



Rewarding Learning

General Certificate of Secondary Education
2022

Centre Number

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Candidate Number

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Mathematics

Unit M8 Paper 1
(Non-Calculator)

Higher Tier



[GMC81]

GMC81

MONDAY 13 JUNE, 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 fifteen** 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.

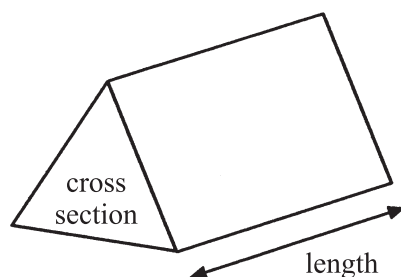
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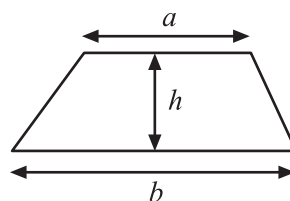
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Formula Sheet

Volume of prism = area of cross section \times length

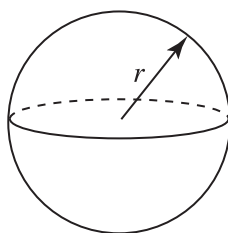


Area of trapezium = $\frac{1}{2}(a + b)h$



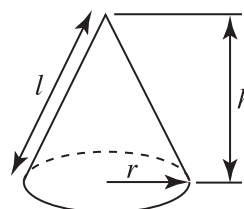
Volume of sphere = $\frac{4}{3}\pi r^3$

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

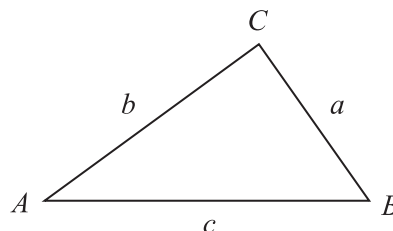


Volume of cone = $\frac{1}{3}\pi r^2 h$

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

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

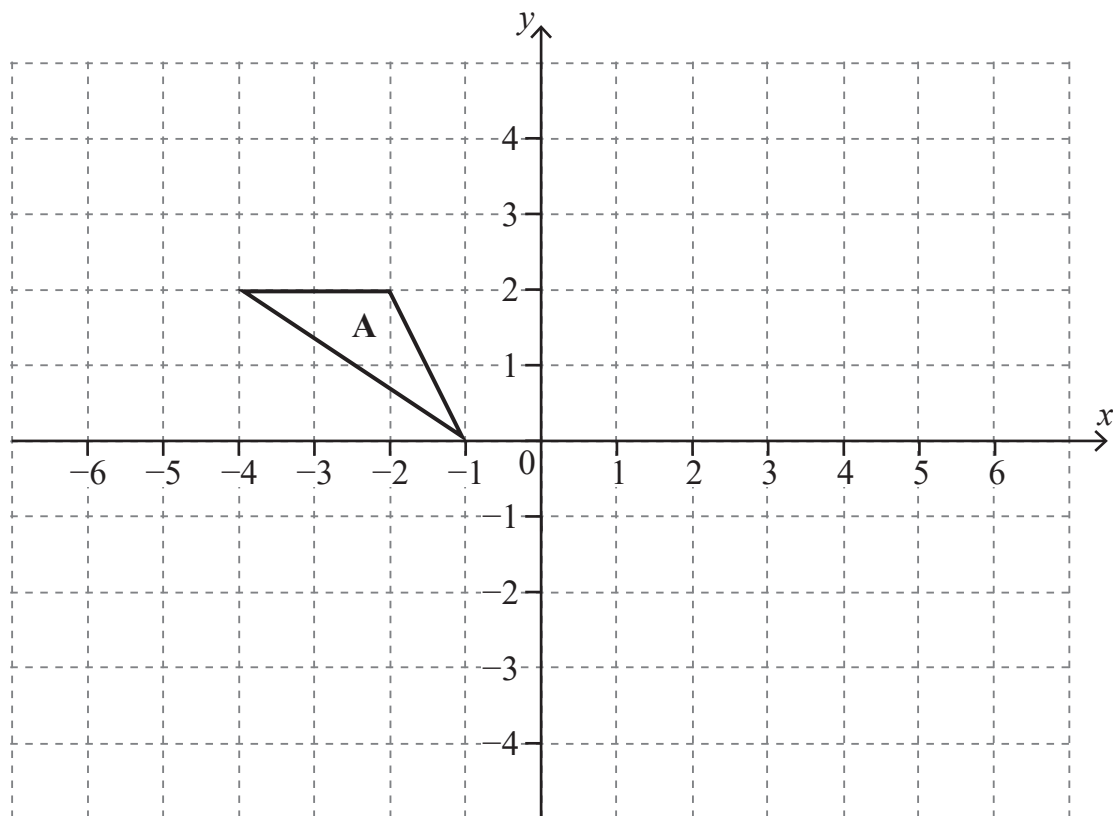
Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



