step in a trigonometry question is to label the triangle's sides.
The three sides are the **hypotenuse, opposite & adjacent** sides.
The **hypotenuse** side is always the longest side.
The **opposite** and the **adjacent** depend on the given angle:

Hypotenuse – HYP – H
Opposite – OPP – O
Adjacent – ADJ – A
θ°

Adjacent – ADJ – A
Hypotenuse – HYP – H
Opposite – OPP – O
θ°

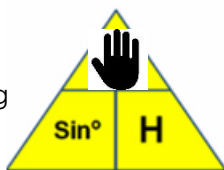**Ex1:** Calculate the value of x:

Opp / x
Hyp / 10cm
Adj
48°

Remember your first step is label the sides!

I am given an angle and a length. I have the hypotenuse and am looking for the opposite.
This means it involves **SOH**

I then cover the O as I am looking for the opposite side.
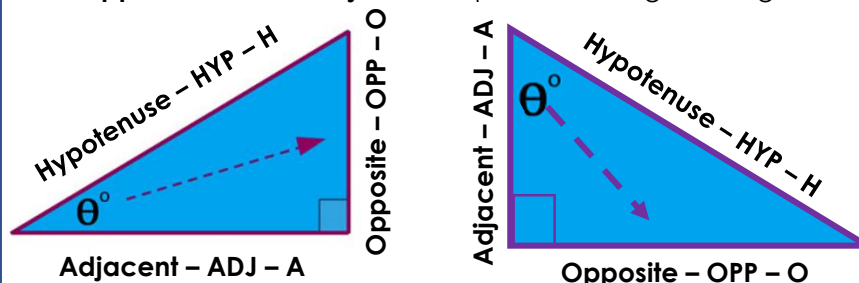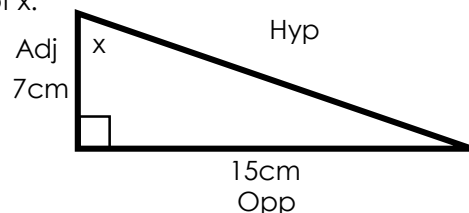This means I need to do:

Sin° / H

$$opposite = Sin(x) \times hypotenuse$$

$$opposite = Sin(48°) \times 10 = 7.43cm \text{ (rounded to 2 d.p.)}$$

Ex2: Calculate the value of x:

Adj / x
7cm
Hyp
15cm
Opp

Remember your first step is label the sides!

am given two lengths, the opposite and adjacent sides, and need to find an angle. This means it involves **TOA**

I then cover Tan° as I am looking for the angle.
This means I need to do:

O / A

$$Tan(x°) = \frac{opposite}{adjacent}$$

$$Tan(x°) = \frac{15}{7}$$

This is what Tan(x°) is equal to. We want just the angle. I need to use Tan^{-1}

$$Tan^{-1}\left(\frac{15}{7}\right) = 64.98° \text{ (rounded to 2 d.p.)}$$

Keyword/Skill	Definition/Tips
Pythagoras	A Greek mathematician. He is famous for proving a theorem about the right-angle triangle.
Pythagoras' Theorem	In a right-angled triangle the square of the long side(**hypotenuse**) is equal to the sum of the squares of the other two sides.
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Tan/Tangent	The ratio of the length of the **opposite** side to the length of the **adjacent** side

Other Topics/Units this could appear in:
- Graphs of trigonometric functions.
- Further trigonometry.
- Appears throughout A-Level in the Core and Mechanics Units

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Calculator Help

Here are the **trig functions** on your calculator. You use these ones when you are finding a length.

To get the **inverse trig functions** you need to press the SHIFT button first before you press the function you need. You use these ones when you are finding an angle.

Pythagoras or Trigonometry

Pythagoras or Trigonometry ???
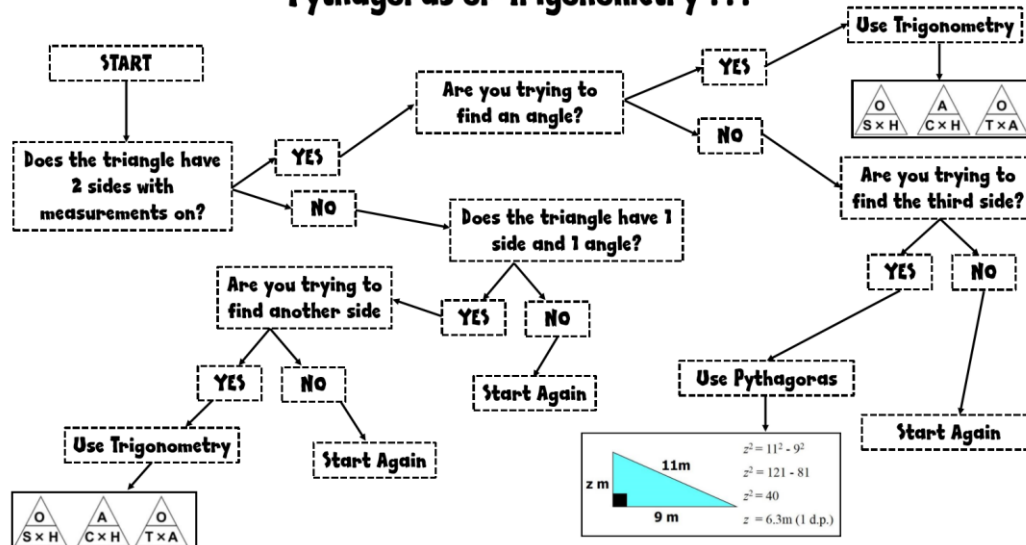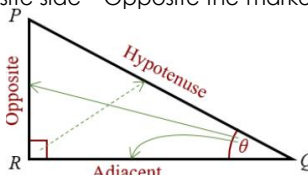
START

Does the triangle have 2 sides with measurements on?

YES → Are you trying to find an angle?
- YES → Use Trigonometry
- NO → Are you trying to find the third side?
  - YES → Use Pythagoras
  - NO → Start Again

NO → Does the triangle have 1 side and 1 angle?
- YES → Are you trying to find another side?
  - YES → Use Trigonometry
  - NO → Start Again
- NO → Start Again

$$z^2 = 11^2 - 9^2$$
$$z^2 = 121 - 81$$
$$z^2 = 40$$
$$z = 6.3m \ (1 \ d.p.)$$

(triangle: 11m, 9m, z m)

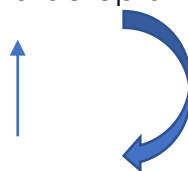| Keyword/Skill	Definition/Tips
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Tan/Tangent	The ratio of the length of the **opposite** side to the length of the **adjacent** side

Other Topics/Units this could appear in:
- Graphs of trigonometric functions.
- Further trigonometry.
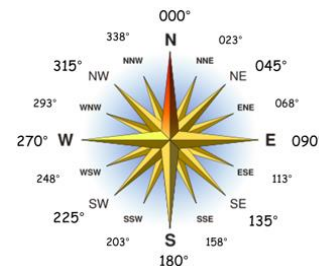- Appears throughout A-Level in the Core and Mechanics Units

Bearings are used to specify direction and are used to navigate ships and aeroplanes.
The key point to remember are:
1. Bearings are measured starting from North.
2. Bearings are always measured in a clockwise direction.
3. Bearings are always written in 3 figures (45° becomes 045°).

Compass Points

Keyword/Skill	Definition/Tips
Bearing	The angle measured in degrees clockwise from North.
Degree	A measure for angles. There are 360 in a full turn.
Perpendicular	A line that is at a right angle, 90°, from another line
North line	A line facing North that all bearings are measured from.
Clockwise	Moving in the direction of the hands of a clock.
Angle	The amount of turn between two lines about their common point.
Bisect	To divide something into two equal parts.
Protractor	An instrument used to draw or measure angles.

Measuring Bearings

Find the bearing of A from B.

75°
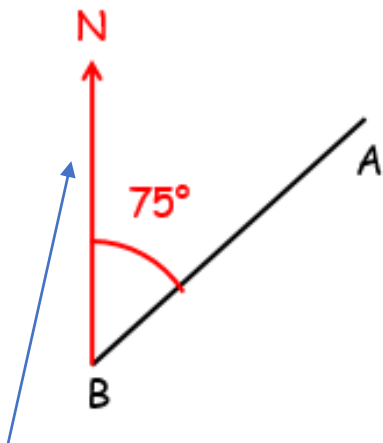
Mark the North line at B. (You can draw this in if there isn't one).

Measure the angle, clockwise from the North line to A.

Give the answer as a three figure bearing.

075°

Drawing Bearings

B is on a bearing of 120° from A and a distance of 4cm.
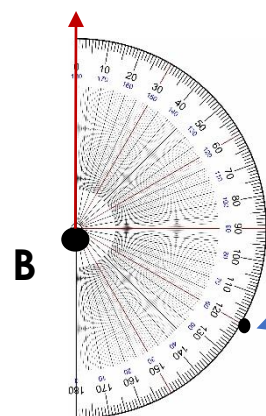
From point B, measure an angle of 120°. Label it so you don't forget where it is.
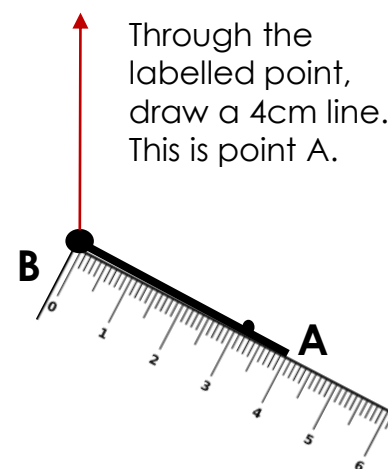
Through the labelled point, draw a 4cm line. This is point A.

Calculating Bearings

Find the bearing of A from B.
You need to remember some angle facts to calculate these without a protractor!

Corresponding angles

57°

180°

57°

Angles on a straight line
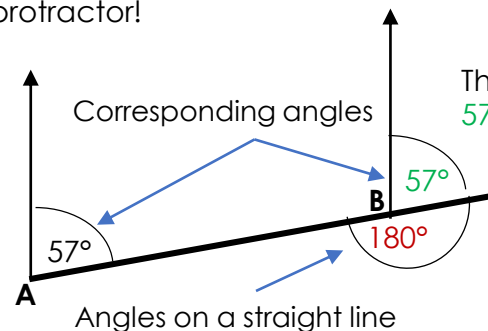
Therefore, the bearing of A from B is:
57° + 180° = 237°

Look at **Crossover U36 - Alternate and Corresponding Angles/Angle Facts** if you need help with the angle facts used here.

Other Topics/Units this could appear in:

- Properties of Shapes
- Angle Facts
- Mensuration

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Alternate Angles
You need to know that alternate angles are equal.

Example
AB is parallel to CD
Q-work out angle y
A- 60°
Q-Give a reason for your answer.
A- Alternate angles are equal.
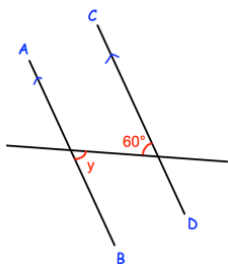
Corresponding Angles
You need to know that corresponding angles are equal.

Example
AB is parallel to CD
Q-work out angle x
A- 72°
Q-Give a reason for your answer.
A- Corresponding angles are equal.
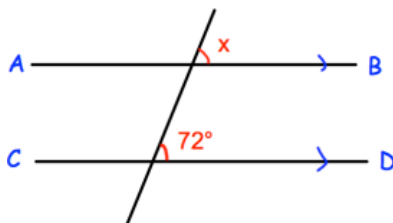
Co-Interior Angles
Co-interior angles add up to 180°

Q-Work out x
A- 180- 105 = 75°
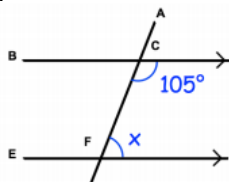
Applying other known angle facts
You need to be able to apply a range of angle facts to more complex angle questions

Example
CE and FI are parallel lines.
Angle EDH = 50°
Angle DGF = 100°
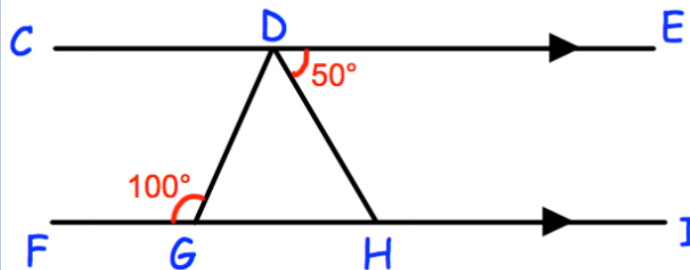
Show, giving reasons that triangle DGH is isosceles.
Angle facts to use
DHG = 50° –alternate angles are equal.
DGH = 80° –angles on a straight line = 180°
GDH = 180-80-50 = 50° - angles in a triangle sum to 180°
Triangle DGH is isosceles as it has 2 equal angles of 50°.
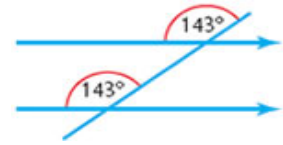
Exams!
- Use a highlighter or a different colour to highlight angle facts on any diagram given.
- Always show your method and give reasons.

Keyword/Skill	Definition/tip
Angle	The amount of turning between two lines meeting at a point.
Alternate angles	Two angles that are formed when a line (transversal) crosses a pair of parallel lines. These angles are equal.
Corresponding angles	Angles that share the same relative position when a transversal crosses a pair of parallel lines. These angles are equal.
Parallel Lines	Lines that are always the same distance apart. (Like train tracks)
Transversal	A line that crosses two other lines. (Red)
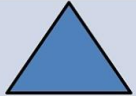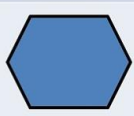
Other topics/Units this could appear in:
- Trigonometry
- Vectors
- Bearings
- Coordinate geometry

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Interior Angles

For the **sum** of interior angles in a polygon we can use this formula:

sum of interior angles= 180(n-2) (n = number of side)

Examples

▲	3	$(3 - 2) \times 180° = 180°$
■	4	$(4 - 2) \times 180°$ $= 2 \times 180° = 360°$
⬠	5	$(5 - 2) \times 180°$ $= 3 \times 180° = 540°$
⬡	6	$(6 - 2) \times 180°$ $= 4 \times 180° = 720°$

For **one** interior angle in a **regular** polygon

$$angle = \frac{180(n-2)}{n}$$

Example

Calculate the size of an interior angle of a regular pentagon:

Pentagon = 5 sides $= \dfrac{180(5-2)}{5} = 108°$

Exterior Angles

To find an exterior angle $= \dfrac{360}{n}$ n= number of sides

Example

The exterior angle y would be $\dfrac{360}{6} = 60°$

regular hexagon

You may be asked to work out how many sides a shape has given the size of it's exterior angles. This formula triangle is really useful!

360 ÷ Number of sides × One exterior angle
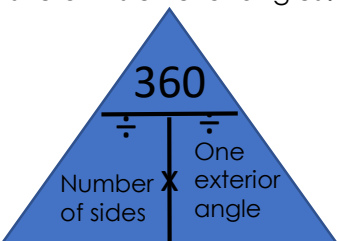
Example
A regular polygon has exterior angles of 24°. Work out how many sides the shape has.
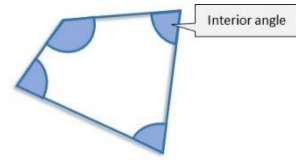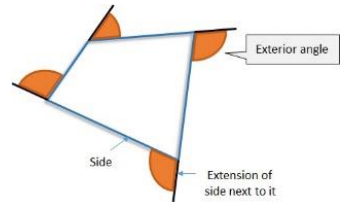
Using formula triangle = 360 ÷ 24 = 15 sides

Remember
Interior angle + exterior angle in Regular polygons = 180°
(They sit on a straight line.)

