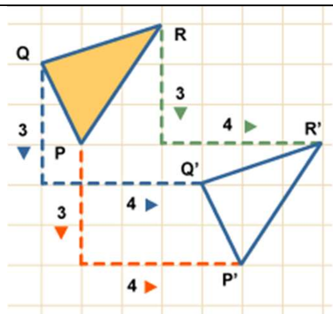
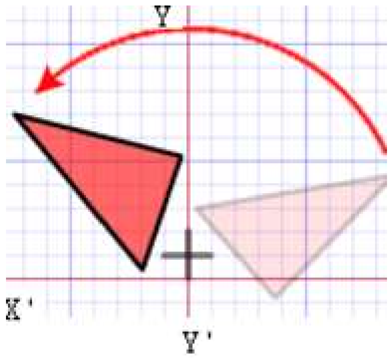
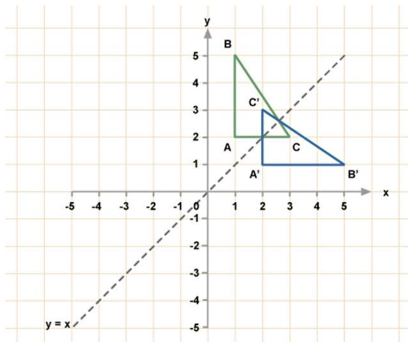
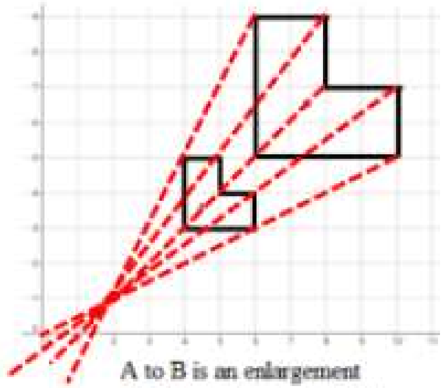
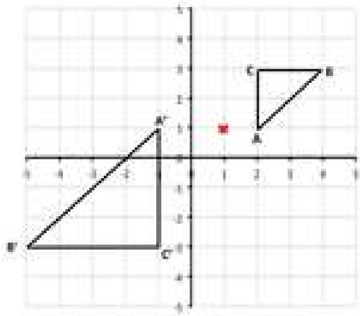
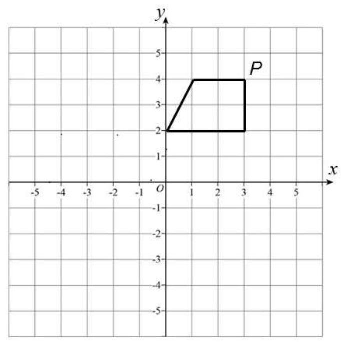
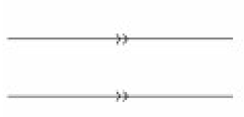
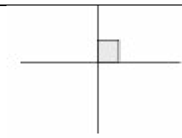
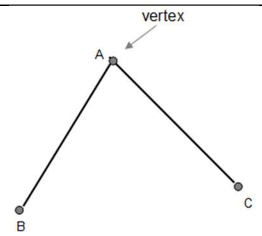
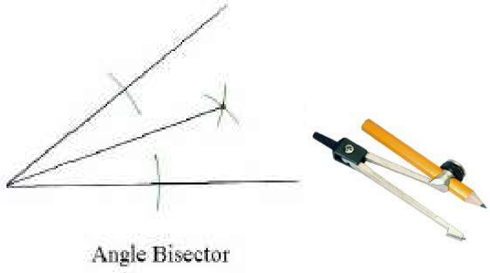
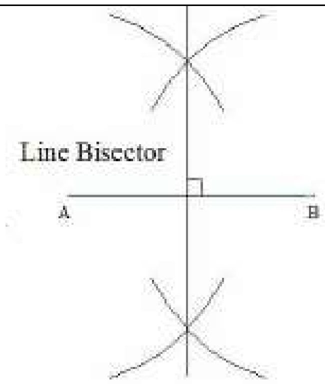
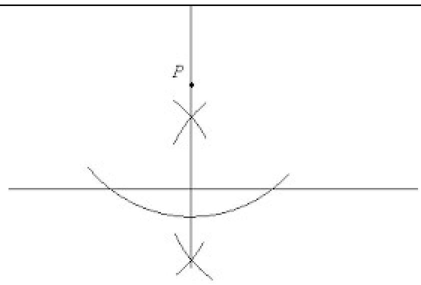
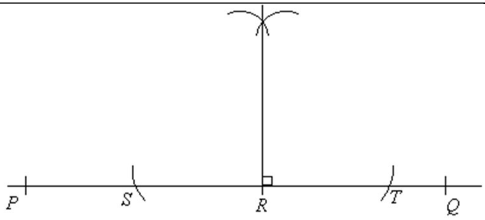
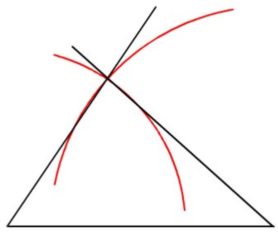
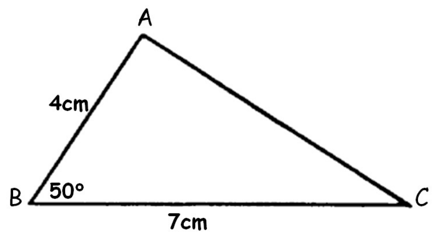
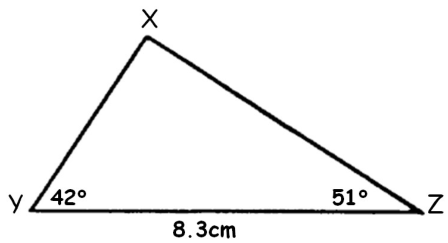
Knowledge Organiser Y10 H Shape Transformations

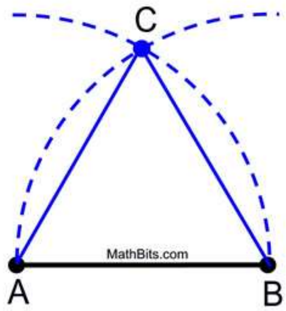
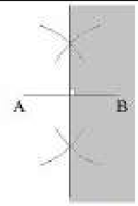
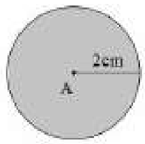
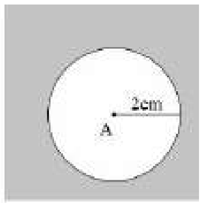
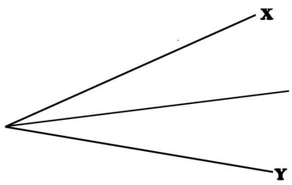
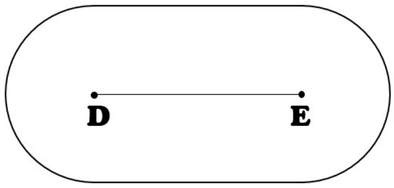
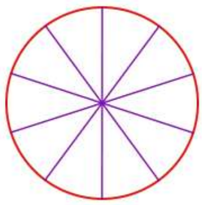
Key Vocabulary	Definition/Tips	Example
1. Translation	**Translate** means to **move a shape**. The shape does not change **size** or **orientation**.	
2. Column Vector	In a column vector, the **top** number moves **left (-) or right (+)** and the **bottom** number moves **up (+) or down (-)**	$\begin{pmatrix}2\\3\end{pmatrix}$ means '2 right, 3 up' $\begin{pmatrix}-1\\-5\end{pmatrix}$ means '1 left, 5 down'
3. Rotation	The size does not change, but the **shape is turned around a point.** Use tracing paper.	Rotate Shape A 90° anti-clockwise about (0,1) 
4. Reflection	The size does not change, but the shape is '**flipped'** like in a **mirror**. Line x =? is a **vertical line**. Line y =? is a **horizontal line**. Line $y = x$ is a **diagonal line**.	Reflect shape C in the line $y = x$ 
5. Enlargement	The shape will get **bigger or smaller**. Multiply each side by the **scale factor**.	Scale Factor = 3 means '3 times larger = multiply by 3' Scale Factor = ½ means 'half the size = divide by 2'

6. Finding the Centre of Enlargement	Draw **straight lines** through **corresponding corners** of the two shapes. The centre of enlargement is the point **where all the lines cross over**. Be careful with negative enlargements as the corresponding corners will be the other way around.	 A to B is an enlargement SF 2 about the point (2,1)
7. Describing Transformations	Give the following information when describing each transformation: Look at the number of marks in the question for a hint of how many pieces of information are needed. If you are asked to describe a 'transformation', you need to say the **name of the type of transformation** as well as the other details.	**- Translation, Vector** **- Rotation, Direction, Angle, Centre** **- Reflection, Equation of mirror line** **- Enlargement, Scale factor, Centre of enlargement**
8. Negative Scale Factor Enlargements	Negative enlargements will **look like they have been rotated**. $SF = -2$ will be rotated, and also twice as big.	Enlarge ABC by scale factor -2, centre (1,1) 
9. Invariance	A point, line or shape is invariant if it **does not change/move** when a transformation is performed. An invariant point 'does not vary'.	If shape P is reflected in the $y-axis$, then exactly one vertex is invariant. 