1



Reflect triangle A in the line $x = 1$

[2]

[Turn over



- 2 (a) What is the main difference between the Binary number system and the Decimal number system?

Answer _____ [1]

- (b) Write the binary number 111111 as a decimal number.

Answer _____ [1]

- (c) Write the decimal number 87 as a binary number.

Answer _____ [1]



3 (a) Simplify

(i) $w^3 \times w^2$

Answer _____ [1]

(ii) $\frac{y^6}{y^2}$

Answer _____ [1]

(b) Work out the n^{th} term of the sequence

7, 14, 21, 28, 35 ...

Answer _____ [1]

(c) Work out the value of

(i) 5^{-2}

Answer _____ [1]

(ii) $1^5 + 6^0$

Answer _____ [1]

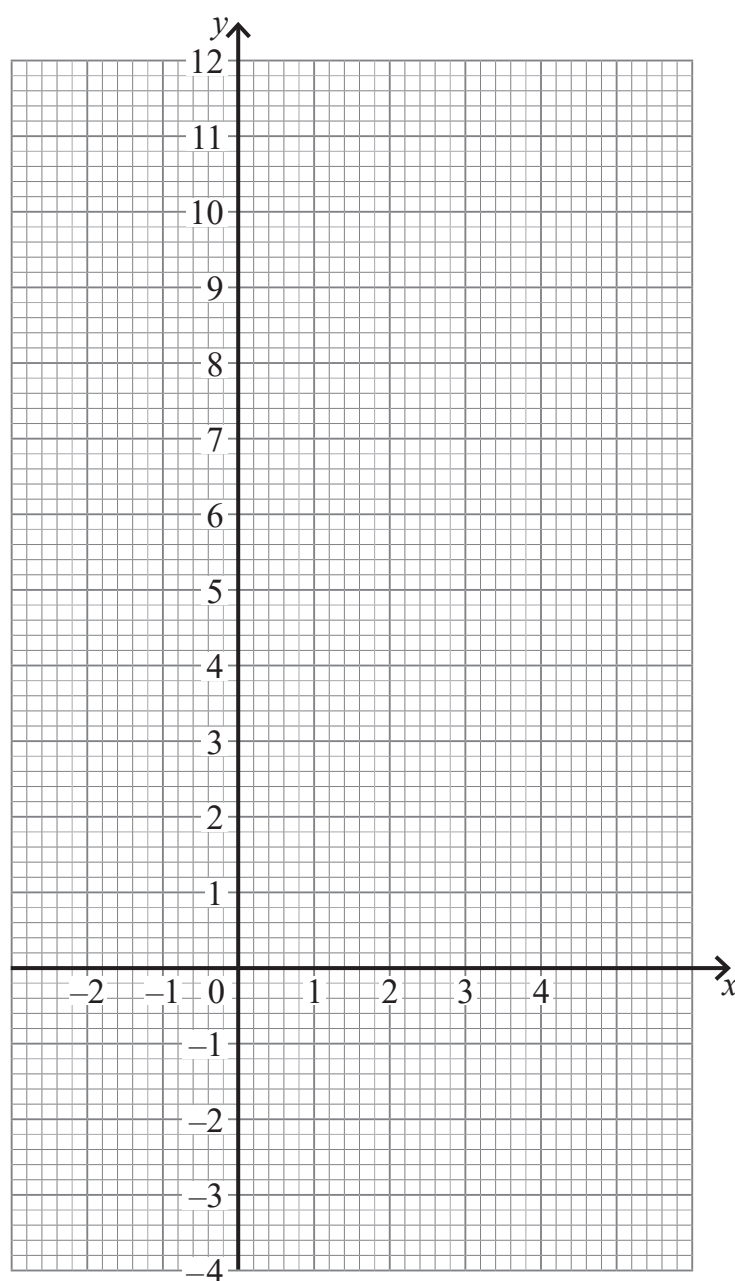
[Turn over]



