Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2023

Mathematics

Unit M4
(With calculator)
Higher Tier

GMC41

[GMC41]

FRIDAY 19 MAY, 9.15 am–11.15 am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

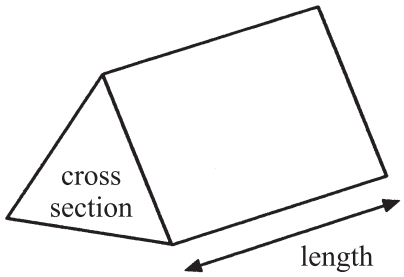
Write your Centre Number and Candidate Number in the spaces provided at the top of this page. **You are provided with Higher Tier Additional Support Materials for use with this paper.**
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all twenty-three** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

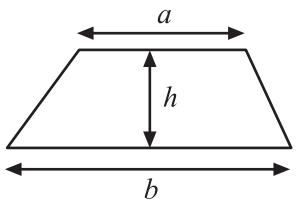
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

Formula Sheet

Volume of prism = area of cross section × length

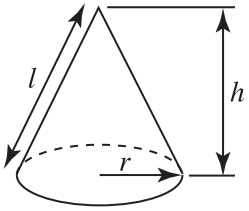


Area of trapezium = $\frac{1}{2}(a+b)h$



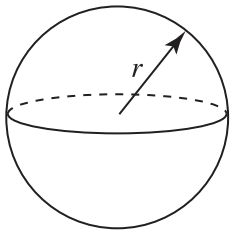
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = πrl

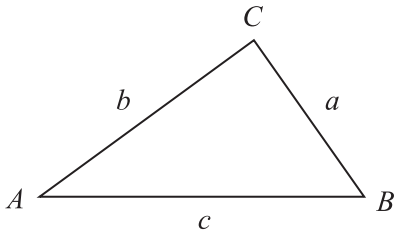


Volume of sphere = $\frac{4}{3}\pi r^3$

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



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 Colm wants to put £4500 into a savings account for 2 years.

He can choose one of the following options.

Option A	**Option B**
3.5% compound interest per year for 2 years	5% compound interest per year for the first year followed by 2% compound interest per year for the second year

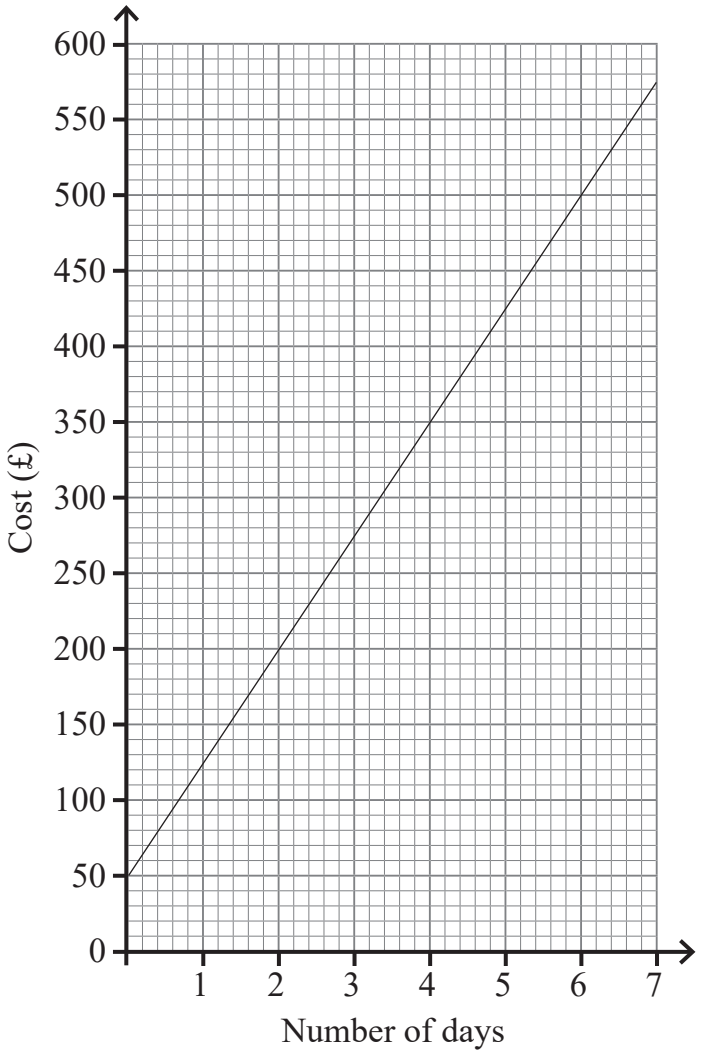
Which option is better and by how much?

