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EDEXCEL · GCSE MATHEMATICS 1MA1

# Higher Tier — Paper 3

Calculator

November 2023 exam series

QUESTION PAPER

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Centre Number | Candidate Number

# Pearson Edexcel Level 1/Level 2 GCSE (9–1)

## Monday 13 November 2023

Morning (Time: 1 hour 30 minutes)

**Paper reference** **1MA1/3H**

# Mathematics

## PAPER 3 (Calculator)

## Higher Tier

**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator, Formulae Sheet (enclosed). Tracing paper may be used.

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used**.
- If your calculator does not have a $\pi$ button, take the value of $\pi$ to be 3.142 unless the question instructs otherwise.

### Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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P 6 9 5 3 5 A 0 1 2 4

Pearson

**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

**1** (a) Write 468 000 in standard form.

.....

**(1)**

(b) Write $5.037 \times 10^{-4}$ as an ordinary number.

.....

**(1)**

**(Total for Question 1 is 2 marks)**

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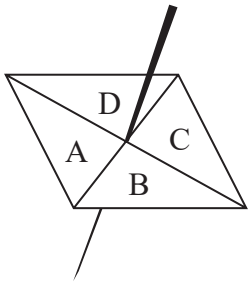
**2** Here is a biased spinner.




The table shows the probabilities that when the spinner is spun it will land on A, on B, on C and on D.

| **Letter** | A | B | C | D |
|---|---|---|---|---|
| **Probability** | 0.4 | 0.21 | 0.32 | 0.07 |

Luka will spin the spinner 200 times.

Work out an estimate for the number of times the spinner will land on A.

.....

**(Total for Question 2 is 2 marks)**

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**3** Seija works at a weather station.
The table gives information about the temperature, $T$ °C, at midday for each of 50 cities in the UK on Tuesday.

| Temperature ($T$ °C) | Frequency |
|---|---|
| $10 < T \leqslant 15$ | 2 |
| $15 < T \leqslant 20$ | 8 |
| $20 < T \leqslant 25$ | 13 |
| $25 < T \leqslant 30$ | 21 |
| $30 < T \leqslant 35$ | 6 |

(a) Calculate an estimate for the mean temperature.

.....°C

**(3)**

Seija says,

> "The median temperature is 22.5 °C because 22.5 is the middle number in the middle group."

(b) Is Seija correct?
Give a reason for your answer.

.....

.....

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**(1)**

**(Total for Question 3 is 4 marks)**

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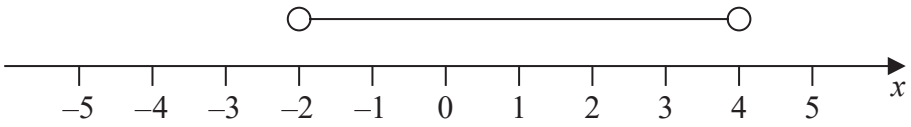
**4** Jenna is asked to show the inequality $-3 < x \leqslant 4$ on a number line.

Here is her answer.




(a) Write down two mistakes Jenna has made.

1 .....

.....

2 .....

.....

**(2)**

(b) Work out the greatest integer that satisfies the inequality

$$5y - 7 < 16$$

.....

**(2)**

**(Total for Question 4 is 4 marks)**

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**5** Ali buys packs of balloons and boxes of pencils.

There are 30 balloons in each pack.
There are 24 pencils in each box.

Ali buys exactly the same number of balloons and pencils.

Work out how many packs of balloons and how many boxes of pencils she could have bought.
You must show all your working.

..... packs of balloons

..... boxes of pencils

**(Total for Question 5 is 3 marks)**

**6** A company orders a large number of plates from a factory.

It would take 30 hours to make all the plates using 4 machines.

How many machines are needed to make all the plates in 6 hours?

.....

**(Total for Question 6 is 2 marks)**

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**7** Riley travelled by car and by aeroplane.