- 4 The following table gives some values for the quadratic equation $y = x^2 - 3x + 1$

x	-2	-1	0	1	2	3	4
y	11	5	1	-1	-1	1	5

- (a) On the grid below, draw the graph of $y = x^2 - 3x + 1$ for values of x between -2 and 4



[2]



(b) Use your graph to estimate the values of x for which $y = 3$

Answer $x =$ _____ [2]



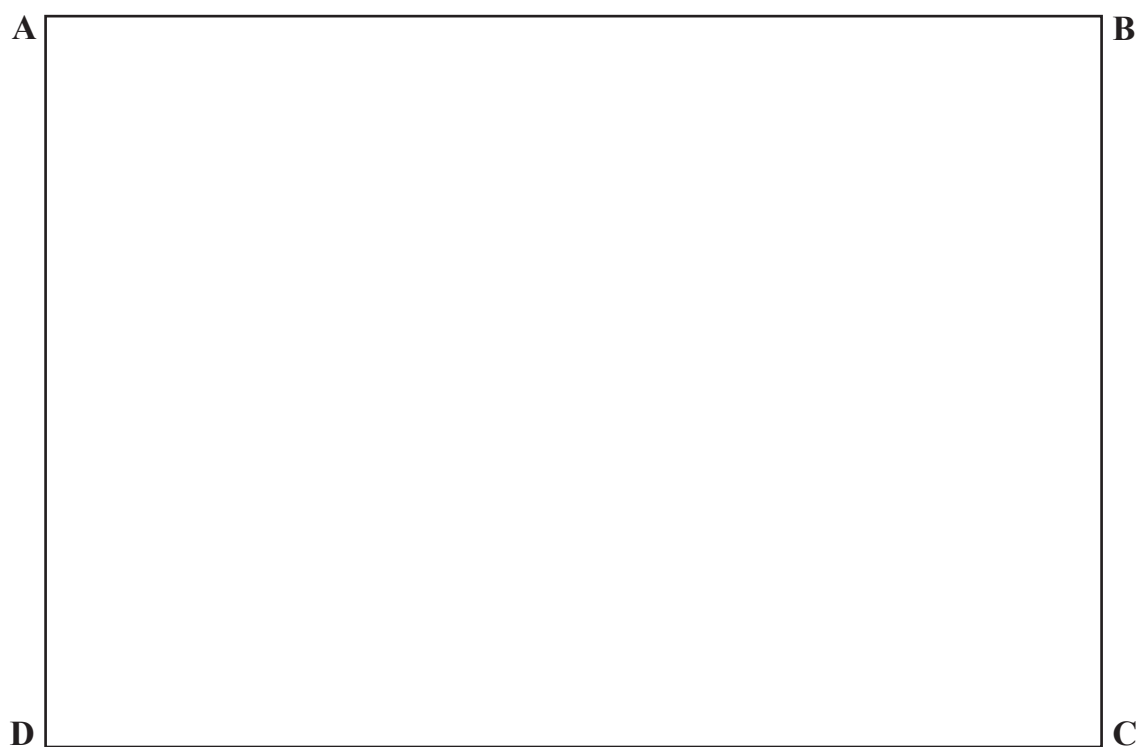
5 Toby walks his dog in the field **ABCD** so that he is always:

more than 40 m from **A**;

nearer to **A** than **B**;

nearer to **DA** than **DC**.

Shade the area where Toby walks his dog.



Scale of diagram: 1 cm = 10 m

[4]



- 6 A tent in the shape of a cone has a perpendicular height of 7 m and a volume of 220 m^3

Using $\pi = \frac{22}{7}$, work out the base radius of this tent.

Write your answer in surd form.

Answer _____ [3]



7 $m = 4.5 \times 10^7$ $n = 5 \times 10^{-3}$

Work out the value of $\frac{m}{n}$, giving your answer in standard form.

Answer _____ [2]

8 Make q the subject of the formula

$$p = \frac{q}{r - q}$$

Answer _____ [3]



9 x is a number with a value between 0 and 1

From the following list

$$x^{-3} \quad \frac{1}{x} \quad x \quad x^{0.5}$$

(i) which would have the lowest value,

Answer _____ [1]

(ii) which would have the biggest value?