Show your working.

Answer Option _____ by £_____ [5]

[Turn over

2 The graph shows the costs of hiring a mini digger for up to seven days, including the delivery charge.



(a) Use the graph to find

(i) the delivery charge,

Answer £_____ [1]

(ii) the gradient of the line.

Answer _____ [2]

(b) What does the gradient represent when hiring the mini digger?

Answer _____ [1]

3 Expand and simplify $2y(3y - 7) - 8y$

Answer _____ [3]

[Turn over

4 A circle of diameter 12 cm just fits inside a semicircle as shown.

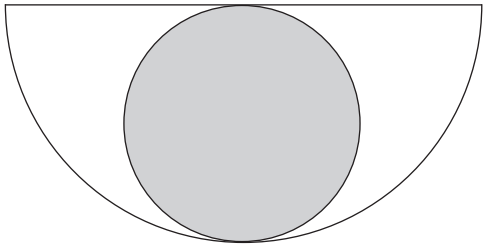


diagram not drawn accurately

Show that the shaded area and unshaded area are exactly the same.

You must show all your work clearly.

[4]

5 The times which members at a gym spend on a treadmill are recorded in the table.

Time (t mins)	Frequency		
$0 < t \leq 15$	8		
$15 < t \leq 30$	3		
$30 < t \leq 45$	5		
$45 < t \leq 60$	4		

(a) Estimate the mean time spent on the treadmill.

Answer _____ mins [4]

(b) Explain why your answer in **(a)** is only an estimate of the mean time.

_____

_____ [1]

[Turn over

6 Is it possible to have a right-angled triangle with sides of 20 cm, 21 cm and 28 cm?

Explain your reasoning clearly.

Answer _____ [3]

7 Barry sold his car for £10 225

The car had depreciated by 18.2 % since Barry bought it originally.

How much did Barry pay for the car originally?

Answer £ _____ [3]

8 Solve $\frac{1}{3}(2x - 5) + \frac{3}{4}(3x + 1) = \frac{5}{6}$

Answer $x =$ _____ [4]

9 Write 4725 as a product of prime factors.

Write your answer in index notation.

Answer _____ [2]

[Turn over

10 **(a)** Factorise $x^2 + 2x - 35$

Answer _____ [2]

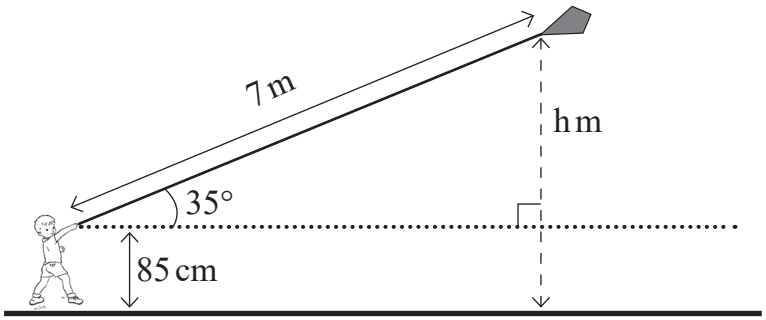
(b) Hence, or otherwise, solve the equation $x^2 + 2x = 35$

Answer x = _____ [1]

11 Find the equation of the line passing through the points (0, −2) and (6, 16)

Answer _____ [3]

12 A boy is flying a kite as shown in the diagram.



Calculate h, the height of the kite above the ground.