He travelled 143 miles by car at an average speed of 55 miles per hour.
Riley then travelled for 5 hours and 20 minutes by aeroplane.

Work out, in hours and minutes, Riley's total travelling time.

..... hours ..... minutes

**(Total for Question 7 is 3 marks)**

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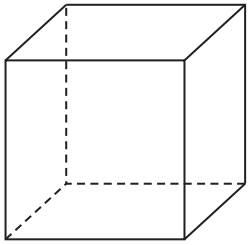
**8** The diagram shows a solid cube placed on a horizontal table.



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The pressure on the table due to the cube is 3.5 newtons/cm$^2$
The force exerted by the cube on the table is 504 newtons.

Show that the total surface area of the cube is less than 900 cm$^2$

**(Total for Question 8 is 3 marks)**

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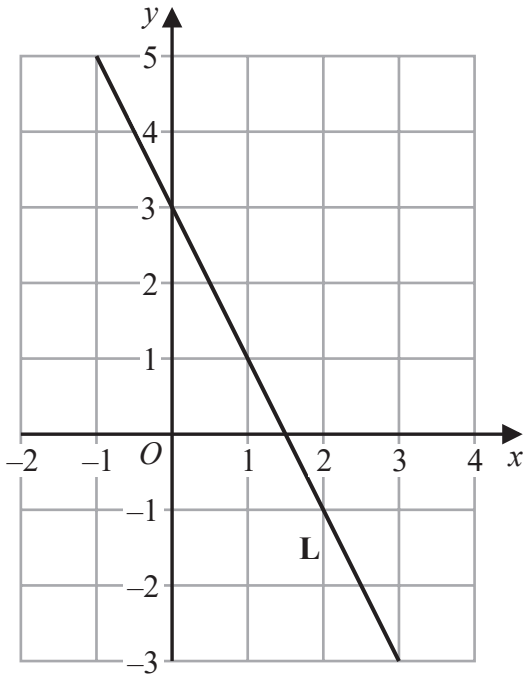
**9** The line **L** is shown on the grid.




Find an equation for **L**.

.....

**(Total for Question 9 is 3 marks)**

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**10** Make $m$ the subject of $\quad k = p + \dfrac{2m}{5}$

.....

**(Total for Question 10 is 3 marks)**

**11** The floor plan of a house is drawn using a scale of 1 : 50
On the plan, a room in the house has a floor area of 48 $cm^2$

Work out the real area of the floor of this room.
Give your answer in $m^2$

..... $m^2$

**(Total for Question 11 is 3 marks)**

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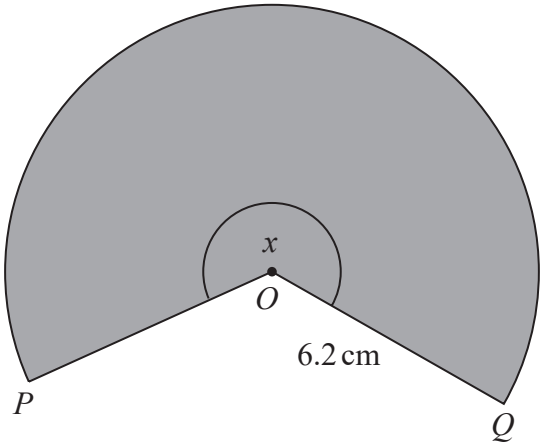
**12** The diagram shows a shaded sector $POQ$ of a circle with centre $O$ and radius 6.2 cm.




The area of the shaded sector is 82.6 $cm^2$

Calculate the size of angle $x$.
Give your answer correct to 3 significant figures.

