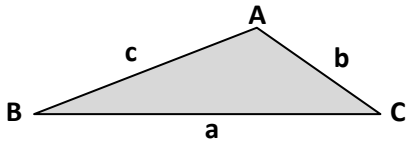
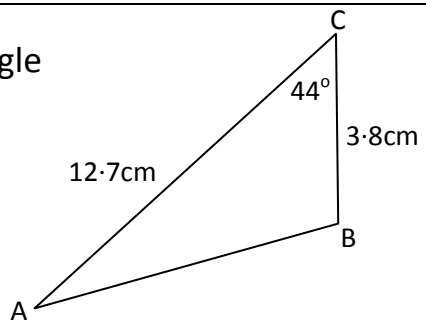
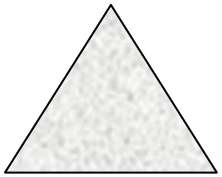
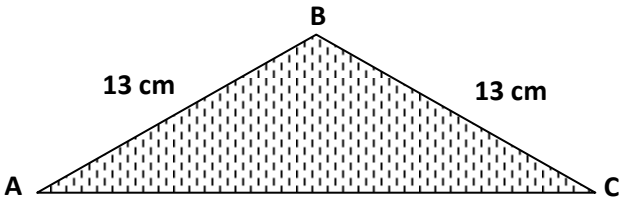
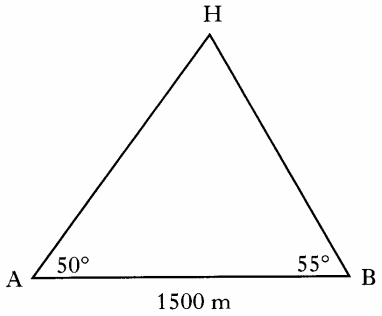
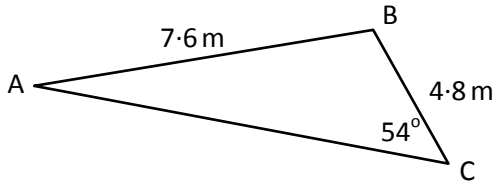
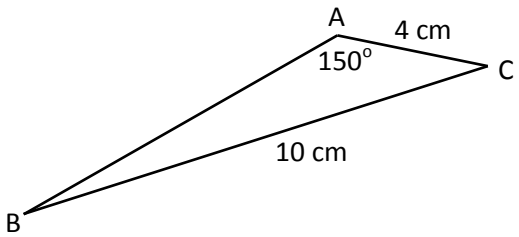
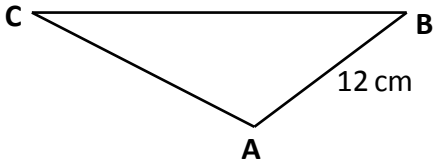
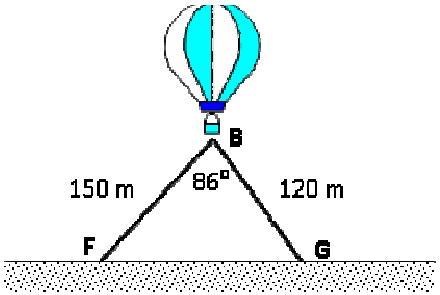
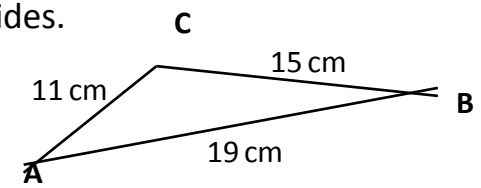
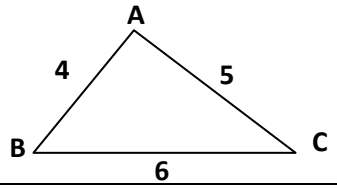
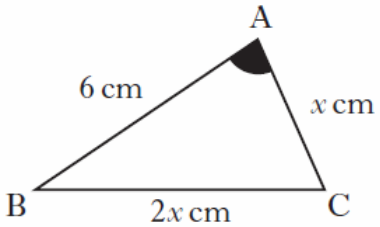
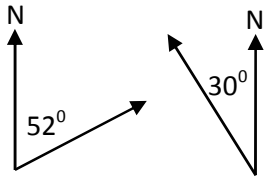
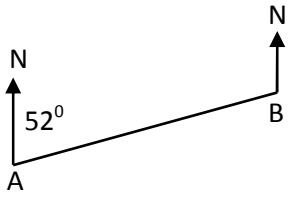
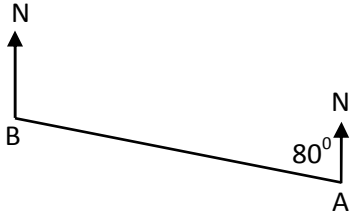
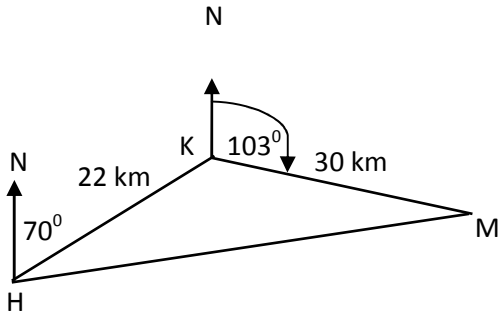
National 5: Applications

