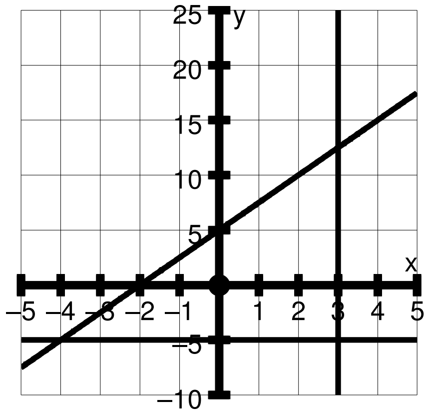
National 5: Relationships

Learning Intention	I can use and interpret straight line equations.		
Success Criteria	☺	😐	☹
• I can use and interpret the straight line equation $y = mx + c$. (1) Write down the gradient of the line $y = 2x - 4$ and the coordinates of the point where it crosses the *y*-axis. (2) Sketch the lines with equation $y = -x + 3$, $y = -5$ and $x = 4$. (3) Find the equation of the straight lines shown in the diagram.  (4) Write down the gradient and the y-intercept of the line $2x + 3y = 6$.			
• I know that $y - b = m(x - a)$ represents a straight line with gradient m, passing through the point (a, b).			
• I can determine the equation of a straight line using $y - b = m(x - a)$. Find the equation of the straight lines which pass through the point: (a) $(1,5)$ with a gradient of 2 (b) $(-4,3)$ with a gradient of $\frac{2}{5}$			
• I can determine the equation of a straight line using two points which lie on the line. Find the equation of the line joining $A(-2,-3)$ and $B(8,2)$.			

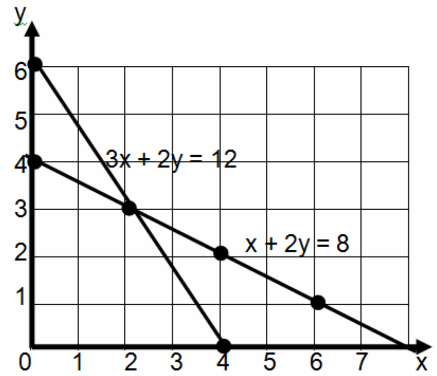
Learning Intention	I can use functional notation.		
Success Criteria	☺	😐	☹
• I know that functional notation can be expressed as $f(x), g(x), h(t)$.....			
• I can evaluate an expression in functional notation. A function is defined as $f(x) = x^2 - 3$, find the value of $f(x)$ when $x = 4$.			
• I can calculate x given the value of $f(x)$. A function is defined by $f(x) = 8 - 3x$. Find x when $f(x) = -13$. A function is defined by $f(t) = t^2 - 1$. Find the **values** of t when $f(t) = 8$.			

Learning Intention	I can solve linear equations and inequations.		
Success Criteria	☺	😐	☹
• I can solve linear equations. Solve $3x + 5 = 17$ $\quad$ $8x - 11 = 5$ $\quad$ $5x - 2 = 2x + 23$ $\quad$ $7x + 11 = 4x - 19$			
• I can solve equations involving brackets. Solve $3(x - 5) = 21$ $\quad$ $5(x + 7) - 2(3x - 4) = 45$ $\quad$ $x(x + 3) = x^2 + 15$ $\quad$ $(x - 1)^2 + 7^2 = x^2$			
• I can solve inequations. Solve $5x + 3 < 12$ $\quad$ $7x - 2 > 10x + 4$ $\quad$ $10 - 2(x + 3) > 3(x - 2)$			

Learning Intention	I can solve problems using simultaneous linear equations.			
Success Criteria		☺	😐	☹

- I know how to solve systems of linear equations graphically.

Use the diagram below to solve $x + 2y = 8$ and $3x + 2y = 12$.



- I know how to solve systems of equations algebraically using **substitution** or **elimination**.

Solve **algebraically** the system of equations (a) $\begin{aligned} 3x + y &= 10 \\ 5x - 2y &= 13 \end{aligned}$ (b) $\begin{aligned} 3x - 2y &= 11 \\ 2x + 5y &= 1 \end{aligned}$

- I know how to create and solve systems of equations algebraically.

Seats on flights from London to Edinburgh are sold at two prices, £30 and £50. On one flight a total of 130 seats were sold. Let x be the number of seats sold at £30 and y be the number of seats sold at £50.