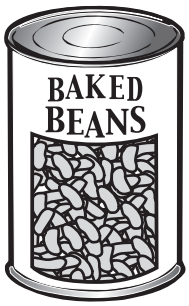
Answer _____ m [4]

[Turn over

13 A cylindrical can of beans has a radius of 3.4 cm and a height of 12 cm.

The entire curved surface area is covered by a label.

The label has a 1 cm overlap to allow for sticking.



Calculate the area of the label.

Answer _____ cm^2 [3]

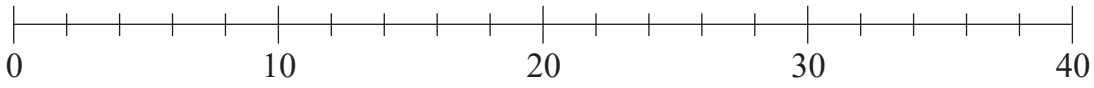
14 The following information is available relating to a data set on age.

The median age is 14

The maximum age is 35
The range of ages is 32

The lower quartile is 12
The interquartile range (IQR) is 8

(a) Use all the above information to draw a box plot for the data set.



[4]

(b) Jane states that the majority of people in this data set are aged below 16
Is she correct?

Give a reason for your answer.

Answer _____ because _____

_____ [1]

15 The distance a car travels is given as 62 km correct to the nearest km.

The time taken for the journey is given as 1 hour 11 minutes correct to the nearest minute.

Find the maximum average speed of the car in km/h.

Answer _____ km/h [4]

16 The equation of a straight line L_1 is $y = mx + 5$

L_1 passes through the point $(4, 8)$

The line L_2 is perpendicular to L_1 and passes through the point $(-3, 2)$

Find the equation of the line L_2

Answer _____ [4]

[Turn over

17 **(a)** O is the centre of the circle.

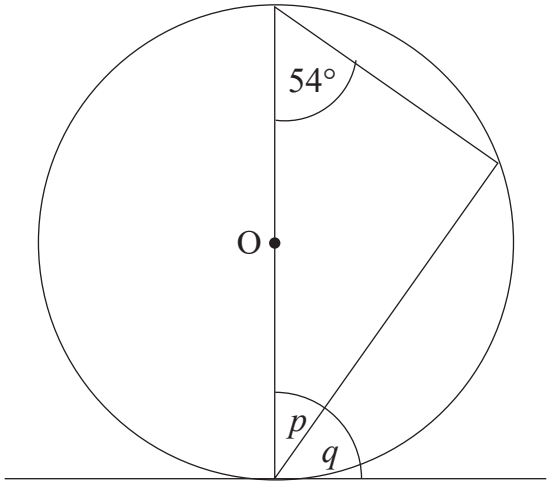


diagram not drawn accurately

Calculate the size of angle

(i) p

Answer _____° [1]

(ii) q

Answer _____° [1]

(b) The lines AB, BC, CA are tangents to the circle.

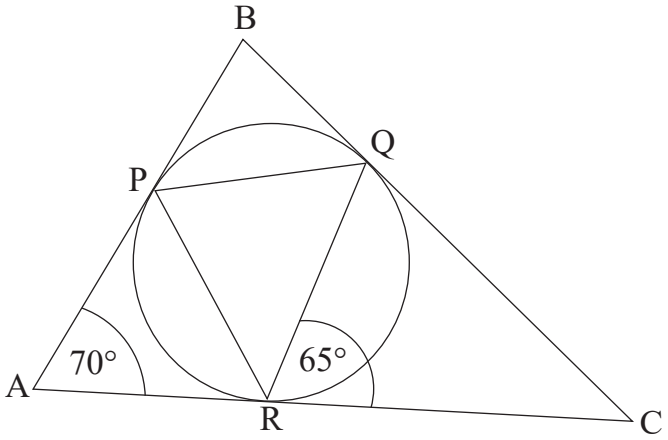


diagram not drawn accurately

What type of triangle is triangle **BPQ**?

You must explain your reasoning clearly.

Answer _____ [4]

[Turn over

18 A golf club has 240 members.

A survey is to be carried out using a stratified sample of the members.

Some of the information relating to the survey is recorded in the table.

