

Williamwood High School



Mathematics Department

S4 Assessment 2 Revision



MATHEMATICS NATIONAL 5

NAME:

TEACHER:



NATIONAL 5 MATHS QUESTIONS BY TOPIC

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- 1.2 MULTIPLYING/DIVIDING
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1. FRACTIONS

1.1 ADDING/SUBTRACTING

a. $2\frac{2}{5} - 1\frac{1}{3}$

b. $1\frac{1}{4} + 2\frac{2}{3}$

c. $5\frac{1}{6} - 3\frac{1}{4}$

1.2 MULTIPLYING/DIVIDING

a. $\frac{2}{5} \times 1\frac{2}{3}$

b. $2 \div 1\frac{1}{5}$

c. $3\frac{2}{5} \times 1\frac{1}{3}$

1.3 BIDMAS

a. $1\frac{2}{3} + \frac{4}{7} \times \frac{14}{3}$

b. $\frac{2}{5}$ of $\frac{3}{4} + 1\frac{1}{3}$

c. $2\frac{2}{5} \left(\frac{2}{3} - \frac{1}{4} \right)$

2. PERCENTAGES

2.1 APPRECIATION/DEPRECIATION

- a. In June 2008 Anthony bought a Honda Shadow motorbike for \$8,240 and he was told it would depreciate at a rate of 4.45% per year.

If Craig sells the bike in June 2014, how much should he expect to make from the sale of the motorbike?

- b. A house was bought in 2014 for £188,500. The value has steadily increased by 5.55% each year. After 4 years, how much is the house now worth?

Give your answer correct to 3 significant figures.

2.2 COMPOUND INTEREST

- a. Brodie invests £6,270 in a high interest bank account for 5 years.

If the interest rate is 7.28%, calculate the compound interest earned. Give your answer correct to the nearest thousand.



2.3 DIFFERENCE OVER ORIGINAL

- Roslyn started her season running 100m in 13.97seconds on March 5th. After a months training she ran 100m in 13.79seconds.
Express the decrease as a percentage of her first run.
- If she continues to lose time at this rate each month, what date will she be running less than 12.58seconds?

2.4 ORIGINAL VALUE

- There is currently a 40% sale on a washing machine.

If the washing machine is priced at £240 in the sale, calculate the original price of the washing machine (Non-calculator).

- A music shop which had gone into administration decided to hold a closing down sale offering 75% off all items.

An electric guitar was offered for £349.75. How much did it originally cost?

3. EQUATIONS AND INEQUATIONS

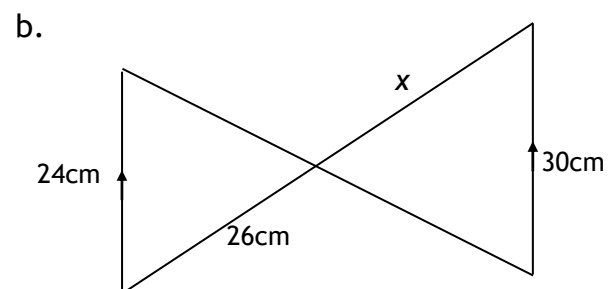
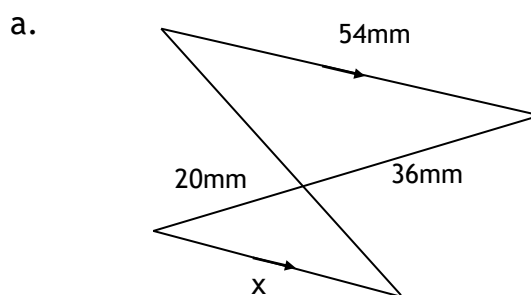
3.1 EQUATIONS/INEQUATIONS WITH FRACTIONS

- $3(2x + 1) = 2(2x + 5)$
- $\frac{x+4}{3} + 1 = 5$
- $\frac{2x-3}{3} + \frac{x+2}{4} = 5$
- $3x + 2 > 2x + 8$
- $2(2x - 3) < 9x$
- $\frac{x+3}{5} > 2$

4. SIMILARITY

4.1 LINEAR SCALE FACTOR

Calculate the length of the side marked x in each diagram below.