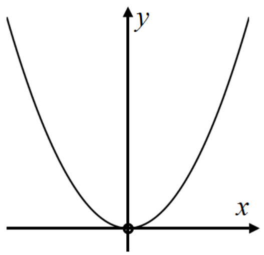
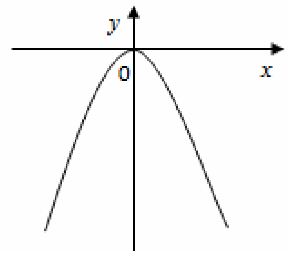
(a) Write down an equation in x and y which satisfies the above condition.

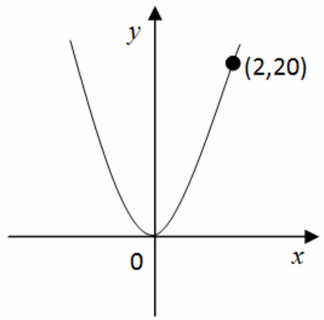
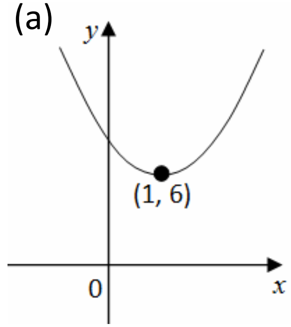
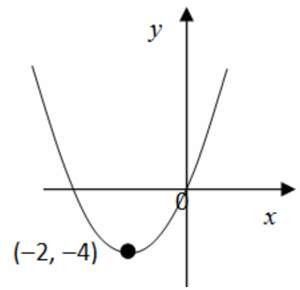
The sale of the seats on this flight totalled £6000.

(b) Write down an equation in x and y which satisfies this condition

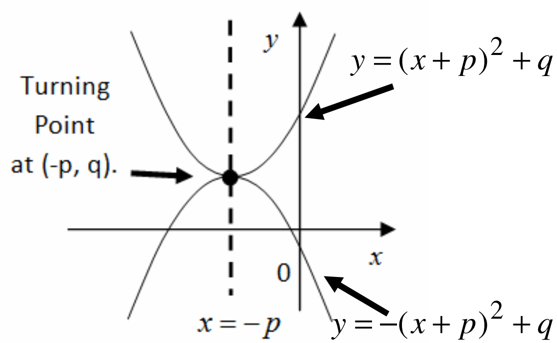
(c) How many seats were sold at each price?

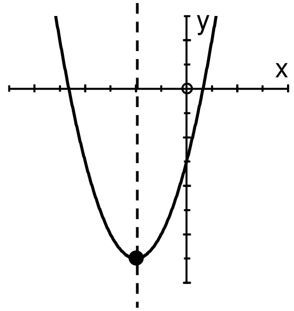
Learning Intention	I can change the subject of a formula.		
Success Criteria	☺	😐	☹
• I recognise formulae that can be rearranged in 1 step when changing the subject to x. $x + A = B$ $\quad gx = k$ $\quad \frac{x}{t} = f$			
• I recognise formulae that can be rearranged in 2 steps or more when changing the subject to x. $dx - h = k$ $\quad \frac{d}{x} = g$ $\quad y = \frac{7x}{3} - 4$			
• I can rearrange formulae involving squares and square roots Change the subject of : $V = \pi r^2 h$ to r $\quad E = \frac{1}{2} m v^2$ to v $\quad r = \sqrt{\frac{A}{\pi}}$ to A $s = \sqrt{\frac{t}{k}}$ to k $\quad gh = \frac{(x-3y)}{A^2}$ to A $\quad b^2 = \sqrt{d} - 4$ to d.			

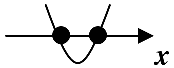
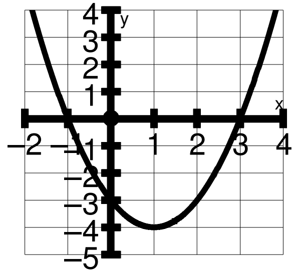
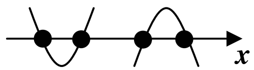
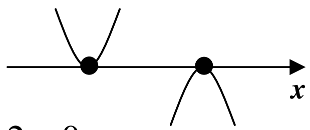
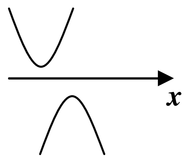
Learning Intention	I can recognise a quadratic function from its graph.			
Success Criteria		☺	😐	☹
• I can recognise and draw $y = x^2$  and $y = -x^2$ 				