Knowledge Organiser Y10 Loci and constructions

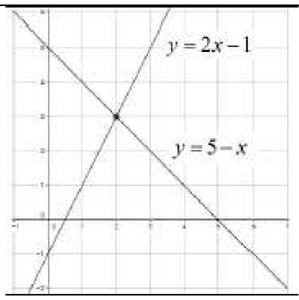
Key Vocabulary	Definition/Tips	Example
1. Parallel	Parallel lines never meet.	
2. Perpendicular	Perpendicular lines are at right angles. There is a 90° angle between them.	
3. Vertex	A corner or a point where two lines meet.	
4. Angle Bisector	**Angle Bisector: Cuts the angle in half**. 1. Place the sharp end of a pair of compasses on the vertex. 2. Draw an arc, marking a point on each line. 3. Without changing the compass put the compass on each point and mark a centre point where two arcs cross over. 4. Use a ruler to draw a line through the vertex and centre point.	
5. Perpendicular Bisector	**Perpendicular Bisector: Cuts a line in half and at right angles**. 1. Put the sharp point of a pair of compasses on A. 2. Open the compass over half way on the line. 3. Draw an arc above and below the line. 4. Without changing the compass, repeat from point B. 5. Draw a straight line through the two intersecting arcs.	
6. Perpendicular from an External Point	The **perpendicular distance** from a point to a line is the **shortest distance** to that line. 1. Put the sharp point of a pair of compasses on the point. 2. Draw an arc that crosses the line twice.	

	3. Place the sharp point of the compass on one of these points, open over half way and draw an arc above and below the line. 4. Repeat from the other point on the line. 5. Draw a straight line through the two intersecting arcs.	
7. Perpendicular from a Point on a Line	Given line PQ and point R on the line: 1. Put the sharp point of a pair of compasses on point R. 2. Draw two arcs either side of the point of equal width (giving points S and T) 3. Place the compass on point S, open over halfway and draw an arc above the line. 4. Repeat from the other arc on the line (point T). 5. Draw a straight line from the intersecting arcs to the original point on the line.	
8. Constructing Triangles (Side, Side, Side)	1. Draw the base of the triangle using a ruler. 2. Open a pair of compasses to the width of one side of the triangle. 3. Place the point on one end of the line and draw an arc. 4. Repeat for the other side of the triangle at the other end of the line. 5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.	
9. Constructing Triangles (Side, Angle, Side)	1. Draw the base of the triangle using a ruler. 2. Measure the angle required using a protractor and mark this angle. 3. Remove the protractor and draw a line of the exact length required in line with the angle mark drawn. 4. Connect the end of this line to the other end of the base of the triangle.	
10. Constructing Triangles (Angle, Side, Angle)	1. Draw the base of the triangle using a ruler. 2. Measure one of the angles required using a protractor and mark this angle. 3. Draw a straight line through this point from the same point on the base of the triangle.	

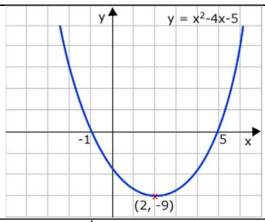
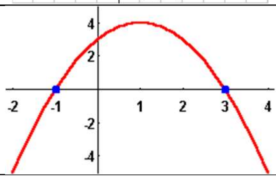
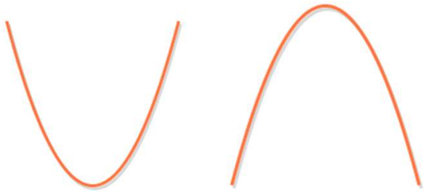
	4. Repeat this for the other angle on the other end of the base of the triangle.	
11. Constructing an Equilateral Triangle (also makes a 60° angle)	1. Draw the base of the triangle using a ruler. 2. Open the pair of compasses to the exact length of the side of the triangle. 3. Place the sharp point on one end of the line and draw an arc. 4. Repeat this from the other end of the line. 5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.	
12. Loci and Regions	A **locus** is a **path of points that follow a rule**. For the locus of points **closer to B than A**, create a **perpendicular bisector** between A and B and shade the side closer to B. For the locus of points **equidistant from A**, use a compass to draw a **circle**, centre A. For the locus of points **equidistant to line X and line Y**, create an **angle bisector**. For the locus of points a set **distance from a line**, create **two semi-circles** at either end joined by **two parallel lines**.	 Points Closer to B than A.  Points less than 2cm from A  Points more than 2cm from A  
13. Equidistant	A point is equidistant from a set of objects if the **distances between that point and each of the objects is the same**.	

Knowledge Organiser Y10 Simultaneous Equations

Key vocabulary	Definition/Tips	Example
1. Simultaneous Equations	A set of **two or more equations**, each involving **two or more variables** (letters). The **solutions** to simultaneous equations **satisfy both**/all of the **equations**.	$2x + y = 7$ $3x - y = 8$ $x = 3$ $y = 1$
2. Variable	A **symbol**, usually a **letter**, which **represents a number** which is usually unknown.	In the equation $x + 2 = 5$, x is the variable.
3. Coefficient	A **number** used to **multiply** a **variable**. It is the number that comes before/in front of a letter.	6z 6 is the coefficient z is the variable
4. Solving Simultaneous Equations (by Elimination)	1. **Balance** the **coefficients** of one of the variables. 2. **Eliminate** this variable by adding or subtracting the equations (**Same Sign Subtract, Different Sign Add**) 3. **Solve** the linear equation you get using the other variable. 4. **Substitute** the value you found back into one of the previous equations. 5. **Solve** the equation you get. 6. **Check** that the two values you get satisfy both of the original equations.	$5x + 2y = 9$ $10x + 3y = 16$ Multiply the first equation by 2. $10x + 4y = 18$ $10x + 3y = 16$ Same Sign Subtract (+10x on both) $y = 2$ Substitute $y = 2$ in to equation. $5x + 2 \times 2 = 9$ $5x + 4 = 9$ $5x = 5$ $x = 1$ Solution: $x = 1, y = 2$
5. Solving Simultaneous Equations (by Substitution)	1. **Rearrange** one of the equations into the form $y = ..$ or $x = ..$ 2. **Substitute** the right-hand side of the rearranged equation into the other equation. 3. Expand and **solve** this equation. 4. **Substitute** the value into the $y = ..$ or $x = ..$ equation. 5. **Check** that the two values you get satisfy both of the original equations.	$y - 2x = 3$ $3x + 4y = 1$ Rearrange: $y - 2x = 3 \rightarrow y = 2x + 3$ Substitute: $3x + 4(2x + 3) = 1$ Solve: $3x + 8x + 12 = 1$ $11x = -11$ $x = -1$ Substitute: $y = 2 \times -1 + 3$ $y = 1$ Solution: $x = -1, y = 1$

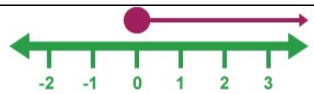
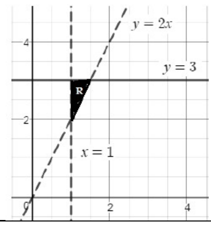
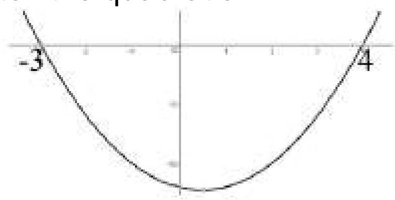
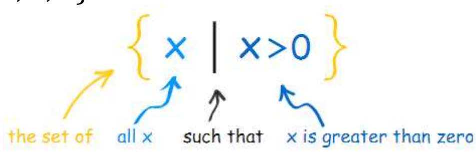
6. Solving Simultaneous Equations (Graphically)	**Draw the graphs** of the two equations. The **solutions** will be **where the lines meet**. The solution can be written as a **coordinate**.	 $y = 5 - x$ and $y = 2x - 1$. They meet at the point with coordinates (2,3) so the answer is $x = 2$ and $y = 3$
7. Solving Linear and Quadratic Simultaneous Equations	Method 1: If both equations are in the same form (eg. Both $y = \ldots$): 1. Set the equations **equal to each other**. 2. **Rearrange** to make the equation **equal to zero**. 3. **Solve** the quadratic equation. 4. **Substitute** the values back in to one of the equations. Method 2: If the equations are not in the same form: 1. **Rearrange** the linear equation into the form $y = \ldots$ or $x = \ldots$ 2. **Substitute** in to the quadratic equation. 3. **Rearrange** to make the equation **equal to zero**. 4. **Solve** the quadratic equation. 5. **Substitute** the values back in to one of the equations. You should get **two pairs of solutions** (two values for x, two values for y.) Graphically, you should have **two points of intersection**.	Example 1 Solve $y = x^2 - 2x - 5$ and $y = x - 1$ $x^2 - 2x - 5 = x - 1$ $x^2 - 3x - 4 = 0$ $(x - 4)(x + 1) = 0$ $x = 4$ and $x = -1$ $y = 4 - 1 = 3$ and $y = -1 - 1 = -2$ Answers: (4,3) and (-1,-2) Example 2 Solve $x^2 + y^2 = 5$ and $x + y = 3$ $x = 3 - y$ $(3 - y)^2 + y^2 = 5$ $9 - 6y + y^2 + y^2 = 5$ $2y^2 - 6y + 4 = 0$ $y^2 - 3y + 2 = 0$ $(y - 1)(y - 2) = 0$ $y = 1$ and $y = 2$ $x = 3 - 1 = 2$ and $x = 3 - 2 = 1$ Answers: (2,1) and (1,2)

