



Rewarding Learning

General Certificate of Secondary Education
November 2022

Centre Number

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Candidate Number

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Mathematics

Unit M8 Paper 1
(Non-Calculator)

Higher Tier



[GMC81]

GMC81

THURSDAY 1 DECEMBER, 9.15am–10.30am

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page. **You are provided with Higher Tier Additional Support Materials for use with this paper.**

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page, on blank pages or tracing paper.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all eleven** questions.

All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.

You **must not** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You should have a ruler, compasses and a protractor.

The Formula Sheet is on page 2.

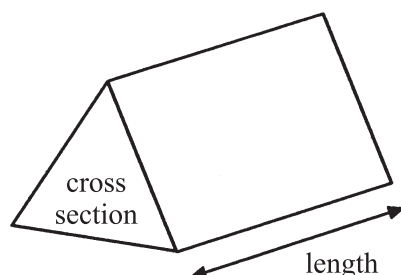
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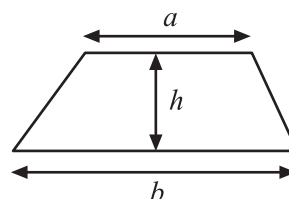
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Formula Sheet

Volume of prism = area of cross section $\times$ length

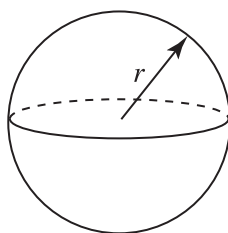


Area of trapezium = $\frac{1}{2}(a + b)h$



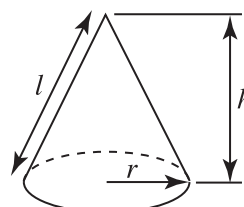
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$

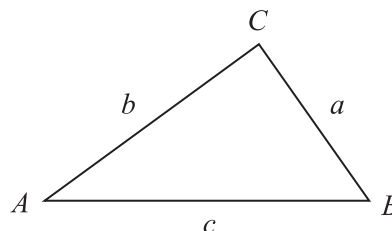


Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$



In any triangle ABC



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2} ab \sin C$



- 1 A shape has a perimeter of 16 cm and an area of 10 cm^2

It is enlarged using a scale factor of 2

- (a) What is the perimeter of the enlarged shape?

Answer _____ cm [1]

- (b) How many times bigger is the area of the enlarged shape than the area of the original shape?

Answer _____ [1]

- 2 Each interior angle of a regular polygon is 140° .

How many sides has the polygon?

Answer _____ [2]

[Turn over]

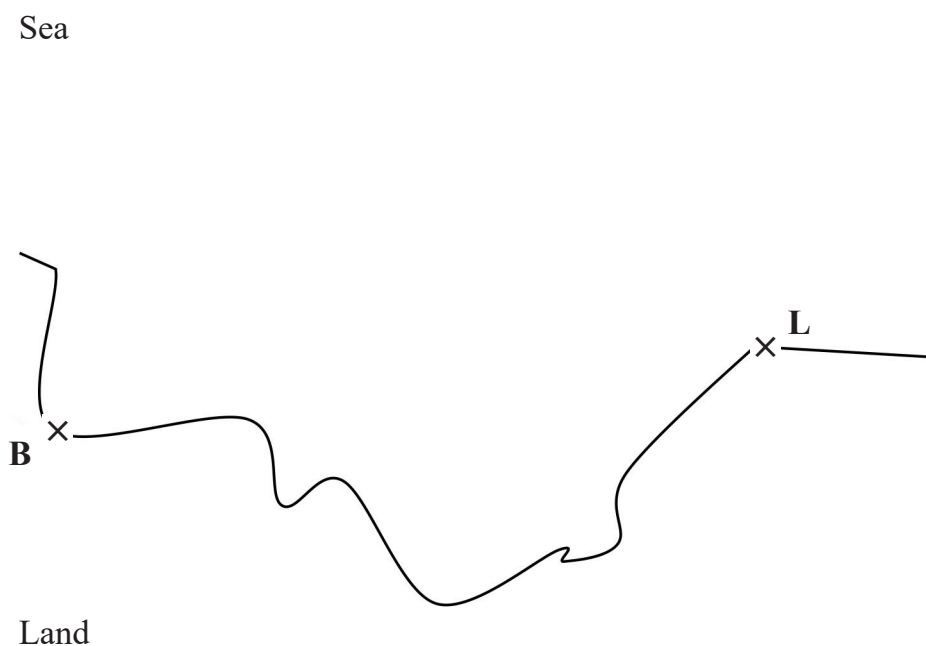


- 3 The diagram shows a section of coastline with a lifeboat station marked at B and a lighthouse marked at L.

