



General Certificate of Secondary Education  
2023

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

# Mathematics

Unit M3  
(With calculator)  
Higher Tier



[GMC31]  
FRIDAY 19 MAY, 9.15 am–11.15 am

\*GMC31\*

## 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-five** 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.

13340



\*28GMC3101\*

# 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** =  $4\pi r^2$

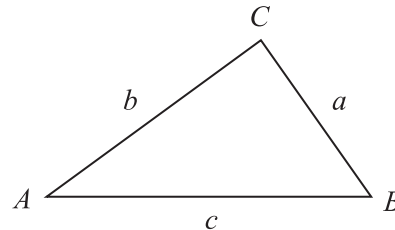


**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

**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 Debbie works as a salesperson for an insurance company.

Her rate of pay is £11.50 per hour.

Every time she sells an insurance policy she receives a bonus of £7.25

Last week Debbie worked these hours.

Monday	8am – 4pm
Tuesday	8am – 4pm
Wednesday	8am – 4pm
Thursday	8am – 4pm
Friday	8am – 12 noon
Saturday	Off
Sunday	Off

Her total pay for the week was £537.25

How many insurance policies did she sell?

Answer \_\_\_\_\_ [4]

[Turn over



2 A survey was issued online, by post, by text and face to face.

The number of responses received for each method are shown in the table.

Method	No of surveys issued	No of responses
Online	240	120
Post	100	30
Text	300	150
Face to face	160	120

Frank thinks that you are most likely to get a response from surveys issued by text.

Is he right?

You must show working to justify your answer.

Answer \_\_\_\_\_ because \_\_\_\_\_

[4]



3

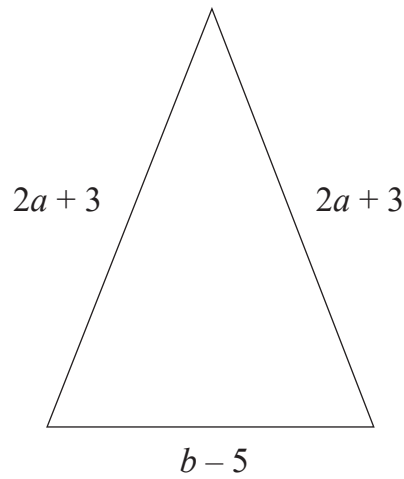


diagram not  
drawn  
accurately

- (a) Write an expression for the perimeter of the triangle.

Simplify your answer.

Answer \_\_\_\_\_ [2]

- (b) The perimeter of the triangle is 30

You are told that  $b = 9$

Work out the value of  $a$

Answer  $a =$  \_\_\_\_\_ [3]

[Turn over



4 A class of 30 pupils chose their favourite drink.

40% chose cola

$\frac{3}{10}$  chose milk

3 chose water

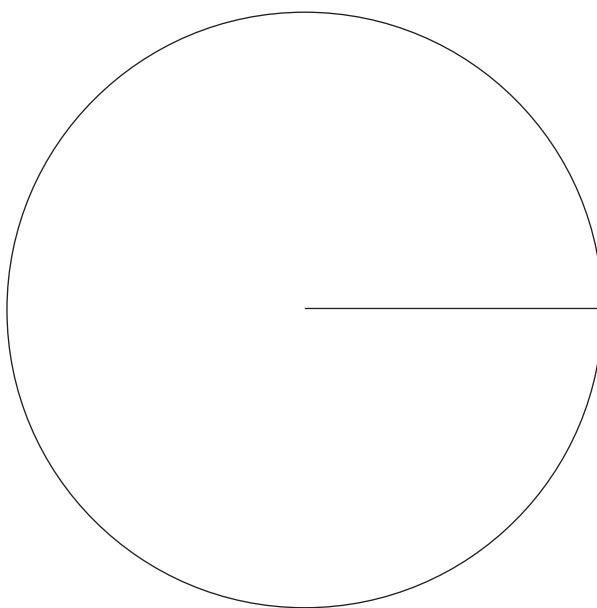
the rest chose other

(a) How many pupils chose other?

Answer \_\_\_\_\_ [2]

Drink	Number of pupils	
Cola		
Milk		
Water		
Other		

(b) Use the information to draw a pie chart for the 30 pupils.



[4]



5 The table shows part of a train timetable from Edinburgh to St Andrews.

The Express trains travel directly. The Standard trains stop at other stations.

	Express	Standard	Express	Standard	Express
Edinburgh	1318	1343	1424	1441	1520
Haymarket		1406		1504	
Kirkcaldy		1418		1516	
Ladybank		1423		1521	
St Andrews	1403	1439	1509	1537	1605

(a) Alex arrives at Edinburgh Airport at 1306

It takes him 26 minutes to collect his luggage.