Knowledge Organiser Y10 Further Quadratics

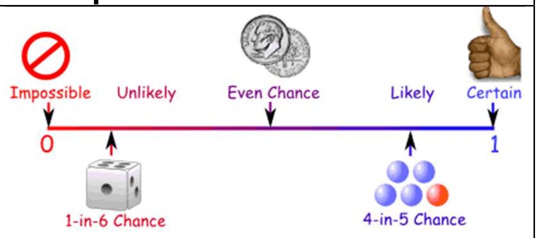
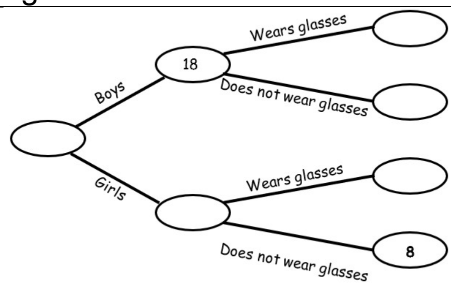
Key vocabulary	**Definition/Tips**	**Example**
1. Quadratic	A quadratic expression is of the form $\boldsymbol{ax^2 + bx + c}$ where a, b and c are numbers, $\boldsymbol{a \neq 0}$	Examples of quadratic expressions: x^2 $8x^2 - 3x + 7$ Examples of non-quadratic expressions: $2x^3 - 5x^2$ $9x - 1$
2. Factorising Quadratics	When a quadratic expression is in the form $x^2 + bx + c$ find the two numbers that **add to give b** and **multiply to give c**.	$x^2 + 7x + 10 = (x + 5)(x + 2)$ (because 5 and 2 add to give 7 and multiply to give 10) $x^2 + 2x - 8 = (x + 4)(x - 2)$ (because +4 and -2 add to give +2 and multiply to give -8)
3. Difference of Two Squares	An expression of the form $\boldsymbol{a^2 - b^2}$ can be factorised to give $(\boldsymbol{a + b})(\boldsymbol{a - b})$	$x^2 - 25 = (x + 5)(x - 5)$ $16x^2 - 81 = (4x + 9)(4x - 9)$
4. Solving Quadratics $(ax^2 = b)$	Isolate the x^2 term and square root both sides. Remember there will be a **positive and a negative solution**.	$2x^2 = 98$ $x^2 = 49$ $x = \pm 7$
5. Solving Quadratics $(ax^2 + bx = 0)$	**Factorise** and then **solve = 0**.	$x^2 - 3x = 0$ $x(x - 3) = 0$ $x = 0 \ or \ x = 3$
6. Solving Quadratics by factorising $(a = 1)$	**Factorise** the quadratic in the usual way. **Solve = 0** Make sure the equation = 0 before factorising.	Solve $x^2 + 3x - 10 = 0$ Factorise: $(x + 5)(x - 2) = 0$ $x = -5 \ or \ x = 2$
7. Quadratic Graph	A '**U-shaped**' curve called a **parabola**. The equation is of the form $y = \boldsymbol{ax^2 + bx + c}$, where a, b and c are numbers, $\boldsymbol{a \neq 0}$. If $\boldsymbol{a < 0}$**,** the parabola is **upside down**.	
8. Roots of a Quadratic	A root is a **solution**. The roots of a quadratic are the **$\boldsymbol{x}$-intercepts of the quadratic graph**.	
9. Turning Point of a Quadratic	A turning point is the **point where a quadratic turns**. On a **positive parabola**, the turning point is called a **minimum**. On a **negative parabola**, the turning point is called a **maximum**.	
10. Factorising	When a quadratic is in the form $ax^2 + bx + c$	Factorise $6x^2 + 5x - 4$

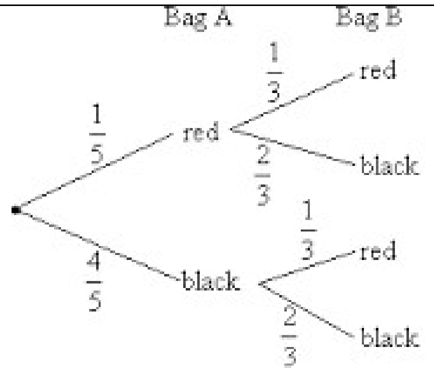
Quadratics when $a \neq 1$	1. Multiply a by c = ac 2. Find two numbers that add to give b and multiply to give ac. 3. Re-write the quadratic, replacing bx with the two numbers you found. 4. Factorise in pairs – you should get the same bracket twice 5. Write your two brackets – one will be the repeated bracket, the other will be made of the factors outside each of the two brackets.	1. $6 \times -4 = -24$ 2. Two numbers that add to give +5 and multiply to give -24 are +8 and -3 3. $6x^2 + 8x - 3x - 4$ 4. Factorise in pairs: $2x(3x+4) - 1(3x+4)$ 5. Answer = $(3x+4)(2x-1)$
11. Solving Quadratics by Factorising $(a \neq 1)$	**Factorise** the quadratic in the usual way.**Solve = 0** Make sure the equation = 0 before factorising.	Solve $2x^2 + 7x - 4 = 0$ Factorise: $(2x-1)(x+4) = 0$ $x = \frac{1}{2}\ or\ x = -4$
12. Completing the Square (when $a = 1$)	A quadratic in the form $x^2 + bx + c$ can be written in the form $(\boldsymbol{x} + \boldsymbol{p})^{\boldsymbol{2}} + \boldsymbol{q}$ 1. Write a set of brackets with x in and **half** the value of b. 2. Square the bracket. 3. Subtract $\left(\frac{b}{2}\right)^2$ and add c. 4. Simplify the expression. You can **use the completing the square form** to help **find the maximum or minimum** of quadratic graph.	Complete the square of $y = x^2 - 6x + 2$ Answer: $(x-3)^2 - 3^2 + 2$ $= (x-3)^2 - 7$ The minimum value of this expression occurs when $(x-3)^2 = 0$, which occurs when $x = 3$ When $x = 3$, $y = 0 - 7 = -7$ Minimum point = $(3, -7)$
13. Completing the Square (when $a \neq 1$)	A quadratic in the form $ax^2 + bx + c$ can be written in the form $\mathbf{p}(\boldsymbol{x} + \boldsymbol{q})^{\boldsymbol{2}} + \boldsymbol{r}$ Use the same method as above, but factorise out a at the start.	Complete the square of $4x^2 + 8x - 3$ Answer: $4[x^2 + 2x] - 3$ $= 4[(x+1)^2 - 1^2] - 3$ $= 4(x+1)^2 - 4 - 3$ $= 4(x+1)^2 - 7$
14. Solving Quadratics by Completing the Square	**Complete the square** in the usual way and **use inverse operations to solve**.	Solve $x^2 + 8x + 1 = 0$ Answer: $(x+4)^2 - 4^2 + 1 = 0$ $(x+4)^2 - 15 = 0$ $(x+4)^2 = 15$ $(x+4) = \pm\sqrt{15}$ $x = -4 \pm \sqrt{15}$
15. Solving Quadratics using the Quadratic Formula	A quadratic in the form $ax^2 + bx + c = 0$ can be solved using the formula: $\boldsymbol{x} = \frac{-\boldsymbol{b} \pm \sqrt{\boldsymbol{b}^2 - 4\boldsymbol{ac}}}{2\boldsymbol{a}}$ Use the formula if the quadratic does not factorise easily.	Solve $3x^2 + x - 5 = 0$ Answer: $a = 3, b = 1, c = -5$ $x = \frac{-1 \pm \sqrt{1^2 - 4 \times 3 \times -5}}{2 \times 3}$ $x = \frac{-1 \pm \sqrt{61}}{6}$ $x = 1.14\ or -1.47\ (2\ d.p.)$

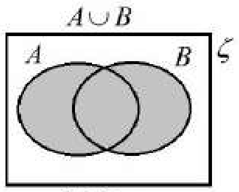
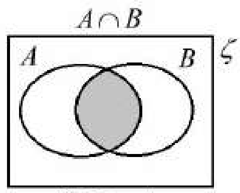
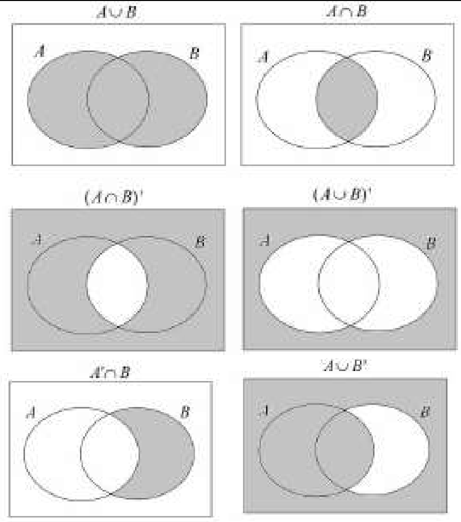
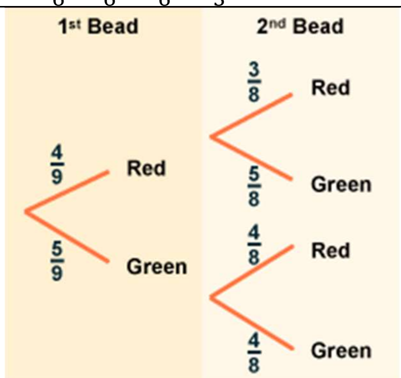
Knowledge Organiser Y10 Inequalities