A sinking ship sends a distress signal.

The ship is less than 70 km from B and less than 30 km from L.

Using a scale of 1 cm = 10 km, **shade the region** in which the ship could be.



[3]



4 Tom has some 20p coins and some 50p coins.

The total value of Tom's coins is £8.60

Seana has twice as many 20p coins as Tom, but only half as many 50p coins as Tom.

The total value of Seana's coins is £8.20

Find how many of each type of coin Tom has.

A solution by trial and improvement will not be accepted.

Answer _____ 20p coins, _____ 50p coins [5]

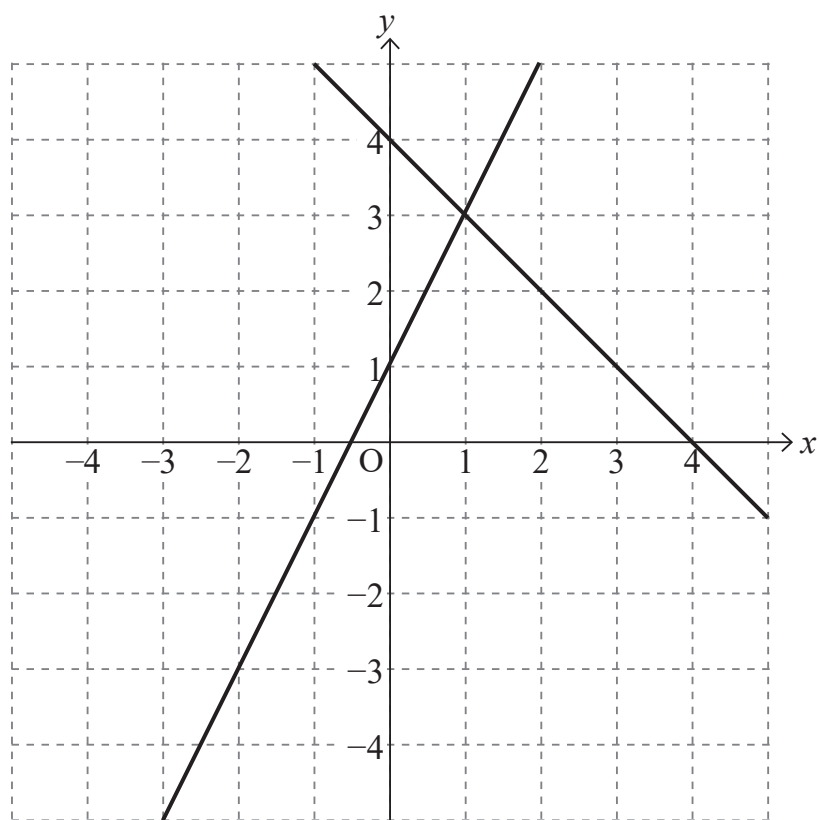
[Turn over]

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5 (a)



