National 5: Expressions and Formulae

Learning Intention I can simplify and carry out calculations using surds.			
Success Criteria	☺	😐	☹
• I know how to find the square, square root, cube or cube root of numbers. Evaluate 3^2 $\sqrt{49}$ 10^3 $\sqrt[3]{64}$			
• I can identify surds.			
• I know that $\sqrt{ab}=\sqrt{a}\times\sqrt{b}$, $\sqrt{a}\times\sqrt{b}=\sqrt{ab}$, $\sqrt{a}\times\sqrt{a}=a$ and $\sqrt{\frac{a}{b}}=\frac{\sqrt{a}}{\sqrt{b}}$.			
• I know how to fully simplify surds. Show that $\sqrt{75}=5\sqrt{3}$ and $\sqrt{72}=6\sqrt{2}$. Simplify $\sqrt{\frac{49}{100}}$			
• I can add and subtract surds. Simplify $2\sqrt{5}+7\sqrt{5}$, $\sqrt{75}-\sqrt{45}$ and $\sqrt{75}-\sqrt{27}$. Express $\sqrt{12}-\sqrt{3}+\sqrt{48}$ as a surd in its simplest form.			
• I can multiply surds. Expand and simplify $\sqrt{3}(\sqrt{3}-1)$ $\sqrt{2}(3-\sqrt{6})$ $(2+\sqrt{2})(3+\sqrt{2})$ $(2\sqrt{5})(2\sqrt{5}-1)$			
• I know how to rationalise the denominator of a fraction of the form $\frac{a}{\sqrt{b}}$. Express $\frac{3}{\sqrt{5}}$ with a rational denominator.			
EXTENSION • I know how to rationalise the denominator of a fraction of the form $\frac{a}{b\pm\sqrt{c}}$. Express $\frac{3}{1+\sqrt{2}}$ with a rational denominator.			

Learning Intention	I can simplify and evaluate expressions using the laws of indices.								
Success Criteria							☺	😐	☹
• I know that $3^4 = 3\times3\times3\times3$ and 3 is the base number and 4 is the index.									
• I know that $a^m \times a^n = a^{m+n}$	Simplify	$x^4 \times x^5$	$3x^7 \times 5x^2$						
• I know that $a^m \div a^n = a^{m-n}$	Simplify	$x^8 \div x^5$	$x^2 \div x^{-3}$						
• I know that $(a^m)^n = a^{mn}$	Simplify	$(2a^3)^4$							
• I know that $a^0 = 1$	Simplify	5^0	$(3ab^2)^0$						
• I know that $a^{-n} = \frac{1}{a^n}$	Rewrite with positive indices	x^{-2}	$3y^{-4}$						
• I know that $\frac{1}{a^{-n}} = a^n$	Rewrite with a positive indice	$\frac{2}{a^{-3}}$							
• I know that $a^{\frac{1}{n}} = \sqrt[n]{a}$	Evaluate	$125^{\frac{1}{3}}$	$81^{-\frac{1}{2}}$						
• I know that $a^{\frac{m}{n}} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$	Evaluate	$16^{\frac{3}{4}}$	$8^{-\frac{2}{3}}$						
• I can simplify expressions of the form	$\frac{x^5 \times x^4}{x^{-2}}$	$6x^2 \times 2x^{-\frac{1}{3}}$	$\sqrt{x}(x^3 - \frac{2}{x})$	$\sqrt[3]{a}(\sqrt[3]{a} - \frac{1}{\sqrt[3]{a}})$					

Learning Intention I can carry out calculations using scientific notation.			
Success Criteria	☺	😐	☹
• I can write large and small numbers in scientific notation. $1820000 = 1 \cdot 82 \times 10^{6}$ $0 \cdot 00049 = 4 \cdot 9 \times 10^{-4}$			
• I can carry out calculations using scientific notation. Calculate $(1 \cdot 2 \times 10^{5}) \times (9 \times 10^{7})$			
• I can use my calculator to carry out calculations using values in scientific notation. There are 5×10^{9} red blood cells in 1 millilitre of blood. The average person has 5·5 litres of blood. How many red blood cells does the average person have in their blood? Give your answer in scientific notation.			