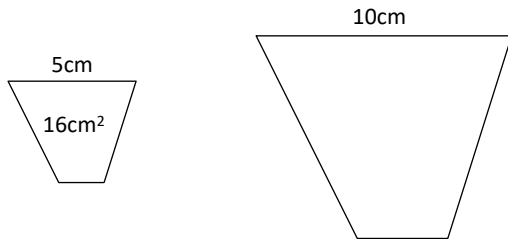




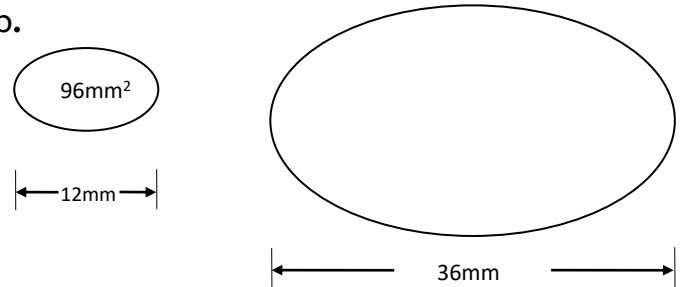
4.2 AREA SCALE FACTOR

Calculate the area of the larger shape in each diagram below.

a.

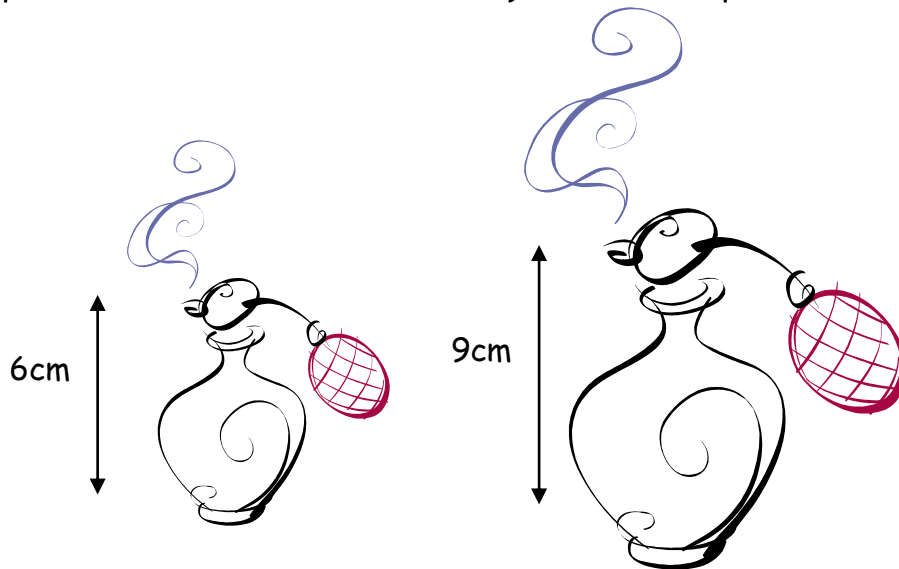


b.



4.3 VOLUME SCALE FACTOR

Two perfume bottles are mathematically similar in shape.



The smaller bottle is 6cm high and holds 30ml of perfume.
The larger bottle is 9cm high.

What volume of perfume will the larger bottle hold?



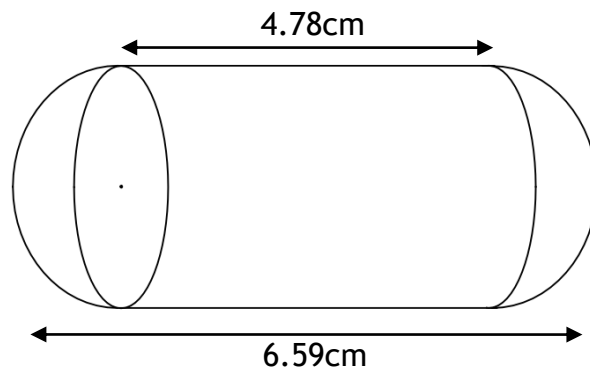
5. VOLUME

5.1 CYLINDER, CONE, SPHERE AND PYRAMID

- Find the volume of a cylinder with radius 5 centimetres and height 12 centimetres.
- Find the volume of a cone with diameter 12 centimetres and height 9 centimetres.
- Find the volume of a sphere with radius 6.3 centimetres.
- Find the volume of a square based pyramid with base length of 3 centimetres and height 14 centimetres.

5.2 COMPOSITE SHAPES

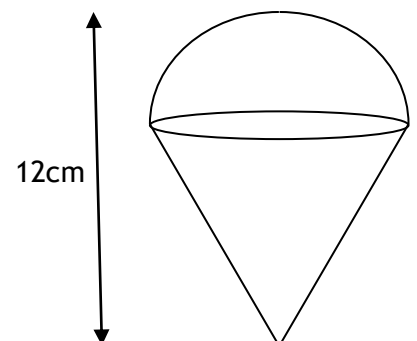
- Calculate the volume of the shape shown below, which consists of a cylinder with a hemisphere on either end.



- Will's Ice Cream Van serve cones of Graham's vanilla ice cream as shown below:

The height of the whole shape is 12cm
The radius of the cone is 2.05cm.