	Junior	**18–40**	**41–60**	**Senior**
Number of members	42		114	
Number in survey	7			5

Complete the table. [3]

19 Factorise

(a) $\frac{4}{9}x^2 - 100$

Answer _____ [2]

(b) $6ax^2 + 7axy - 3ay^2$

Answer _____ [3]

20 The side of a shed is in the shape of a trapezium as shown.

The height at the back of the shed is 3.5 m

The height at the front is given as $(2x - 1)$ m and the length is given as $(5x - 4)$ m

The area of the side of the shed is 19.5 m^2

By forming and solving a quadratic equation find the height at the front and the length of the shed.

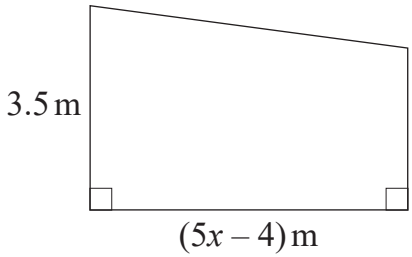


diagram not drawn accurately

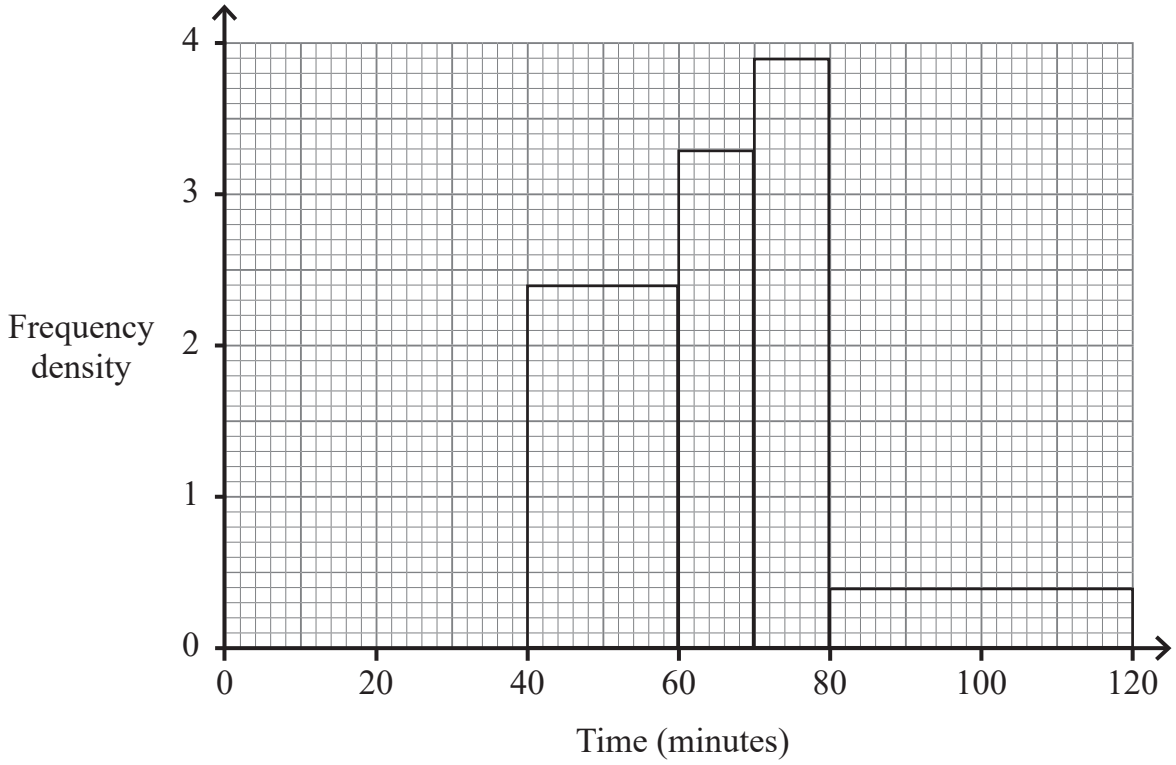
Answer height = _____ m

length = _____ m [6]

[Turn over

21 The table and histogram show some information relating to the time taken by 140 office workers to travel to work.

Time, t minutes	Frequency
$0 < t \leq 40$	
$40 < t \leq 60$	
$60 < t \leq 70$	33
$70 < t \leq 80$	39
$80 < t \leq 120$	16



(a) (i) Complete the frequency table. [2]

(ii) Complete the histogram. [1]

(b) Calculate an estimate of the median time.