.....
°

**(Total for Question 12 is 2 marks)**

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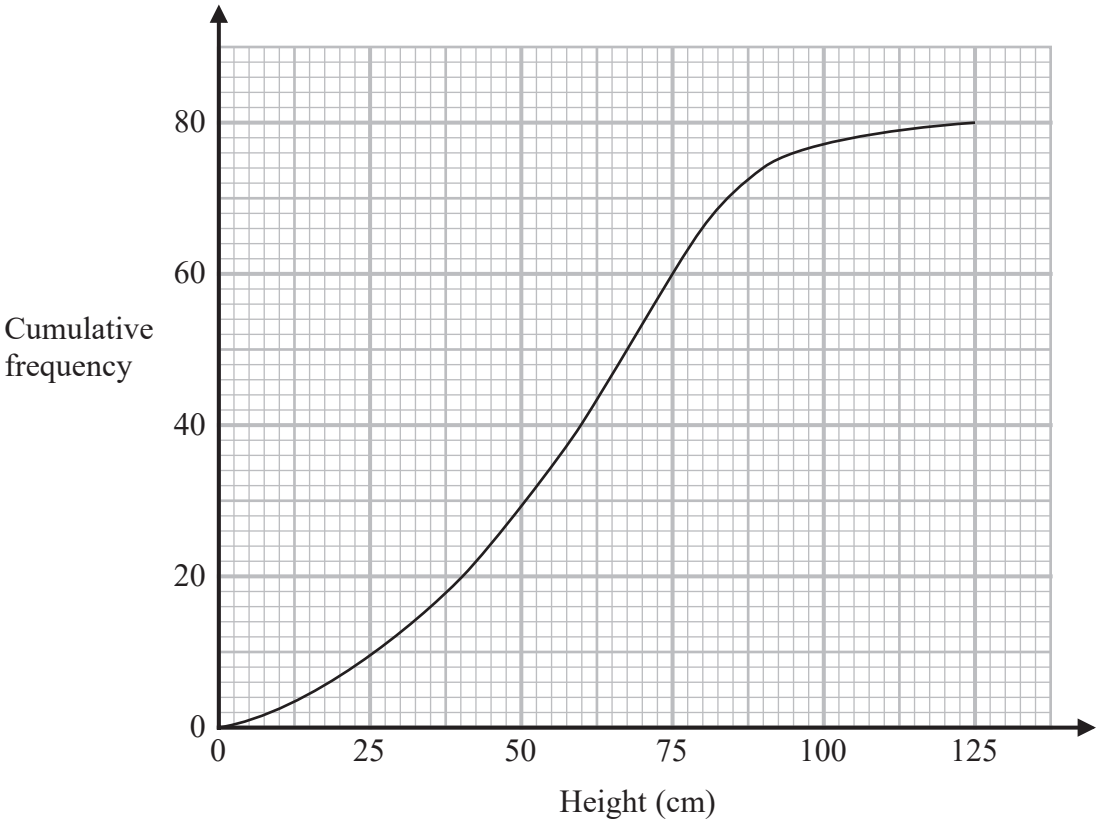
**13** Alan grew 80 plants of the same type outside.
The cumulative frequency graph shows information about the heights, in cm, of these plants.




One of the plants is chosen at random.

(a) Find an estimate for the probability that this plant will have a height greater than 90 cm.

.....

**(2)**

(b) Use the graph to find an estimate for the median height.

..... cm

**(1)**

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(c) Use the graph to find an estimate for the interquartile range of the heights.

..... cm

**(2)**

Alan also grew plants of the same type inside.

The interquartile range of the heights of these plants is 30 cm.

(d) Give one comparison between the distribution of the heights of the plants grown inside with the distribution of the heights of the plants grown outside.

.....

.....

.....

.....

**(1)**

**(Total for Question 13 is 6 marks)**

**14** Here are the first six terms of a quadratic sequence.

5 11 21 35 53 75

Find an expression, in terms of $n$, for the $n$th term of this sequence.

.....