Exterior Angle 150°
Interior Angle 30° 180°
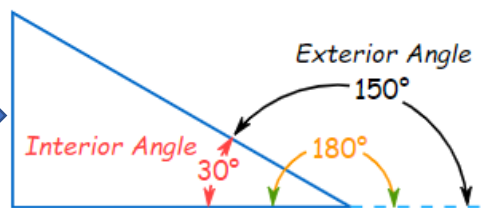
Exams!
- You will gain 2 marks for just having to work out an interior or exterior angle of a given polygon.
- A question that requires application of interior/exterior angles knowledge will be worth up to 4/5 marks.

Keyword/ Skill	Definition/tip
Angle	The amount of turning between two lines meeting at a point.
Polygon	A 2D shape with straight sides.
Interior angles	An angle inside a shape, between two joined sides.
Exterior angles	The angle between any side of a shape and a line extended from the next side.
Regular polygon	Has all equal length sides and all equal sized angles.
Irregular polygon	Has differing sized lengths and angles.

Other topics/Units this could appear in:
Unit 15 – Circle theorem
Unit 19 – Congruence and geometric proof **47**

Sampling is a method of choosing a smaller group of the whole population to use in your investigation. Population means the total number of people who could be included in the survey.

Types of Data

Data can be qualitative or quantitative:

Qualitative Data – Descriptive information (it describes something)
Examples: Colours of cars, Friend's favourite holiday destination…
Quantitative Data – Numerical information
Examples: Height, Weight, Customers in a shop, …

Quantitative data can be discrete or continuous.

Discrete Data – Can only take certain values (whole numbers).
Examples: How many students…, Results of rolling a dice.
Continuous Data – Can take any value (within a range).
Examples: Height (e.g. 24.82cm), Weight, Time in a race, …

Understanding Bias.

Bias is something that is unfair. E.G. if a commentator only talked about one football team because he supported that team.
Avoiding bias - Don't ask leading questions such as isn't it true that or do you agree that?
Think about where the survey is being done.
(E.G. If you want to find out how pupils get to school, don't just ask pupils who are on your bus).

Collecting Data

There are two main points to remember when collecting data:
1. Questions must be specific and have specific answers. (E.G. Do you like going to zoos? Yes/no NOT how do you feel about zoos).
2. Questions must be fair and non-biased (E.G What channel do you prefer to watch, NOT do you agree that BBC is the best T,V. channel).

Types of Sampling

Random Sampling

Random Sampling is when every person in the in the group you are interested in has an equal chance of being chosen. Names might be placed in a hat and then picked out or names could be chosen randomly by a computer.

Systematic Sampling

This follows a system. E.G every fourth person is chosen.
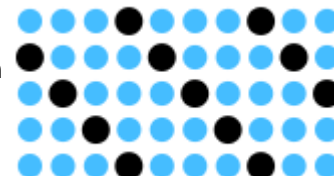
Stratified Sampling.
Where the group of people, (population) is divided into smaller groups so that the same PROPORTION can be taken.

E.G. if 50 out of 1000 pupils were asked a favourite pop group,,

Year Group	No. of Pupils	How to work out pupils in each group.	No of Pupils in Sample
7	180	$\frac{180}{1000}$ X 50 =9	9
8	200	$\frac{200}{1000}$ X 50 =10	10
9	240	$\frac{240}{1000}$ X 50 = 12	12
10	220	$\frac{220}{1000}$ X 50 = 11	11
11	160	$\frac{160}{1000}$ X 50 = 8	8
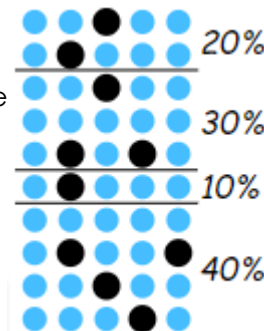
Check your answers add up to 50 (9+10+12+11+8 = 50).

Keyword/Skill	Definition/Tips
Primary Data	Data you collect yourself. E.G. from asking people questions in person or by telephone.
Secondary Data	Data which other people have collected(E.G. from a book, newspaper or from the internet).
Population.	The whole group that you are interested in.
Census.	A collection of data from the whole population.
Sample	A collection of data from part of the population(the whole group).
Discrete Data	Data that only takes in certain values. E.G. number of people in class.
Continuous Data	Data that has a number of possibilities between two fixed points. (E.G. The weight of a newborn baby would have a lowest possible weight to highest possible weight.
Data	Facts that are collected.
Survey.	To gather information by taking individual samples so that we can learn about the whole thing.
Qualitative Data	Data that is given in words, describes something
Quantitative Data	Data that is given in numbers
Discrete Data	Data that only takes certain values
Continuous Data	Data that can take any values

Other Topics/Units this could appear in:

• Interpreting Data
• Sampling (Higher)
• Statistical Sampling

You may need to look at **Working Toward Unit 5 – Angle Facts & Crossover Unit 14 – Fractions** before starting this knowledge organiser

Keyword/Skill	Definition/Tips
Pie Chart	A type of graph in which a circle is divided into sectors or slices. A way of representing data.
Key	A key is used to identify categories. It tells you what each colour/picture stands for.
Angle	Amount of turn between two lines around a common point. (The vertex).
Sector	A "pie slice", part of a circle.
Proportion	When two fractions/ parts are equal.
Fraction	How many parts of a whole
Interpret	Getting information from a graph/ pie chart.
Construct	To draw a shape, line or angle accurately using a ruler and protractor.
Category	Data that can be divided into groups such as favourite colour, sport etc.

There are 360° in a circle. You need to know the some key angles:

Favourite Sports in Year 8
- Football
- Rugby
- Cricket
- Other

Football = $\frac{1}{2}$ or 50% = $\frac{360°}{2}$ = 180°

Rugby = $\frac{1}{4}$ or 25% = $\frac{360°}{4}$ = 90°

Cricket = $\frac{1}{8}$ or 12.5% = $\frac{360°}{8}$ = 45°

Example:

8 pupils have cricket as their favourite sport. How many people are in Year 8?

$\frac{1}{8}$ of Year 8 = 8

Therefore, 8 x 8 = 64   64 pupils in Year 8

Constructing a Pie Chart
Example:
Jenny surveyed 90 students in Year 8 about their favourite pets.
Complete a pie chart to show this information.

Step 1: A whole circle is 360° so 360° ÷ 90 = 4°
        (So one person is worth 4°)
Step 2: Multiply each category by your answer
        (In this case, 4°)
Step 3: Measure your angles for your pie chart.
        (Your angles should add up to 360°)

Subject	Number of Students	Working Out	Angle
Cat	30	30 x 4°	120°
Dog	35	35 x 4°	140°
Fish	15	15 x 4°	60°
No Pet	10	10 x 4°	40°
Total	90		360°

Year 8 Students Favourite Pet
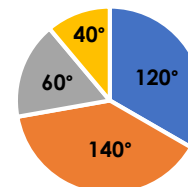
■ Cat ■ Dog ■ Fish ■ No Pet

Always remember to include a key and label your pie chart

Interpreting Pie Charts

Example:
How many games did the Under 13's lose?
Under 13's lost 75% of games.
75% of 28 = 21

How many games did the Under 15's lose?
Under 15's lost $\frac{2}{3}$ of their games.

$\frac{2}{3}$ of 18 = 12

Under 13's
Won
Lost
The Under 13's played 28 matches

Under 15's
Won
120°
Lost
The Under 15's played 18 matches

Other Topics/Units this could appear in:
• Angles
• Drawing and interpreting tables

49

Probability

Probability is always between 0 and 1. When a single dice is thrown, there are six possible outcomes: **1, 2, 3, 4, 5, 6**.

The probability of any one of them is $\frac{1}{6}$

Construct sample space diagrams

Sample space diagrams provide a systematic way to display outcomes from events.

The possible outcomes from rolling a dice

	1	2	3	4	5	6
H	1,H	2,H	3,H	4,H	5,H	6,H
T	1,T	2,T	3,T	4,T	5,T	6,T

The possible outcomes from tossing a coin

This is the set notation to list the outcomes S =

In between the { } are all the possible outcomes.

S = { 1H, 2H, 3H, 4H, 5H, 6H, 1T, 2T, 3T, 4T, 5T, 6T}
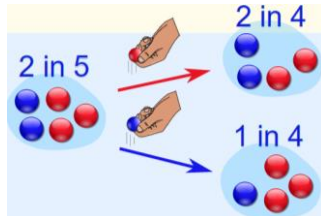
Replacement

The probability of getting a blue in the first bag is $\frac{2}{5}$

But after taking one out the chances change!

If we got a red marble before, then the probability of getting a blue marble from the second bag is $\frac{2}{4}$ or $\frac{1}{2}$

- With replacement the events are independent (the chances do not change)
- Without replacement the events are dependent (the changes change)

Probability from two-way tables

	Car	Bus	Walk	Total
Boys	15	24	14	53
Girls	6	20	21	47
Total	21	44	35	100

P (Girl walk to school) = $\frac{21}{100}$

The event

The total in the set

The total number of items

Probability from sample space

The possible outcomes from rolling a dice

	1	2	3	4	5	6
H	1,H	2,H	3,H	4,H	5,H	6,H
T	1,T	2,T	3,T	4,T	5,T	6,T

The possible outcomes from tossing a coin

What is the probability that an outcome has an even number and a tails?

This is the set notation that represents the question P

In between the ( ) is the event asked for

P (Even number and Tails) = $\frac{3}{12}$

There are three even numbers with tails

Numerator: the event

Denominator: the total number of outcomes
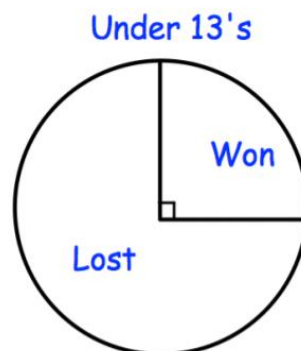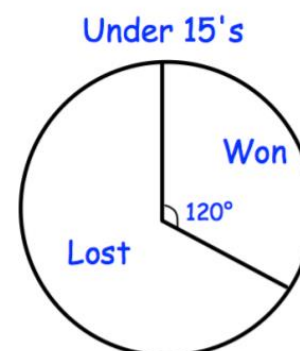
There are twelve possible outcomes

Keyword/Skill	Definition/Tips
Probability	$\frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$
Dependent event	One outcome affects another. For example – choosing one red card reduces the chance of choosing another red card.
Independent event	One event does not affect the probability of the other.
Mutually exclusive	Two events that cannot happen at the same time, i.e. if you cannot turn left and right at the same time.
Conditional	The probability of something happening, given something else has occurred.
Sample space	The **set of all possible outcomes** of an experiment.
Theoretical	$\frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Possible Outcomes}}$
Relative Frequency	$\frac{\text{Number of Successful Trials}}{\text{Total Number of Trials}}$
Experimental	An estimated probability based on the results of an experiment. The more trials are performed, the more reliable the results

Other Topics/Units this could appear in:

- Conditional probability

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Mutually Exclusive

When two events (call them "A" and "B") are Mutually Exclusive it is **impossible** for them to happen together:

$$P(A \text{ and } B) = 0$$

"The probability of A and B together equals 0 (impossible)"

Aces and Kings are **Mutually Exclusive** (can't be both)

Hearts and Kings are **not** Mutually Exclusive (can be both)

Probability Trees

Here is a tree diagram for the toss of a coin:
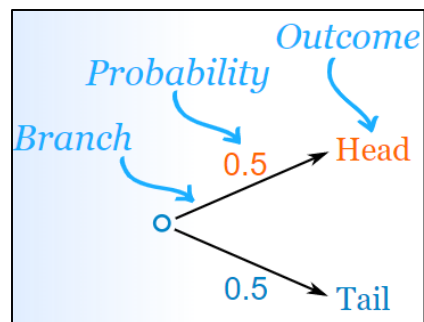
There are two "branches" (Heads and Tails)
•The probability of each outcome is written on the branch
•The outcome is written at the end of the branch

We can extend the tree diagram to two tosses of a coin:
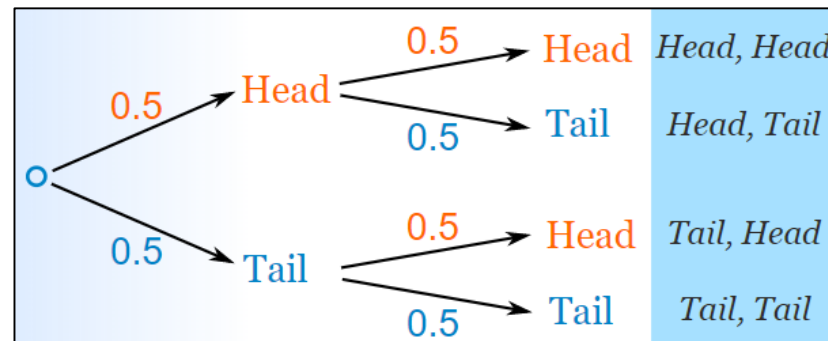
How do we calculate the overall probabilities?
• We **multiply** probabilities **along the branches**
• We **add** probabilities down **columns**
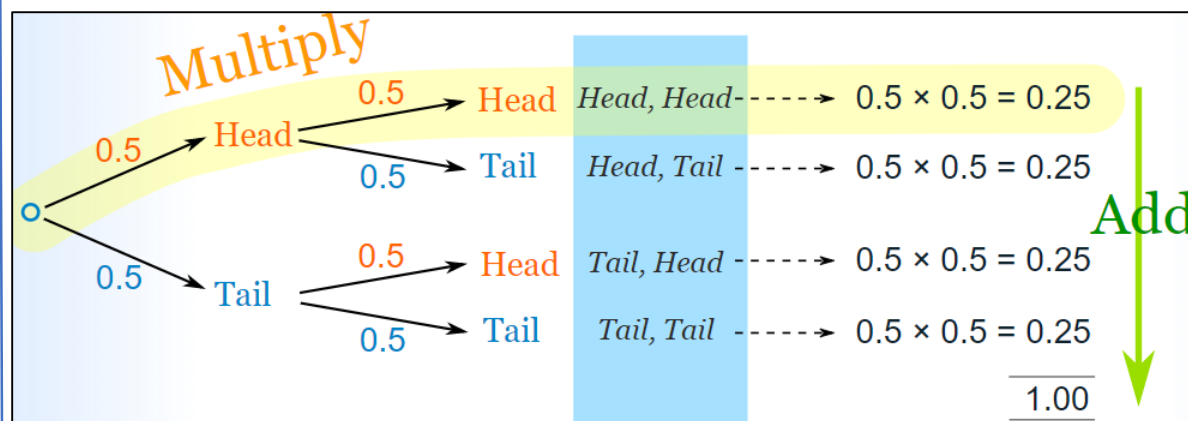
Now we can see such things as:
• The probability of "Head, Head" is 0.5×0.5 = **0.25**
• All probabilities add to **1** (which is always a good check)
• The probability of getting **at least one** Head from two tosses is 0.25+0.25+0.25 = **0.75**

Keyword/Skill	Definition/Tips
Probability	$$\frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
Dependent event	One outcome affects another. For example – choosing one red card reduces the chance of choosing another red card.
Independent event	One event does not affect the probability of the other.
Mutually exclusive	Two events that cannot happen at the same time, i.e. if you cannot turn left and right at the same time.
Conditional	The probability of something happening, given something else has occurred.
Sample space	The **set of all possible outcomes** of an experiment.
Theoretical	$$\frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Possible Outcomes}}$$
Relative Frequency	$$\frac{\text{Number of Successful Trials}}{\text{Total Number of Trials}}$$
Experimental	An estimated probability based on the results of an experiment. The more trials are performed, the more reliable the results

Other Topics/Units this could appear in:

• Conditional probability

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Plans and Elevations

Plan
The view from above.

Front Elevation
The view from the front of the solid.

Side Elevation
The view from The side of the solid.