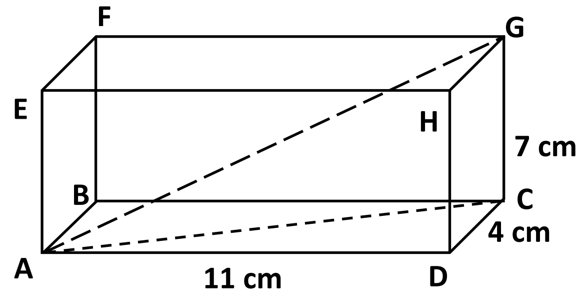
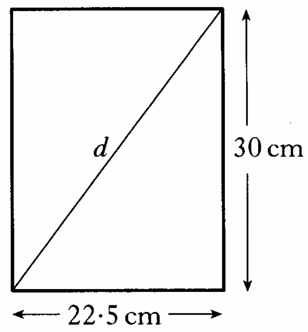
Learning Intention	I can recognise and determine the equation of a quadratic function from its graph.			
Success Criteria		☺	😐	☹
• I know how to identify the value of a from the graph of $y = ax^2$. The graph with equation $y = ax^2$ is shown. The point (2, 20) lies on the graph. Determine the value of a.				
• I can identify the values of p and q from the graph of $y = (x + p)^2 + q$. The two diagrams show graphs of $y = (x + p)^2 + q$. Write down the values of p and q.	(a)  (b) 			

Learning Intention	I can identify the main features and sketch a quadratic function of the form $y=(x-m)(x-n)$.		
Success Criteria	☺	😐	☹
• I can identify the roots and y-intercept of $y=(x-m)(x-n)$. Find the roots and y-intercept of $y=(x-1)(x-5)$ and $y=(x-3)(x+4)$.			
• I can find the equation of the axis of symmetry and the coordinates and nature of the turning point of $y=(x-m)(x-n)$. Find the equation of the axis of symmetry and the coordinates and nature of the turning point of $y=(x-1)(x-5)$ and $y=(x-3)(x+4)$.			
• I can sketch and annotate $y=(x-m)(x-n)$. Sketch the graph $y=(x-4)(x+2)$ on plain paper showing clearly where the graph crosses the axes and state the coordinates and nature of the turning point.			

Learning Intention	I can identify the main features and sketch a quadratic function of the form $y=(x+p)^2+q$ and $y=-(x+p)^2+q$ or $y=q-(x+p)^2$.			
Success Criteria		☺	😐	☹
• I know that $y=(x+p)^2+q$ has a **minimum** value of q when $x=-p$. Hence the **minimum turning point** is at $(-p,q)$ and $x=-p$ is the equation of the axis of symmetry.				
• I know that $y=-(x+p)^2+q$ or $y=q-(x+p)^2$ has a **maximum** value of q when $x=-p$. Hence the **maximum turning point** is at $(-p,q)$ and $x=-p$ is the equation of the axis of symmetry.				

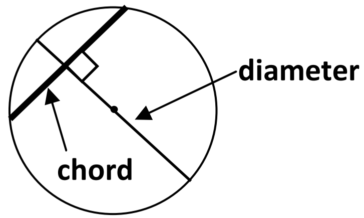
Success Criteria	☺	😐	☹
• I can identify the equation of the axis of symmetry and the coordinates and nature of the turning point of $y=(x+p)^2+q$ and $y=-(x+p)^2+q$ or $y=q-(x+p)^2$.  The equation of the parabola in the diagram is $y=(x-2)^2-7$ (a) State the coordinates of the minimum turning point of the parabola. (b) State the equation of the axis of symmetry of the parabola.			
• I can sketch and annotate $y=(x+p)^2+q$ and $y=-(x+p)^2+q$ or $y=q-(x+p)^2$. A parabola has equation (a) $y=(x-4)^2+9$ (b) $y=11-(x+2)^2$. For each example (i) State the equation of the axis of symmetry. (ii) Write down the coordinates of the turning point stating whether it is a maximum or minimum. (iii) Make a sketch of the function.			