Learning Intention	I can calculate the area of a triangle using trigonometry.			
Success Criteria		☺	😐	☹
• I can draw and label the sides and angles of any triangle. In any triangle I know that the **largest angle** is opposite the **longest side**. In any triangle I know that the **smallest angle** is opposite the **shortest side**.				
• I know how to use the area rule, $Area = \frac{1}{2}ab\sin C$, to calculate the area of any triangle given two sides and the included angle. Calculate the area of the triangle shown giving your answer to 3 significant figures.				
• Mr Fields is planting a rose-bed in his garden. It is to be in the shape of an **equilateral triangle** of side 2m. What area of lawn will he need to remove to plant his rose-bed?				
• The area of a triangular napkin is 80·4 cm^2. Calculate the size of the **obtuse** angle ABC.				

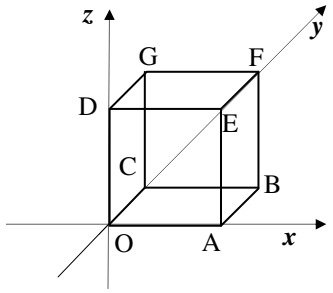
Learning Intention	I can use the sine rule to find a side or angle.			
Success Criteria		☺	😐	☹
• I know how to use the sine rule, $\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$ to find a side. A helicopter, at point H, hovers between two aircraft carriers at points A and B which are 1500 metres apart. From carrier A, the angle of elevation of the helicopter is 50º. From carrier B, the angle of elevation of the helicopter is 55º. Calculate the distance from the helicopter to the **nearest carrier**.				
• I know how to use the sine rule, $\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$, to find an angle. Calculate the size of angle BAC in this triangle.				
• In triangle ABC: AC = 4 centimetres, BC = 10 centimetres and Angle BAC =150^0. Given that sin 150^0= $\frac{1}{2}$, show that sin B = $\frac{1}{5}$.				
• In triangle ABC, AB = 12 cm, sin C = $\frac{1}{2}$ and sin B = $\frac{1}{3}$. Find the length of side AC.				

Learning Intention	I can use the cosine rule to find a side or angle.			
Success Criteria		☺	😐	☹
• I know how to use the cosine rule, $a^2 = b^2 + c^2 - 2bc\cos A$, to find a side given 2 sides and the included angle. A hot air balloon B is fixed to the ground at F and G by 2 ropes 150m and 120 m long. If $\angle$FBG is 86°, how far apart are F and G?				
• I know how to use the cosine rule, $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$, to find an angle given all 3 sides. Calculate the size of angle ABC.				
• In triangle ABC, AB = 4 units, AC = 5 units and BC = 6units. Show that cos A = $\frac{1}{8}$.				
• In triangle ABC: cos A =0·5, AB = 6 centimetres, BC = 2x centimetres and AC = x centimetres. Show that $x^2 + 2x - 12 = 0$.				

Learning Intention	I can solve trigonometry problems with bearings.		
Success Criteria		☺	😐	☹
• I know that a bearing is measured from a North line in a **clockwise** direction. • I know that North has a bearing of 000°. (1) Write down the 3 figure bearing to represent these angles. (2) In each of the following write down the 3 figure bearing of: (a) B from A and (b) A from B.	  			
• I know to draw and annotate a triangle to illustrate a problem. I know to draw North lines in order to find angles.				
• I can solve problems by applying the sine and cosine rules. In the diagram shown three towns, Holton, Kilter and Malbrigg are represented by the points H, K and M respectively. A helicopter flies from Holton for 22 kilometres on a bearing of 070⁰ to Kilter. It then flies from Kilter for 30 kilometres on a bearing of 103° to Malbrigg. The helicopter then returns directly to Holton. (a) Calculate the size of angle HKM. (b) Calculate the total distance travelled by the helicopter. Do not use a scale drawing.				