Isometric Drawing

A representation of a solid where all of the dimensions are drawn to scale.
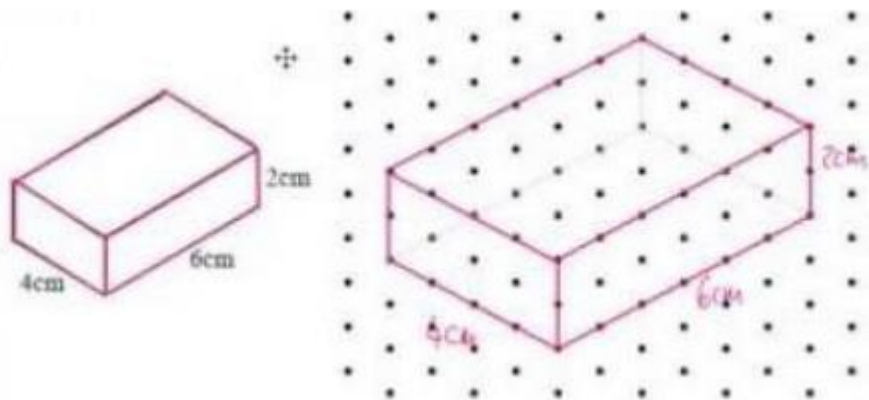
Worked Exam Question

Draw the plan, the front elevation and the side elevation of this cuboid on the grid below.
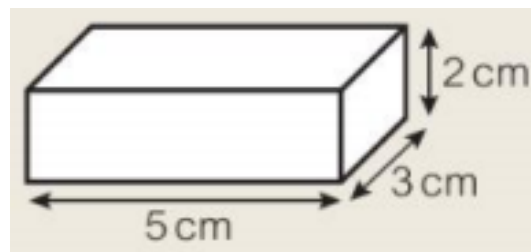
Use a ruler.
Measure accurately.
Label Lengths.

Plan:
5 cm, 3 cm

Front:
5 cm, 2 cm

Side:
3 cm, 2 cm
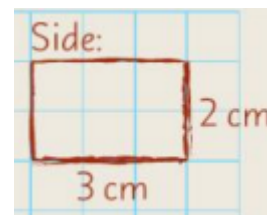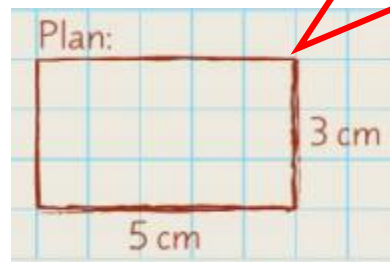
Keyword/Skill	Definition/Tips
Face	A flat surface that forms part of a solid.
Edge	The boundary of 2 faces.
Vertex	The point at which 2 or more edges meet (corner).
2D	Having only two dimensions, such as width and height but no thickness. Squares, circles, triangles etc are 2D shapes.
3D	Having three dimensions, such as height, width and depth, like any object in the real world. Cuboids, Cones, Spheres etc are 3D shapes.
Solid	A 3D object.
Elevations	Different views of an object, e.g. Side elevation – view from the side. Or front elevation – view from the front.
Plan	A drawing of something as viewed from above.

Other Topics/Units this could appear in:

• Surface Area and Volume
• Similarity in 2D and 3D

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Crossover Unit 43 – Constructions

Construction Equipment
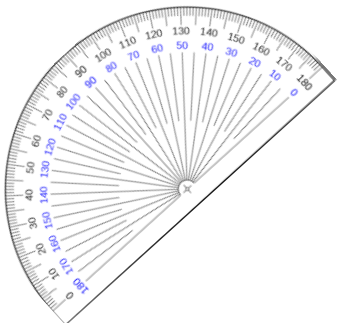
You will need a **ruler**, **protractor**, **eraser**, **sharpened pencil** and **pair of compasses** for your exam.
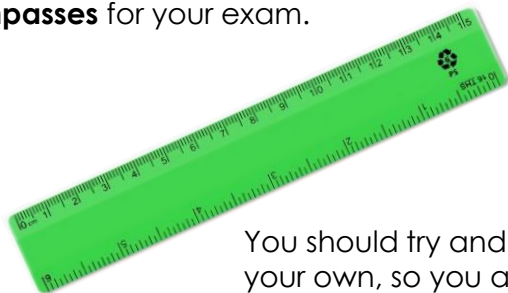
You should try and get your own, so you are used to using them all.

Using Compasses

Make sure your pencil is sharp and your compasses don't wobble.

Tighten the compasses so the points of the pencil and compasses are as close together as possible.

Try to hold only the black part of the compasses when you are drawing so you don't change the gap you have set.

Using a protractor

Always position your protractor with the + over the end of the line and line up the 0 on the scale. Count from 0 on the scale when measuring an angle.

This angle measures 25° and is acute.
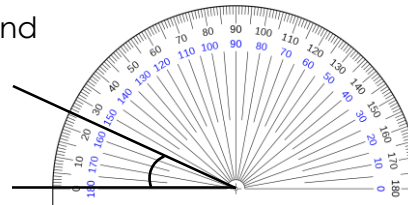
You may also want to look at the knowledge organisers for:

Year 7 Unit 7 - Angles
and
Working Towards Unit 5 - Angle Facts & Shape Properties

Check you can measure these angles correctly.

Measuring and Drawing Angles
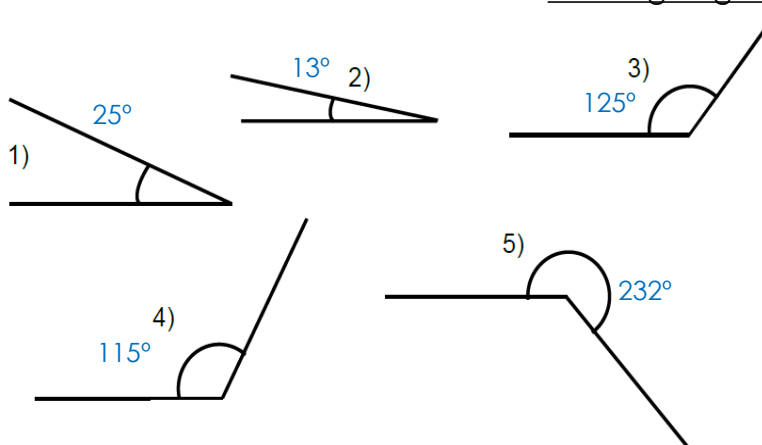
1) 25°
2) 13°
3) 125°
4) 115°
5) 232°

Keyword/Skill	Definition/Tips
Vertex	A corner where two edges meet at a point.
Line segment	A section of a line, usually between two letters, such as AB.
Angle	The corner point of an angle is called the **vertex**. And the two straight sides are called **arms**. The angle is the **amount of turn** between each arm.
Degree	The unit of measurement for turn, shown by the symbol ° 90° = ¼ turn, 180° = ½ turn, 270° = ¾ turn.
Adjacent	Next to one another.

Constructing Triangles – given 3 side lengths

Using **ruler** and **compasses**, you can **construct** any triangle, given its three side lengths.

This triangle has side lengths 6cm, 5cm and 4 cm.

The 6cm line was drawn with a ruler.

Then arcs with radii 5cm and 4cm were constructed at either end of the 6cm line, using compasses.

The intersection point shows where the other vertex should be.
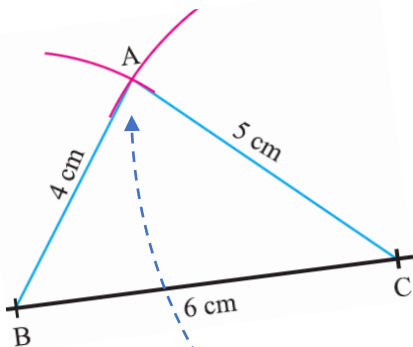
Constructing Triangles – given 2 sides and 1angle

Using **ruler** and **protractor**, you can **construct** any triangle, given two of its side lengths and the angle between them.

This triangle has two side lengths 5cm and 4cm with a 50° angle between them.

The 4cm line is drawn first, then an angle of 50° is measured and marked from the end of the line.

A 5cm line is drawn at this angle.

don't rub these construction lines out – the examiner will want to see them!
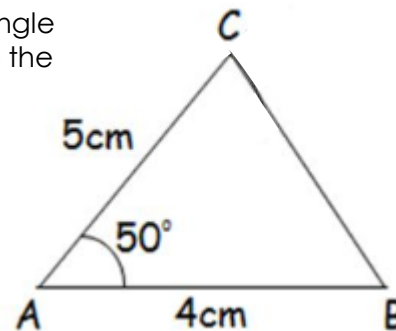
Using **ruler** and **protractor**, you can **construct** any triangle, given two of its angles.

These triangles both have interior angles of 48° and 25°, but the side lengths are different.

Draw the side in between the two angles first; sometimes this is given to you in the question.

Then measure the angles from each end of the line – make sure the protractor is lined up correctly! Extend your construction lines until they intersect.

The intersection points show where the other vertex (corner) should be.

Constructing Triangles – given 2 angles
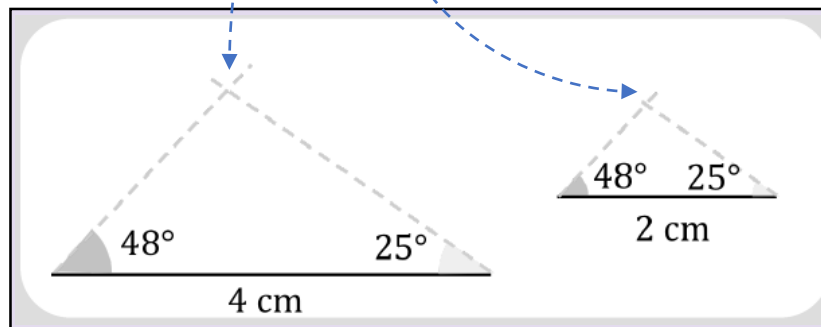
Keyword/Skill	Definition/Tips
Arc	Part of the circumference of a circle.
Vertex	A corner where two edges meet at a point.
Line segment	A section of a line, usually between two letters, such as AB.
Construct	Use ruler, pencil, protractor and/or compasses to accurately draw a given shape.
Angle	The corner point of an angle is called the **vertex**. And the two straight sides are called **arms**. The angle is the **amount of turn** between each arm.
Degree	The unit of measurement for turn, shown by the symbol ° 90° = ¼ turn, 180° = ½ turn, 270° = ¾ turn.
Adjacent	Next to one another.
Intersect (intersection)	Where two or more line segments cross or meet at a point.

Constructing Angle Bisectors

Using **ruler**, and **compasses**, you can **construct** an angle bisector, which cuts an angle in half.

Keep the gap on your compasses the same for the whole construction.

Draw two short arcs with the compass point placed at the vertex of the angle.
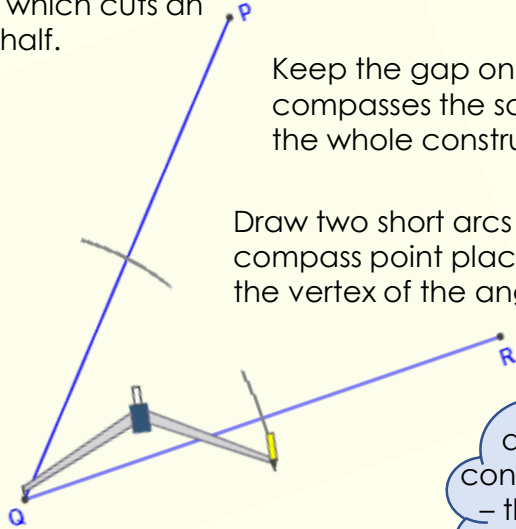
Draw two short arcs with the compass point placed on your first pair of arcs.

Draw a straight line joining the vertex and the intersection point. This is your **bisector**.

don't rub these construction lines out – the examiner will want to see them!

Constructing Perpendicular Bisectors

Using **ruler**, and **compasses**, you can **construct** a perpendicular bisector, which cuts a line in half at a right angle.

Remember to open the compasses more than half the length of the line you are bisecting.

Keep the gap on your compasses the same for the whole construction.

Draw two long arcs with the compass point placed at either end of the line you are bisecting.

Draw a straight line joining the two intersection points. This is your **bisector**.

Perpendicular Bisector from a point to a line
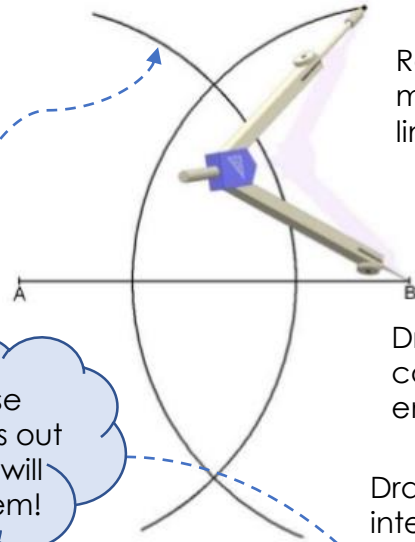
When constructing a perpendicular bisector from a point to a line, add this first step, then continue as above.
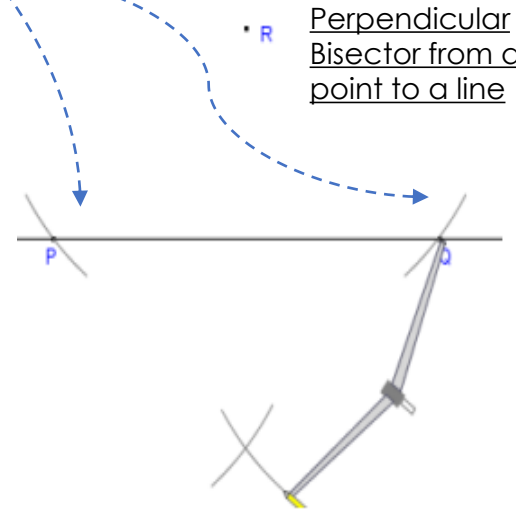
Keyword/Skill	Definition/Tips
Bisect	Cut exactly in half.
Loci/Locus of points	A **locus** is a path formed by a point which moves according to a rule. The plural is **loci**.
Perpendicular	Straight lines which meet or cross at right angles (90°) to one another.
Scale	The scale is the ratio of a distance on the drawing or model to the corresponding distance in real life, eg 1:20 means 1cm on the drawing represents 20 cm in real life.
Region	A specific part of something, usually shown by shading or labelling R.
Plan	A plan is similar to a map, usually showing a small area such as a playground or house.

Exams!

- You can use all these construction skills to construct loci or scale drawings.
- Any correct part of a construction scores a mark, so always have a go, even if you're not sure.

55

Diameter and Radius of a Circle

The diameter is double the size of the radius.

Example:

A circle has a radius of 16 cm. What is the diameter?

Radius = 16cm

6cm x 2 = 32cm

Diameter = 32cm

16cm radius

32cm diameter
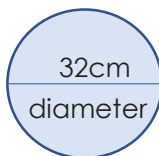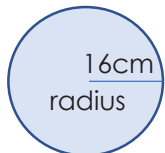
Circumference of a Circle

The circumference of a circle is the distance around the circle. It is the correct name for the perimeter of a circle.

Circumference = π x diameter

Example: Find the circumference of this circle

Circumference = π x 8

= 25.13cm (2d.p.)

8cm
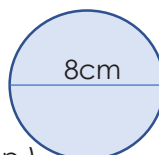
You may be given the radius instead of the diameter, so you need to know the relationship between them (this information is stated above).

Example:
Radius = 5cm.
Diameter = 5cm x 2 = 10cm

5cm

Circumference = π x 10
= 31.41cm (2d.p.)
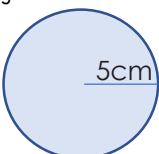
Area of a Circle

Area = πr^2

$= \pi \times radius^2$

r
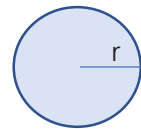
Example: Find the area of the circle.

6cm

Radius = 6cm

Area = πr^2
$= \pi \times 6^2$
$= 36\pi cm^2 = 113.1cm^2$

Exam!

In an exam it may ask you for your answer in terms of π. This means instead of doing the final calculation you just leave it with π in the answer e.g. $10\pi cm$

The Area of a Compound Shape

This shape is made up of a rectangle and a semicircle.