Learning Intention	I can solve quadratic equations.		
Success Criteria	☺	😐	☹
• I know that a quadratic equation is of the form $y = ax^2 + bx + c$ where $a \neq 0$.			
• I know the meaning of root. 			
• I know that to solve a quadratic equation it must be of the form $ax^2 + bx + c = 0$.			
• I can solve a quadratic equation graphically.  The diagram shows the graph of the function $y = x^2 - 2x - 3$. Use the graph to solve the equation $x^2 - 2x - 3 = 0$.			
• I can solve a quadratic equation using factorisation. Solve the equation $x^2 - x - 12 = 0$.			
• I can solve a quadratic equation using the quadratic formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. Solve the equation $2x^2 + 3x - 1 = 0$ using the quadratic formula giving your answers correct to one decimal place.			
• I know that the value of the discriminant "$b^2 - 4ac$" determines the nature of the roots of a quadratic equation: If $b^2 - 4ac > 0$ the roots are real and unequal/distinct  If $b^2 - 4ac = 0$ the roots are real and equal  If $b^2 - 4ac < 0$ there are no real roots.  (1) Find the nature of the roots of $x^2 - x - 12 = 0$. (2) Find the values of k for which the equation $2x^2 + 4x + k = 0$ has equal roots.			

Learning Intention	I can use and apply the Theorem of Pythagoras.		
Success Criteria	☺	😐	☹
• I can solve problems by applying the Theorem of Pythagoras to 2D and 3D shapes by identifying and drawing a right angled triangle and labelling the sides appropriately. In the cuboid shown opposite. (a) Calculate the length of the face diagonal AC. (b) Hence calculate the length of the space diagonal AG.  			
• I know when to use the converse of the Theorem of Pythagoras.			
• I know how to use the converse of the Theorem of Pythagoras and can communicate my solution and conclusion correctly. A rectangular picture frame is to be made. It is 30 centimetres high and 22·5 centimetres wide, as shown. To check that the frame is rectangular, the diagonal, d, is measured. It is 37·3 centimetres long. Is the frame rectangular?  			

Learning Intention I can solve problems involving chords in circles, often using Pythagoras.

Success Criteria	☺	😐	☹
• I know that a chord is a line joining two points on the circumference of a circle.			
• I know that the diameter is a special chord passing through the centre of a circle.			
• I know that, at the point of contact, a chord is perpendicular to the radius or diameter of a circle.			

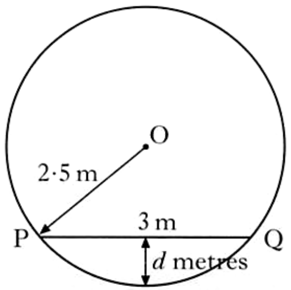


(1) The diagram shows a circular cross-section of a cylindrical oil tank.

In the figure opposite.

- ➢ O represents the centre of the circle
- ➢ PQ represents the surface of the oil in the tank
- ➢ PQ is 3 metres
- ➢ the radius OP is 2·5 metres

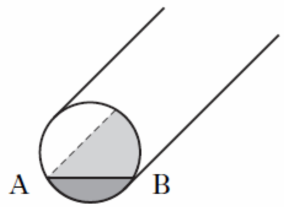
Find the depth, d metres, of oil in the tank.

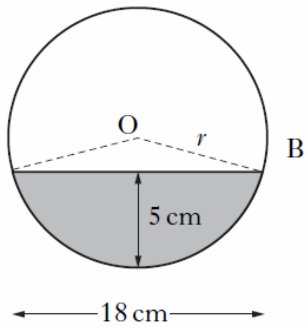


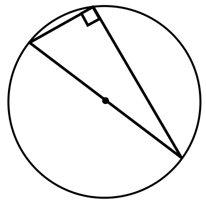
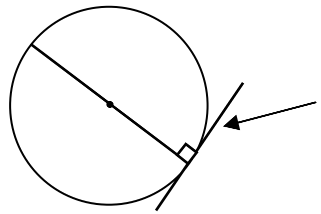
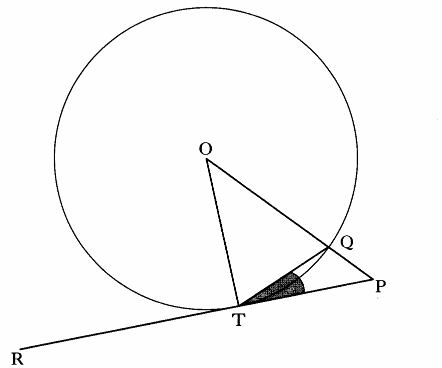
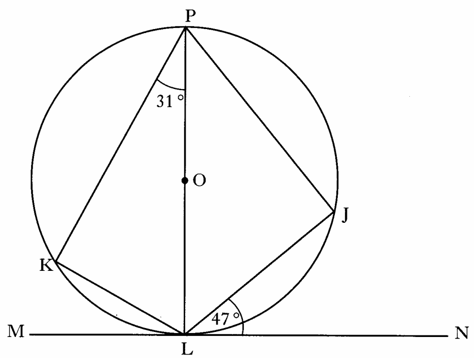
(2) A pipe has water in it as shown.