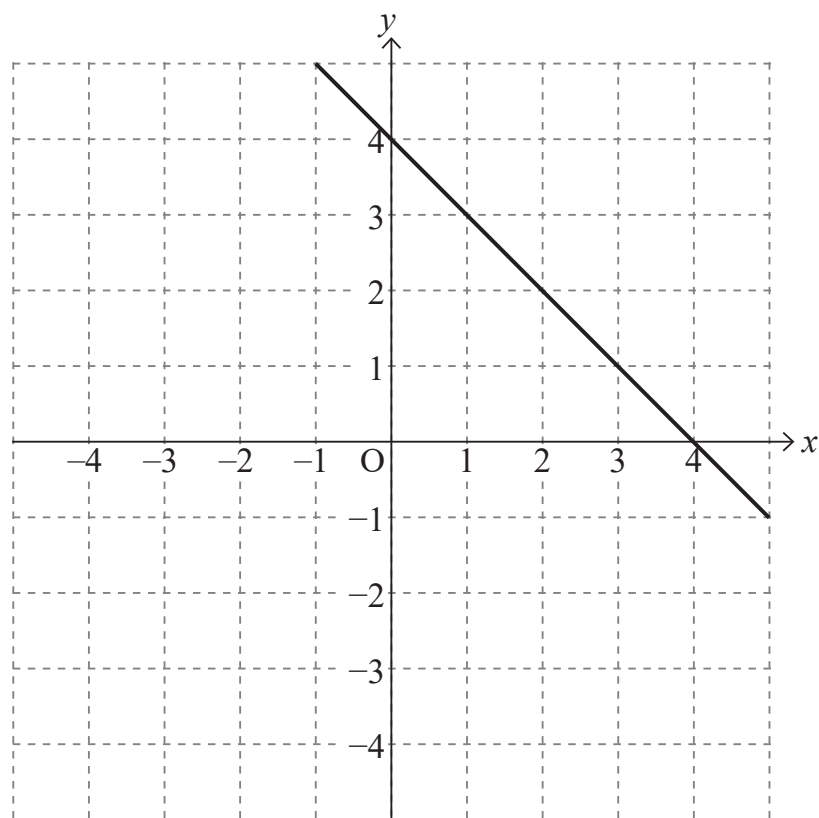
The lines $y = 2x + 1$ and $x + y = 4$ have been drawn on the grid.

By drawing another line on the grid above, indicate clearly by the letter R

the region satisfying $y \geq 2x + 1$ and $x + y \leq 4$ and $x \geq -1$ [2]



(b)



By drawing more lines on the grid above, indicate clearly by the letter B

the region satisfying $y \leq 2x$ and $x + y \leq 4$ and $y \geq 1$

[2]



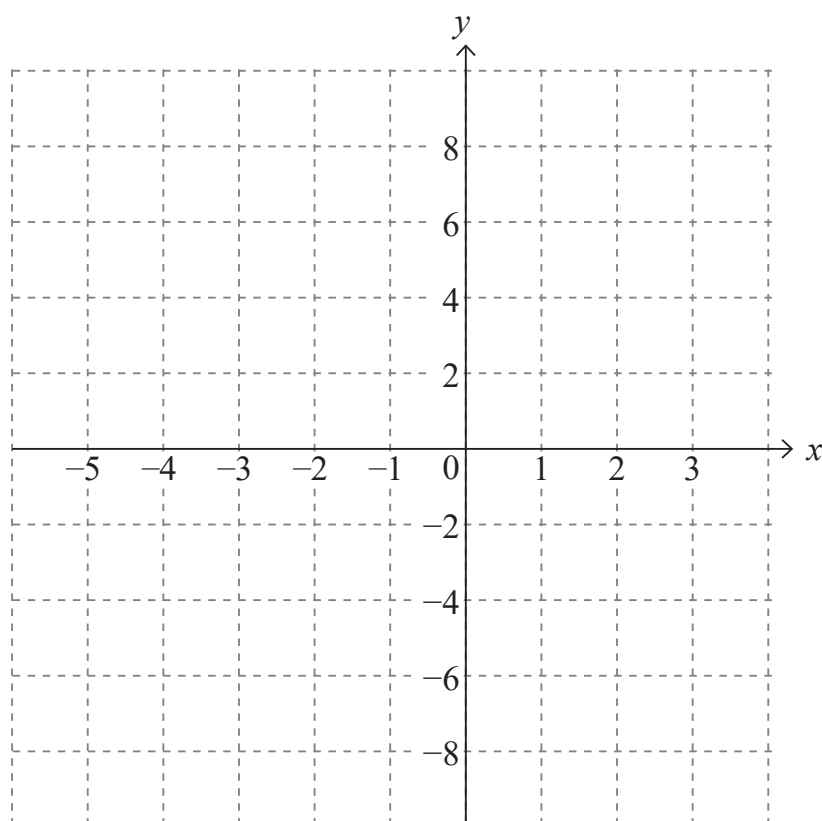
- 6 (a) Complete the table for $y = x^2 + 3x - 3$

x	-4	-3	-2	-1	0	1	2
y	1		-5	-5	-3	1	

[2]