To find the total area we just find the area of each part and add them together.
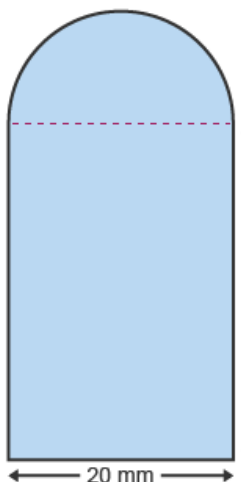
Area of rectangle = l x w

$= 20 \times 30$
$= 600mm^2$

Area of circle = πr^2

$= 3.14 \times 10 \times 10$
$= 314mm^2$

30 mm

20 mm

Area of semicircle

$= 314 \div 2 = 157mm^2$

$Total\ area = 600 + 157$
$= 757mm^2$

Semicircles

The perimeter of a Semicircle:

Remember that the **perimeter** is the distance round the outside.

A semicircle has two edges. One is half of a circumference and the other is a diameter.

8 cm
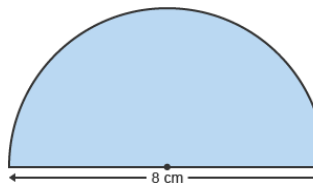
$C = \pi d$
$= 3.14 \times 8$
$= 25.12cm$

Remember this is the circumference of the whole circle, so now we need to half this answer and remember to add on the other edge.

$25.12 \div 2 = 12.56cm$

Total Perimeter = $12.56 + 8 = 20.56cm$

The Area of a Semicircle:

A semicircle is just half of a circle. To find the **area** of a semicircle we calculate the area of the whole circle and then half the answer.

4 cm
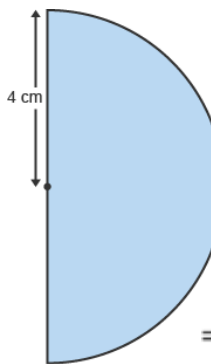
$A = \pi r^2$
$= 3.14 \times 4 \times 4$
$= 50.24cm^2$

$= 50.24 \div 2 = 25.12cm^2$

Keyword/Skill	Definition/Tips
Area	The size of a surface. The space inside a 2D surface.
Perimeter	The distance around a two-dimensional shape.
Formula	A rule or fact written with mathematic symbols.
Semi-Circle	It is half of a circle
Accuracy	How close a measured value is to the actual (true) value.
Surface Area	The total area of the surface of a three-dimensional object.
Segment	The smallest part of a circle made when it is cut by a line.
Arc	Part of the circumference of a circle or any curve.
Sector	A "pie-slice" part of a circle.
Circumference	The distance around the edge of a circle (or any curvy shape). It is a type of perimeter.
Radius	The distance from the centre to the circumference of a circle. It is half of the circle's diameter.
Diameter	The distance from one point on a circle through the centre to another point on the circle.
Pi	The ratio of a circle's circumference to its diameter. The symbol is π. π = 3.14159265358979323846... (the digits go on forever without repeating)

Other Topics/Units this could appear in:

- Properties of shape and simple angle facts
- Perimeter and Area
- Mensuration
- Similarity in 2D & 3D
- Circle Geometry – Gradients & Tangents
- Circle Theorems
- Coordinate Geometry and Circles

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1. Evidence for human evolution

Ardi (Ardipithecus ramids)	• Human like female fossil • Walked upright • Long arms and short legs • Small skull and brain
Lucy (Australopithecus afarensis)	• More human like female fossil than Ardi • Walked upright better than Ardi • Arm and legs were the length between ape and human • Skull and brain slightly larger than Ardi
Turkana Boy (Homo erectus) discovered by Richard Leakey	• More human like female fossil than Lucy • Walked upright better than Lucy • Arm and legs were human length • Skull and brain larger than Lucy

Evidence for human evolution can also be gained from looking at stone tools, which become more sophisticated overtime

2. Darwin's Theory of Evolution

Evolution is a change in the inherited characteristics of a population over time. This occurs through a process called natural selection.

• The differences in a population gives some
• individuals an advantage.
• This individual is more likely to survive for longer and be able to breed to pass on desirable genes.
• Nature is selecting the individual with the phenotypes most suited to survival ('survival of the fittest'). This is called natural selection.

Our understanding of evolution has also been helped by the study of antibiotic resistance in bacteria.

Genetic Mutation Causes Drug Resistance

3. Classification

The number of organisms in each group gets smaller, but they have more features in common

Kingdom
Phylum
Class
Order
Family
Genus
Species
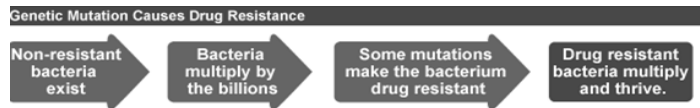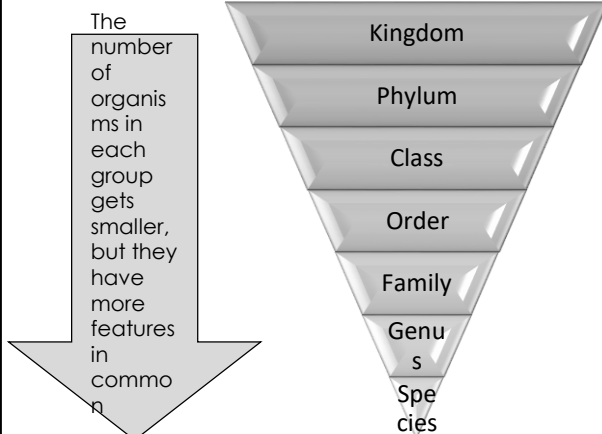
4. Genetic Engineering and Tissue Culture
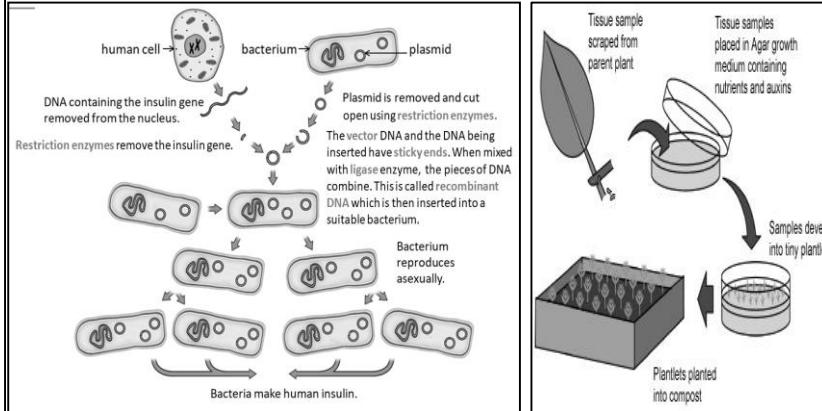
In **genetic engineering, genes from** the chromosomes of **humans** and other organisms are **cut out** of the **DNA** using **enzymes**. The **genes** are then **transferred** to the **cells of the organism** to be genetically modified.

Keyword	Definition
Binomial system	The system of naming organisms using two Latin words
Evolution	A change in one or more characteristic of a population over a long period of time
Genetic variation	Differences between organisms caused by differences in the alleles they inherit from their parents, or differences in genes caused by mutation. Also called inherited variation
Natural selection	A process in which certain organisms are more likely to survive and reproduce than other members of the same species because they possess certain genetic variations
Resistance	When an organism has resistance to something, it is unaffected by it, or not affected very much
Pentadactyl limb	A limb that has five digits (fingers and thumbs). Amphibians, reptiles, birds and mammals share this characteristics
Classification	The process of sorting organisms into groups based on their characteristics
Kingdoms	There are five kingdoms into which organisms are usually divided: plants, animals, fungi, protists and prokaryotes
Selective breeding	When humans choose an organism that has a certain characteristic and breed more of these organisms, making that chosen characteristic more and more obvious
Varieties	Groups of plants of the same species that have characteristics that make them different to other members of the species
Genetic engineering	Altering the genome of an organism, usually by adding genes from another species.
GMOs	An organism that has had its genome genetically altered (genetic modification)
Yield	The amount of useful product that you can get from something
Disease resistance	Unaffected or less affected by a certain disease
Stem cells	An unspecialised cell that continues to divide by mitosis to produce more stem cells and other cells that differentiate into specialised cells
Tissue culture	Growing tiny pieces of tissue, or cells, in the lab
Pests	Animals that cause problems, such as damaging crops
Biological control	Using organisms to kill problem organisms, such as pests or weeds
Insecticides	A substance used to kill insect pests

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Keyword	Definition
Magnification	The number of times larger an image is than the initial object that produced it
Objective lens	The part of the microscope that is closest to the specimen
Resolution	The smallest change that can be measured by an instrument
Nucleus	The control centre of the "eukaryotic cell"
Eukaryotic	A cell with a nucleus
Microvilli (us)	A tiny fold in the cell surface membrane of a cell, increase the surface area of the cell
Adaptations	The features of something that enable it to do a certain function
Gametes	A haploid cell produced by meiosis used for sexual reproduction
Haploid	A cell or nucleus that has one set of chromosomes. Gametes are haploid
Epithelial cells	A cell found on the surface of internal organs
Chromosomal DNA	The main bulk of DNA found in a cell. In humans, this DNA is found in chromosomes
Prokaryotic	A cell with no nucleus is prokaryotic
Monomers	A small molecule that can join with other molecules like itself to form a polymer
Polymers	A long-chain molecule made by joining many smaller molecules (monomers)
Biuret test	A test that uses copper sulfate solution and potassium hydroxide solution to test for proteins. It turns from blue to purple in the presence of proteins
Benedicts solution	A solution used to detect the presence of reducing sugars (eg. Glucose) in foods
Calorimeter	Apparatus used to measure the energy content of substances by burning them and measuring the temperature increase
Ethanol emulsion test	A test using ethanol to detect lipids (fats) in food
Active site	The space in an enzyme where the substrate fits during an enzyme-catalysed reaction
Denatured	A denatured enzyme is one where the shape of the active site has changed so much that the substrate no longer fits and the reaction can no longer happen
Optimum temperature	The temperature at which an enzymes rate of reaction is greatest, or at which a population of microorganisms grow most rapidly
Osmosis	The movement of water from a high concentration to a low concentration through a partially permeable membrane
Active Transport	The pumping of particles across a cell membrane from a low concentration to high concentration (requires energy)

1. Magnification

2. Plant and animal cells : compare and contrast

3. Enzymes and food tests

Name of large biological molecule	Name of enzyme that digests it	Digested molecule	Food test	Positive result
Carbohydrates – Starch	Carbohydrase	Glucose	Starch – Iodine solution Glucose – Benedict's solution	Blue/black colour Green, yellow, orange, brick red colour
Proteins	Protease	Amino acids	Biuret reagent	Violet colour
Lipids	Lipase	Glycerol and three fatty acids	N/A	N/A

4. Enzyme substrate complex

6. Active transport

5. Osmosis

Y9 Art - CONTEMPORATY ILLUSTRATION 1960'S TO NOW) KNOWLEDGE ORGANISER

Developing ideas/artist research
Using resources – testing out ideas/media.
Making a personal response – final outcome.

What key knowledge will I learn?

By the end of this topic you should know:
- How perspective can alter the appearance of body parts and how foreshortening can help us draw bodies in proportion.
- How artist's manipulate the formal elements to create stylized figurative illustration.

What key skills will I learn?

- How to draw the human body in proportion and in dynamic poses.
- How to draw body parts from different angles.
- Be able to visually link to the style of contemporary artist's

CONTEMPORARY ILLUSTRATION

- Contemporary illustration is a term used to describe a range of art styles that are non-realistic. Illustrators exaggerate certain features to create interesting characters.

Develop drawing Skills.

Alex T Smith

Quentin Blake

Brian Konietzco

Experimentation with dynamic drawing techniques.

Wider Thinking:
Watch You tube video's on how to create a Manga or Anime character.

Stretch and Challenge:
How can you convey a character through artwork?
How do you create a narrative?

Keyword	Definition
Figurative	A drawing that depicts a human body.
Foreshortening	Foreshortening is technique used in perspective to create the illusion of an object receding strongly into the distance or background.
Dynamic	A piece of art that shows movement.
Pose	Apply materials, techniques and processes with a high level of understanding, ability and control.
Angle	Can be eye level, high or low level. Birds-eye view, worms eye view. It's the angle from which the viewer sees the artwork.
Viewpoint	The spot from which the viewer is looking.
Perspective	Usually refers to the representation of three-dimensional objects or spaces in two dimensional artworks.
Exaggerate	The representation of something as more extreme or dramatic than it really is.
Narrative	Is art that tells a story.

Y9 TEXTILES POP ART KNOWLEDGE ORGANISER

ORMISTON SWB ACADEMY

POW!

Watercolour and oil pastel

Weaving

Warp / Weft

Batik

Shading Techniques

Hatching Cross-Hatching Stipling

Overlay Scumbling Burnishing

LOWEST LEVEL ➡ HIGHEST LEVEL

What is Shibori?
Shibori is a Japanese term for several methods of dyeing cloth and creating a pattern by binding, twisting, folding and compressing it. It can create interesting colours as well as textures.
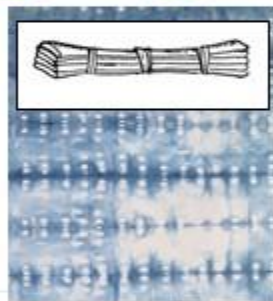
Draw design onto fabric

Trace with wax *(glue)* using **Tjanting** tool.

Paint with fabric dye.

Iron to melt wax away. *(Peel glue)*

Keyword	Definition
Influence	Something or someone that influences a person or thing, then, has an influence on that person or thing.
Texture	The feel, appearance or consistency of a substance, substance or fabric.
Batik	Method of producing coloured designs on textiles by dyeing them, having first applied wax to the parts to be left undyed.
Tjanting Tool	An arrangement of images, materials, pieces of text, etc. intended to evoke or project a particular style or concept.
Tie - Dye	A hand method of producing patterns in textiles by tying portions of the fabric or yarn so that they will not absorb the **dye**.
Fabric Pastel	Blending and mark making of pastels on fabric. Use water to blend colours and create gradients of colour.
Weaving	The craft or action of forming fabric by interlacing threads.
Artist Copy	Analyse an artists' work and replicate the piece using the same techniques, media, colours and style.

Year 9 – Computing – Robotics Laws & Ethics
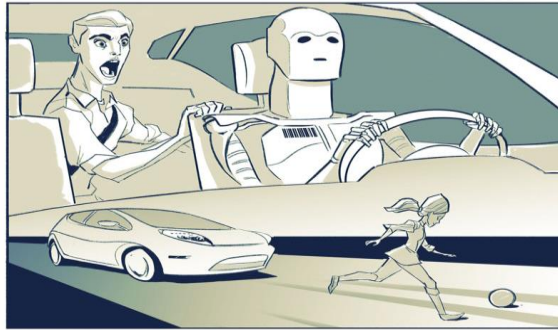
Possible Careers
- Legal Consultant (Lawyers)
- Data analyst
- Environmental officer
- Teaching

Legal vocabulary

Data Protection Act 1998	This Act states that anyone who stores personal details must keep them secure. Companies with computer systems that store any personal data must have processes and security mechanisms designed into the system to meet this requirement. Made up of 8 principles.
Freedom of Information Act 2000	This Act gives people access to data held by public authorities, including state schools, police forces, local authorities and the NHS. It does not give access to personal data about people, but it means, for example, that anyone can ask for a list of all of the state schools in a certain area.
Computer Misuse Act 1990	This Act has three main principles, primarily designed to prevent unauthorised access or 'hacking' of programs or data. These are: unauthorised access to computer material; unauthorised access with intent to commit or facilitate a crime; unauthorised modification of computer material.
Copyright Designs and Patents Act 1988	This Act is designed to protect the creators of books, music, video and software from having their work illegally copied.
Creative Commons Licensing	When an author is willing to give people the right to share or use a work that they have created. The creator can choose to allow only non-commercial use, so that their work cannot be copied and distributed for profit.