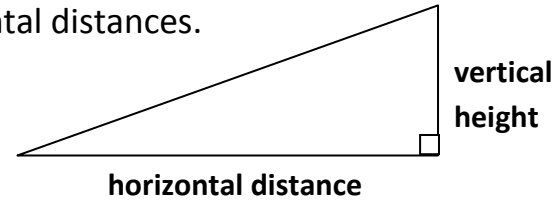
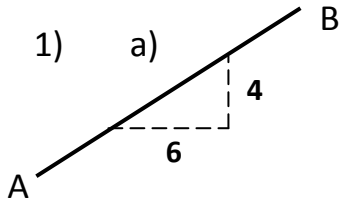
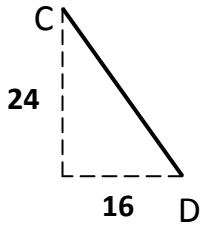
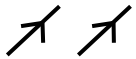
Learning Intention I can simplify algebraic expressions involving the expansion of brackets.			
Success Criteria	☺	😐	☹
• I know how to expand a bracket and simplify: $3 + 4(b - 2)$ $4c - (c - 3)$ $4(2t + 1) + 5(3t - 2)$			
• I know how to expand a bracket of the form: $2t(3t + 1)$ $7g(6 - g)$			
• I know how to expand pairs of brackets with 2 linear expressions: $(x + 3)(x + 5)$ $(4y + 1)(3y - 2)$ $(3x - 4)^2$			
• I know how to expand brackets with a linear and a quadratic expression: $(4y + 1)(3y^2 + 5y - 2)$			

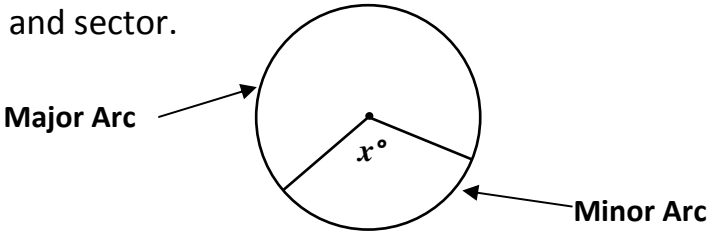
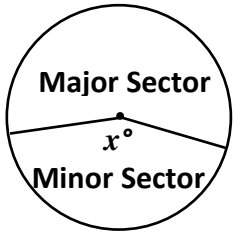
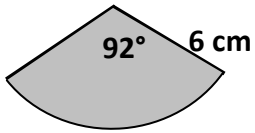
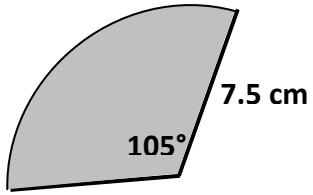
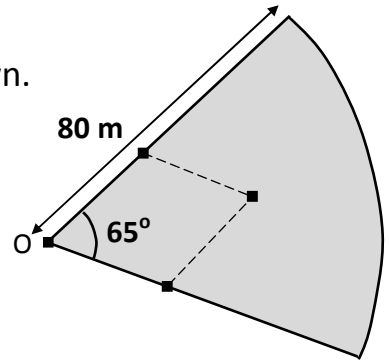
Learning Intention	I can factorise an algebraic expression.		
Success Criteria	☺	😐	☹
• I can factorise an expression by finding the Highest Common Factor (HCF). Factorise the following: $21-35x$ $8a^2b-12ac$			
• I know how to factorise an expression using a difference of two squares. Factorise the following: x^2-y^2 t^2-36 $9x^2-y^2$ $64-49y^2$			
• I know how to factorise an expression using a common factor and a difference of two squares. Factorise the following: $5x^2-20y^2$			
• I know that a trinomial expression is of the form ax^2+bx+c.			
• I know how to factorise a trinomial expression of the form x^2+bx+c. Factorise the following: x^2+6x+8 x^2-x-6 x^2+5x-6 x^2-5x-6			
• I know how to factorise a trinomial expression of the form ax^2+bx+c. Factorise the following: $2x^2+7x+3$ $3x^2-10x-8$ $3x^2-16x+5$			

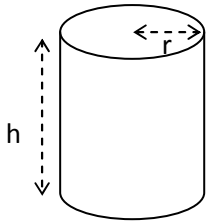
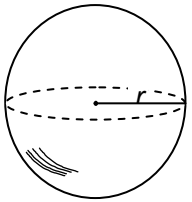
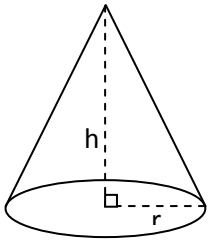
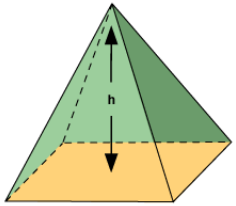
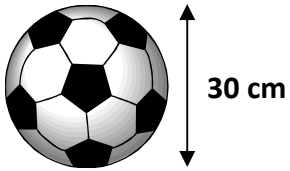
Learning Intention	I can complete the square in a quadratic expression with unitary x^2 coefficient.		
Success Criteria	☺	😐	☹
• I know how to express x^2+bx+c in the form $(x+p)^2+q$. Express x^2+6x-2 and x^2-3x+4 in the form $(x+p)^2+q$.			