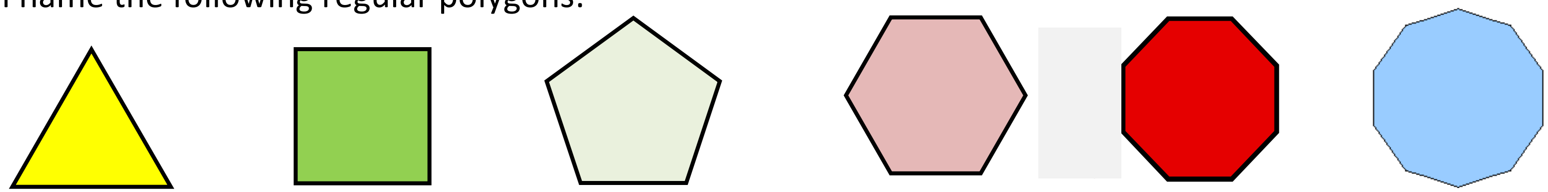
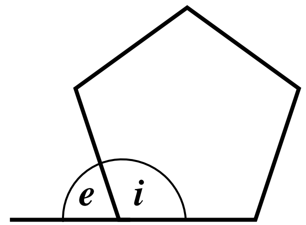
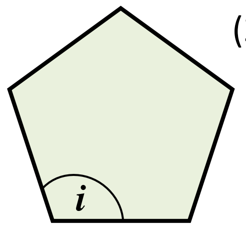
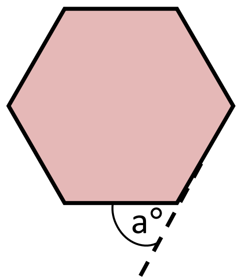
- ➢ The depth of the water is 5 centimetres.
- ➢ The width of the surface, AB, is 18 centimetres.

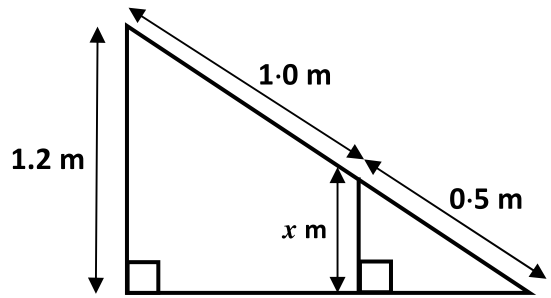
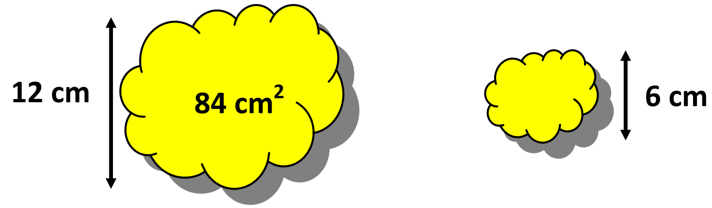
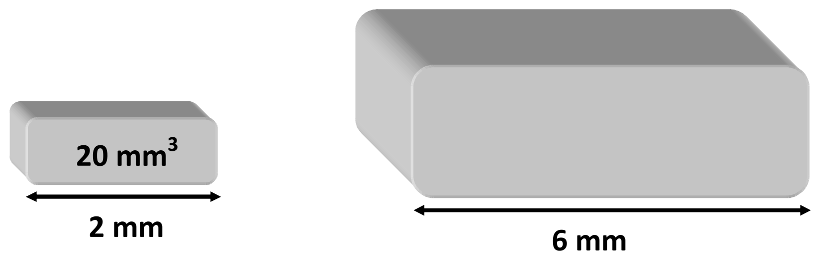
Calculate, r, the radius of the pipe.