Ethical and cultural vocabulary

Driverless cars	A vehicle that is capable of sensing its environment and navigating without human input.
Manufacturing	Computer technology is used to produce items faster, more accurately and cheaper than can be done by hand.
Shopping	Online shopping has led to the closing of many high street stores. It has also helped people who find it difficult to get to a supermarket for their food shopping.
Communication	Advancements in technology now make it much easier to communicate all over the world using social media, email, texting and phone calls. Information is spreads at a much faster rate.
Employment	The advancement of computer technology has made many new jobs, but has also put many people out of work in a number of industries (for example, manufacturing). Some jobs are now automated or controlled by robots.
Developments in software	Computer software is becoming substantially more developed as time goes on – this is especially visible within the field of artificial intelligence.
Artificial Intelligence	The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.
Healthcare	Technology is used to monitor patients, administer drugs and diagnose illnesses. Health apps are used more regularly on smartphones than ever before.
Social networking	Many people of all ages use social networking sites to keep in touch with others. It is much easier to communicate in this way than it would be to send a card, for example.
Rating culture	Services use star or score-based rating systems to judge people's performance. For example, the taxi company Uber does this to assess the performance of their drivers, based on what their passengers suggest.
Privacy	According to a recent study, Google is within a few years of having sufficient information to be able to track the exact movements and intentions of every individual, via Google Earth and other software they are developing. Greater advancements in technology could further risk our privacy.
Cookies	File, often unique identifiers, that are sent by web servers to web browsers and which may then be sent back to the server each time the browser request a page from the server. Can be used to recognise computers when they revisit a website, track users navigating the site, etc.

Attribution
BY
Others can copy, distribute, display, perform and remix your work if they credit your name as requested by you

No Derivative Works
ND
Others can only copy, distribute, display or perform verbatim copies of your work

Share Alike
SA
Others can distribute your work only under a license identical to the one you have chosen for your work

Non-Commercial
NC
Others can copy, distribute, display, perform or remix your work but for non-commercial purposes only.

creative commons

Environmental vocabulary

Carbon footprint	The amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organization, or community.
Pollution	The presence in or introduction into the environment of a substance which has harmful or poisonous effects.
Computer-aided manufacturing	The use of software to control machine tools and related ones in the manufacturing of workpieces.
Sensors	A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture, pressure, or any one of a great number of other environmental phenomena.

Digital Divide

Money – people need money to access the internet or buy the latest devices.

Location – access to network coverage & high speed broadband depends on where you live, some rural areas can have limited internet coverage.

IT literacy – knowing how to use technology can be a major benefit. People who don't know how to use computers and the internet do not have the opportunities that those who can.

Advantages of using technology	Disadvantages of using technology
Using email and working electronically means that less printing is required, and so less paper is used	Technology consumes energy. Computers require electricity, and most smartphones and tablets require recharging after just a few hours of use.
Using systems like FaceTime, Skype and video conferences can reduce the need for people to travel to meet each other, and so less fuel is used	Tablets and mobile phones use less energy than desktops and laptops as the hand-held devices use flash memory instead of hard drives and RISC CPUs instead of CISC CPUs.
People can work from home - which reduces commuting (less fuel is used) and means that less office space is needed	Technological waste - also known as e-waste - sometimes contains poisonous chemicals and can be an environmental hazard.

Type of Functions

There are many types of Functions that can be used in spreadsheets helping to make calculations a lot easier. Some common uses are **MIN** of Minimum, **MAX** for Maximum, **AVG** for Average and **SUM** for Sum total

=SUM(A1:A20)

Equal sign	Function name	Argument
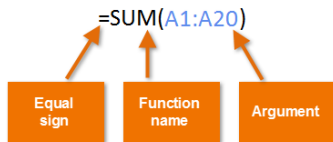
This is the correct way to structure a function – Remember always start with a =

Absolute Cell Referencing

Absolute Reference in Excel

=E35*E33

	B	C	D	E	F
			GST	10%	
	Item	Quantity	Price (Rs.)	Total Price	Total Price with GST
	Marie Gold Biscuits	5	40	200	=E35*E33

Select a cell which you need to permanently look at and press **F4** on you keyboard to make the absolute cell referencing $ to appear around the selected cells.

Type of Graphs

Bar chart	Visual tool, uses bars easy to see difference, long bar means greater value
Pie chart	size of portion represents the quantity, visually simple to flow, good for summaries
Scatter graph	show relationship between 2 variables, maximum and minimum values are easy to work out

In 2009

In 2010

■ KitKat ■ Mars ■ S'mores ■ Toffee Crisp ■ Twix
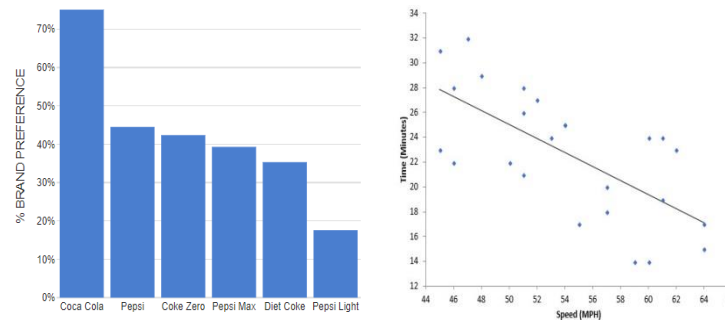
Keywords	Definition
Absolute Cell Referencing	When you want a formula to consistently refer to a particular cell.
Function	is a predefined **formula** that performs calculations in a particular order
Formula	is an expression which calculates the value of a **cell**
Conditional formatting	is a feature which allows you to apply a format to a cell or a range of cells based on certain criteria

IF Statement…

C2   =IF(B2<=50,"Fail","Pass")

	A	B	C	D	E	F
1	Student Name	Scores	Result			
2	BRUCE GEYER	37	Fail			
3	ELIZABETH STERN	73	Pass			
4	MASATOSHI HENDERSON	62	Pass		Criteria	Result
5	CHRISTINE YOSHIMURA	43	Fail		Below or Equal to 50	Fail
6	JOHN ADAMSON	35	Fail		Above 50	Pass
7	IRVING PIANKA	86	Pass			
8	EILEEN HAAS	81	Pass			
9	VINCENZO KWAN	50	Fail			

The **IF function** can perform a logical test and return one value for a TRUE result, and another for a FALSE result.
For example, a "Fail" is scores below 50:
=IF(B2<=50,"Fail","Pass")

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Year 9 – Computing – CS & IT Industry Project

Excel Spreadsheet toolbar

AutoSum
Automatically add totals of selected cells
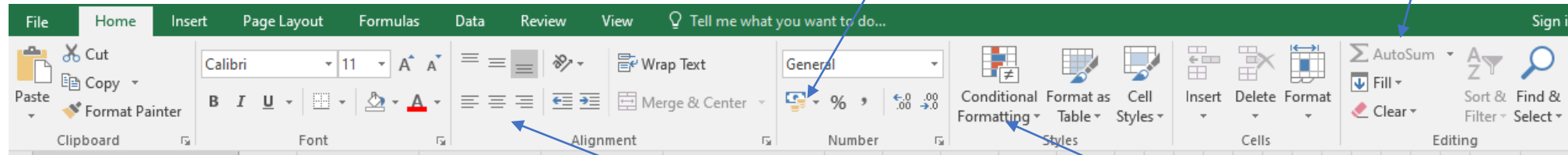
Currency / Accounting format
Used to add currency to the numbers in the cell

Conditional Formatting
Used to spot trends and patterns in your data

Text Alignment
Helps user align the text within the selected cell/s

Layout of a spreadsheet

Finding a function
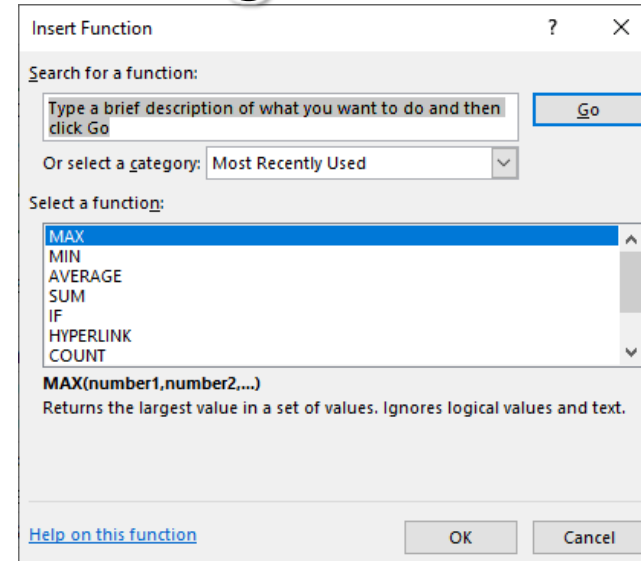
is a predefined **formula** that performs calculations using specific values in a particular order

Variables
- Variables are for storing values in memory.
- A variable is declared (set up) and values are assigned.
- Variables are assigned a value using the = operator.
- It chooses the bets data type for the value.

- No spaces in names but can use under_score or camelCase.
- No numbers at start of variable names.

```
myvariable = 28

x = 3

name = "Bob"

my_wage = 3.5

favCol = "red"
```

Comments
- Comments are for explaining lines of code or while sections.

```
x = 3   #can comment at the side

#or comment above
house = "open"
```

Print
- Print information to the screen.
- Can be text, numbers or values in variables.

```
print("hello world")

print(12)

print(name)
```

Input
- Allows user to type in data and store in a variable.
- User prompt requires the " ".

- May need to convert data type.

```
variable = input("message")

name = input("please enter your name")

age = int(input("please enter your age"))
```

Data Types

Real /Float
Number with decimal Point
Integer
Number without a decimal Point
String
A series of characters/TEXT
Character
A single letter or symbol
Date/Time
Date and Time in any format
Boolean
Yes no, true false value

Comparative Operators

==	Equal to
!=	Not equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to

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Year 9 – Computing – CS & IT Industry Project

If and elseif statement
- **Allows SELECTION of different paths.**
- **Use of THEN & ENDIF.**
- **MUST include indent of 4 spaces or TAB**
- **ELSE is optional.**

- **Conditions are set using different comparison operators.**

==	Equal to
!=	Not equal to
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to

- **Can use more than 1 condition using Boolean operators.**

AND	Both conditions are True
OR	Either of the conditions is True
NOT	If condition not True

- **Use of ELSEIF allows for further selection.**
- **Can have as many as wanted.**
- **ELSE still optional.**

```
if password ==  "pa55word1":
    print("you may enter")
```

```
if score > 80:
    print ("grade A")
elif score > 70:
    print ("grade B")
elif score > 60:
    print ("grade C")
else:
    print ("redo")
```

```
if password !=  "password1" or tries < 3:
    print("you shall not pass")
else:
    print ("please enter")
```

Sequence: Completing steps in the order which they must happen

Selection: Where a choice is made in a program depending on a condition or outcome

Iteration: Act of repeating or lopping specific sections of code

Count controlled Iteration: Repeats a set number of times
Condition controlled Iteration: Repeats until a condition is met or something in the program changes

Year 9 – Computing – CS & IT Industry Project

| **While Loop**<br><br>**Will keep asking the user to type in a value.** | ```python
#--while loop--
password = input("enter password:")

while password !=  "password1":
    password = input("try again")
``` | • Loops are a way for python to do blocks of code more than once |
| **While True (Break)**<br><br>**If the user types in a value that matches 7 the loop will break (end), if not they will be told to try again.** | ```python
#--while True with break--
while True:
    guess = input("guess the number")
    if guess == "7":
        break
    else:
        print ("try again")
``` | • Without having to keep copying the code

• Blocks of code being repeatedly run is called **iteration** |
| **For Loop**<br><br>**Start at 0 and stop at 7 (up to 7 but not including),**<br>    **print hello each time (7 times).** | ```python
#--for loop--
for i in range(0,7):
    print ("hello world")
``` | • Python offers two ways of looping<br>   – `while` loop<br>   – `for` loop |
| **For Loop (Break)**<br><br>**Start at 0 and stop at 4,**<br>**If the user types in a value that matches mypassword the loop will break (end), if not they will be told to try again and have an attempt recorded.** | ```python
#--for with break--
for i in range(0, 4):
    if password  == "password1":
        break
    else:
        password = input("enter password")
``` | |

Empty list of 0 spaces.

Arrays with values. Use the , to split up space.

Can be different data types, strings need " ".

```
#--format--
mylist = [ ]

group = ["Tim", "Jane", "Bob"]

ages = [14,11,17,10.5,"Apple",True,False]
```

Print whole array.
Print 1st value in array.
Print 3rd value in array.
Prints from 1st value to 2nd value.

```
#--print--
print(group)
print(group[0])
print(group[2])
print(group[0:2])
```

Update a value to position 3 in array.

Update a value to position 0(start) in array.

```
#--update value--
group[2] = "Mike"

group[0] = "Destiny "
```

Add value to end of array.

Remove first instance of value from array.

Insert a value to a specific position in the array

```
#--adding/remove/insert--
group.append("Fred")

group.remove("Jane")

group.insert(2,"Miya")
```

- An array is like a variable that can hold more than 1 value at once

- Must all be the same data type

- Array can be as big as you want

- Sometimes called lists

- Will need a name/identify

- The index, are the position number

- Always starts at 0

- The spaces are called the elements

- These hold the values/items

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Year 9 – Drama – Basic Drama Blood Brothers

I wish I was our Sammy,
Our Sammy's nearly ten
He's got two worms and a catapult
An' he's built an underground den.
But I'm not allowed to go in there,
I have to stay near the gate,
'Cos me Mam says I'm only seven,
But I'm not, I'm nearly eight!
I sometimes hate our Sammy,
He robbed me toy car y'know,
Now the wheels are missin' an' the top's broke off,
An' the bleedin' thing won't go.
An' he said that when he took it, it was just like that,
But it wasn't, it was dead straight.
But y'can't say nott'n when they think y' seven,
An y' not, y' nearly eight.
I wish I was our Sammy, Y' wanna see him spit,
Straight in the eye from twenty yards An' every time a hit.
He's allowed to play with matches,
And he goes to bed dead late,
And I have to go at seven,
Even though I'm nearly eight.

What needs to be included in a good monologue performance?

- Facial expressions
- Accent
- Body Language
- Gestures
- Projection
- Vocal Tone

A good monologue should explain to the audience what the relationships are in the play.

Steps to use Line Memory Recall.

Start with the first line. While looking at it, repeat it ten times.

Cover up the line and attempt to say it without looking. If correct, move to next step. If wrong, start again.

Then add the second line. Say it ten times while looking at it.

Cover up the line and attempt to say it without looking. If correct, move to next step. If wrong, start again.

Repeat until all lines are memorised.

Keyword	Definition
Accent	A voice linked to a specific place. Example- Liverpool
Body Language	Using posture or movement to communicate how your character is feeling.
Collaboration	Working together as a group to create something new
Communication	Exchanging information
Facial Expressions	Showing your emotion through your face.
Focus	Not laughing while you are on stage and staying in character.
Freeze Frame	A frozen snapshot in time showing a key moment in a story.
Gestures	Using your hands to show the audience where to look through pointing, waving etc.
Line Memory Recall	A technique used to remember lines. Repeat one line with the rest covered up.
Monologue	A speech said by one person to the audience.
Projection	Using a loud volume to make sure you are heard.
Prologue	A speech at the beginning of the play introducing characters and setting.
Vocal Tone	Showing emotion through your voice.

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Year 9 Music – World Music

How did Reggae develop?

REGGAE is one of the traditional musical styles from **JAMAICA**. It developed from :

→ **REGGAE** ←

MENTO

A form of Jamaican **FOLK MUSIC** like **CALYPSO** popular in the 1950's.

SKA

Fast dance music that emerged in the 1950's fusing American R&B with **MENTO** rhythms and featuring **ELECTRIC GUITARS, JAZZY HORN SECTIONS** and characteristic **OFFBEAT RHYTHMS**.