By taxi, he arrives at Edinburgh Train Station 18 minutes later.

How long will he have to wait at the station for the next train to St Andrews?

Answer \_\_\_\_\_ minutes [3]

(b) The distance between Edinburgh and St Andrews is 54 miles.

Calculate the average speed at which the Express train travels between Edinburgh and St Andrews.

Answer \_\_\_\_\_ miles/hr [3]

[Turn over



- 6 The diagram shows a net which is to be folded to make an open box.

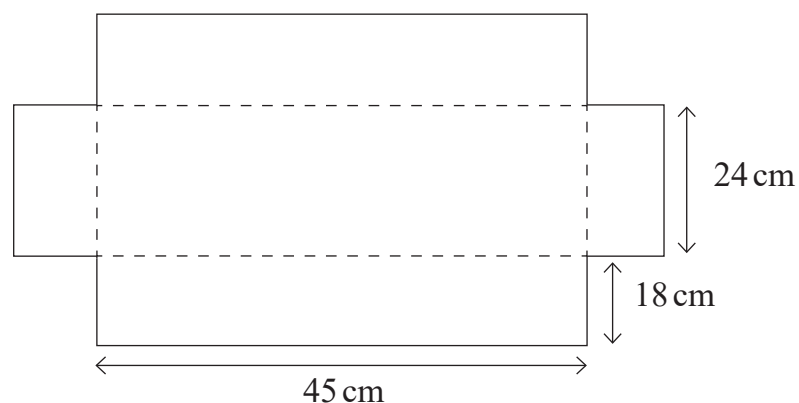


diagram  
not  
drawn  
accurately

- (a) Calculate the volume of the box.

Answer \_\_\_\_\_  $\text{cm}^3$  [2]

- (b) Calculate the length of the longest straight line that can be drawn on the base of the box.

Answer \_\_\_\_\_ cm [3]



7 Greg bought a mobile phone for £180

A year later he sold it for £54

What was Greg's percentage loss on the phone?

Answer \_\_\_\_\_ % [3]

8 Solve the equation  $4(y + 2) = 22$

Answer  $y =$  \_\_\_\_\_ [3]

[Turn over

13340



\*28GMC3109\*

9 A local sports club runs a tuck shop during matches.

Before last week's match the club bought

25 packs, each containing 6 drinks, costing £3 per pack,

15 packs, each containing 12 bags of crisps, costing £2.40 per pack,

35 packs, each containing 5 chocolate bars, costing £1 per pack.

(a) Calculate the total cost to the club.

Answer £ \_\_\_\_\_ [2]



(b)

Tuck shop prices

Drinks	80p each
Crisps	50p per bag
Chocolate Bars	30p each

***Special Deal***     ***1 drink, 1 bag of crisps, 1 chocolate bar for £1.50***

During the match, 115 people bought the Special Deal.

By the end of the match the tuck shop had sold **all** the drinks, crisps and chocolate bars.

What was the tuck shop's profit for that day?

Answer £ \_\_\_\_\_ [4]

[Turn over



10

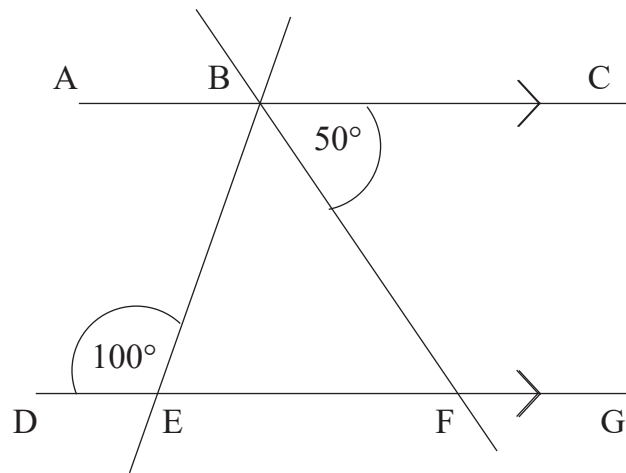


diagram  
not  
drawn  
accurately

AC and DG are parallel lines.

Angle  $CBF = 50^\circ$  and angle  $BED = 100^\circ$

What type of triangle is BEF?