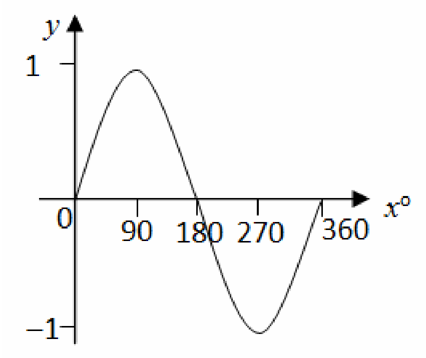
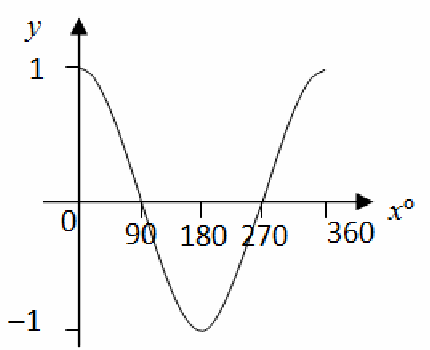
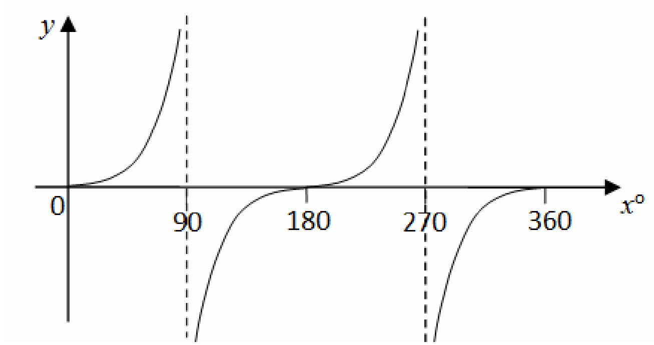
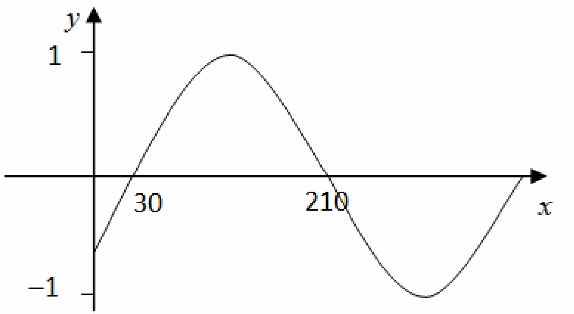
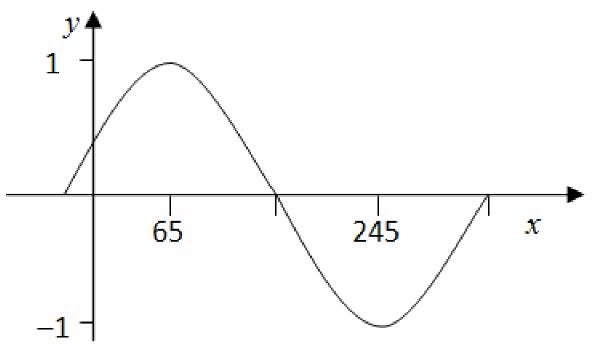


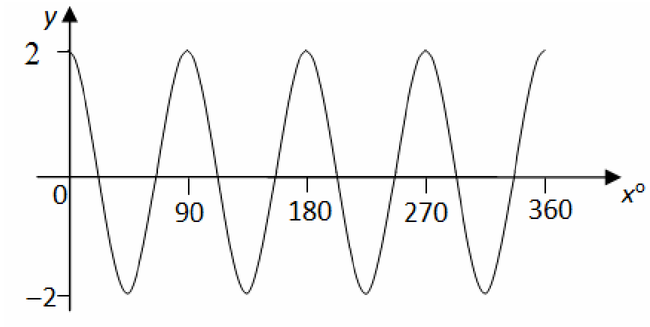
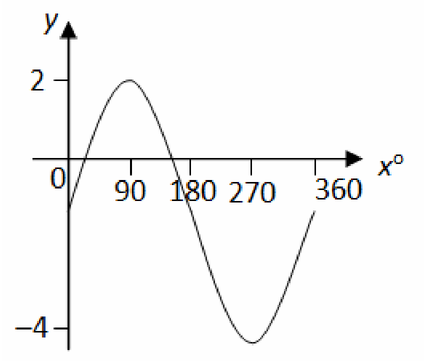
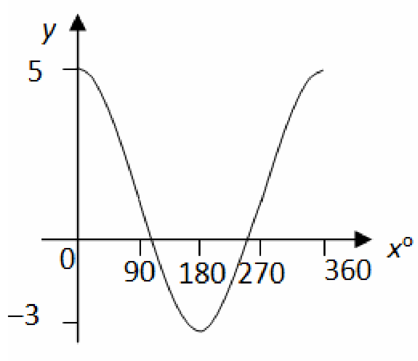