ROCK STEADY

A more vocal style of dance music which used **RIFFS, SIMPLE HARMONIES, OFFBEAT RHYTHMS** and a strong **BASS LINE**.

Reggae was first heard in the UK in the 1950's when immigrants began to settle. During the 1960's, people began importing singles from Jamaica to sell in UK shops. Now, Reggae is known as the national music of Jamaica.

Reggae Key Words

MELODY – The main 'tune' of a piece of music, often sung by the **LEAD SINGER**.

RIFF – A repeated musical pattern. Often the **BASS GUITAR** plays repeated **MELODIC BASS RIFFS** in Reggae songs.

BASS/BASS LINE – The lowest pitched part of a piece of music often played by the **BASS GUITAR** in Reggae which plays an important role.

CHORD – 2 or more notes played together in **HARMONY**.

TEXTURE – Layers of sound combined to make music.

African Music

African instruments are often made from plants and animal products such as hide and bone. African musicians are very fond of **PERCUSSION** instruments and use a wide variety of drums (called **MEMBRANOPHONES**) Drums are traditionally used as an accompaniment to singing, dancing, working and communicating between villages. Drummers are typically the most respected members of their community.

Texture

In West Africa, drum ensembles have 3-5 players each with a distinctive method of striking their drum and playing interlocking rhythms. This creates a **THICK** and complex **POLYPHONIC** texture.

The **MASTER DRUMMER** can elaborate and decorate his solo drum part with **ACCENTS** and playing in a technically demanding style to "show off" to the rest of the drum ensemble and audience.

Texture

In West Africa, drum ensembles have 3-5 players each with a distinctive method of striking their drum and playing interlocking rhythms. This creates a **THICK** and complex **POLYPHONIC** texture.

Samba

Music in Latin America is widely influenced by colourful and exotic carnivals and a range of dance styles. Carnivals may include **FANFARRAS**, featuring brass instruments associated with fanfare, and almost always a **SAMBA BAND**.

Intro	Groove	Break 1	Groove	Break	Groove	Mid-Section 1	Groove	Break 1	Groove	End

Tempo

Samba music is generally fast at around 104 bpm and keeps a constant tempo to assist the dancers or processional nature of the music. Sometimes the **SAMBISTA** (Samba leader) uses **(TEMPO) RUBATO** – tiny fluctuations in tempo for expressive effect.

Music – Composing / Performing Skills – Soundtracks

Film Music is a type of **DESCRIPTIVE MUSIC** that represents a **MOOD, STORY, SCENE** or **CHARACTER** through music, it is designed to **SUPPORT THE ACTION AND EMOTIONS OF THE FILM ON SCREEN**. Film Music can be used to:

- Create or enhance a mood (though the **ELEMENTS OF MUSIC**) ->
- Function as a **LEITMOTIF** (see D)
- To emphasise a gesture (**MICKEY-MOUSING** – when the music fits precisely with a specific part of the action in a film e.g. cartoons)
- Provide unexpected juxtaposition/irony (using music the listener wouldn't expect to hear giving a sense of uneasiness or humour!)
- Link one scene to another providing continuity
- Influence the pacing of a scene making it appear faster/slower
- Give added commercial impetus (released as a **SOUNDTRACK**) – sometimes a song, usually a pop song is used as a **THEME SONG** for a film.
- Illustrate the geographic location (using instruments associated with a particular country) or historical period (using music 'of the time').

Jerry Goldsmith
Planet of the Apes
Star Trek: The Motion Picture
The Omen
Alien

John Williams
Star Wars
Jaws
Harry Potter
Indiana Jones
Superman, E.T.

James Horner
Titanic
Apollo 13
Braveheart
Star Trek II
Aliens

Ennio Morricone
The Good, The Bad and The Ugly
For a Few Dollars More
The Mission

Danny Elfman
Mission Impossible
Batman Returns
Men in Black
Spider Man

Hans Zimmer
The Lion King
Gladiator
Dunkirk
Blade Runner 2049
No Time to Die

Bernard Hermann
Psycho
Vertigo
Taxi Driver

Steps to a good performance.

Collaborate as a group and discuss initial ideas

↓

Experiment with some sounds you may wish to use in your performance.

↓

Arrange the sounds so they fit with the action on the screen and **rehearse** as a pair/group.

↓

As a group, decide on a **narrator** and add a **narration** to the start of your scene to introduce characters and setting.

Keyword	Definition
Soundtrack	The music and sound recorded on a motion-picture film. The word can also mean a commercial recording of a collection of music and songs from a film.
Collaboration	Working together as a group to create something new.
Communication	Exchanging information through speaking, writing, or non-verbal communication.
Concentration	Focussing on the set task.
Experiment	To try something out or discover what works best.
Focus	Not laughing while you are on stage and staying focused on your performance.
Arrange	Organise/ put things in order.
Storyboard	A graphic organiser in the form of illustrations and images displayed in sequence to help the composer plan their soundtrack.
Music Spotting	A meeting/session where the composer meets with the director and decides when and where music and sound effects are to feature in the finished film.

Year 9 What is Design Technology?

Design and technology gives young people the skills and abilities to engage positively with the designed and made world and to harness the benefits of technology.

3d Drawing Techniques

3D drawings are used to present ideas so clients are able to understand features more clearly.

One-Point Perspective:
- Uses one vanishing point
- Used for Room interiors
- Front surface 2D and flat

Two-Point Perspective:
- Uses two vanishing points
- Connected by a horizontal line
- Used for developing ideas in 3D.

Oblique Projection:
- Horizontal going backwards drawn at 45 de
- Front surface is drawn in 2D
- Looks out of proportion
- Simpler process to isometric drawing

Isometric Projection:
- 30 degree angle is applied to its sides
- In proportion
- All vertical lines parallel to paper
- Drawing Board and isometric set square r

Design Specification: A list of points to state what the product must have to meet the needs:

Possible Sections: Material, Safety, Ergonomics, Environmental, Costing, Manufacture, Finishes, Age Range, Functions,

Material Properties
- **DURABLE:** able to withstand wear, pressure, or damage; hard-wearing (Wood for a bench)
- **STRENGTH:** The ability of a material to stand up to forces being applied without it bending, breaking, shattering or deforming in any way (Metal when being shaped for a product)
- **TOUGHNESS:** A characteristic of a material that does not break or shatter when receiving a blow or under a sudden shock (Wood work bench)
- **MALLEABILITY:** The ability of a material to be reshaped in all directions without cracking (Metal when casted into a shape)

Design Brief: A Design Brief is a short paragraph explaining the situation you have been given and the problem you need to solve.

Purpose:
- Identify a Problem
- Identify the client
- How to go about solving the problem
- Solutions

Client Needs/Brief: What the client requires of a product, here are some examples:

- Function
- Disabilities
- Social
- Anthropometrics/Measurements
- Material/Finishes
- Health and Safety
- Costing

Keywords	Tools and Machines	Materials
Analysing	Metal files	Acrylic
Investigating	Pillar drill	Aluminium
Collate	Wet & dry paper	Ferrous
Develop	Vacuum former	Non-ferrous
Improve	Wire wool	Metal
Manufacture	Laser Cutter	Alloy
Evaluate	2D Design	Polyvinyl chloride (PVC)
Explain	Bench Vice	High-density
Technical	Junior Hacksaw	polyethylene ABS
Dimension	Safety ruler	Copper
Tolerance	Pliers	Mild steel
Quality check	Engraver	Polypropylene

Year 9 What is Engineering?

Engineering is the application of science and math to solve problems. Engineers figure out how things work and find practical uses for scientific discoveries.

Engineering definition

A general definition for engineering is 'the safe application of technical and practical knowledge to transform ideas and materials into products

There are **four main engineering disciplines** of areas of study

Mechanical engineering studies the design, manufacture and use of machines

Electrical engineering studies the practical applications of electricity and magnetism

Civil engineering studies the design, planning and construction of large structures

Chemical engineering studies the process and equipment needed to manufacture chemical products on a large scale

Engineering Sectors

- A **sector** is a term used to describe a particular type of industry within the nation's overall economy
- The main **Engineering sectors** include the following – Aerospace, Automotive, Communications, Electrical/electronics, Mechanical, Environmental, Transport, Rail & Marine

Engineered Organisations

- **Research and development** – Improve existing ideas or develop ideas for new products
- **Design** – Sketching what the final product may look like, making models to visualise any problems
- **Planning** – Develop a plan so that the product can be made in a timely, cost-effective and safe manner.
- **Making** – Produce an engineered product that meets the requirements of the design

Engineered Products

- Engineering sectors & their Engineered products
- **Mechanical** – Gears, shafts and hydraulics
- **Automotive** - engines, gearbox, suspension and braking systems
- **Aerospace** – Engines, wings and rotor blades
- **Communications** – Satellite dishes, smartphones and wireless routers
- **Environmental** – Photovoltaic cells and wind turbines
- **Marine** – Ships, boats, submarines, yachts

Engineered Job Roles

- Engineering organisations employ many different people with a variety of skills

- **Maintenance technician** – Service and repair mechanical and electrical equipment and systems

- **Machine operator** - Operate machinery, such as drills and lathes

- **Aircraft Fitter** – Employed in both aircraft manufacturing and aircraft maintenance
- Engines, wings and rotor blades

CAD

CAM

Keywords	Tools and Machines	Materials
Analysing	Metal files	Acrylic
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Develop	Vacuum former	Non-ferrous
Improve	Wire wool	Metal
Manufacture	Laser Cutter	Alloy
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Technical	Junior Hacksaw	polyethylene ABS
Dimension	Safety ruler	Copper
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There are **seven** major classes of nutrients: carbohydrates, fats, dietary fibre, minerals, proteins, vitamins, and water. These nutrient classes can be categorised a either **macronutrients** (needed in relatively large amounts) or **micronutrients** (needed in smaller quantities).

Macronutrients:

Carbohydrates provides the body with **energy**. There are two main types, complex and simple. **Complex carbohydrates** give **long lasting energy**. These are found in foods such as bread, pasta and cereals. **Simple carbohydrates** make blood sugar levels go up very quickly. This provides a **short burst** of **energy.** These are found in 'sugary; foods such as cakes, jams and sweets.

Protein is needed for **growth** and to **repair** cells. Protein is made up of amino acids. Proteins that are high in essential amino acids are called **high biological value (HBV)** proteins. These are found in milk, cheese, fish, eggs, meat and soya beans. Proteins that are low in amino acids are called **low biological value (LBV)** proteins. These are found in nuts, cereals and pulses.

Fats are used by the body for **energy.** Fat also forms an insulating layer under your skin to keep us **warm** and **protect our organs,** such as our kidneys. There are two main types of fat, **saturated** and **unsaturated.** Foods such as meat, cheese and butter are high in saturated fats. Foods such as seeds, fish and vegetable oils are high in unsaturated fats. We should eat less saturated fats.

Fibre helps food to move through our bowels and prevent **constipation**. Foods such as vegetables, wholemeal bread and beans are high in fibre.

Water is needed for lots of reasons, keeping our body at the right **temperature**, **digesting** food, **lubricating** our bones and keeping us **hydrated**. Water is found in drinks, fruits and vegetables.

Keywords	Definition
Constipation	Difficulty empting the bowels
Cholesterol	A type of fat found in our blood
Immune System	A set of tissues which work together to resist infection
Diabetes	A disease that occurs when your blood glucose (blood sugars), is too high.

Micronutrients:

Vitamin	What we need it for	Examples of where we get it from
A	Good vision, especially when it is dark	
B Group	Releasing energy from carbohydrates	Meat
C	Fighting diseases and helping the body to absorb iron	
D	Along with calcium, it helps our body make strong bones and teeth	Oily
Minerals	**What we need it for**	**Examples of where we get it from**
Iron	To make red blood cells to carry oxygen around the body	Green leafy veg
Calcium	Along with vitamin D, calcium helps make strong bones and teeth	

Consequences of a poor diet:
- Eating too many carbohydrates, fatty foods or sugary foods can lead to **obesity,** which can increase the risk of **type 2 diabetes** and **heart disease.**
- Eating too many salty foods can cause **high blood pressure.**
- Too much saturated fat can lead to **high cholesterol.**

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Nutritional needs according to age – Everyone should aim to follow the healthy eating guidelines, but our nutritional needs change throughout each stage of our lives.

Children, grow quickly and are very active. They need protein to help them grow and repair the body. Carbohydrates are needed for energy to support their physical activity. Calcium and Vitamin D are needed for healthy teeth and bone development.

Teenagers, should aim for a balanced diet. Rapid growth spurts happen around the early teens, girls usually start these earlier than boys. Protein is needed to cope with growth spurts, boys tend to need more due to muscular tissue development. Girls need more iron and Vitamin C as they lose these nutrients through a period. Teenagers also need Calcium and Vitamin D, to support the skeleton reach peak size and bone density.

Adulthood, at this stage growth and development stops. Men require more calories than women because they have more lean muscle and are generally taller and larger. Iron is important for adult women as they continue their periods. Calcium and Vitamin D to keep the skeleton strong as women tend to lode bone strength.

Late Adulthood, as we age our muscle is replaced with fat, so eating high in fat foods must be avoided. Calcium and Vitamin D is needed to help stop bones from becoming weak and brittle. Vitamin B12 is needed to keep the brain healthy and prevent memory loss. Fibre is needed to prevent constipation as the digestive system begins to weaken and Vitamin A is needed to help maintain good eyesight.

Diet and Lifestyle – You may have to plan a meal for someone with a dietary requirement (intolerances, allergies, ethical, religious beliefs and diet related health problems) all affect what people eat.

Vegetarians avoid eating meat and fish for a variety of reasons, including:
- Dislike the taste and texture of meat
- Religious beliefs
- Family influences

Vegans do not eat any foods from animal origin. This includes meat, fish, dairy and honey. To obtain a range of nutrients, vegetarians and vegans do eat:
- Wholemeal bread and flour
- Soya/ plant based products
- Fruit and vegetables

An **allergy** is a reaction to the immune system your body has to a particular food. The most common types are nuts and shellfish. Symptoms include a rash to swelling of the throat and mouth and difficulty breathing.

Food intolerance occurs when a person has difficultly digesting a particular food. Common examples include lactose (cow milk) and gluten (wheat).

Keyword	Definition
Diet	The type of food we eat and drink
Growth Spurt	Growing quickly and suddenly in a short period of time
Rickets	A disease in children from a lack of vitamin D and calcium, causing bones to soften and bend, particularly in legs
Osteoporosis	A medical condition in which the bones become brittle and fragile from a lack of calcium and vitamin D
Iron deficiency anaemia	A condition where a lack of iron in the body leads to a reduction in the number of red blood cells.
Bone density	The amount of bone mineral in bone tissue
Obesity	The state of being grossly fat or overweight
Diabetes	A disease in which the body's ability to produce or respond to the hormone insulin is impaired, resulting in abnormal metabolism of carbohydrates and elevated levels of glucose in the blood.
Tooth Decay	Damage to a tooth caused by dental plaque turning sugars into acid.
Constipation	Difficulty emptying the bowels

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A. Parle-moi de tes vacances l'année dernière. Tell me about your holidays last year.

Past time phrase	Perfect tense	Country	Family members	Past tense activities		
Il y a deux ans Two years ago **L'année dernière** Last year **L'été dernier** Last summer **L'hiver dernier** Last winter	**je suis allé[e]** I went **nous sommes allés** we went	**en France** to France **en Écosse** to Scotland **en Espagne** to Spain **en Grèce** to Greece **en Irlande** to Ireland **en Italie** to Italy **en Turquie** to Turkey **au Canada** to Canada **au Pays de Galles** to Wales **au Portugal** to Portugal **aux États-Unis** to the USA	**avec ma famille.** with my family. **avec mes amis.** with my friends. **avec mes parents.** with my parents.	**J'ai bronzé** I sunbathed **J'ai fait des excursions** I did trips **J'ai fait du vélo** I went cycling **J'ai joué au volley** I played volleyball **J'ai mangé aux restaurants** I ate at restaurants **J'ai nagé dans la mer** I swam in the sea **J'ai oublié mes problèmes** I forgot my problems **J'ai rencontré de nouveaux amis** I made new friends **J'ai visité des monuments** I visited monuments	**et**	**je suis allé[e] à la plage.** I went to the beach. **je suis sorti[e] avec des amis.** I went out with friends.