Key vocabulary	Definition/Tips	Example
1. Inequality	An inequality says that two values are **not equal**. $a \neq b$ means that a is not equal to b.	$7 \neq 3$ $x \neq 0$
2. Inequality symbols	$\boldsymbol{x > 2}$ means **x is greater than 2** $\boldsymbol{x < 3}$ means **x is less than 3** $\boldsymbol{x \geq 1}$ means **x is greater than or equal to 1** $\boldsymbol{x \leq 6}$ means **x is less than or equal to 6**	State the integers that satisfy $-2 < x \leq 4.$ -1, 0, 1, 2, 3, 4
3. Inequalities on a Number Line	Inequalities can be shown on a number line. **Open circles** are used for numbers that are **less than or greater than** $(< or >)$ **Closed circles** are used for numbers that are **less than or equal or greater than or equal** $(\leq or \geq)$	 $x \geq 0$  $x < 2$  $-5 \leq x < 4$
4. Graphical Inequalities	Inequalities can be represented on a coordinate grid. If the inequality is **strict** $(x > 2)$ then use a **dotted line**. If the inequality is **not strict** $(x \leq 6)$ then use a **solid line**. **Shade** the **region** which satisfies all the inequalities.	Shade the region that satisfies: $y > 2x, x > 1 \; and \; y \leq 3$ 
5. Quadratic Inequalities	**Sketch the quadratic graph** of the inequality. If the expression is $> \boldsymbol{or} \geq$ then the answer will be **above the x-axis**. If the expression is $< \boldsymbol{or} \leq$ then the answer will be **below the x-axis**. Look carefully at the inequality symbol in the question. Look carefully if the quadratic is a **positive or negative parabola**.	Solve the inequality $x^2 - x - 12 < 0$ Sketch the quadratic:  The required region is below the x-axis, so the final answer is: $-3 < x < 4$ If the question had been > 0, the answer would have been: $x < -3 \; or \; x > 4$
6. Set Notation	A **set** is a **collection of things**, usually numbers, denoted with brackets { } $\{x \mid x \geq 7\}$ means 'the set of all x's, such that x is greater than or equal to 7' The 'x' can be replaced by any letter. Some people use ':' instead of '|'	$\{3, 6, 9\}$ is a set.  $\{x : -2 \leq x < 5\}$

Knowledge Organiser Y10 Probability

<table>
<tr><th>Topic/Skill</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Probability</td><td>The likelihood/chance of something happening.
Is expressed as a number between 0 (impossible) and 1 (certain).
Can be expressed as a fraction, decimal, percentage or in words (likely, unlikely, even chance etc.)</td><td>
</td></tr>
<tr><td>2. Probability Notation</td><td>P(A) refers to the probability that event A will occur.</td><td>P(Red Queen) refers to the probability of picking a Red Queen from a pack of cards.</td></tr>
<tr><td>3. Theoretical Probability</td><td>$\frac{\textit{Number of Favourable Outcomes}}{\textit{Total Number of Possible Outcomes}}$</td><td>Probability of rolling a 4 on a fair 6-sided die = $\frac{1}{6}$.</td></tr>
<tr><td>4. Relative Frequency</td><td>$\frac{\textit{Number of Successful Trials}}{\textit{Total Number of Trials}}$</td><td>A coin is flipped 50 times and lands on Tails 29 times.
The relative frequency of getting Tails = $\frac{29}{50}$.</td></tr>
<tr><td>5. Expected Outcomes</td><td>To find the number of expected outcomes, multiply the probability by the number of trials.</td><td>The probability that a football team wins is 0.2 How many games would you expect them to win out of 40?
$0.2 \times 40 = 8\ games$</td></tr>
<tr><td>6. Exhaustive</td><td>Outcomes are exhaustive if they cover the entire range of possible outcomes.
The probabilities of an exhaustive set of outcomes adds up to 1.</td><td>When rolling a six-sided die, the outcomes 1, 2, 3, 4, 5 and 6 are exhaustive, because they cover all the possible outcomes.</td></tr>
<tr><td>7. Mutually Exclusive</td><td>Events are mutually exclusive if they cannot happen at the same time.
The probabilities of an exhaustive set of mutually exclusive events adds up to 1.</td><td>Examples of mutually exclusive events:
- Turning left and right
- Heads and Tails on a coin
Examples of non mutually exclusive events:
- King and Hearts from a deck of cards, because you can pick the King of Hearts</td></tr>
<tr><td>8. Frequency Tree</td><td>A diagram showing how information is categorised into various categories.
The numbers at the ends of branches tells us how often something happened (frequency).
The lines connected the numbers are called branches.</td><td>
</td></tr>
<tr><td>9. Sample Space</td><td>The set of all possible outcomes of an experiment.</td><td><table>
<tr><th>+</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr>
<tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr>
</table></td></tr>
</table>

1. Combination	A collection of things, where the **order does not matter**.	How many combinations of two ingredients can you make with apple, banana and cherry? Apple, Banana/ Apple, Cherry Banana, Cherry/ 3 combinations
2. Permutation	A collection of things, where the **order does matter**.	You want to visit the homes of three friends, Alex (A), Betty (B) and Chandra (C) but haven't decided the order. What choices do you have? ABC, ACB, BAC, BCA, CAB, CBA
3. Permutations with Repetition	When something has n different types, there are $\boldsymbol{n}$ **choices each time**. Choosing r of something that has n different types, the permutations are: $n \times n \times \dots (r\ times) = \boldsymbol{n^r}$	How many permutations are there for a three-number combination lock? 10 numbers to choose from $\{1, 2, \dots .10\}$ and we choose 3 of them → $10 \times 10 \times 10 = 10^3 = 1000$
4. Permutations without Repetition	We have to **reduce the number of available choices each time**. One you have chosen something, you cannot choose it again.	How many ways can you order 4 numbered balls? $4 \times 3 \times 2 \times 1 = 24$
5. Product Rule for Counting	If there are $\boldsymbol{x}$ **ways of doing something** and $\boldsymbol{y}$ **ways of doing something else**, then there are $\boldsymbol{xy}$ **ways of performing both**.	To choose one of $\{A, B, C\}$ and one of $\{X, Y\}$ means to choose one of $\{AX, AY, BX, BY, CX, CY\}$ The rule says that there are $3 \times 2 = 6$ choices.
6. Tree Diagrams	Tree diagrams show **all the possible outcomes** of an event and calculate their probabilities. **All branches must add up to 1 when adding downwards.** This is because the **probability of something not happening** is **1 minus the probability that it does happen**. **Multiply** going **across** a tree diagram. **Add** going **down** a tree diagram.	
7. Independent Events	The outcome of a **previous event does not influence/affect the outcome of a second event**.	An example of independent events could be replacing a counter in a bag after picking it.
8. Dependent Events	The outcome of a **previous event does influence/affect the outcome of a second event**.	An example of dependent events could be not replacing a counter in a bag after picking it. 'Without replacement'
9. Probability Notation	**P(A)** refers to the **probability that event A will occur**. **P(A')** refers to the **probability that event A will not occur**. **P(A ∪ B)** refers to the **probability that event A or B or both will occur.**	P(Red Queen) refers to the probability of picking a Red Queen from a pack of cards. P(Blue') refers to the probability that you do not pick Blue. P(Blonde ∪ Right Handed) refers to the probability that you pick

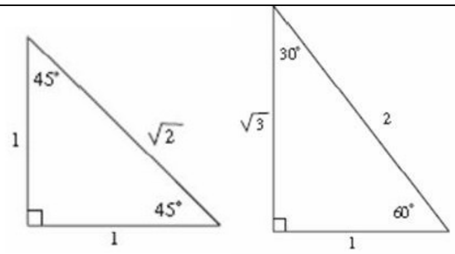
	P(A ∩ B) refers to the **probability that <u>both</u> events A and B will occur.**	someone who is Blonde or Right Handed or both. P(Blonde ∩ Right Handed) refers to the probability that you pick someone who is both Blonde and Right Handed.
10. Venn Diagrams	A Venn Diagram shows the **relationship between a group of different things** and how they overlap. You may be asked to shade Venn Diagrams as shown below and to the right.  The Union 'A or B or Both'  The Intersection 'A and B'	
11. Venn Diagram Notation	∈ means '**element of a set**' (a value in the set) { } means the collection of values in the set. ξ means the '**universal set**' (all the values to consider in the question) **A' means 'not in set A' (called complement) A ∪ B means 'A or B or both' (called Union) A ∩ B means 'A and B (called Intersection)**	Set A is the even numbers less than 10. A = {2, 4, 6, 8} Set B is the prime numbers less than 10. B = {2, 3, 5, 7} A ∪ B = {2, 3, 4, 5, 6, 7, 8} A ∩ B = {2}
12. AND rule for Probability	When two events, A and B, are **independent**: $\boldsymbol{P(A\ and\ B) = P(A) \times P(B)}$	What is the probability of rolling a 4 and flipping a Tails? $P(4\ and\ Tails) = P(4) \times P(Tails)$ $= \frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$
13. OR rule for Probability	When two events, A and B, are **mutually exclusive**: $\boldsymbol{P(A\ or\ B) = P(A) + P(B)}$	What is the probability of rolling a 2 or rolling a 5? $P(2\ or\ 5) = P(2) + P(5) = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$
14. Conditional Probability	The probability of an event A happening, **given that** event B has already happened. With conditional probability, check if the numbers on the second branches of a tree diagram changes. For example, if you have 4 red beads in a bag of 9 beads and pick a red bead on the first pick, then there will be 3 red beads left out of 8 beads on the second pick.	