**(Total for Question 14 is 2 marks)**

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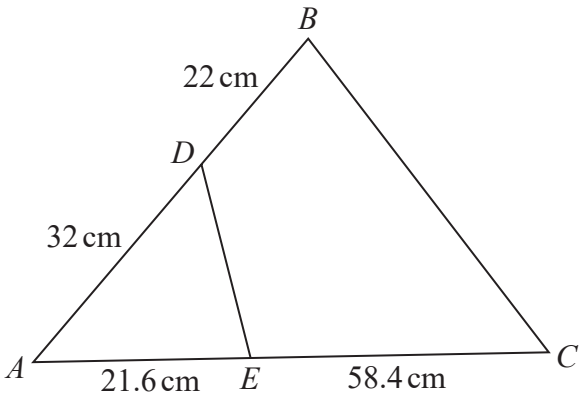
**15** The diagram shows triangle *ABC* and triangle *AED*.




Show that triangle *ABC* and triangle *AED* are similar.

**(Total for Question 15 is 2 marks)**

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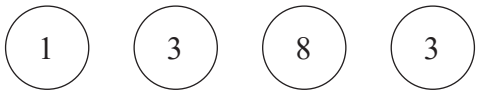
**16** Zia has to set a 4-digit security passcode on her phone.

Each digit of the passcode is a number from 1 to 9
She can use each number more than once.

Zia tells her friend Amber that

the first digit is a cube number
the second digit is a prime number
the third digit is greater than 6
the fourth digit is an odd number.

The diagram shows one possible 4-digit passcode.




Amber is going to have one attempt at guessing Zia's passcode.

Work out the probability that Amber guesses Zia's passcode on the first attempt.

.....

**(Total for Question 16 is 3 marks)**

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**17** (a) (i) Write $x^2 - 8x + 3$ in the form $(x - a)^2 - b$ where $a$ and $b$ are integers.

.....

**(2)**

(ii) Hence, write down the coordinates of the turning point on the graph of $y = x^2 - 8x + 3$

(..... , .....)

**(1)**

(b) Solve $7x^2 + 8x - 5 = 0$
Give your solutions correct to 3 significant figures.

.....

**(3)**

Alex has to find the solutions of the quadratic equation $3k^2 + 10k - 8 = 0$
Here is his working and answer.

$(3k - 2)(k + 4) = 0$

$k = 2$ or $k = -4$

(c) What mistake has Alex made?

.....

.....