Calculate the volume of ice cream in each cone.





5.3 WORKING BACKWARDS

- Find the radius of a hemisphere with volume $2,499\text{m}^3$.
- A cone has volume 581.3cm^3 . Given it has a radius of 7 centimetres find the height of the cone.

6. CIRCLE GEOMETRY

6.1 ARC LENGTH/AREA OF A SECTOR

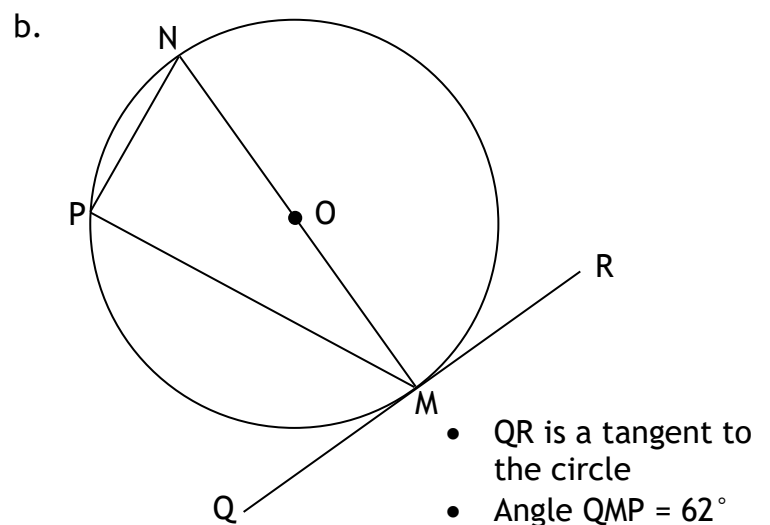
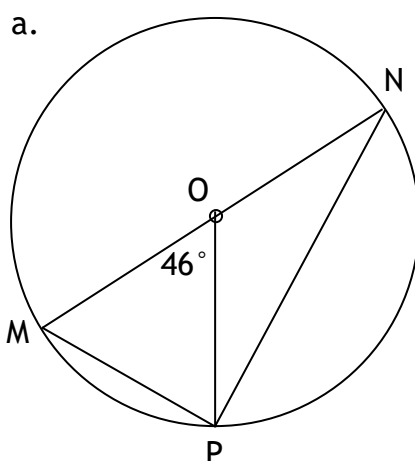
- A circle sector with radius 2.1cm has an angle of 42° at the centre. Find the sector's arc length.
- A circle sector with radius 5.3cm has an angle of 189° at the centre. Find the sector's area.

6.2 ARC LENGTH/AREA OF A SECTOR WORKING BACKWARDS

- A circle sector with radius 3.9m is known to have an area of 24m^2 . Find the angle at the centre of the sector.
- A circle sector with angle at the centre of 48° has an area of 35m^2 . Find the length of the radius of the sector.

6.3 ANGLES IN A CIRCLE

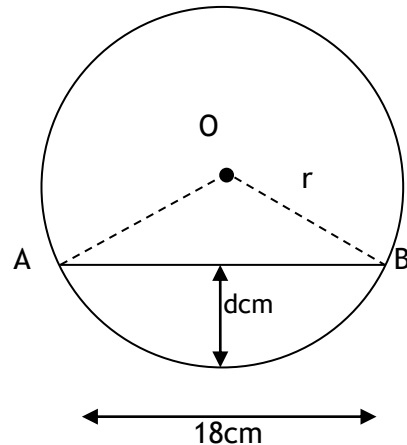
Find the size of the angle MNP in each circle shown below.





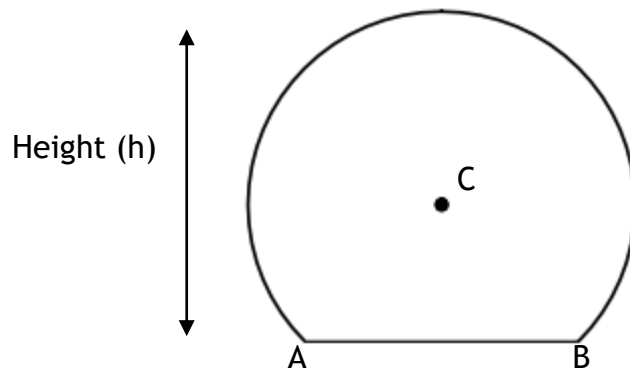
6.4 PYTHAGORAS IN A CIRCLE

a. A pipe has water in it as shown:



The radius of the tunnel is 14 centimetres.
The width of the water surface, AB, is 18 centimetres.
Calculate the depth (d) of the water.

b. A new tunnel for a fast link train has been designed with the cross section being shown below.