Knowledge organiser Y10 Maths Trigonometry

<table>
<tr><th>Key vocabulary</th><th>Definition/Tips</th><th>Example</th></tr>
<tr>
<td>1. Exact Values for Angles in Trigonometry</td>
<td>

	0°	30°	45°	60°	90°
sin	**0**	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	**1**
cos	**1**	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	**0**
tan	**0**	$\frac{1}{\sqrt{3}}$	**1**	$\sqrt{3}$	**----**

</td>
<td>



</td>
</tr>
<tr>
<td>2. Sine Rule</td>
<td>

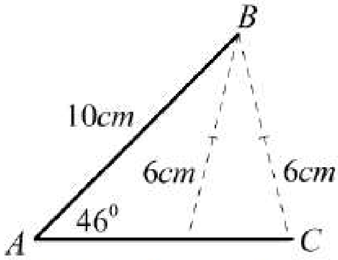
Use with **non right angle triangles**.
Use when the question involves **2 sides and 2 angles**.
For missing side:

$$\frac{\boldsymbol{a}}{\sin \boldsymbol{A}} = \frac{\boldsymbol{b}}{\sin \boldsymbol{B}}$$

For missing angle:

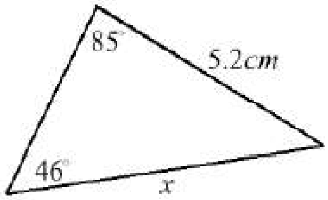
$$\frac{\sin \boldsymbol{A}}{\boldsymbol{a}} = \frac{\sin \boldsymbol{B}}{\boldsymbol{b}}$$

There is an **ambiguous case** (where there are two potential answers)



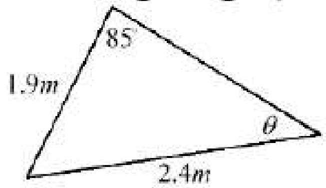
To find the two angles, use **sine** to find one, and then **subtract your answer from 180** to find the other answer.

</td>
<td>



$$\frac{x}{\sin 85} = \frac{5.2}{\sin 46}$$

$$x = \frac{5.2 \times \sin 85}{\sin 46} = 3.75cm$$



$$\frac{\sin \theta}{1.9} = \frac{\sin 85}{2.4}$$

$$\sin \theta = \frac{1.9 \times \sin 85}{2.4} = 0.789$$

$$\theta = sin^{-1}(0.789) = 52.1°$$

</td>
</tr>
<tr>
<td>3. Cosine Rule</td>
<td>

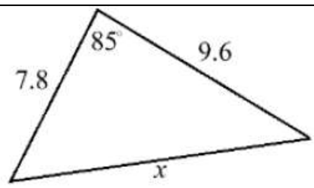
Use with **non right angle triangles**.
Use when the question involves **3 sides and 1 angle**.
For missing side:

$$\boldsymbol{a^2 = b^2 + c^2 - 2bccosA}$$

For missing angle:

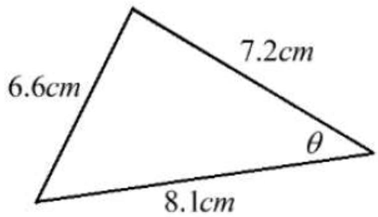
$$\cos \boldsymbol{A} = \frac{\boldsymbol{b^2 + c^2 - a^2}}{\boldsymbol{2bc}}$$

</td>
<td>



$$x^2 = 9.6^2 + 7.8^2 - (2 \times 9.6 \times 7.8 \times \cos 85)$$

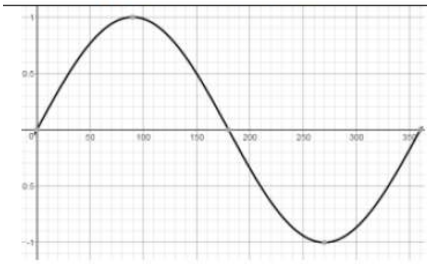
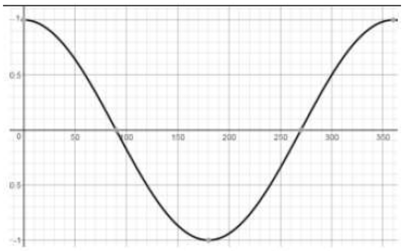
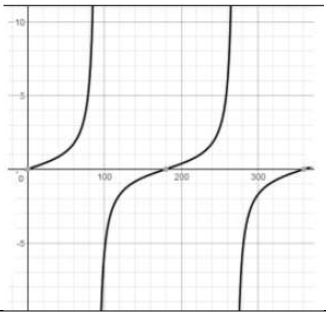
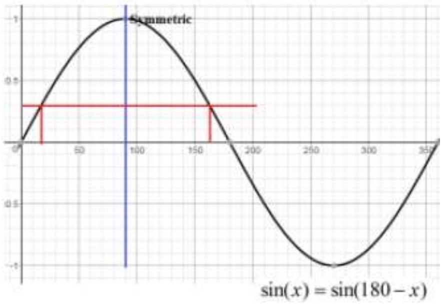
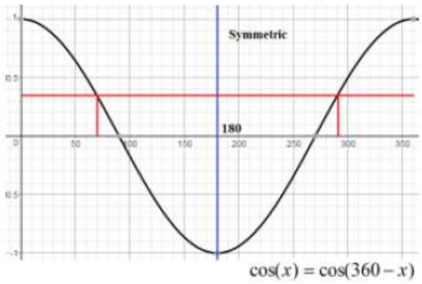
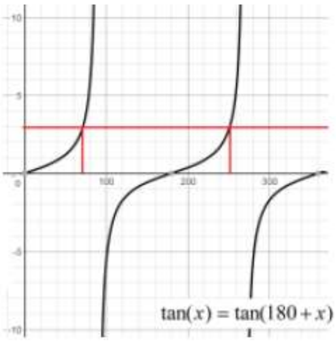
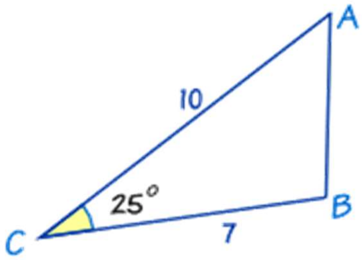
$$x = 11.8$$



$$\cos \theta = \frac{7.2^2 + 8.1^2 - 6.6^2}{2 \times 7.2 \times 8.1}$$

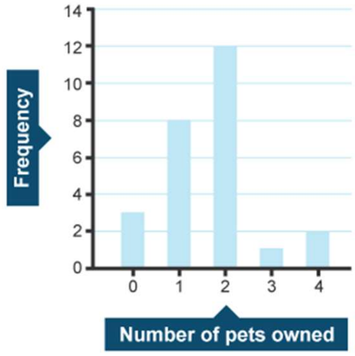
$$\theta = 50.7°$$

</td>
</tr>
</table>

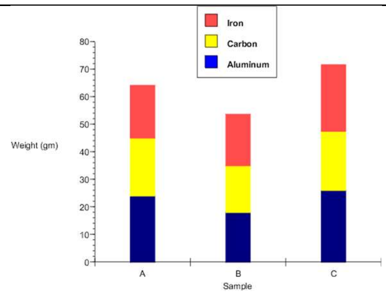
4. Graphs of Trigonometric Functions	$y = \sin(x)$ for $0 \le x \le 360^o$  $y = \cos(x)$ for $0 \le x \le 360^o$  $y = \tan(x)$ for $0 \le x \le 360^o$ 	  
5. Area of a Triangle	Use when given the **length of two sides and the included angle**. $\boldsymbol{Area\ of\ a\ Triangle = \frac{1}{2}ab\sin C}$	 $A = \frac{1}{2}ab\sin C$ $A = \frac{1}{2} \times 7 \times 10 \times \sin 25$ $A = 14.8$

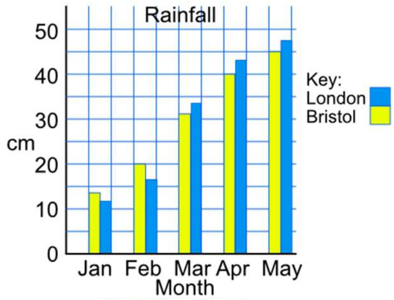
Knowledge Organiser Y10 Representing Data

<table>
<tr><th>Key Vocabulary</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Frequency Table</td><td>A record of how often each value in a set of data occurs.</td><td>
<table>
<tr><th>Number of marks</th><th>Tally marks</th><th>Frequency</th></tr>
<tr><td>1</td><td>𝍸 ||</td><td>7</td></tr>
<tr><td>2</td><td>𝍸</td><td>5</td></tr>
<tr><td>3</td><td>𝍸 |</td><td>6</td></tr>
<tr><td>4</td><td>𝍸</td><td>5</td></tr>
<tr><td>5</td><td>|||</td><td>3</td></tr>
<tr><td>Total</td><td></td><td>26</td></tr>
</table>
</td></tr>
<tr><td>2. Bar Chart</td><td>Represents data as vertical blocks.