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**(1)**

**(Total for Question 17 is 7 marks)**

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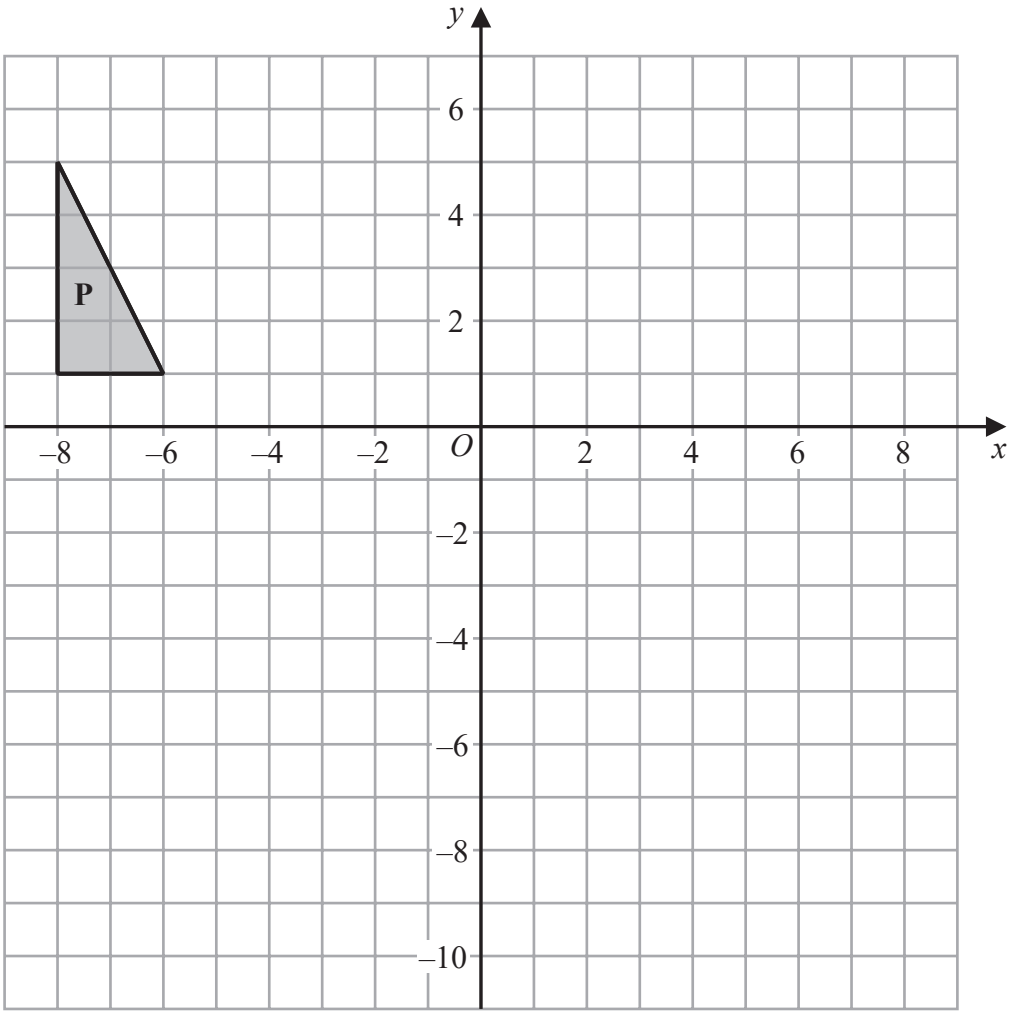
**18**




(a) Enlarge triangle **P** by scale factor $-1\frac{1}{2}$ with centre of enlargement (–2, –1)

Label your image **Q**.

**(2)**

Triangle **P** is transformed by a combined transformation of a rotation of 90° anticlockwise about the origin followed by a translation to give triangle **R**.

Exactly one vertex of triangle **P** is invariant under the combined transformation.

(b) Find one possible column vector for the translation.

( ..... )
( ..... )

**(1)**

**(Total for Question 18 is 3 marks)**

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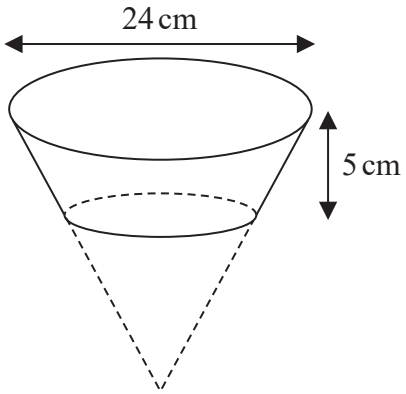
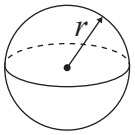
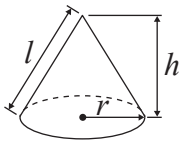
**19**




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

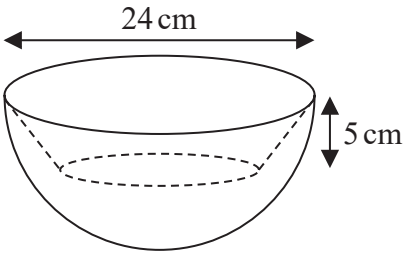



Volume of cone = $\frac{1}{3}\pi r^2 h$




The diagram above shows a frustum **F** of a cone.
The frustum is made by removing a cone with height 10 cm from a solid cone with height 15 cm and base diameter 24 cm.

The solid **S** is made by removing **F** from a solid hemisphere as shown in the diagram below.