**Give a reason for each angle found.**

Answer \_\_\_\_\_ [3]

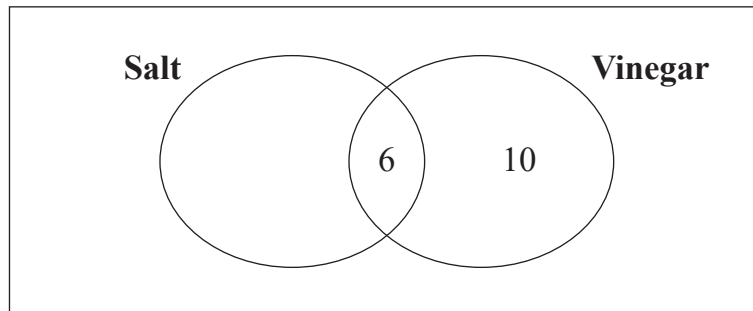


11 40 customers order chips in a takeaway.

6 customers take **both** salt and vinegar on their chips.

10 customers take vinegar **only**.

This information is shown on the Venn diagram.



22 customers take salt on their chips.

Use the Venn diagram to work out how many customers take neither salt nor vinegar on their chips.

Answer \_\_\_\_\_ [3]



12 The ages of 21 workers in an office are recorded as

28 32 38 40 42 49 51 23 26 27 53  
49 45 36 38 37 62 23 46 58 47

(a) Draw a stem and leaf diagram to display this set of data.

[3]

(b) A new worker joins the office. He is aged 34

What effect will this have on the median age?

Answer \_\_\_\_\_ [1]



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

He can choose one of the following options.

**Option A**

3.5% compound interest  
per year for 2 years

**Option B**

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?

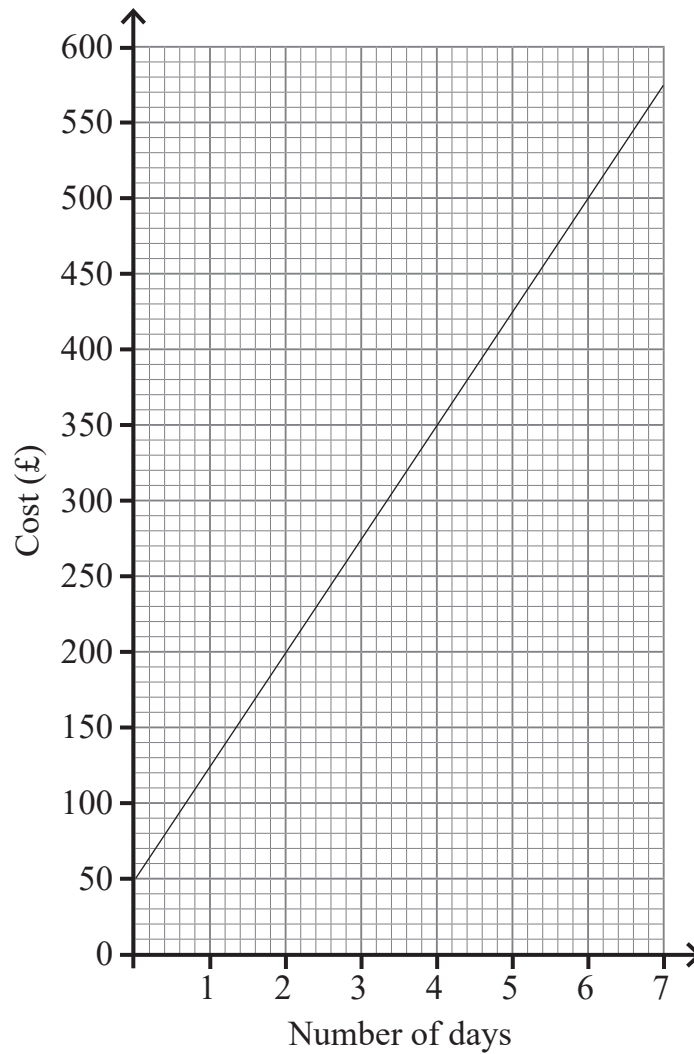
Show your working.

Answer Option \_\_\_\_\_ by £ \_\_\_\_\_ [5]

[Turn over



- 14 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]

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

Answer \_\_\_\_\_ [3]



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

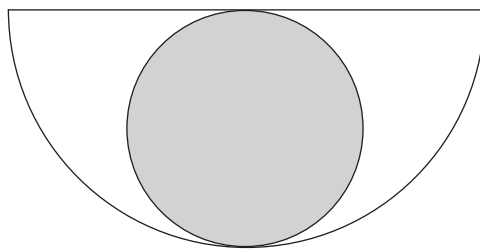


diagram  
not  
drawn  
accurately

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

**You must show all your work clearly.**

[4]



17 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



18 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]

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

Answer  $x =$  \_\_\_\_\_ [4]



20 Write 4725 as a product of prime factors.

Write your answer in index notation.