$x - axis$ shows the type of data
$y - axis$ shows the frequency for each type of data
Each bar should be the same width
There should be gaps between each bar
Remember to label each axis.</td><td>


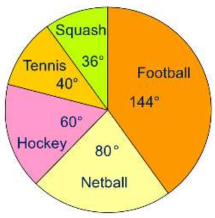
</td></tr>
<tr><td>3. Types of Bar Chart</td><td>Compound/Composite Bar Charts show data stacked on top of each other.

Comparative/Dual Bar Charts show data side by side.</td><td>




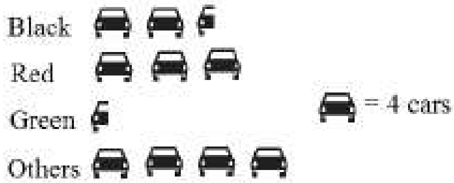
Dual Bar Chart
</td></tr>
<tr><td>4. Pie Chart</td><td>Used for showing how data breaks down into its constituent parts.

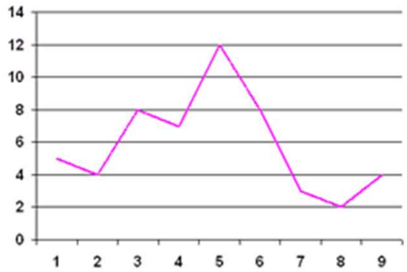
When drawing a pie chart, divide 360° by the total frequency. This will tell you how many degrees to use for the frequency of each category.

Remember to label the category that each sector in the pie chart represents.</td><td>


If there are 40 people in a survey, then each person will be worth 360÷40=9° of the pie chart.
</td></tr>
</table>

<table>
<tr><td>5. Pictogram</td><td>Uses pictures or symbols to show the value of the data.

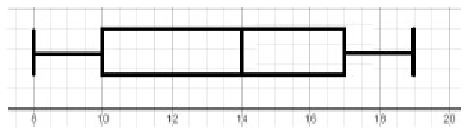
A pictogram must have a key.</td><td>
</td></tr>
<tr><td>6. Line Graph</td><td>A graph that uses points connected by straight lines to show how data changes in values.

This can be used for time series data, which is a series of data points spaced over uniform time intervals in time order.</td><td>
</td></tr>
<tr><td>7. Two Way Tables</td><td>A table that organises data around two categories.

Fill out the information step by step using the information given.

Make sure all the totals add up for all columns and rows.</td><td>Question: Complete the 2 way table below.
<table>
<tr><th></th><th>Left Handed</th><th>Right Handed</th><th>Total</th></tr>
<tr><td>Boys</td><td>10</td><td></td><td>58</td></tr>
<tr><td>Girls</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td></td><td>84</td><td>100</td></tr>
</table>
Answer: Step 1, fill out the easy parts (the totals)
<table>
<tr><th></th><th>Left Handed</th><th>Right Handed</th><th>Total</th></tr>
<tr><td>Boys</td><td>10</td><td>48</td><td>58</td></tr>
<tr><td>Girls</td><td></td><td></td><td>42</td></tr>
<tr><td>Total</td><td>16</td><td>84</td><td>100</td></tr>
</table>
Answer: Step 2, fill out the remaining parts
<table>
<tr><th></th><th>Left Handed</th><th>Right Handed</th><th>Total</th></tr>
<tr><td>Boys</td><td>10</td><td>48</td><td>58</td></tr>
<tr><td>Girls</td><td>6</td><td>36</td><td>42</td></tr>
<tr><td>Total</td><td>16</td><td>84</td><td>100</td></tr>
</table></td></tr>
<tr><td>8. Box Plots</td><td>The minimum, lower quartile, median, upper quartile and maximum are shown on a box plot.

A box plot can be drawn independently or from a cumulative frequency diagram.</td><td>Students sit a maths test. The highest score is 19, the lowest score is 8, the median is 14, the lower quartile is 10 and the upper quartile is 17. Draw a box plot to represent this information.

</td></tr>
<tr><td>9. Comparing Box Plots</td><td>Write two sentences.
1. Compare the averages using the medians for two sets of data.
2. Compare the spread of the data using the range or IQR for two sets of data.

The <u>smaller</u> the range/IQR, the <u>more consistent</u> the data.

You must compare box plots in the context of the problem.</td><td>‘On average, students in class A were more successful on the test than class B because their median score was higher.’

‘Students in class B were more consistent than class A in their test scores as their IQR was smaller.’</td></tr>
</table>

Knowledge Organiser Y10 Summarising Data

<table>
<tr><th>Key Vocabulary</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Types of Data</td><td>Qualitative Data – non-numerical data
Quantitative Data – numerical data

Continuous Data – data that can take any numerical value within a given range.
Discrete Data – data that can take only specific values within a given range.</td><td>Qualitative Data – eye colour, gender etc.

Continuous Data – weight, voltage etc.

Discrete Data – number of children, shoe size etc.</td></tr>
<tr><td>2. Grouped Data</td><td>Data that has been bundled in to categories.

Seen in grouped frequency tables, histograms, cumulative frequency etc.</td><td><table><tr><th>Foot length, l, (cm)</th><th>Number of children</th></tr><tr><td>$10 \leqslant l < 12$</td><td>5</td></tr><tr><td>$12 \leqslant l < 17$</td><td>53</td></tr></table></td></tr>
<tr><td>3. Primary /Secondary Data</td><td>Primary Data – collected yourself for a specific purpose.

Secondary Data – collected by someone else for another purpose.</td><td>Primary Data – data collected by a student for their own research project.

Secondary Data – Census data used to analyse link between education and earnings.</td></tr>
<tr><td>4. Mean</td><td>Add up the values and divide by how many values there are.</td><td>The mean of 3, 4, 7, 6, 0, 4, 6 is
$\frac{3+4+7+6+0+4+6}{7} = 5$</td></tr>
<tr><td>5. Mean from a Table</td><td>1. Find the midpoints (if necessary)
2. Multiply Frequency by values or midpoints
3. Add up these values
4. Divide this total by the Total Frequency

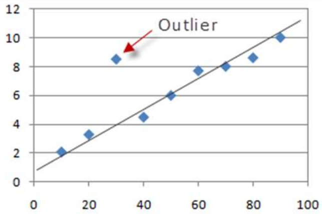
If grouped data is used, the answer will be an estimate.</td><td><table><tr><th>Height in cm</th><th>Frequency</th><th>Midpoint</th><th>F × M</th></tr><tr><td>$0 < h \leq 10$</td><td>8</td><td>5</td><td>8×5=40</td></tr><tr><td>$10 < h \leq 30$</td><td>10</td><td>20</td><td>10×20=200</td></tr><tr><td>$30 < h \leq 40$</td><td>6</td><td>35</td><td>6×35=210</td></tr><tr><td>Total</td><td>24</td><td>Ignore!</td><td>450</td></tr></table>Estimated Mean height: 450 ÷ 24 = 18.75cm</td></tr>
<tr><td>6. Median Value</td><td>The middle value.