B. Où aimerais-tu aller si tu pouvais ? Where would you go if you could?

If clause	Conditional verb	Preposition + country	Conditional verb	Adjective/adjectival phrase
Si j'avais l'argent If I had the money **Si je gagnais à la loterie** If I won the lottery **Si j'étais riche** If I were rich **Si je pouvais** If I could	**j'aimerais aller** I would like to go	**à Madagascar** to Madagascar **au Canada** to Canada **au Congo** to Congo **au Sénégal** to Senegal **au Viêt Nam** to Vietnam **en Australie** to Australia **en Polynésie** to Polynesia **aux Caraïbes** to the Caribbean **aux États-Unis** to the USA **aux Seychelles** to the Seychelles	**ce serait** it would be	**une expérience enrichissante** an enriching experience **un rêve devenu réalité** a dream come true **la chance d'une vie** the chance of a lifetime **divertissant** entertaining **formidable** terrific **incroyable** incredible **merveilleux** marvellous **passionnant** exciting **pittoresque** picturesque **reposant** relaxing

Future time phrase	Future tense verb	City + country	Future tense verb phrase		Verb	Quantifier	Adjective
Cet été This summer **Cette année** This year **L'année prochaine** Next year	**je vais aller** I'm going to go **nous allons aller** we're going to go	**à Paris en France** to Paris in France **à Montréal au Canada** to Montreal in Canada **à Bruges en Belgique** to Bruges in Belgium **à Bora Bora en Polynésie** to Bora Bora in Polynesia **à Marrakech au Maroc** to Marrakech in Morocco **en Martinique aux Caraïbes** to Martinique in the Caribbean **au Monaco** to Monaco	**j'y vais** there I'm going to	**acheter des souvenirs** to buy souvenirs **aller à la plage** to go to the beach **bronzer** to sunbathe **découvrir la culture** to discover the culture **faire de la plongée** to do diving **faire du tourisme** to do sightseeing **manger de la cuisine locale** to eat local food **regarder le coucher du soleil** to watch the sunset **visiter des monuments** to visit monuments	**ce sera** it will be	**complètement** completely **plutôt** rather **totalement** totally	**divertissant** entertaining **formidable** terrific **incroyable** incredible **merveilleux** marvellous **passionnant** exciting **pittoresque** picturesque **reposant** relaxing

C. Où vas-tu aller cet été ? Where are you going to go this summer?

My extra vocabulary:

Year 9 – Geography – There is no Planet B

Climate Change

- The planet experiences cold (glacial) and warm (interglacial) periods every 100,000 years.
- However, global average temperature is increasing dramatically.
- There is currently more carbon dioxide in ppm in the atmosphere than is 'safe' and sea levels are rising exponentially.
- Bystander Effect – we think other people will handle issues such as climate change and we are brain bias (programmed) to only care for our immediate interests and have a lack of concern for future generations.

Food

- The average human needs to consume 2350kcal per day and, on average, the world produces enough food for a person to consume 5940kcal per day (nearly 2.5 times more).
- Through food waste or animal feed, there is only 2070kcal left per person per day.
- Over 800 million people are undernourished – they cannot afford, or do not choose, a healthy diet.
- If we cut the world's food waste by half, the world's food supply would grow by 20%.
- All food has a carbon footprint associated with it – from fertiliser to harvesting to storage and transport.
- Beef and lamb are both very high in greenhouse gas emissions (per 50g of protein) compared to plant-based proteins.

Energy

- We all use energy – the average person uses around 59kWh per day.
- Energy consumption is not equal around the world – the average European uses twice the global average and the average American uses nearly four times the global average.
- Our energy consumption is increasing – we use three times as much energy as we did 50 years ago.
- We use energy for food, transport, industries, domestic use and services.
- We also use a mix of energy resources such as coal and oil (non-renewable), and HEP and solar (renewable).
- However, we still get 83% of our energy from fossil fuels – which contributes to human-induced climate change.

Travel and Transport

- 80% of the world's population have never flown on a plane.
- 15% of the UK's population take 70% of UK flights every year.
- Domestic flights release the most emissions per passenger per km overall, however, a diesel car with one passenger remits the most CO2 per passenger per km.
- Carbon offsetting is where you compensate for CO2 emissions from an activity (e.g. flying) by participating in schemes designed to make equivalent reductions of CO2 in the atmosphere (e.g. planting trees).
- Autonomous cars are being designed – however, there are pros and cons linked to these.

Keyword	Definition
Anthropogenic	Originating in human activity.
Anthropocene	Proposed geological period dating from the start of significant human impact on Earth's geology and ecosystems, including, but not limited to, anthropogenic climate change.
Carbon footprint	The amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organisation, or community.
Carbon Offsetting	The action or process of compensating for carbon dioxide emissions arising from industrial or other human activity, by participating in schemes designed to make equivalent reductions of carbon dioxide in the atmosphere.
Demand	An insistent request.
Economic	Relating to money.
Feedback Loop	A process in which the outputs of a system are circled back and used as inputs.
IPCC	The Intergovernmental Panel on Climate Change (IPCC) is a UN body that evaluates climate science
Paris Agreement (2016)	An agreement within the United Nations dealing with greenhouse gas emissions mitigation, adaptation, and finance.
Parts per Million (ppm)	The number of units per million units of something.
Ruminate	To think deeply about something.
Sustainable	Able to be maintained. It helps the people now without negatively impacting the people of the future.
Tipping Point	A point of no return – once you cross the tipping point, you cannot stop or change the effects which will happen.
Vulnerable	Exposed to the possibility of being attacked or harmed.

Year 9 – Geography – There is no Planet B

Economic growth

- Around 50% of global money belongs to only 1% of the global population, the poorest 70% only have 2.7% of all wealth.
- Even if countries are considered 'rich', many people still live in poverty as there is massive inequality.
- Happy Planet Index – measures wellbeing, life expectancy, inequality of outcomes, and ecological footprint.
- Our current economic growth isn't sustainable – we need to move from a linear economy to a circular economy.
- A linear economy takes a 'take, make, dispose' approach, this is where we use things once and no longer use or need them.
- A circular economy benefits businesses, people and the environment. This is where we share, reuse and refurbish.
- Circular economies will support people to thrive and limits environmental issues.

People

- The threat is not so much the total size of our human population, rather the total cumulative impact each person has in terms of consumption.
- As the population grows the demand for energy will increase.
- The supply of energy will need to change from mainly non-renewable to renewable for us to look after our planet.
- Our populations need to be educated on how they can live with minimal impacts.

Business and Technology

- A tipping point is a point of no return – once you cross the tipping point, you cannot stop or change the effects which will happen.
- If we cross a climate change 'tipping point; then climate change will be irreversible.
- The planet will end up with a much hotter climate overall and there will be increased flooding of coastal areas and most living species will be destroyed.
- The four main tipping points are: melting glaciers, warming waters, deforestation of the Amazon, and the melting of Arctic ice and permafrost.
- The greater the impact of climate change, the more vulnerable we are and the harder it will be to adapt.

Careers Link

- Companies need to meet targets in terms of reducing their carbon emissions reducing their negative impacts on the planet.
- It is an environmental officers job to ensure companies are sticking to these targets.
- Advertising is increasingly focused on how companies are working on being better for the environment. This means marketers will need to have knowledge of sustainability.

Values, Truth and Trust

- The impacts of global warming are becoming more widespread over time, however, some countries are affected more.
- The countries most at risk from climate change are: Cambodia, Vietnam, Bangladesh, Senegal and Mozambique.
- These are all low-lying countries (close to sea level) and have populations living in coastal areas.

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Timeline:

1955 Emmett Till murder	1955 Rosa refuses to give up her seat	1957 Little Rock Nine	1961 Freedom rides	1963 March on Washington	1964 Civil Rights Act	1965 Malcolm X Killed	1965 Bloody Sunday	1965 Voting Rights Act	1968 MLK killed

Emancipation Proclamation

President Abraham Lincoln issued the **Emancipation Proclamation** on January 1, 1863.
The proclamation declared "that all persons held as slaves" within the rebellious states "are, and henceforward shall be free."
This meant that for the first time since their transportation to the nation, African-Americans were **legally** free.

Important figures

Martin Luther King

Martin Luther King Jnr was a campaigner for equality. Most known for his 'I have a dream' speech and the youngest person ever to win a Nobel peace prize.

Malcolm X

Malcolm X was a campaigner who did not rule out violence in self-defence and used the phrase 'by any means necessary'

Rosa Parks

Best known for her role in the Montgomery bus boycott where she refused to give up her seat on a segregated bus.

Emmitt Till

A fourteen-year-old murdered for supposedly flirting with a white woman. The nation was shocked by these events.

What was the American Civil Rights Movement?

The American Civil rights movement was a decades-long struggle by African Americans to end racial discrimination and racial segregation in the United States.
After the end of the American Civil War in 1865, black people were supposedly free from suppression.
However, African-Americans still faced hostility and persecution. This led to a movement against segregation.

The Black Panthers

The Black Panthers were a controversial group who also followed Malcolm X. They took part in shoot outs with police officers, but also provided breakfast clubs to children and free medical and legal advice to poor African-Americans.

What were the Jim Crow Laws?

States in America had introduced a series of laws to keep the races separated and the black population under control.
The black population was segregated from:
- Public transport waiting rooms
- Public places such as shops, hotels, cinemas, - theatres and libraries
- In education black children could be educated in separate schools

Who were the white supremacists?

Groups of people who thought they were superior and did not want equality, particularly the Ku Klux Klan.
They campaigned hate and violence against African Americans.
They used violence such as beatings, burnings, brandings, attacks with acid and lynching.

Little Rock Nine

In September 1957 Nine black students tried to attend an all white school.
The school Governor called in the National Guard to stop the black students' entering the school.
As a result, President Dwight D. Eisenhower sent in federal troops to escort the "Little Rock Nine" into the school.

Key Words

Segregation	the action or state of setting someone or something apart from others.
Activists	a person who campaigns to bring about political or social change
Assassination	to kill someone suddenly or secretively
Abolished	formally put an end to
Prejudice	preconceived opinion that is not based on reason or actual experience
Equality	the state of being equal, especially in status, rights, or opportunities
Supremacists	a person who believes that a particular group, especially one determined by race, religion, or sex, is superior and should therefore dominate society.
Discrimination	the unjust or prejudicial treatment of different categories of people,
Legislation	laws, considered collectively.
Civil Rights Act	The **Act** outlawed discrimination on the basis of race, colour, religion, sex, or national origin
Brown V Board	decision of the U.S. Supreme Court that U.S. state laws establishing racial segregation in public schools are unconstitutional
Boycott	withdraw from commercial or social relations with as a punishment or protest
Lynching	When a of a group of people kill (someone) for an alleged offense without a legal trial

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The Yalta Conference

Feb 1945

- Germany and Berlin would be divided into four zones
- Declaration of Liberated Europe – countries liberated from Nazi rule would have elections
- Eastern Europe would be a Soviet 'sphere of influence'.

BUT – disagreement on amount of reparations and the exact location of the German-Polish border.

The Potsdam Conference

Aug 1945

- Confirmed decision to divide Germany and Berlin into four
- Germany to be demilitarised, democratised, de-Nazified
- Germany to pay reparations to Allies – most of which to go to USSR
- Poland's border with Germany to be moved to the Oder-Neisse Line.

BUT – disagreement on how harshly Germany would be punished, and on free elections in Eastern Europe.

1946
Churchill's Iron Curtain Speech

- Churchill gave a speech in the USA claiming that an 'Iron Curtain' now divided Europe.
- Stalin saw it as deliberately provocative whilst it also helped to convince Truman of the need to be involved in European affairs

Causes of Tension

1948
The Berlin Blockade

- In response the USSR introduced its own currency – the Ostmark – to the Soviet Zone and cut off road, rail and canal traffic in an attempt to starve West Berlin.

1961
Construction of the Berlin Wall.

- Ultimatum repeated at Vienna summit.
- JFK refuses. Both sides increase arms spending.
- Construction of Wall begins in August.

Bay of Pigs Invasion

- 1500 CIA-trained Cuban exiles (La Brigada 2506) landed at the Bay of Pigs with the aim of toppling Castro.
- 20,000 men from Castro's army fought back and defeated La Brigada

1962
The Cuban Missile Crisis

- US spy plane photographs reveal Soviet IRBM missiles on Cuba.
- JFK demands the missiles are removed – US army on high alert
- Khrushchev sends letter offering to remove missiles in return for promise not to invade Cuba.
- Second letter adds condition that USA must remove missiles from Turkey.
- US spy plane shot down over Cuba.
- JFK accepts second letter and ignores first. Warns invasion if refused.
- Khrushchev accepts offer. JFK agrees to remove aging Turkish missiles in future.

Key Words

Capitalism	An economic and political system in which a country's trade and industry are controlled by private owners for profit, rather than by the state.
Communism	A theory or system of social organization in which all property is owned by the community and each person contributes and receives according to their ability and needs.
Bay of Pigs	An inlet on the southern coast of Cuba
Iron Curtain	A metaphor for the line that divided Europe between the democratic west and communist east
Containment	The US policy which aimed to stop the spread of communism
NATO	The North Atlantic Treaty Organisation is an alliance of democratic countries who agree to defend each other against attack
Nuclear Weapon	Highly destructive explosive device that gets it power from nuclear reactions.
NASA (National Aeronautical and Space Administration)	Agency in charge of U.S. science and technology related to airplanes or space.
La Brigada	The 1500 Cuban exiles trained by the CIA to invade Cuba.
Espionage	The act of organized spying, usually with the goal of uncovering sensitive military or political information.

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Key Words

Guerilla War	Ambushes, raids and hit and run operations carried out behind enemy lines (Vietcong tactic)
Containment	A foreign policy aimed at containing the influence of another country – in this case to stop Communism spreading
Domino theory	The theory that if one country comes under Communist rules it will cause others to follow
Tet Offensive	The Vietcong tried to get ordinary Vietnamese people to join in – it did not work
Ceasefire	The ending of violence
Conscription	The law that forces men to sign up to the army and go to war

Why did America get involved in the war?