Answer \_\_\_\_\_ [2]

21 (a) Factorise  $x^2 + 2x - 35$

Answer \_\_\_\_\_ [2]

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

Answer  $x =$  \_\_\_\_\_ [1]

[Turn over

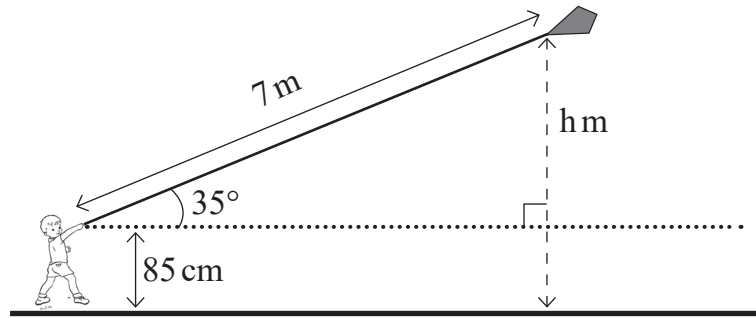


22 Find the equation of the line passing through the points  $(0, -2)$  and  $(6, 16)$

Answer \_\_\_\_\_ [3]



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



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

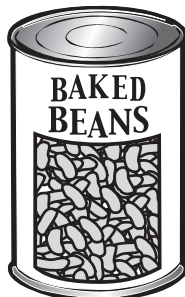
Answer \_\_\_\_\_ m [4]



24 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 \_\_\_\_\_  $\text{cm}^2$  [3]



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

The median age is 14

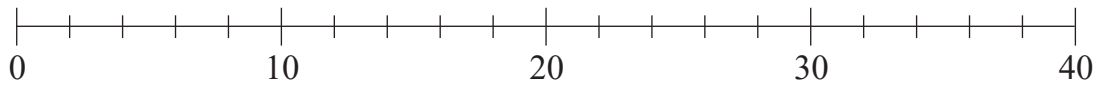
The maximum age is 35

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]



---

**THIS IS THE END OF THE QUESTION PAPER**

---

**BLANK PAGE**

**DO NOT WRITE ON THIS PAGE**

13340



\*28GMC3126\*





**BLANK PAGE**  
**DO NOT WRITE ON THIS PAGE**

13340



\*28GMC3127\*

Sources: All images © CCEA unless stated

**DO NOT WRITE ON THIS PAGE**

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	

<b>Total Marks</b>	
--------------------	--

Examiner Number

Permission to reproduce all copyright material has been applied for.  
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA will be happy to rectify any omissions of acknowledgement in future if notified.

13340/4



\*28GMC3128\*



*Rewarding Learning*

**General Certificate of Secondary Education  
Summer 2023**

---

# **GCSE Mathematics**

---

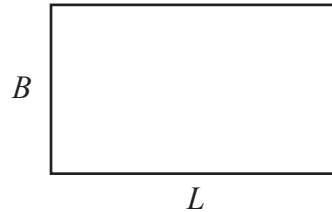
## **HIGHER TIER ADDITIONAL SUPPORT MATERIALS (For use in Summer 2023)**

## HIGHER TIER ADDITIONAL SUPPORT MATERIALS (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  $180^\circ$  on a straight line.

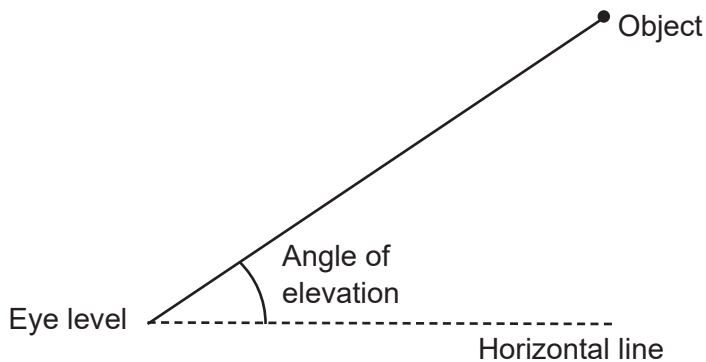
There are  $180^\circ$  inside a triangle.

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

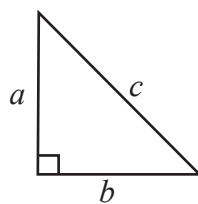
If a person stands and looks up at an object, the **angle of elevation** is the angle between the horizontal line of sight and the object.



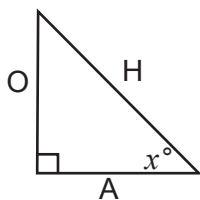
### Pythagoras' Theorem

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



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

## 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.

## 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  $360^\circ$

## Probability

The sum of the probabilities of all outcomes equals 1

## Frequency density in histograms

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