The radius of the circle is found to be 19.2m. The width of the train track AB measures 14.3m, calculate the height of the tunnel.



7. ALGEBRAIC OPERATIONS

7.1 EXPANDING BRACKETS

Expand and simplify the following:

a. $(x + 3)(x + 6)$

b. $(w - 5)(2w + 3)$

c. $3(e - 5)(3e - 7)$

d. $(2w + 3)(5w^2 - 3w - 1)$

7.2 FACTORISING

Factorise fully:

a. $x^2 - 5x - 36$

b. $x^2 + 6x - 5$

c. $4x^2 - 9$

d. $6x^2 + 2x - 4$

e. $3x^2 + 13x + 12$

f. $3x^2 - 5x - 28$

7.3 COMPLETING THE SQUARE

Write the following in the form $(x + a)^2 + b$:

a. $x^2 + 6x - 2$

b. $x^2 - 4x - 5$

c. $x^2 + 3x - 1$

8. LINEAR RELATIONSHIPS

8.1 EQUATION OF A LINE USING $y - b = m(x - a)$

Find the equation of the straight line passing through the points:

a. $(7, 4)$ and $(9, 7)$

b. $(-2, 0)$ and $(4, 1)$

c. $(3, 1)$ and $(-3, 5)$

8.2 FINDING X AND Y - INTERCEPTS

Find the coordinates of the x and y - intercepts of:

a. $5y - 3x + 9 = 0$

b. $7x - 2y = 5$

c. $15 - 3x - 2y = 0$

8.3 REARRAGING TO FIND GRADIENT

Find the gradient of the equations:

a. $5y - 10x + 15 = 0$

b. $8y + 2x = 12$

c. $6x - 12y + 9 = 0$



9. STATISTICS

9.1 MEAN AND STANDARD DEVIATION

a. A series of numbers can be found below which represent the reaction time of athletes in a 100m (in milliseconds):

1.9, 2.3, 3.1, 2.2 and 3.4

Find the mean and standard deviation of these numbers.

b. Another group of athletes had a mean time of 2.8 milliseconds and a standard deviation of 1.3. Make two statements comparing the 100m times of the two groups of athletes.

9.2 MEDIAN AND SIQR

a. The formal homework marks (out of 30) for a class are displayed below:

11, 17, 23, 24, 25, 26, 27, 28, 28, 28, 28, 28, 28, 29, 29, 29, 29, 30

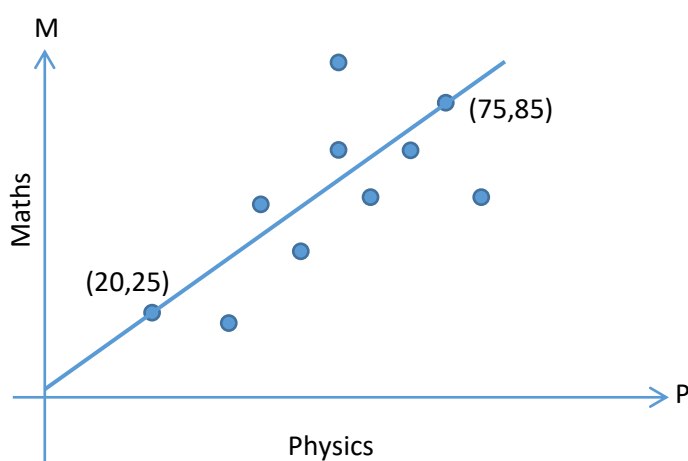
Find

- The 5 figure summary for this data.
- The semi-interquartile range.

b. Another class had a median mark of 27 and a semi-interquartile range of 3.5. Make two statements comparing the marks between the classes.

9.3 EQUATION OF LINE OF BEST FIT

The following shows a group of pupil's maths test scores and physics test scores.



a. Find the equation of the line of best fit in terms of M and P.

b. If a pupil scored 66 in his physics test, use your line of best of to estimate their maths score.



10. CHANGE THE SUBJECT OF THE FORMULA

Change the subject of the formula to x in the following:

a. $y = 3x + 6$

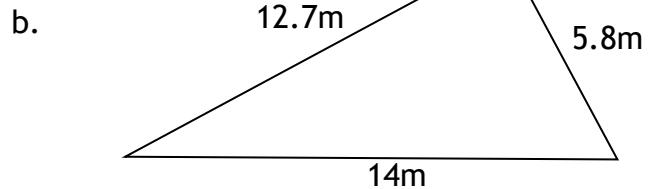
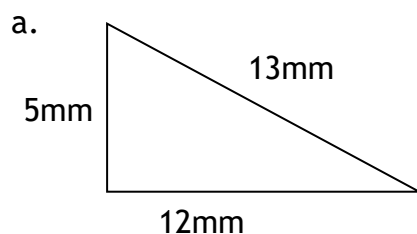
b. $y = \frac{x+5}{3} - 1$

c. $y = \frac{2x+1}{2}$

d. $y = 4x^2 - 3$

11. CONVERSE OF PYTHAGORAS

Which of the triangles shown below is right angled?