Learning Intention	I can reduce an algebraic fraction to its simplest form.			
Success Criteria		☺	😐	☹
• I can simplify fractions.	Simplify the following: $\frac{7}{21}$ $\frac{27}{63}$			
• I can simplify algebraic fractions.	Simplify the following: $\frac{x^2}{x^5}$ $\frac{10y^7}{15y^4}$ $\frac{(y+2)(y-3)}{(y-3)(y-4)}$ $\frac{x^2-4}{2x+4}$			

Learning Intention	I can carry out calculations with algebraic fractions.			
Success Criteria		☺	😐	☹
• I can add, subtract, multiply and divide fractions.	Evaluate $3\frac{2}{5}+1\frac{1}{3}$, $2\frac{3}{4}\times 1\frac{1}{5}$ and $2\frac{1}{3}\div 1\frac{3}{4}$.			
• I can add and subtract algebraic fractions.	Simplify the following: $\frac{x}{2}-\frac{x}{3}$, $\frac{5}{x}+\frac{2}{y}$, $\frac{t}{x}-\frac{3}{y}$ and $\frac{x+1}{2}+\frac{x-1}{3}$.			
• I can multiply and divide algebraic fractions.	Simplify the following: $\frac{t}{5}\times\frac{3}{y}$, $\frac{t}{15}\times\frac{25}{t^2}$ and $\frac{x}{7}\div\frac{x^3}{14}$.			

Learning Intention	I can calculate the gradient of a straight line, given two points.			
Success Criteria		☺	😐	☹
• I can calculate the gradient of a line using vertical and horizontal distances. $\text{Gradient} = \dfrac{\text{vertical height}}{\text{horizontal distance}}$  Find the gradient of these lines: 1) a)  b)  			
• I can recognise lines with positive ／ and negative ＼ gradients.				
• I can recognise lines with zero — and undefined | gradients.				
• I know that parallel lines have equal gradients. 				
• I know that the gradient formula is $m = \dfrac{y_2 - y_1}{x_2 - x_1}$.				
• I know how to use the gradient formula. Calculate the gradient of the line joining $A(1,-7)$ and $B(4,3)$. Calculate the gradient of the line joining $C(2,-3)$ and $D(8,-3)$. Calculate the gradient of the line joining $E(4,5)$ and $F(4,3)$.				

Learning Intention	I can calculate the length of an arc and the area of a sector of a circle.			
Success Criteria		☺	😐	☹
• I can calculate the circumference and area of a circle using $C = \pi d$ and $A = \pi r^2$.				
• I know the meaning of arc and sector.   				
• I know how to calculate the length of an arc using arc length = $\frac{x}{360} \times \pi d$. Calculate the length of the arc shown.  				
• I know how to calculate the area of a sector using sector area = $\frac{x}{360} \times \pi r^2$. Calculate the area of the sector of the circle shown.  				
A school baseball field is in the shape of a sector of a circle as shown. Given that O is the centre of the circle, calculate: (a) the perimeter of the playing field (b) the area of the playing field.  				

Learning Intention	I can calculate the volume of a standard solid rounding my answer appropriately.			
Success Criteria		☺	😐	☹
• I can calculate the volume of any solid given its formula. cylinder  $V = \pi r^2 h$ sphere  $V = \frac{4}{3}\pi r^3$ cone  $V = \frac{1}{3}\pi r^2 h$ pyramid  $V = \frac{1}{3}Ah$ The football has a diameter of 30 cm. Calculate its volume, take $\pi = 3 \cdot 14$.(non-calculator example)  			
• I can solve problems rounding my final answer using significant figures. A child's toy is in the shape of a hemisphere with a cone on top, as shown. The toy is 10 cm wide and 16 cm high. Calculate the volume of the toy. Give your answer correct to 2 significant figures.