Learning Intention I can determine an angle involving at least two steps.			
Success Criteria	☺	😐	☹
• I know that every triangle in a semi-circle is right angled. 			
• I know that a tangent is a straight line which touches a circle at one point only. • I know that, at the point of contact, a tangent is perpendicular to the radius or diameter of a circle. 			
(1) RP is a tangent to the circle; centre O, with a point of contact at T. The shaded angle PTQ = 24°. Calculate the sizes of angle OPT.   (2) The tangent, MN, touches the circle, centre O, at L. Angle JLN = 47° Angle KPL = 31° Find the size of angle KLJ.			

Success Criteria	☺	😐	☹
• I know that a polygon is a many sided shape.			
• I can name the following regular polygons:  • I know how to find the sum of the angles inside any polygon.			
• I know that interior angles are the angles inside a polygon. • I know that exterior angles are formed by extending one side of a polygon as shown in the diagram. • I know that interior angle + exterior angle = 180°.  ***i*** = interior angle ***e*** = exterior angle			
• I know how to determine the value of an interior and an exterior angle for any regular polygon. (1) Here is a regular pentagon. Calculate the size of angle i°.  (2) Here is a regular hexagon. Calculate the size of angle a°. 			

Learning Intention	I can solve problems involving similarity.			
Success Criteria		☺	😐	☹
• I know that similar shapes are equiangular and that their corresponding sides are in the same ratio.				
• I know how to find a linear scale factor.				
• I can solve problems using a linear scale factor. The diagram shows the design for a house window. Find the value of x.				
• I know how to find an area scale factor.				
• I can solve problems using an area scale factor. These shapes are mathematically similar. The area of the larger shape is 84 cm^2. Calculate the area of the smaller shape.				
• I know how to find a volume scale factor.				
• I can solve problems using a volume scale factor. These solid shapes are mathematically similar. The volume of the smaller shape is 20 mm^3. Calculate the volume of the larger shape				

Learning Intention	I can interpret and sketch trigonometric graphs.		
Success Criteria	☺	😐	☹
• I can recognise and sketch: $y = \sin x°$ $y = \cos x°$ and $y = \tan x°$.    			
• I know the value of $y = \sin x°$, $y = \cos x°$ and $y = \tan x°$ at 0°, 90°, 180°, 270° and 360°.			
• I know the meaning of amplitude, period, vertical translation and phase angle.			
• I can identify and sketch the graph of $y = \sin(x \pm a)°$ and $y = \cos(x \pm a)°$. (1) Write down the equation for each graph. (a)  (b)  (2) Make a neat sketch of these trigonometric functions showing the important values for $0° \le x \le 360°$. (a) $y = \cos(x - 60)°$ (b) $y = \sin(x + 30)°$ (c) $y = \cos(x - 90)°$			

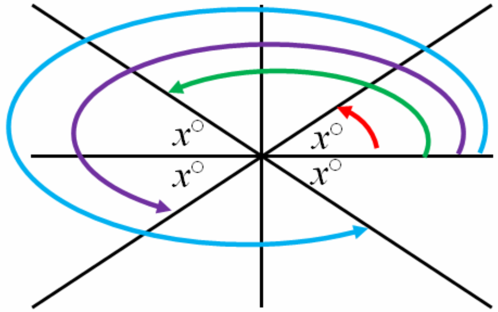
Success Criteria	☺	😐	☹
• I can identify and sketch the graph of $y = a\sin bx°$ and $y = a\cos bx°$. (1) Part of the graph of $y = a\cos bx°$ is shown in the diagram. State the values of a and b.  (2) Identify the maximum value, minimum value and period of $y = 5\sin 3x°$.			
• I can identify and sketch the amplitude, period and vertical translation from the graph of $y = a\sin bx° + c$ and $y = a\cos bx° + c$ (1) Determine the amplitude, period and equation for each graph. (a)  (b)  (2) Make sketches of the following functions for $0° \leq x \leq 360°$, clearly marking any important points. (a) $y = 3\cos x° + 2$ (b) $y = 4\sin x° - 5$ (c) $y = 5\sin 4x° + 6$			

Learning Intention	I can solve trigonometric equations.			
Success Criteria		☺	😐	☹

- I know when $y = \sin x°$, $y = \cos x°$ and $y = \tan x°$ are positive or negative in value.