12. SIMULTANEOUS EQUATIONS

12.1 SOLVE SIMULTANEOUS EQUATIONS ALGEBRAICALLY

Solve the following system of equations:

a. $7y + 3x = 24$
 $6y - 4x = 14$

b. $3p = 5q + 11$
 $4q = 5p - 1$

12.2 SOLVE SIMILTANEOUS EQUATIONS IN CONTEXT

Ross and Katie take their 4 children to a theme park. The total cost of their tickets is £56.

a. Let a pounds represent the cost of an adult ticket and c represent the cost of a child's ticket. Write an equation in a and c which represents the above information.

Sarah takes her 3 children to the same theme park. Their total tickets cost £36.

b. Write a second equation to represent this information.

c. Hence, or otherwise, find the cost of a child ticket and adult ticket.



12.3 FIND THE POINT OF INTERSECTION

- a. Find the coordinates of the point of intersection of the lines $2x + y = 10$ and $3x - 4y = 26$.
- b. Find the coordinates of the point of intersection of the lines $2x - 3y = 6$ and $5x - 4y = 1$.

13. FUNCTION NOTATION

- a. Two functions, defined on suitable domains, are given by $f(x) = 3x^2 + 5x$ and $g(x) = 2x^2 + 6x$.
- i. Evaluate $f(2)$
 ii. Evaluate $g(-3)$
- b. Given the function $f(x) = 3x - 4$ and $f(p) = 14$, find the value of p .

14. POLYGONS

- a. Find the sum of the interior angles of an octagon.
- b. Find the size of one of the interior angles of a hexagon.

15. SURDS AND INDICES

15.1 SIMPLIFY SURDS

Simplify

- | | | |
|-----------------------------|----------------------------|---|
| a. $\sqrt{75}$ | b. $\sqrt{48}$ | c. $\sqrt{20} + 4\sqrt{5} + \sqrt{125}$ |
| d. $\sqrt{72} - \sqrt{200}$ | e. $\sqrt{45} - \sqrt{20}$ | f. $\sqrt{40} + 4\sqrt{10} + \sqrt{90}$ |

15.2 RATIONALISE THE DENOMINATOR

Rationalise the denominator

- | | | |
|-------------------------|--------------------------|---------------------------|
| a. $\frac{3}{\sqrt{7}}$ | b. $\frac{15}{\sqrt{5}}$ | c. $\frac{13}{2\sqrt{5}}$ |
|-------------------------|--------------------------|---------------------------|



15.3 USE INDICES RULES

Simplify the following, expressing your answer as a positive index where possible:

a. $5f^2 \times 3f^{-6}$

b. $(2e)^2 \times 5e^7$

c. $36j^{-9} \div 18j^{-3}$

d. $\sqrt[2]{3} \times \sqrt[1]{7}$

e. $\frac{7h^2 \times 5h}{10h}$

f. $\sqrt{m} \times \sqrt[3]{m}$

Evaluate the following:

a. $36^{\frac{1}{2}}$

b. $144^{-\frac{1}{2}}$

c. $8^{\frac{2}{3}}$

d. $64^{-\frac{1}{3}}$

e. $243^{\frac{2}{5}}$

f. $16^{\frac{3}{4}}$

15.4 PERFORM CALCULATIONS USING SCIENTIFIC NOTATION

Answer each of the following questions leaving your answers in standard form.

a. Light travels at 1.85×10^8 miles per second. How far will it travel in an hour?

b. The radius of the earth is 6.45×10^6 metres. What is its circumference (in km)?

16. ALGEBRAIC FRACTIONS

16.1 FACTORISE AND SIMPLIFY

Simplify

a. $\frac{2x-10}{x^2-25}$

b. $\frac{x^2-5x-14}{x^2-2x-35}$

c. $\frac{2x^2-50x}{x^2-3x-10}$

16.2 ADD/SUBTRACT

Express as a single fraction in its simplest form.