Learning Intention I can work with 2D vectors.			
Success Criteria	☺	😐	☹
• I know that a vector has magnitude and direction.			
• I know that a vector can be illustrated as a directed line segment and it can be named as $\overrightarrow{AB} = \underline{u}$ • I can add and subtract vectors using directed line segments. The diagram shows 3 vectors $\underline{\boldsymbol{a}}$, $\underline{\boldsymbol{b}}$ and $\underline{\boldsymbol{c}}$. Draw representations of these vectors. (a) $\underline{\boldsymbol{a}} + \underline{\boldsymbol{b}}$ (b) $2\underline{\boldsymbol{b}} + \underline{\boldsymbol{c}}$ (c) $-2\underline{\boldsymbol{a}}$ (d) $3\underline{\boldsymbol{a}} + 2\underline{\boldsymbol{b}}$ (e) $\underline{\boldsymbol{b}} - \underline{\boldsymbol{c}}$ (f) $\underline{\boldsymbol{c}} - \underline{\boldsymbol{a}}$ (g) $\underline{\boldsymbol{a}} + \underline{\boldsymbol{b}} - \underline{\boldsymbol{c}}$			
• I can solve problems in a diagram with directed line segments. Express each of the following displacements in terms of vectors $\underline{\boldsymbol{a}}$ and $\underline{\boldsymbol{b}}$. (a) $\overrightarrow{PQ}$ (b) $\overrightarrow{QP}$ (c) $\overrightarrow{PR}$ (d) $\overrightarrow{RQ}$ (e) $\overrightarrow{QR}$			
• I can write a 2D vector in component form $\begin{pmatrix} x \\ y \end{pmatrix}$. Write the vectors $\underline{\boldsymbol{a}}$, $\underline{\boldsymbol{b}}$ and $\underline{\boldsymbol{c}}$ in component form.			

• I can add and subtract 2D vectors in component form and multiply 2D vectors in component form by a scalar. If $\underline{\boldsymbol{u}} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ and $\underline{\boldsymbol{v}} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ calculate in component form the value of : (a) $\underline{\boldsymbol{u}} + \underline{\boldsymbol{v}}$ (b) $\underline{\boldsymbol{u}} - \underline{\boldsymbol{v}}$ (c) $3\underline{\boldsymbol{u}} - 4\underline{\boldsymbol{v}}$.			
• I know that the magnitude is the length of a vector and that $\lvert\underline{\boldsymbol{u}}\rvert$ represents the magnitude of vector $\underline{u}$.			
• I know how to calculate the magnitude of a 2D vector. If $\underline{\boldsymbol{u}} = \begin{pmatrix} x \\ y \end{pmatrix}$ then $\lvert\underline{\boldsymbol{u}}\rvert = \sqrt{x^2 + y^2}$. If $\underline{\boldsymbol{u}} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ and $\underline{\boldsymbol{v}} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ calculate (a) $\lvert\underline{\boldsymbol{u}}\rvert$ (b) $\lvert\underline{\boldsymbol{v}}\rvert$ (c) $\lvert 2\underline{\boldsymbol{u}} + \underline{\boldsymbol{v}}\rvert$ (d) $\lvert 3\underline{\boldsymbol{u}} - 4\underline{\boldsymbol{v}}\rvert$.			

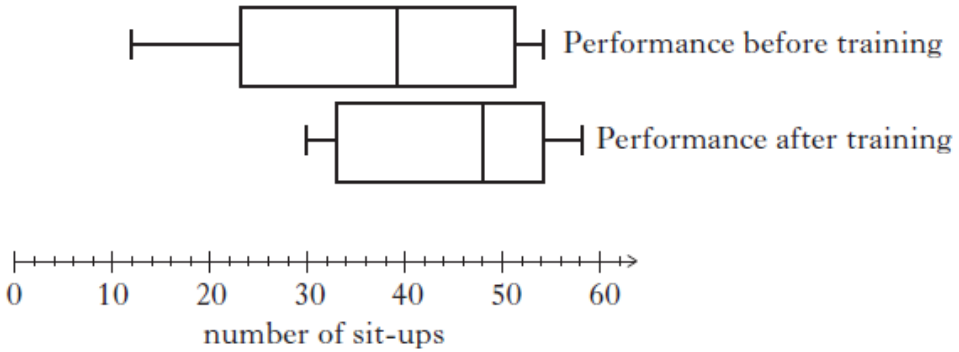
Learning Intention I can work with 3D coordinates.			
Success Criteria	☺	😐	☹
• I know that (x, y, z) represents the coordinates of a point in 3 dimensions. • I can determine the 3D coordinates of a point from a diagram. A **cube** of side 6 units is placed on coordinate axes as shown in the diagram. Write down the coordinates of each vertex of the cube. 			