- (b) Draw the graph of $y = x^2 + 3x - 3$ from $x = -4$ to $x = 2$

[2]



- (c) Use your graph to estimate the solutions to $x^2 + 3x - 3 = 0$

Answer _____ [2]



(d) (i) By drawing a line on the grid, solve $x^2 + 3x - 3 = x + 1$

Answer _____ [2]

(ii) Write down in simplest form the quadratic equation that has been solved in (i).

Answer _____ [1]

(e) What line would be drawn on the grid to solve $x^2 + 4x - 6 = 0$?

Answer _____ [2]

[Turn over]



7 (a) Write the decimal number 15 as a binary number.

Answer _____ [1]

(b) Write the binary number 1000000 as a decimal number.

Answer _____ [1]

8 Change 0.081818181... into a fraction.

Answer _____ [2]





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(Questions continue overleaf)

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[Turn over



16GMC8111

9 A $(8, -6)$ and B $(-8, 6)$ are ends of the diameter AB of a circle.

(a) What is the centre of the circle?

Answer _____ [1]

(b) What is the equation of the circle?

Answer _____ [1]

(c) What is the gradient of the diameter AB?

Answer _____ [1]

(d) Find the equation of the tangent to the circle at A.

Answer _____ [3]



- (e) Write down the equations of the two tangents to this circle which are parallel to the y axis.

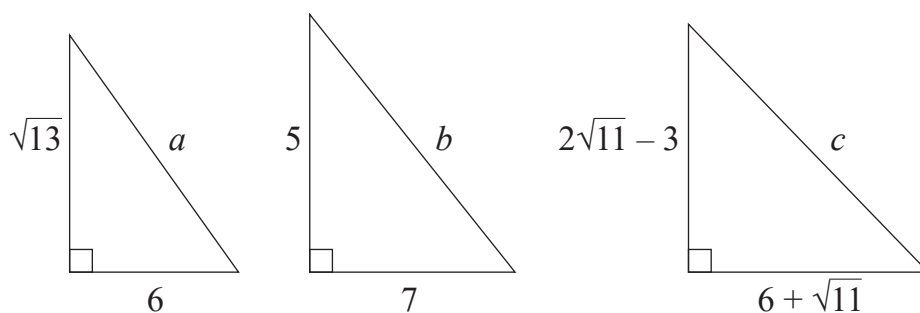
Answer _____ and _____ [2]

- (f) Find the points of intersection of these tangents with the tangent at A.

Answer _____ and _____ [2]

[Turn over]





diagrams
not
drawn
accurately

For each of the right-angled triangles above, state whether the length of the hypotenuse is rational or irrational, giving reasons for your answers.

Answer a is _____ because _____

b is _____ because _____

c is _____ because _____

[6]



11

$$4^{-\frac{1}{2}}$$

$$\left(\frac{1}{9}\right)^{-\frac{1}{2}}$$

$$64^{\frac{2}{3}}$$

$$3^{\frac{3}{2}}$$

$$1^{\frac{5}{7}}$$

Prove that one of the above is a prime number and one is a surd.

[3]

THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
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Total Marks	
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Examiner Number

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Rewarding Learning

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November 2022**

GCSE Mathematics

HIGHER TIER ADDITIONAL SUPPORT MATERIALS (For use in November 2022)

HIGHER TIER ADDITIONAL SUPPORT MATERIALS (November 2022)

Numbers

Highest Common Factor (HCF): The highest common factor is the largest number that divides evenly into two or more numbers, e.g. 4 is the HCF of 8 and 20

Trial and Improvement

This is a method of trying different values in an equation until you get a suitable solution (e.g. to 1 decimal place).