- Vietnam was divided into two after it gained independence from France
- America were scared Vietnam would become completely communist and so helped set up a non communist government in the South
- As this government was corrupt and refused to hold elections, many turned to the Communist party instead
- The non Communist government was weak and needed the USA's support to fight off the Communists
- After JFK's assassination, President Johnson sent 1000s of troops into Vietnam to fight against Communism

Vietcong tactics
- Retreat when the enemy attacks
- Launch surprise attacks on enemy camps
- Pursue the enemy when he retreats
- Wear the enemy down by ambushing troops and laying booby traps and mines
- Use the local area, tunnels or jungle to hide
- Live amongst civilians for protection
- Decide not to wear uniform to make it difficult to identify you

US tactics
- Damage Vietcong supply lines
- Damage North Vietnam's industry and military production
- Extensive bombing
- Chemical weapons were used (Agent Orange) to destroy the jungles
- Napalm was a highly flammable substance used to burn everything it came into contact with
- Search and destroy – landing helicopters in Vietnamese villages and killing all soldiers found

Failings in Vietnam
- US tactics could not match the Vietcong's
- Many of the troops from the US were inexperienced
- The Tet Offensive – this showed the US that it would take many more troops, violence and death to beat the Vietcong

The media
- At the beginning of the war, very few newspapers/TV shows criticised the war
- After 1967 news reports started showing shocking scenes of violence from Vietnam
- Many celebrities such as Muhammed Ali publically spoke out about the war and how America should not have got involved

Failings at home
- My Lai Massacre – over 400 civilians (no Vietcong soldiers) were killed in 4 hours
- The lead soldier was sentenced to 20 years in prison for murder but served only 3 years
- Protests occurred in America against inequality – men at university did not need to go to war – but this was mostly white men – so many African American soldiers had to fight in Vietnam
- Guardsmen shot students at a protest at Kent State University
- The USA felt humiliated that they – a world superpower – could not defeat Vietnam

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Year 9 – History – Histories Mysteries

Were the gunpowder plotters framed?
- It has been suggested Robert Cecil (a Protestant) wanted to make Catholics unpopular
- Barrels of gunpowder were found in a cellar rented by one of Cecil's friends
- Records of gunpowder went missing for that year
- A week passed before the stores of gunpowder were searched
- One of the plotters died suspiciously
- The King was not popular

Who/what was to blame for the Titanic disaster?
- Captain Smith was due to retire and some people think he wanted to break the speed record before – he was going too fast
- The rivets that put the ship together were of a poor quality
- The watertight compartments didn't go high enough to stop it from sinking – this was to create more space for first class passengers
- It is claimed the owner of the company 'White Star Line; who owned the Titanic forced the captain to increase the speed of the ship
- The captain of a nearby ship the Californian sent the radio operator to bed and so they did not pick up distress signals – they thought the flares were fireworks

Did Emily Davison mean to kill herself?
- Davison had a criminal record and believed in actions not words
- She made comments she was planning something that would get her into the newspapers
- Witnesses say she put her hand up to either grab the reins of the horse or to save herself, suggesting death wasn't in her plan
- She had a history of injuring herself to get her message across
- She left no message or note behind suggesting she did not mean to die

Why did the police fail to catch Jack the Ripper?
- A letter was received by the police taunting them for not catching the killer
- This is how he got his nickname
- Lots of newspaper printed information that was exaggerated and even untrue at times to get people to read them
- More letters arrived but it was hardtop tell if they came from the same person
- There were five victims that we know of
- Police interviewed thousands of people, handed out leaflets, used sniffer dogs and took photos of the women's eyes in case they could see the killer's reflection!
- There was no forensic science like DNA and fingerprinting
- Descriptions of 'Jack' were always different
- He attacked and killed vulnerable women

Histories Mysteries
Key Words

Mystery	Something that hasn't been solved
Gunpowder	A powder that explodes when it is set on fire
Protestant	Someone who follows the Church of England religion
Catholic	Someone who follows the Catholic religion
Parliament	Where the MPs meet and make decisions
Rivet	A metal screw to connect metal panels
Watertight compartment	A section of a ship where water should not be able to get into to stop it from sinking
Suffragette	Someone who campaigned for Women's Rights in the 1900s
Jack the Ripper	A serial killer in the 1800s in Whitechapel
Whitechapel	An area of London
Witness	Someone who sees a crime/event happen

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Year 9 PRE – Term 3 – Is all life sacred?

Key Words

Sanctity of Life: The idea that life is sacred and given by God
Quality of Life: The standard of health, comfort and happiness experienced by an individual or group
Intrinsic Value: The idea that we have value automatically and naturally, and we cannot lose this.
Soul: The spiritual or immaterial part of a human being or animal, regarded as immortal.
Conception: When sperm fertilises an egg
Viability: When it is medically acknowledged that a foetus could survive outside the womb
Saviour Siblings: The concept of creating a zygote through IVF (In-Vitro Fertilisation – outside of the body) which is a genetic match for a sick sibling

What is the Sanctity of Life?

- Many religious believers, for example Christians and Muslims, believe that **all human life is sacred (special).** Life is a gift that should be valued.
- The concept of sanctity of life often stems from the belief that we were created by God, therefore we automatically have intrinsic value; we can never lose what it is that makes us so special.
- For example, in **Christianity**, the Bible teaches that *'God breathed life into Adam',* which teaches Christians that our special nature comes from God
- Many religions link our sacred nature with the idea of us having a **soul.**

Can human life be used as a means to an end?

- One advancement in medicine in recent times is the idea of **'Saviour Siblings'.**
- This is the idea that a child is born in order to provide an organ or cell transplant to a sibling that is affected by a fatal disease.
- The child is **conceived through IVF**, a procedure where the sperm and the egg are combined outside of the womb and, if they are a genetic match for the sick child, the fertilized egg will be implanted into the mother's womb. This fertilized egg is called a zygote.
- Whilst some people believe this offers a genius opportunity to save a child's life, others, such as **Roman Catholics**, believe it is not acceptable to create a child to simply use them to save another's life. A Catholic Archbishop taught: *'To conceive a child to use him – even if it is to cure – is not respectful of his dignity'.*
- In addition, if a zygote is created that is not a genetic match, it is destroyed.
- Many religious believers would consider this zygote to already be a life.

When does life become sacred?

- The question of 'when does life begin' has been debated for many years.
- Many religious believers have clear views about abortion, and these beliefs generally stem from the debate of when we get our 'sacred' nature. Is it at birth, or some earlier point?

Conception	Heartbeat	Viability	Birth
- When the sperm meets the egg - At this point, DNA has been determined and something has been created which, if it continues, will become a human.	- A foetus' heartbeat can be detected 3-6 weeks into pregnancy. - For many, it makes sense that if a foetus has a heartbeat, they are considered a 'life'	- This is when the foetus is considered 'viable', meaning that they would be likely to survive outside the womb. - Legally, this is at 24 weeks, and abortion is illegal under a number of circumstances at this point. 24	- A full term pregnancy is considered to be 37-40 weeks. - This is when the baby is here in the world; we celebrate a birthday from this point and there is no denial that this is a life.

Do religious believers support abortion?

Christianity	- Christianity teaches that life begins at conception, and we would receive our soul at that point too. - The Bible suggests that God has planned the life of every human, even before conception: *'Before I formed you in the womb I knew you'.* - Therefore, abortion does end a sacred life, meaning it is **generally considered to be wrong.** Catholics are very strict and follow a strong sanctity of life ethic, meaning they consider abortion to be murder and therefore against the 10 commandments: *'Do not commit murder'.* - Some Christians, such as Methodists, still disagree with abortion but would say it is **acceptable in some circumstances**, such as if the child would be severely disabled, or if the mother's life was at risk.
Hinduism	- Hindus follow a key principle called **'ahimsa', the principle of non-violence.** - When considering abortion, Hindus choose the path that causes the least harm to all involved; the mother and father, the foetus and society. - **Hinduism therefore is generally against abortion**, except where it is necessary to save the mother's life. - Many Hindus believe that we have our **soul from conception**, so if an abortion takes place, **that soul has lost the opportunity to build good karma.**

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Key Words

Ahimsa: The Hindu principle of non-violence

Agape: The Christian teaching meaning compassionate love; showing kindness to those in need

Euthanasia: 'A good or gentle death'; the painless killing of someone who has an incurable or painful disease

Active euthanasia: When active steps are taken to end someone's life, e.g., giving them a lethal injection

Passive euthanasia: When doctors stop providing the treatment that is keeping a patient alive.

Capital Punishment: The death penalty – punishing someone by death, lawfully, for crimes committed.

Deterrent: To put someone off e.g. the death penalty may put offenders off committing serious crimes.

Reformation: To help someone to change their ways.

Do our actions affect our sanctity of life?

- Some people do actions which do not respect the sanctity of life of others, for example they may commit crimes such as murder.
- If this happens, **does the criminal lose their sanctity of life**?
- Religious people would generally say no – you cannot 'lose' your sanctity of life, because it is intrinsic – it's just part of who we are.
- **The Death Penalty:**
- In some countries, those who take the life of others may be given the death penalty as a punishment. They may be killed, for example, by hanging or lethal injection.
- This is **not legal** in the UK but still happens in countries such as the USA, China and Saudi Arabia.

Arguments in support of the death penalty	Arguments against the death penalty
- *An eye for an eye*: if you kill, you deserve to be killed. - It puts other people off committing such serious crimes (it's a **deterrent**) - It brings justice to the family of the victim. - **Muslim** countries, who follow Islamic Law (Sharia Law) very strictly, would **support the death penalty** for extreme crimes such as intentional murder. **The victim's family would be able to choose** whether the criminal receives the death penalty. - Muslim quote: *...Take not life, which God has made sacred, except by way of justice and law.*	- It goes against the sanctity of life – the criminal is still sacred. - Many religions teach against the death penalty because **killing is considered a sin,** and it is God's choice when someone dies. - Christian quote: *'Human beings were made in God's image'.* - One of the 10 commandments*: 'Do not kill'.*

Is the Quality of Life more important than the Sanctity of Life?

- Sadly, when people become old or sick, their **quality of life** reduces.
- Some countries allow a procedure called **euthanasia**, which is where someone who is terminally ill or has a very poor quality of life may choose to end their life early, in a painless way.
- This is **illegal in the UK** but is allowed in some countries such as the Netherlands, Belgium and Canada. In Switzerland, assistant suicide is legal, which is where a medical professional supports in ending a patient's life.

- **Most religions are strongly against euthanasia** as it can be seen as **'playing God'** – just because someone's life loses its quality does not mean that it is no longer sacred.
- Muslims strictly forbid euthanasia in any form: *'Do not take life, which Allah made sacred'.*
- Christians do not support euthanasia either; the Catholic Church describes it as a **crime against God**. Some Christians may show understanding towards it if the patient is in unbearable pain and may show **agape – compassionate love.**

PRE Key Skills

Skill 1: Accurately recall subject specific vocabulary/ key religious facts	**Skill 6: Give reasoned arguments to support a point of view (could include a religious view)**
Skill 2: Describe religious teachings/ stories/ practices	**Skill 7: Give reasoned arguments to support a different point of view (could include a religious view)**
Skill 3: Interpret meaning of religious teachings/ stories/ practices/ quotations	
Skill 4: Explain the influence and impact of religion (beliefs, teachings and practices) on a believer.	**Skill 8:Evaluate the differing viewpoints**
Skill 5: Explain diversity and contrast in religion	**Skill 9: Form a justified conclusion**
	Skill 10: Spell and punctuate with consistent accuracy

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Leadership

Warm up

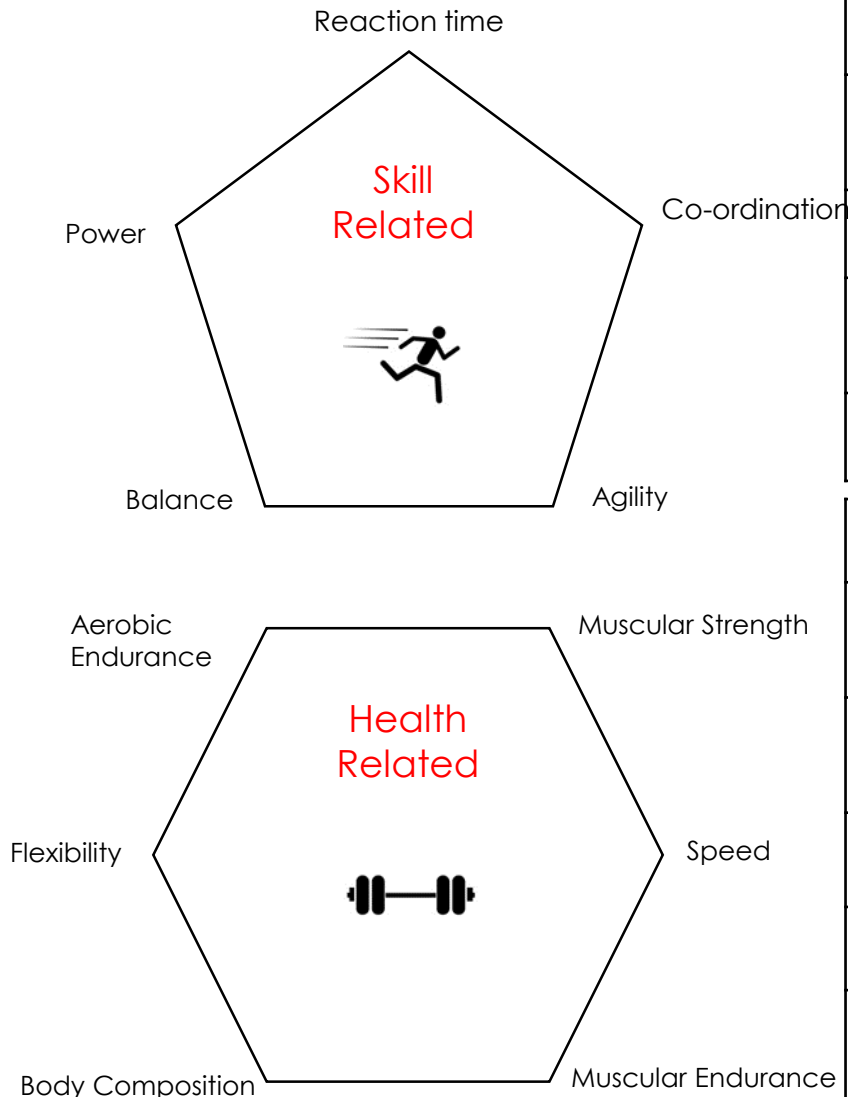|	
Pulse Raiser	An activity which raises heart rate
Stretches	Static – Holding a stretch without moving Dynamic – Performing stretches whilst moving
Mobility	Moving joints through full ranges of movement Dynamic – Changing speed and direction
Skill Rehearsal	Practising skills used in the activity

Cool Down

Lower Pulse	Light jogging/walking
Stretches	Static – Holding a stretch without moving

Top Tips:

1. **Confidence** – Act and look like the leader.
2. **Volume** – Be sure to speak loud and clear when leading, projecting your voice above all others.
3. **Be organised** – show you are ready!
4. **Body Position** – Be sure to position yourself away from distractions. e.g. out of view of the sunlight, or other groups

Health & Fitness

Components of Fitness

Skill Related pentagon: Reaction time, Co-ordination, Agility, Balance, Power

Health Related hexagon: Aerobic Endurance, Muscular Strength, Speed, Muscular Endurance, Body Composition, Flexibility

Power	The ability to apply high force to an object
Balance	To hold the body's centre of mass above the support
Reaction Time	Time taken to react to a stimulus
Coordination	The ability to use 2 or more body parts together
Agility	The ability to change direction at speed

Strength	The amount of force a muscle can exert
Muscular Endurance	The ability to use muscles repeatedly without tiring
Body Composition	The percentage of body fat, muscle and bone
Flexibility	The range of movement at a joint
Speed	The ability to move quickly
Cardiovascular Fitness	The ability to transport oxygen to allow for long periods of activity without tiring

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Creative

Key Terminology

Choreography Devices	A specific way of manipulating movement to develop a routine.
Formation	Any dance in which a number of couples form a certain arrangement, such as two facing lines or a circle.
Unison	Dancers moving at the same time doing the same movements.
Cannon	A device where movements are repeated exactly by subsequent dancers in turn.
Repetition	A device in which movements or motifs are repeated.
Change of speed/, level or dynamic	Where movements are changed within a routine through changing the speed, level or execution.
Inversion	Inverting the movement phrase would mean executing it as if 'looking in a mirror'.
Cumulative Canon	Each dancer joins in with the lead dancer at various stages and all finish at the same time
Retrograde	A device whereby movements or a motif are performed backwards (like a rewound video).

Performance

Key Terminology

What is a Rule?	Rules define what is allowed or not allowed to occur during the game, e.g. a game is played to 21 in badminton.
What is a Regulation?	A regulation usually gets set by the sports governing body and usually refer to the equipment, court or length of the game.
Scoring System	How the sport is scored, e.g. Wolves 2 Cardiff 1.
Sport Officials	Any person who acts in a sports contest as an umpire, referee, judge and enforces the games rules and regulations.
Technical Skills	These are the skills and techniques required for the sport, e.g., Overhead clear in badminton or instep pass in football.
Tactical Skills	These are skills such as decision making, knowing when to defend and attack, choice and use of shots or strokes, variation, conditions, use of space.
Isolated practice	An isolated practice is where you focus on one technique/skill at a time unopposed before moving on to the next one.
Conditioned practice	This is small-sided games, with restrictions such as, a limited number of touches or a set number of defenders or attackers.
Competitive situation	This refers to full-sided games, with appropriate opposition, with match officials.