Learning Intention I can work with 3D vectors.			
Success Criteria	☺	😐	☹
• I can write a 3D vector in component form $\begin{pmatrix} x \\ y \\ z \end{pmatrix}$.			
• I can add and subtract 3D vectors in component form and multiply 3D vectors in component form by a scalar. If $\underline{u} = \begin{pmatrix} 4 \\ 5 \\ -2 \end{pmatrix}$ and $\underline{v} = \begin{pmatrix} -3 \\ 0 \\ 1 \end{pmatrix}$ calculate in component form the value of: (a) $\underline{u} + \underline{v}$ (b) $2\underline{u} - \underline{v}$ (c) $3\underline{u} + 4\underline{v}$.			
• I know how to calculate the magnitude of a 3D vector. If $\underline{u} = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$ then $\lvert\underline{u}\rvert = \sqrt{x^2 + y^2 + z^2}$. If $\underline{u} = \begin{pmatrix} 4 \\ 5 \\ -2 \end{pmatrix}$ and $\underline{v} = \begin{pmatrix} -3 \\ 0 \\ 1 \end{pmatrix}$ calculate (a) $\lvert\underline{u}\rvert$ (b) $\lvert\underline{v}\rvert$ (c) $\lvert\underline{u} + 3\underline{v}\rvert$ (d) $\lvert 2\underline{u} - 3\underline{v}\rvert$			

Learning Intention	I can solve problems using reverse percentages.			
Success Criteria		☺	😐	☹
• I can recognise reverse percentages problems.				
• I know how to use reverse percentages to find the **original amount**. (1) A coat was reduced by 30% in a sale to £105 what was its original price? (2) A gym's membership has increased by 17% over the past year. It now has 585 members. How many members did it have a year ago?				

Learning Intention	I can solve appreciation and depreciation problems.			
Success Criteria		☺	😐	☹
• I know the meaning of appreciation and depreciation and can recognise appreciation and depreciation problems.				
• I can recognise compound interest problems.				
• I can solve appreciation, depreciation and compound interest problems. (1) A house was bought for £80 000 3 years ago. It appreciated in value by 4% the first year, 7% the second and 11% the third. Calculate the value of the house after 3 years. Give your answer to 3 significant figures. (2) A computer was bought for £999. If it depreciates in value by 18% per year when will its value be less than half its original price? (3) David Smith buys a flat for £120 000. If it appreciates in value by 7% per year for 5 years how much is it worth after 5 years? (4) Joseph invests £4500 in a bank that pays 6·4% interest per annum. If Joseph does not touch the money in the bank, how much interest will he have gained after 3 years? Give your answer to **the nearest penny**.				

Learning Intention	I can carry out calculations involving fractions.			
Success Criteria		☺	😐	☹
• I can recognise a mixed number and an improper fraction.				
• I can change any mixed number into an improper fraction. Write $3\frac{2}{5}$ as an improper fraction.				
• I can change any improper fraction into a mixed number. Write $\frac{27}{4}$ as a mixed number.				
• I can add and subtract fractions. Evaluate each of the following: (a) $\frac{2}{7}+\frac{1}{8}$ (b) $\frac{1}{6}+\frac{3}{5}$ (c) $\frac{7}{9}-\frac{3}{7}$ (d) $4\frac{2}{3}+3\frac{1}{12}$ (e) $8\frac{2}{5}-1\frac{3}{10}$				
• I can multiply and divide fractions. Evaluate each of the following: (a) $\frac{5}{7}\times\frac{14}{15}$ (b) $2\frac{1}{4}\times3\frac{1}{2}$ (c) $\frac{3}{7}\div\frac{11}{14}$ (d) $3\frac{3}{5}\div2\frac{1}{4}$ (e) $3\frac{1}{3}\times1\frac{1}{8}\times8\frac{1}{3}$				
• I can apply the rules of operations, or BODMAS to fraction calculations. Evaluate (a) $\frac{2}{3}$ ***of*** $3\frac{1}{2}+\frac{4}{5}$ (b) $\frac{2}{7}\left(1\frac{3}{4}+\frac{3}{8}\right)$ (c) $\frac{4}{9}+\frac{3}{4}$ ***of*** $2\frac{1}{5}$				
• I can solve problems involving fraction calculations. (1) A rectangle has length $3\frac{5}{7}$ cm and breadth $1\frac{2}{5}$ cm. Calculate its perimeter. (2) A triangle has base $2\frac{3}{4}$ cm and height $3\frac{2}{5}$ cm. Calculate its area. (2)Jamie is going to bake cakes for a party. He needs $\frac{2}{5}$ of a block of butter for 1 cake. He has 7 blocks of butter. How many cakes can Jamie bake? 				