a. $\frac{5}{y} + \frac{6}{5y}, y \neq 0$

b. $\frac{1}{x^2} + \frac{1}{x}, x \neq 0$

c. $\frac{7}{3+j} + \frac{5}{4j}, j \neq 0, j \neq -3$

d. $\frac{3}{x-4} - \frac{2}{x-5}, x \neq 4, x \neq 5$



16.3 MULTIPLY/DIVIDE

Simplify

a. $\frac{5pq}{2} \times \frac{3}{4pq}$

b. $\frac{7ab^3}{6c} \times \frac{2c^3}{3a^2}$

c. $\frac{10xy^2}{3} \times \frac{12xy}{5y^2}$

d. $\frac{24xy}{35z} \div \frac{20xy}{21z}$

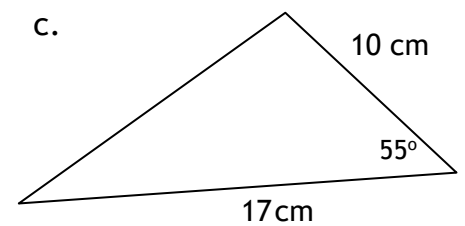
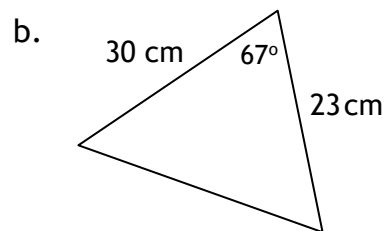
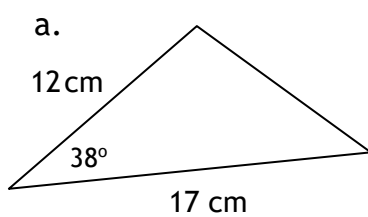
e. $\frac{6q^2}{25p} \div \frac{9q}{20p^2}$

f. $\frac{8ab}{2c} \div \frac{9b}{14c}$

17. TRIANGLE TRIGONOMETRY

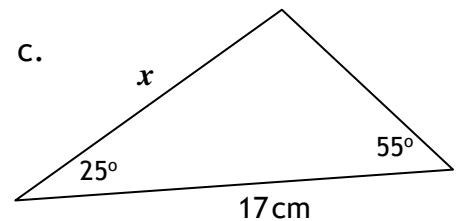
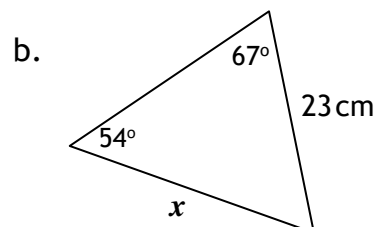
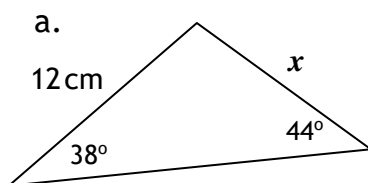
17.1 AREA OF A TRIANGLE

Calculate the area of the triangles below:

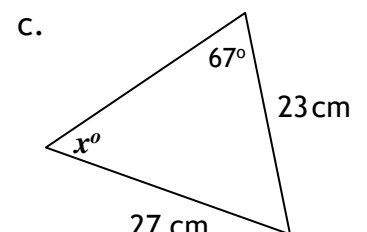
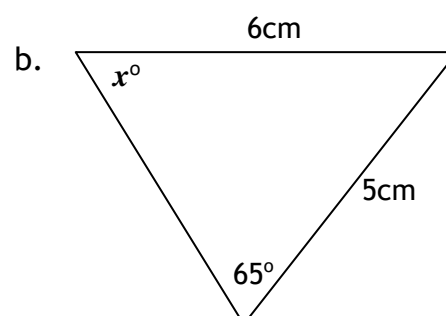
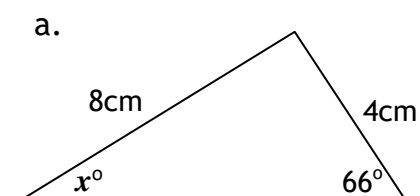


17.2 SINE RULE

17.2.1 SINE RULE MISSING SIDE



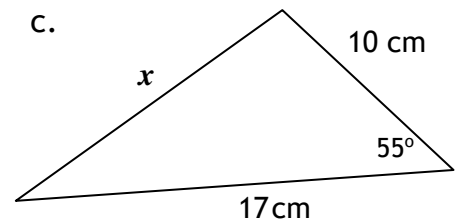
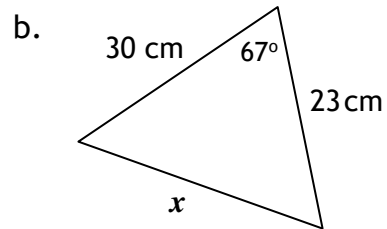
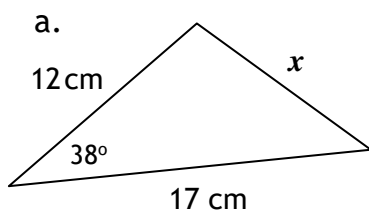
17.2.2 SINE RULE MISSING ANGLE