Answer _____ mins [4]

[Turn over

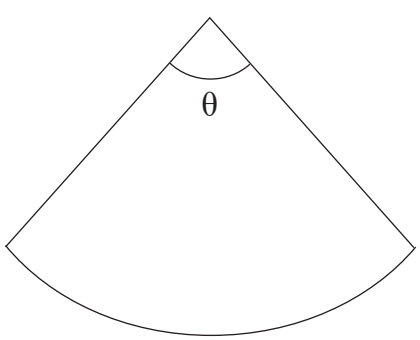
22 Solve $\dfrac{3}{3x-1} = 5 - \dfrac{4}{2x+3}$

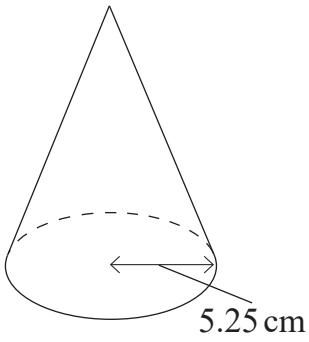
Give your answer to 2 decimal places.

Answer $x =$ _____ [7]

23 A cone with a base radius of 5.25 cm and a volume of 497 cm^3 is made by folding a sector as shown.

Calculate (to the nearest degree) the angle θ at the apex of the sector needed to form the cone.





Answer _____ ° [7]

Sources: All images © CCEA unless stated

THIS IS THE END OF THE QUESTION PAPER

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

Examiner Number

Rewarding Learning

General Certificate of Secondary Education
Summer 2023

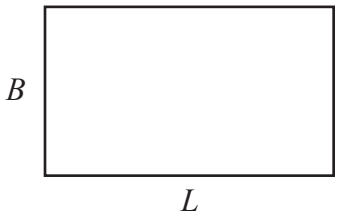
GCSE Mathematics

HIGHER TIER
ADDITIONAL SUPPORT MATERIALS
(For use in Summer 2023)

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

Perimeter, Area and Volume

The perimeter of a polygon is the distance around the outside of the polygon.



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.

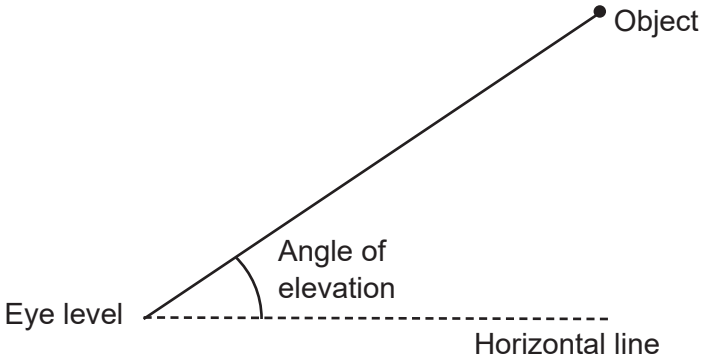
If a straight line has gradient m, then a line which is perpendicular to this line has a gradient $-\frac{1}{m}$

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 elevation

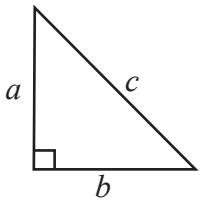
If a person stands and looks up at an object, the **angle of elevation** is the angle between the horizontal line of sight and the object.



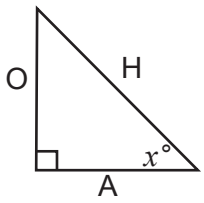
Pythagoras' Theorem

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



$\sin x° = \frac{O}{H}$ $\cos x° = \frac{A}{H}$ $\tan x° = \frac{O}{A}$

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.

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

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