The hemisphere has diameter 24 cm.

Calculate the volume of solid **S**.
Give your answer correct to 3 significant figures.

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..... $cm^3$

**(Total for Question 19 is 4 marks)**

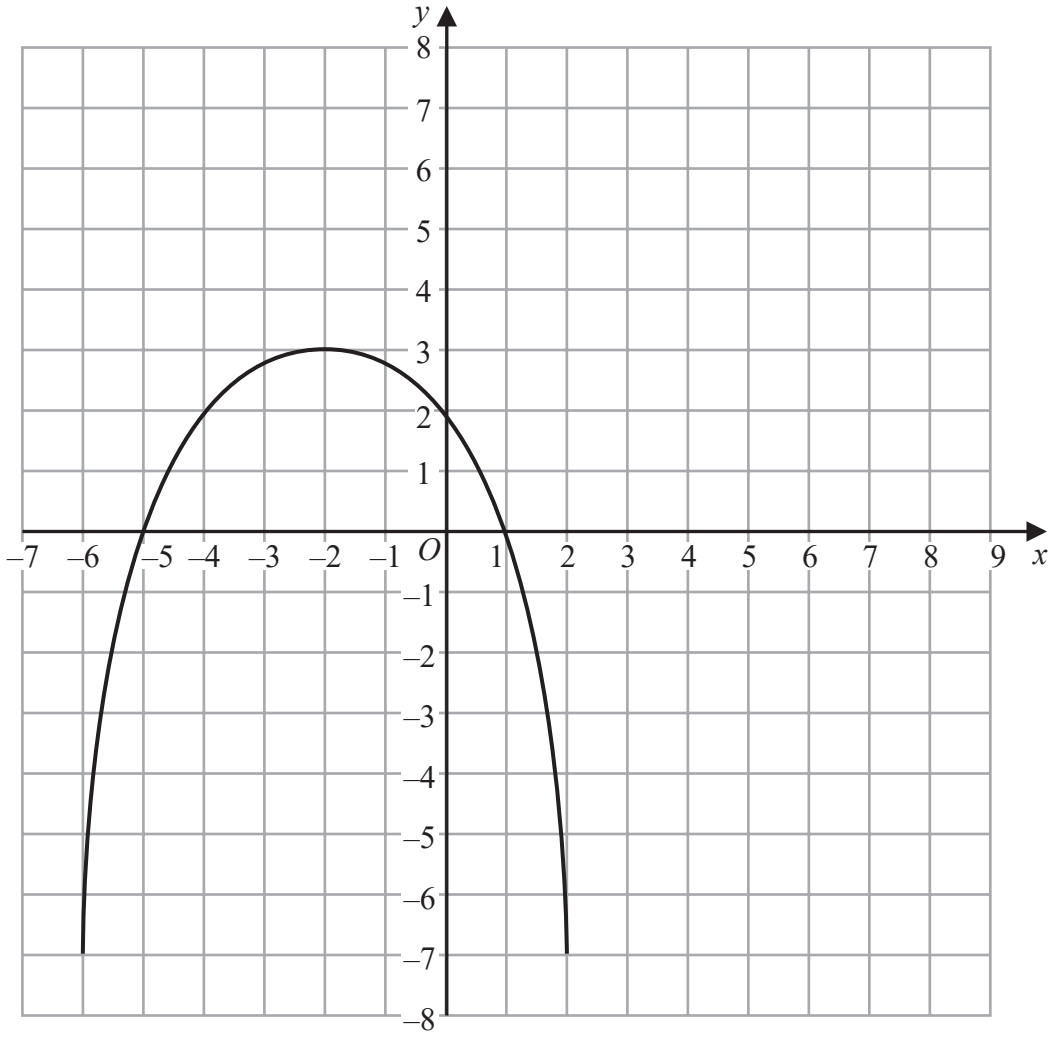
**20** The turning point on the graph of $y = g(x)$ has coordinates $(-3, 6)$

(a) Write down the coordinates of the turning point on the graph of $y = g(x - 7)$

(.....  , .....)