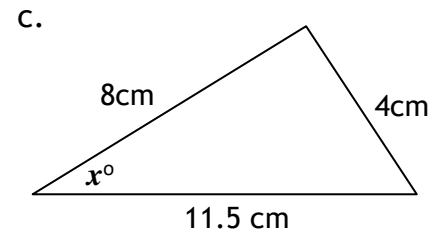
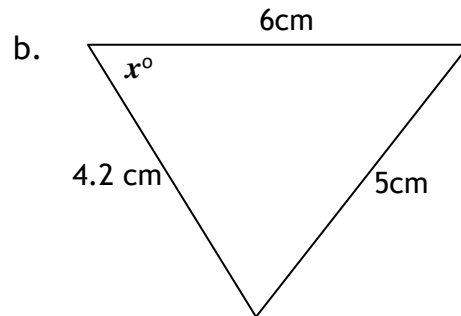
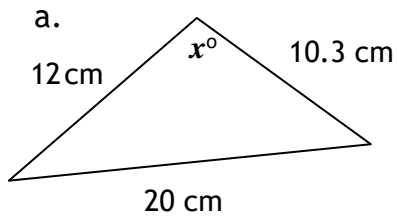


17.3 COSINE RULE

17.3.1 COSINE RULE MISSING SIDE

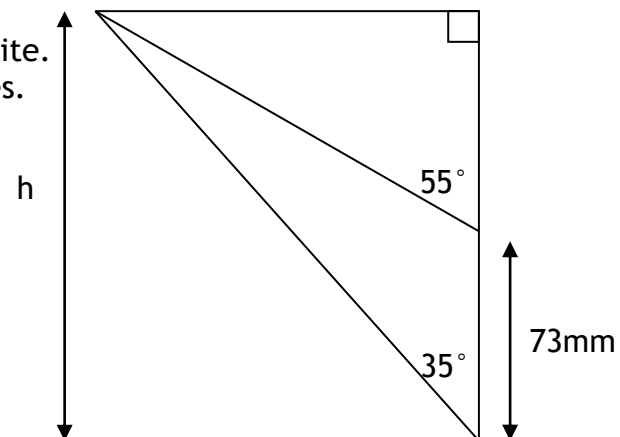


17.3.2 COSINE RULE MISSING ANGLE



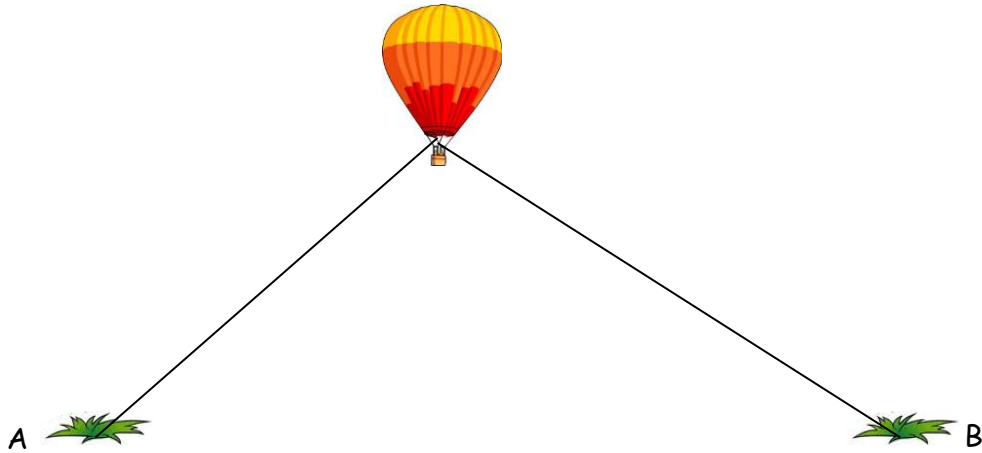
17.4 HEIGHT OF A TRIANGLE

- a. Find the height, h , of the triangle shown opposite. Give your answer correct to 2 significant figures.





- b. A hot air balloon is being held in place by two ropes pinned at point A and point B. Rope A is at an angle of 58° to the ground. Rope B is at an angle of 47° to the ground.