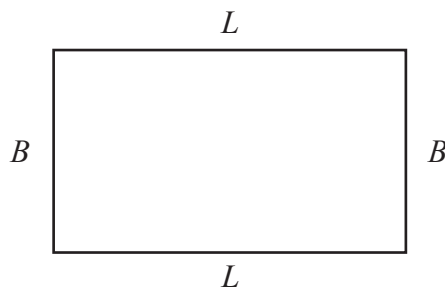
Range

The range of a set of data is the difference between the largest value and the smallest value in the data set.

Mean

The mean of a set of data is the sum of all the data values divided by the number of data values.

Area and Volume



The area of a rectangle is found by multiplying the length of the rectangle by the breadth.

$A = L \times B$ where A is area, L is length and B is breadth.

The area of a triangle is found by multiplying half the length of the base by the perpendicular height of the triangle.

$A = \frac{1}{2}bh$ where b is the base and h is the perpendicular height of the triangle.

The area of a circle is $A = \pi r^2$ where r is the radius of the circle.

The volume of a cuboid is found by multiplying the length by the breadth by the height of the cuboid.

$V = L \times B \times H$ where V is volume, L is length, B is breadth and H is height.

Angles

There are 180° on a straight line.

There are 180° inside a triangle.

An isosceles triangle is a triangle with 2 equal sides and 2 equal angles.

The sum of all the angles inside a polygon is given by $180(n - 2)$ where n is the number of sides in the polygon.

Pie Chart

In a pie chart, the total angle that corresponds to the entire data set is 360°

Probability

The sum of the probabilities of all outcomes equals 1

Compound Measures

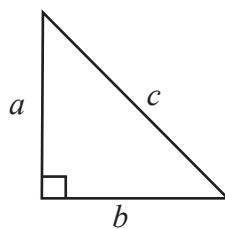
$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Pythagoras' Theorem

If a , b and c are the sides of a right angled triangle shown below, then

$$a^2 + b^2 = c^2$$



Midpoint of a line

If (x_1, y_1) and (x_2, y_2) are the end points of a line, then the coordinates of the midpoint M of the line are

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Gradient of a line

If (x_1, y_1) and (x_2, y_2) are two points on a line, then the gradient m of the line is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Lines

Parallel lines have the same gradient.

If a straight line has gradient m , then a line which is perpendicular to this line has a gradient $-\frac{1}{m}$

Equation of a circle

The equation of a circle of radius r and centre, the origin $(0, 0)$, is given by $x^2 + y^2 = r^2$ where (x, y) are the coordinates of any point on the circumference of the circle.

Tangent/Radius property

The tangent to a circle is perpendicular to the radius at the point of contact with the circle.

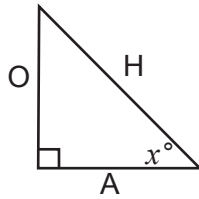
Cyclic Quadrilateral property

The opposite angles of a cyclic quadrilateral add up to 180°

Alternate Segment Theorem

In a circle, the angle between a chord and a tangent through one of the end points of the chord is equal to the angle in the alternate segment.

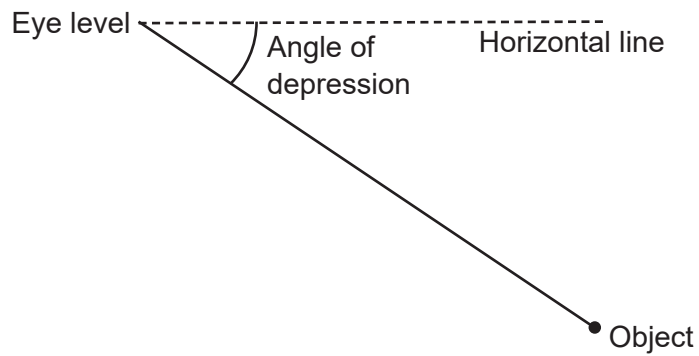
Trigonometric ratios in right angled triangles



$$\sin x^\circ = \frac{O}{H} \quad \cos x^\circ = \frac{A}{H} \quad \tan x^\circ = \frac{O}{A}$$

Angle of depression

If a person stands and looks down at an object, the **angle of depression** is the angle between the horizontal line of sight and the object.



Frequency density in histograms

$$\text{Frequency density} = \frac{\text{Frequency}}{\text{Class width}}$$