**(1)**

The graph of $y = f(x)$ is shown on the grid.




(b) On the grid, sketch the graph of $y = f(-x) + 3$

**(2)**

**(Total for Question 20 is 3 marks)**

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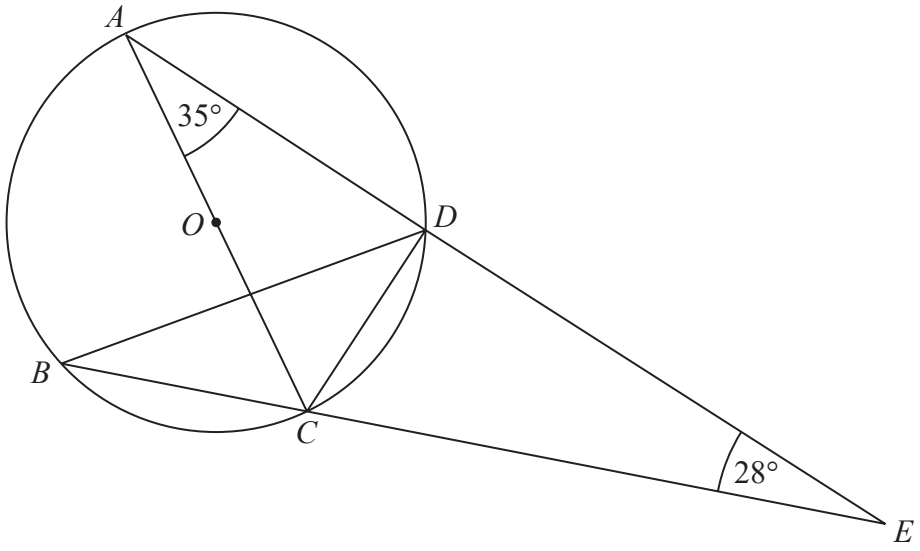
**21**




*A*, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
*AC* is a diameter of the circle.

*ADE* and *BCE* are straight lines.

Work out the size of angle *BDC*.
Write down any circle theorems that you use.

°

**(Total for Question 21 is 4 marks)**

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**22** Ebony makes some bracelets to sell.

The materials to make all the bracelets cost £190, correct to the nearest £5
Ebony sells all the bracelets for a total of £875, correct to the nearest £5

The total time taken to make and sell all these bracelets was 72 hours, correct to the nearest hour.

Ebony uses this method to calculate her hourly rate of pay

$$\text{Hourly rate of pay} = \frac{\text{total selling price} - \text{total cost of materials}}{\text{total time taken}}$$

The minimum hourly rate of pay for someone of Ebony's age is £8.20

By considering bounds, determine if Ebony's hourly rate of pay was definitely more than £8.20
You must show all your working.

**(Total for Question 22 is 4 marks)**

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**23** Given that $\frac{2x^2 + y^2}{4x^2 - y^2} = \frac{43}{11}$ where $x > 0$ and $y > 0$

find, in its simplest form, the ratio $x : y$

.....

**(Total for Question 23 is 4 marks)**

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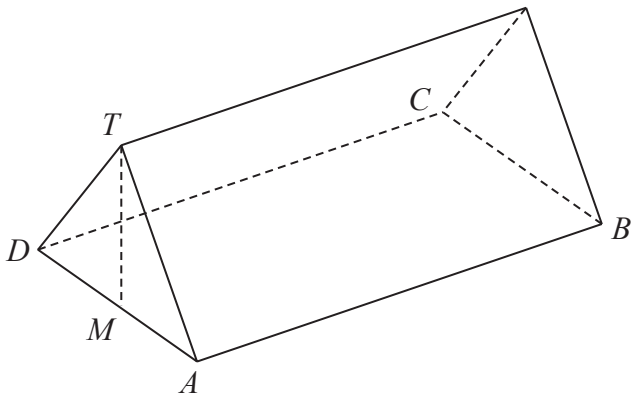
**24** The diagram shows a triangular prism with a horizontal rectangular base $ABCD$.