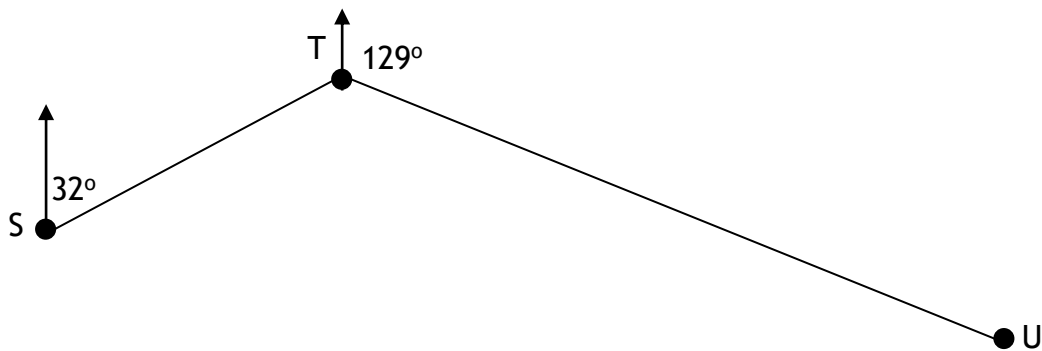


If points A and B are 150m apart, calculate the height of the balloon.

17.5 BEARINGS

A group are out on a trek, leaving from point S and walking for 2.9km to Point T.

At Point T the group change direction and walk for a further 6.2km to point U which can be seen from the diagram below.



Calculate the closest distance the group are from their starting point.



18. VECTORS

18.1 ADDING/SUBTRACTING IN COMPONENT FORM

Three vectors u, v and w are represented by $\begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix}$, $\begin{pmatrix} -1 \\ -4 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ -3 \\ -2 \end{pmatrix}$ respectively.

Express the following in component form

a. $2v - u$

b. $3u + 2w - v$

18.2 MAGNITUDE

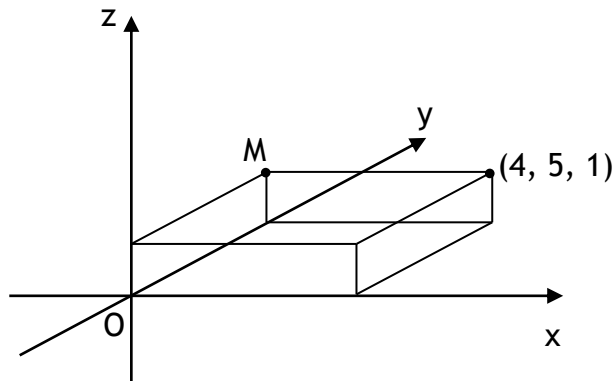
Three vectors u, v and w are represented by $\begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix}$, $\begin{pmatrix} -1 \\ -4 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ -3 \\ -2 \end{pmatrix}$ respectively.

a. Calculate $|3u - v|$

b. Calculate $|2v + w|$

18.3 3D COORDINATES

Use the cuboid shown below to ascertain the coordinates of point M.





19. QUADRATIC EQUATIONS

19.1 FACTORISE AND SOLVE

Solve the equations:

a. $x^2 - 64 = 0$

c. $x^2 - 4x - 45 = 0$

e. $3x^2 - 14x - 5 = 0$

b. $2x^2 - 14x = 0$

d. $x^2 - 3x = 18$

f. $4x^2 - 18x - 20 = 0$

19.2 SOLVE USING QUADRATIC FORMULA

Solve the equations below, giving your answers correct to 1 decimal place

a. $3x^2 - 2x - 10 = 0$

b. $3x^2 + 5x - 7 = 0$

19.3 DISCRIMINANT

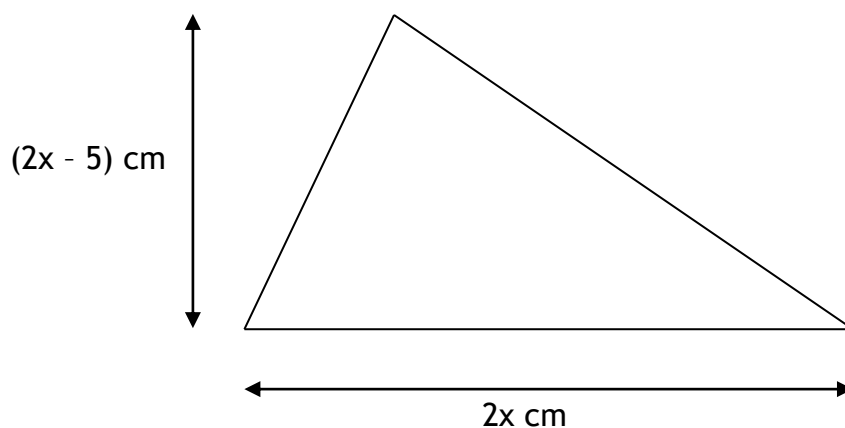
Determine the nature of the roots for

a. $2x^2 - 2x - 5 = 0$

b. $5x^2 + 2x + 8 = 0$

19.4 QUADRATIC EQUATION PROBLEM SOLVING

The height of a triangle is $(2x - 5)$ centimetres and the base is $2x$ centimetres.



The area of the triangle is 7 square centimetres.

Calculate the value of x .