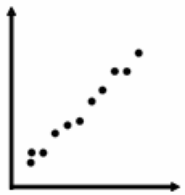
Learning Intention	I can compare two data sets using statistics.		
Success Criteria	☺	😐	☹
• I know that a 5 figure summary consists of the Lowest (L), Highest (H), median (Q2), lower quartile (Q1) and upper quartile (Q3) values in an **ordered data set**. The median (Q2) is the middle value. The lower quartile (Q1) is in the middle of the lower half and the upper quartile (Q3) is in the middle of the upper half of the ordered list.			
• I know how to construct a boxplot using a 5 figure summary.			
• I can make a 5 figure summary from a data set and draw a boxplot to illustrate the results. The marks obtained in a test were: 24 16 17 15 17 18 19 12 25 26 18 13 15 21 20 24 Find the maximum, minimum, median and quartiles of the data set and draw a boxplot to illustrate your results.			
• I know that the interquartile range and semi-interquartile range is a measure of spread of data. • I can calculate the interquartile range (IQR) and semi-interquartile range (SIQR) from a data set using the formulae $IQR = Q_3 - Q_1$ and $SIQR = \frac{Q_3 - Q_1}{2}$ **Before** training athletes were tested on how many sit-ups they could do in one minute. The following information was obtained : lower quartile 23 median 39 upper quartile 51 (a) Calculate the semi-interquartile range. After training the athletes were tested again. **Both** sets of data are displayed as boxplots.  (b) Make **two** set of valid statements to compare the performances before and after training.			

Learning Intention I can compare two data sets using statistics.

Success Criteria	☺	😐	☹
• I can calculate the mean, $\bar{x}$ from a set of data using the formula $\bar{x} = \frac{\sum x}{n}$.			
• I know that standard deviation is a measure of spread of data.			
• I can calculate the standard deviation of a data set using the formula $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$ or $s = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$. A hotel inspector recorded the volume of wine, in millimetres, in a sample of six glasses. The results were 120 126 125 131 130 124 Use an appropriate formula to calculate the standard deviation.			
• I know that a high standard deviation, or SIQR, indicates data that is widely spread out from its mean. The terms more varied or less consistent describe the result			
• I know that a low standard deviation, or SIQR, indicates data is closer to the mean. The terms less varied or more consistent to describe the result.			
• I can make appropriate comments by comparing the means and standard deviations of two data sets. A group of people attended a course to help them stop smoking. The following table shows the statistics before and after the course.			

	Mean number of cigarettes smoked per person per day	***Standard Deviation***
Before	20·8	8·5
After	9·6	12·0

Make **two valid** comments about these results.

Learning Intention	I can determine and use the equation of the line of best fit on a scatter graph.		
Success Criteria	☺	😐	☹
• I know that on a scattergraph we describe the relationship between the two quantities plotted as a **correlation**.			
• I can identify if there is a positive, negative or no correlation between two quantities.  Positive Correlation  Negative Correlation  No Correlation			
• I can draw a line of best fit on a scatter graph. I know that approximately the same number of points should lie on each side of the line, the line should pass through at least two points and be extended to pass through the y-axis.			
• I can find the equation of the line of best fit using $y = mx + c$ or $y - b = m(x - a)$.			
• I can use the line of best fit to estimate one value given the other. The graph shows the relationship between the number of hours (h) a swimmer trains per week and the number of races (R) they have won. A best fitting straight line has been drawn. (a) Use information from the graph to find the equation of this line of best fit. (b) Use the equation to predict how many races a swimmer who trains 22 hours per week should win.