Put the data in order and find the middle one.
If there are two middle values, find the number half way between them by adding them together and dividing by 2.</td><td>Find the median of: 4, 5, 2, 3, 6, 7, 6

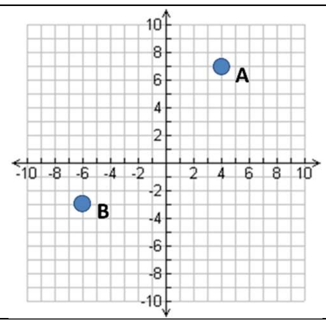
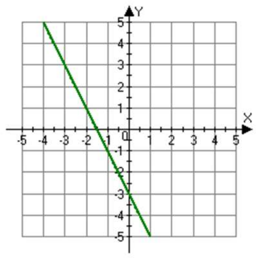
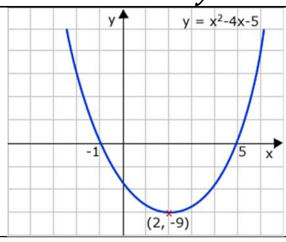
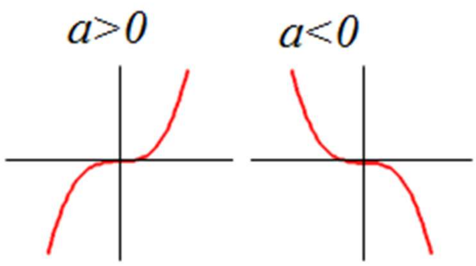
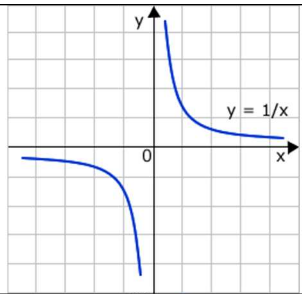
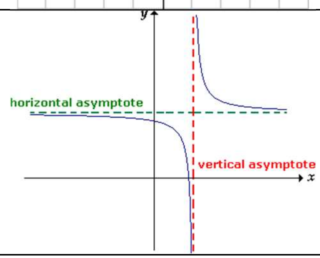
Ordered: 2, 3, 4, 5, 6, 6, 7

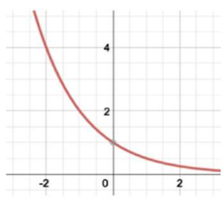
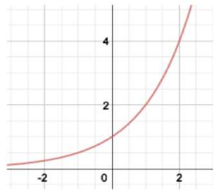
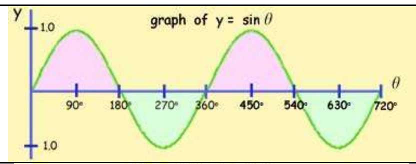
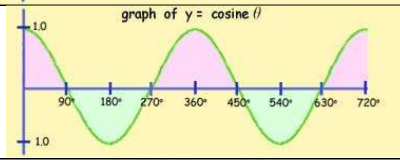
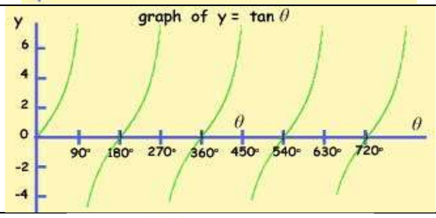
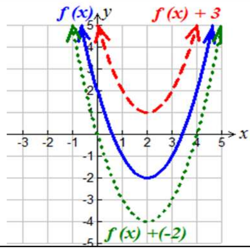
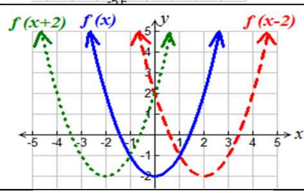
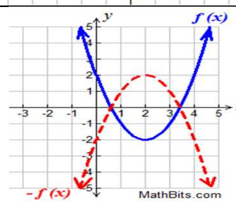
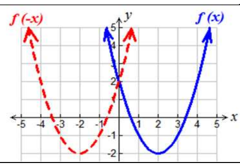
Median = 5</td></tr>
<tr><td>7. Median from a Table</td><td>Use the formula $\frac{(n+1)}{2}$ to find the position of the median.

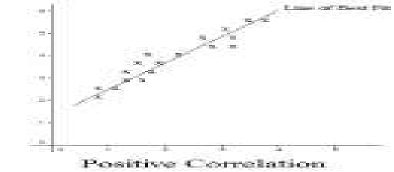
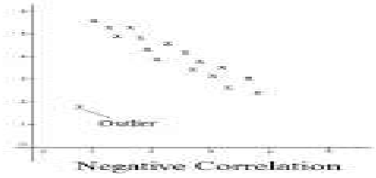
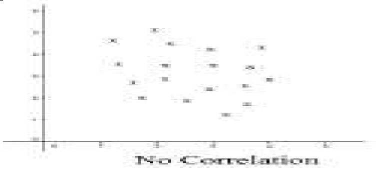
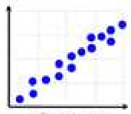
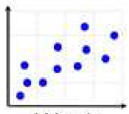
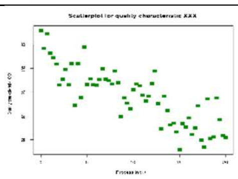
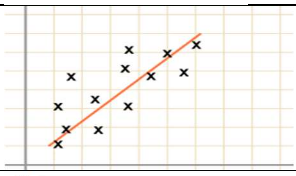
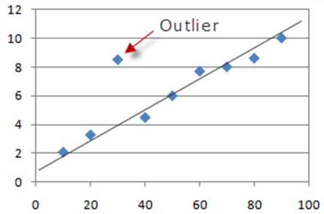
n is the total frequency.</td><td>If the total frequency is 15, the median will be the $\left(\frac{15+1}{2}\right) =$ $8th$ position</td></tr>
</table>

8. Mode /Modal Value	**Most** frequent/common. Can have more than one mode (called bi-modal or multi-modal) or no mode (if all values appear once)	Find the mode: 4, 5, 2, 3, 6, 4, 7, 8, 4 Mode = 4
9. Range	**Highest value subtract the Smallest value** Range is a 'measure of spread'. The smaller the range the more <u>consistent</u> the data.	Find the range: 3, 31, 26, 102, 37, 97. Range = 102-3 = 99
10. Outlier	A value that '**lies outside**' most of the other values in a set of data. An outlier is **much smaller or much larger** than the other values in a set of data.	
11. Lower Quartile	**Divides** the **bottom half** of the data into **two halves**. **LQ =** $\boldsymbol{Q_1 = \frac{(n+1)}{4} th}$ **value**	Find the lower quartile of: 2, **<u>3</u>**, 4, 5, 6, 6, 7 $Q_1 = \frac{(7+1)}{4} = 2nd$ value → 3
12. Lower Quartile	**Divides** the **top half** of the data into **two halves**. **UQ =** $\boldsymbol{Q_3 = \frac{3(n+1)}{4} th}$ **value**	Find the upper quartile of: 2, 3, 4, 5, 6, **<u>6</u>**, 7 $Q_3 = \frac{3(7+1)}{4} = 6th$ value → 6
13. Interquartile Range	The **difference** between the **upper quartile and lower quartile.** $\boldsymbol{IQR = Q_3 - Q_1}$ The **smaller** the **interquartile range**, the **more consistent** the data.	Find the IQR of: 2, 3, 4, 5, 6, 6, 7 $IQR = Q_3 - Q_1 = 6 - 3 = 3$

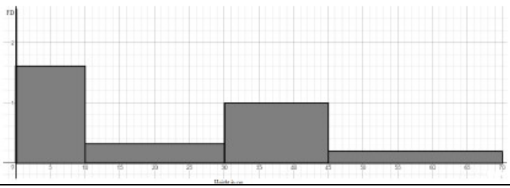
Knowledge organiser Y10H Graphs and Graph Transformations

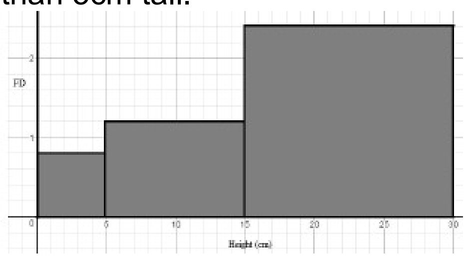
Key vocabulary	Definition/Tips	Example
1. Coordinates	Written in **pairs**. The **first** term is the **x-coordinate** (movement **across**). The **second** term is the **y-coordinate** (movement **up or down**)	 A: (4,7) B: (-6,-3)
2. Linear Graph	**Straight line** graph. The **equation** of a linear graph can contain an **x-term**, a **y-term** and a **number**.	Example:  Other examples: $x = y$ $y = 4$ $x = -2$ $y = 2x - 7$ $y + x = 10$ $2y - 4x = 12$
3. Quadratic Graph	A '**U-shaped**' curve called a **parabola**. The equation is of the form $y = \boldsymbol{ax^2 + bx + c}$, where a, b and c are numbers, $\boldsymbol{a \neq 0}$. If $\boldsymbol{a < 0}$**,** the parabola is **upside down**.	
4. Cubic Graph	The equation is of the form $\boldsymbol{y = ax^3 + k}$, where $\boldsymbol{k}$ **is an number**. If $\boldsymbol{a > 0}$, the curve is **increasing**. If $\boldsymbol{a < 0}$, the curve is **decreasing**.	
5. Reciprocal Graph	The equation is of the form $\boldsymbol{y = \frac{A}{x}}$, where $\boldsymbol{A}$ **is a number** and $\boldsymbol{x \neq 0}$. The graph has **asymptotes** on the **x-axis and y-axis**.	
6. Asymptote	A **straight line** that a graph **approaches** but **never touches**.	