Answer _____ [1]

10 $\frac{3}{4\sqrt{5}}$ can be expressed in the form $a\sqrt{5}$

Find the value of a

Answer $a =$ _____ [2]

[Turn over]

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16GMC8111

11 A scale model of a car is made.

The length of the model is $\frac{1}{10}$ of the length of the car.

The volume of the petrol tank of the car is $50\,000\text{ cm}^3$

What is the volume of the petrol tank of the model?

Answer _____ cm^3 [2]

12 Express the recurring decimal $0.2\dot{6}\dot{9}$ as a fraction in its simplest form.

Answer _____ [3]



13 A circle of radius r cm has circumference C cm and area A cm²

Circle whether each value is rational or irrational in the table.

r	C	A
$\frac{3}{\pi}$	rational / irrational	rational / irrational
$\sqrt{\frac{3}{\pi}}$	rational / irrational	rational / irrational
$3\sqrt{\pi}$	rational / irrational	rational / irrational

[4]

[Turn over



14 A cuboid has sides of length

$$3 + 2\sqrt{3}, \quad 3 + \sqrt{3}, \quad 9 - \sqrt{3}$$

Find the length of the space diagonal, giving your answer in the form $a\sqrt{b}$

Answer _____ [5]

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15 A bag contains x green and 5 red beads. Two beads are taken without replacement from the bag at random.

(a) What is the probability of taking 2 green beads if $x = 3$?

Answer _____ [2]

(b) What is the probability of taking 2 green beads if x has the larger value of 10?

Answer _____ [1]

(c) Hence find the smallest value of x for which the probability of taking 2 green beads is greater than $\frac{1}{2}$

Answer _____ [3]

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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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6	
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11	
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14	
15	

Total Marks	
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Examiner Number

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Rewarding Learning

**General Certificate of Secondary Education
Summer 2022**

GCSE Mathematics

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

HIGHER TIER ADDITIONAL SUPPORT MATERIALS (Summer 2022)

Numbers

Lowest common multiple (LCM): The lowest common multiple is the lowest multiple shared by 2 or more numbers.

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).

Metric units

$$1 \text{ ml} = 1 \text{ cm}^3$$

Compound Measures

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

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

Perimeter, Area and Volume



The perimeter of a rectangle is the distance around the outside of the rectangle. It is found by adding the lengths of the 4 sides of the rectangle.

$P = 2L + 2B$ where P is perimeter, L is length and B is breadth.

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

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

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.

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

The circumference (perimeter) of a circle is $C = 2\pi r$ where r is the radius of the circle. An alternative formula is $C = \pi d$ where d is the diameter of the circle.

Mid point 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 $-\frac{1}{m}$

Geometry and Angles

There are 180° on a straight line.

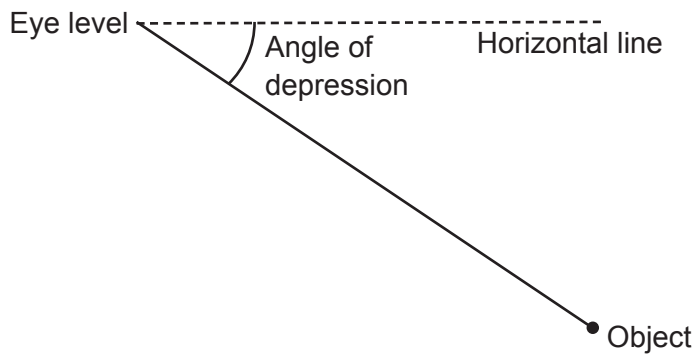
There are 180° inside a triangle.

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.

Angle of depression

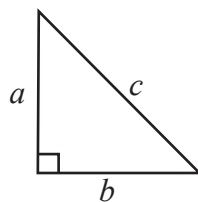
If a person stands and looks down at an object, the **angle of depression** is the angle between the horizontal line of sight and the object.



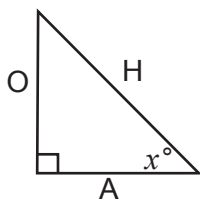
Pythagoras' Theorem

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

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



Trigonometric ratios in right angled triangles



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

Tangent/Radius property

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

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.

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.

Estimate for the mean of a grouped frequency distribution

Estimated mean = sum of (mid interval values multiplied by their frequency) divided by the sum of all the frequencies.

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

Frequency density in histograms

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