$M$ is the midpoint of $AD$.
The vertex $T$ of the prism is vertically above $M$.

$AB = 14.7\,\text{cm}$ $BC = 3.8\,\text{cm}$ $MT = 2.3\,\text{cm}$

$P$ is the point on $AB$ such that

$$AP : PB = 5 : 2$$

Calculate the size of the angle between $TP$ and the base $ABCD$ of the prism.
Give your answer correct to 1 decimal place.

.....°

**(Total for Question 24 is 4 marks)**

**TOTAL FOR PAPER IS 80 MARKS**

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# Pearson Edexcel GCSE (9–1) Mathematics

## Monday 13 November 2023 – Morning

Syllabus reference **1MA1/3H**

# Mathematics

**PAPER 3 (Calculator)**
**Higher Tier**

**Formulae Sheet**
**Do not return this Sheet with the question paper.**

*Turn over* ▶

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## Higher Tier Formulae Sheet

### Perimeter, area and volume

Where $a$ and $b$ are the lengths of the parallel sides and $h$ is their perpendicular separation:

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

Volume of a prism = area of cross section × length

Where $r$ is the radius and $d$ is the diameter:

Circumference of a circle = $2\pi r = \pi d$

Area of a circle = $\pi r^2$

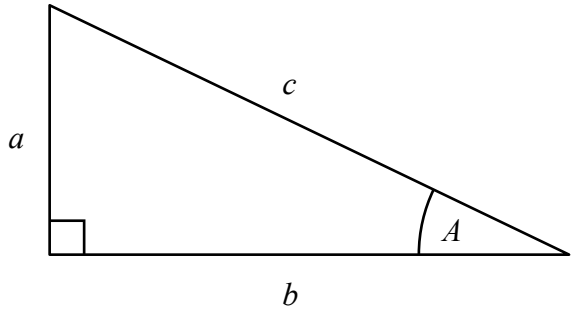
### Quadratic formula

The solution of $ax^2 + bx + c = 0$

where $a \neq 0$

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

### Pythagoras' Theorem and Trigonometry

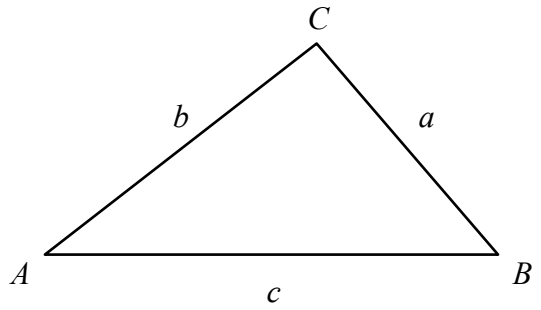



In any right-angled triangle where $a$, $b$ and $c$ are the length of the sides and $c$ is the hypotenuse:

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

In any right-angled triangle $ABC$ where $a$, $b$ and $c$ are the length of the sides and $c$ is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$




In any triangle $ABC$ where $a$, $b$ and $c$ are the length of the sides:

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 = $\frac{1}{2}\,a\,b \sin C$

### Compound Interest

Where $P$ is the principal amount, $r$ is the interest rate over a given period and $n$ is number of times that the interest is compounded:

Total accrued = $P\left(1 + \frac{r}{100}\right)^n$

### Probability

Where P ($A$) is the probability of outcome $A$ and P ($B$) is the probability of outcome $B$:

P ($A$ or $B$) = P ($A$) + P ($B$) – P ($A$ and $B$)

P ($A$ and $B$) = P ($A$ given $B$) P($B$)

**END OF EXAM AID**