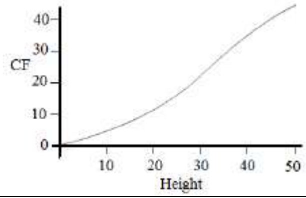
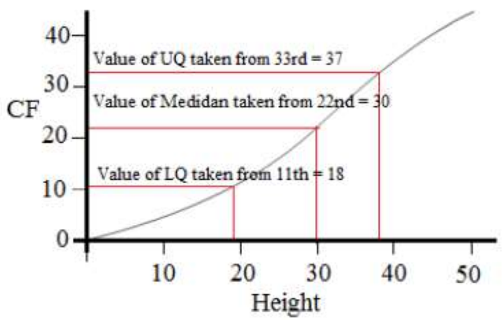
7. Exponential Graph	The equation is of the form $\boldsymbol{y = a^x}$, where a is a number called the **base**. If $\boldsymbol{a > 1}$ the graph **increases**. If $\boldsymbol{0 < a < 1}$, the graph **decreases**. The graph has an **asymptote** which is the **x-axis**.	 
8. $y = \sin x$	Key Coordinates: $(\mathbf{0},\mathbf{0}), (\mathbf{90},\mathbf{1}), (\mathbf{180},\mathbf{0}), (\mathbf{270},\mathbf{-1}), (\mathbf{360},\mathbf{0})$ y is never more than 1 or less than -1. Pattern repeats every 360°.	
9. $y = \cos x$	Key Coordinates: $(\mathbf{0},\mathbf{1}), (\mathbf{90},\mathbf{0}), (\mathbf{180},\mathbf{-1}), (\mathbf{270},\mathbf{0}), (\mathbf{360},\mathbf{1})$ y is never more than 1 or less than -1. Pattern repeats every 360°.	
10. $y = \tan x$	Key Coordinates: $(\mathbf{0},\mathbf{0}), (\mathbf{45},\mathbf{1}), (\mathbf{135},\mathbf{-1}), (\mathbf{180},\mathbf{0}),$ $(\mathbf{225},\mathbf{1}), (\mathbf{315},\mathbf{-1}), (\mathbf{360},\mathbf{0})$ **Asymptotes** at $\boldsymbol{x = 90}$ and $\boldsymbol{x = 270}$ Pattern repeats every 360°.	
11. $f(x) + a$	**Vertical translation** up a units. $\begin{pmatrix} 0 \\ a \end{pmatrix}$	
12. $f(x + a)$	**Horizontal translation** <u>left</u> a units. $\begin{pmatrix} -a \\ 0 \end{pmatrix}$	
13. $-f(x)$	**Reflection** over the **x-axis**.	
14. $f(-x)$	**Reflection** over the **y-axis**.	

Key vocabulary	Definition/Tips	Example
1. Correlation	Correlation between two sets of data means they are **connected** in some way.	There is correlation between temperature and the number of ice creams sold.
2. Causality	When one variable **influences** another variable.	The more hours you work at a particular job (paid hourly), the higher your income from that job will be.
3. Positive Correlation	As one value **increases** the other value **increases**.	
4. Negative Correlation	As one value **increases** the other value **decreases**.	
5. No Correlation	There is **no linear relationship** between the two.	
6. Strong Correlation	When two sets of data are **closely linked**.	 Strong Positive Correlation
7. Weak Correlation	When two sets of data have correlation, but are **not closely linked**.	 Weak Positive Correlation
8. Scatter Graph	A graph in which values of **two variables** are plotted along two axes to **compare** them and see if there is any **connection** between them.	
9. Line of Best Fit	A **straight line** that **best represents the data** on a scatter graph.	
10. Outlier	A value that 'lies outside' most of the other values in a set of data. An outlier is **much smaller or much larger** than the other values in a set of data.	

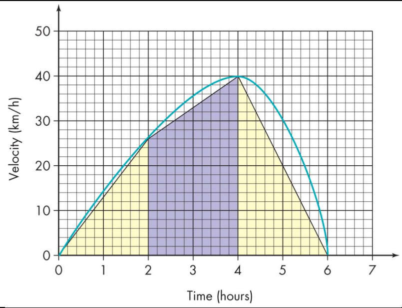
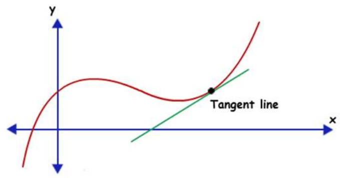
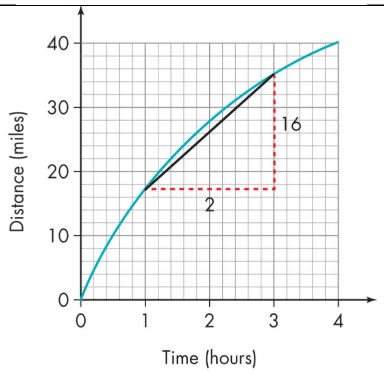
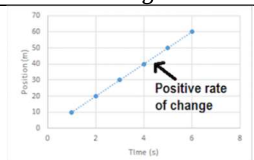
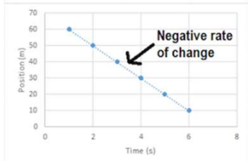
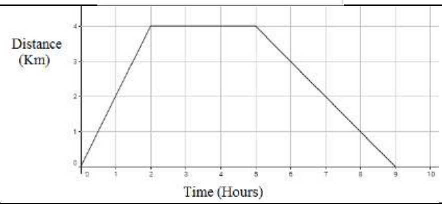
<table>
<tr><th>Key vocabulary</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Histograms</td><td>A visual way to display frequency data using bars.
Bars can be unequal in width.
Histograms show frequency density on the y-axis, not frequency.

$$\boldsymbol{Frequency\ Density} = \frac{\boldsymbol{Frequency}}{\boldsymbol{Class\ Width}}$$</td><td>
<table>
<tr><th>Height(cm)</th><th>Frequency</th><th>Frequency Density (FD)</th></tr>
<tr><td>$0 < h \leq 10$</td><td>8</td><td>$8 \div 5 = 1.6$</td></tr>
<tr><td>$10 < h \leq 30$</td><td>6</td><td>$6 \div 20 = 0.3$</td></tr>
<tr><td>$30 < h \leq 45$</td><td>15</td><td>$15 \div 15 = 1$</td></tr>
<tr><td>$45 < h \leq 70$</td><td>5</td><td>$5 \div 25 = 0.2$</td></tr>
</table>

</td></tr>
<tr><td>2. Interpreting Histograms</td><td>The area of the bar is proportional to the frequency of that class interval.

$$\boldsymbol{Frequency} = \boldsymbol{Freq\ Density} \times \boldsymbol{Class\ Width}$$</td><td>A histogram shows information about the heights of a number of plants. 4 plants were less than 5cm tall. Find the number of plants more than 5cm tall.


Above 5cm:
1.2 x 10 + 2.4 x 15 = 12 + 36 = 48</td></tr>
<tr><td>3. Cumulative Frequency</td><td>Cumulative Frequency is a running total.
<table>
<tr><th>Age</th><th>Frequency</th></tr>
<tr><td>$0 < a \leq 10$</td><td>15</td></tr>
<tr><td>$10 < a \leq 40$</td><td>35</td></tr>
<tr><td>$40 < a \leq 50$</td><td>10</td></tr>
</table></td><td>
<table>
<tr><th>Cumulative Frequency</th></tr>
<tr><td>15</td></tr>
<tr><td>$15 + 35 = 50$</td></tr>
<tr><td>$50 + 10 = 60$</td></tr>
</table></td></tr>
<tr><td>4. Cumulative Frequency Diagram</td><td>A cumulative frequency diagram is a curve that goes up. It looks a little like a stretched-out S shape.
Plot the cumulative frequencies at the end-point of each interval.</td><td>

</td></tr>
<tr><td>5. Quartiles from Cumulative Frequency Diagram</td><td>Lower Quartile (Q1): 25% of the data is less than the lower quartile.
Median (Q2): 50% of the data is less than the median.
Upper Quartile (Q3): 75% of the data is less than the upper quartile.
Interquartile Range (IQR): represents the middle 50% of the data.</td><td>


$IQR = 37 - 18 = 19$</td></tr>
</table>

Key Vocabulary	Definition/Tips	Example
1. Area Under a Curve	To find the area under a curve, **split it up into simpler shapes** – such as rectangles, triangles and trapeziums – that approximate the area.	
2. Tangent to a Curve	A straight **line** that **touches** a curve at **exactly one point**.	
3. Gradient of a Curve	The **gradient of a curve** at a point is the same as the **gradient of the tangent** at that point. 1. Draw a tangent carefully at the point. 2. Make a right-angled triangle. 3. Use the measurements on the axes to calculate the rise and run (change in y and change in x) 4. Calculate the gradient.	 $Gradient = \frac{Change\ in\ y}{Change\ in\ x} = \frac{16}{2} = 8$
4. Rate of Change	The rate of change at a particular instant in time is represented by the **gradient of the tangent to the curve** at that point.	 
5. Distance-Time Graphs	You can find the **speed** from the **gradient** of the line (Distance ÷ Time) The steeper the line, the quicker the speed. A **horizontal** line means the object is not moving (**stationary**).	
6. Velocity-Time Graphs	You can find the **acceleration** from the **gradient** of the line (Change in Velocity ÷ Time) The steeper the line, the quicker the acceleration. A **horizontal line** represents no acceleration, meaning a **constant velocity**. The **area** under the graph is the **distance**.