- I can use a quadrant diagram to find related angles.

SIN Positive Related angle $= 180 - x°$	**All Positive** Basic angle $= x°$
TAN Positive Related angle $= 180 + x°$	**COS** Positive Related angle $= 360 - x°$



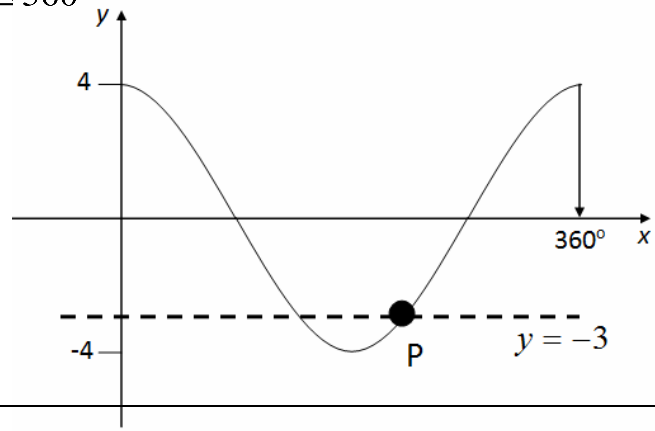
- I can solve trigonometric equations.

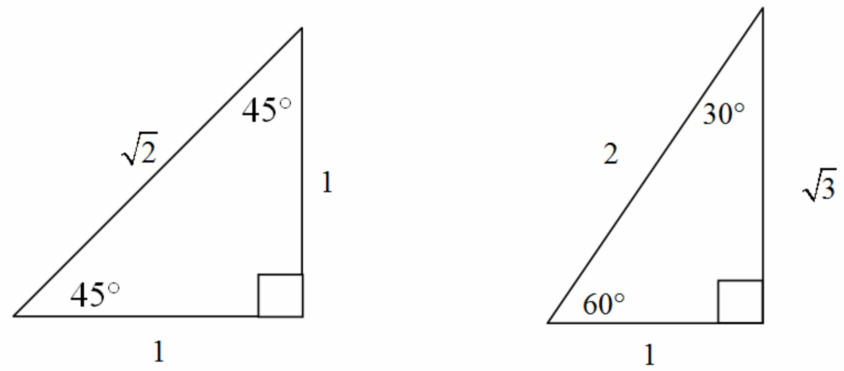
(1) Solve (a) $\cos x° = 0 \cdot 5$ (b) $3\sin x° - 2 = 0$ for $0° \leq x \leq 360°$

(2) The graph in the diagram has an equation of the form $y = a\cos x°$.

(a) The broken line in the diagram has equation $y = -3$.

(b) Determine the coordinates of the point P.



<table>
<tr><td colspan="4">Learning Intention I can work with exact values and trigonometric identities.</td></tr>
<tr><td>Success Criteria</td><td>☺</td><td>😐</td><td>☹</td></tr>
<tr><td>• I know the exact values of $y = \sin x°$, $y = \cos x°$ and $y = \tan x°$ at 30°, 45° and 60° using these two triangles.

</td><td></td><td></td><td></td></tr>
<tr><td>• I can calculate the exact value of obtuse and reflex angles from their related angles.
Determine the exact value of (a) cos150° (b) sin 240° (c) tan 315°.</td><td></td><td></td><td></td></tr>
<tr><td>• I can simplify trigonometric expressions using the trigonometric identities $\sin^2 x + \cos^2 x = 1$ and $\tan x = \dfrac{\sin x}{\cos x}$.
(a) Show that $\dfrac{1-\cos^2 x}{\cos^2 x} = \tan^2 x$ (b) Simplify $\cos x \tan x$ (c) Prove that $3\sin^2\theta + 2\cos^2\theta = 2 + \sin^2\theta$.</td><td></td><td></td><td></td></tr>
</table>