



Please write clearly in block capitals.

Centre number

Candidate number

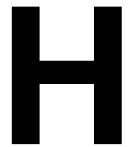
Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS



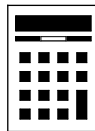
Higher Tier Paper 2 Calculator

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24	
TOTAL	

Advice

In all calculations, show clearly how you work out your answer.



JUN2283002H01

Answer **all** questions in the spaces provided.

1 Circle the fraction that is equal to 1.25%

[1 mark]

$$\frac{1}{8}$$

$$\frac{1}{25}$$

$$\frac{1}{80}$$

$$\frac{1}{125}$$

2 Circle the expression that means the probability of A and **not** B.

[1 mark]

$$P(A' \cup B)$$

$$P(A \cup B')$$

$$P(A' \cap B)$$

$$P(A \cap B')$$

3 Circle the triangular number.

[1 mark]

9

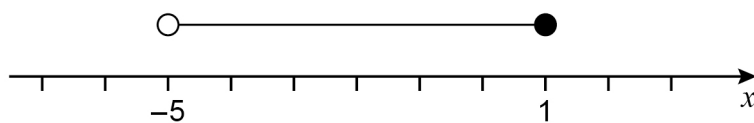
12

15

18



- 4 Circle the inequality represented by the diagram.



[1 mark]

$$-5 < x < 1$$

$$-5 < x \leq 1$$

$$-5 \leq x < 1$$

$$5 \leq x \leq 1$$

①

- 5 Solve $5(2x - 1) = 6x + 9$

[3 marks]

$$10x - 5 = 6x + 9$$

$$10x - 6x = 9 + 5$$

$$4x = 14$$

$$x = \frac{14}{4} = 3.5$$

$$x = 3.5$$



- 6 Show that 2125 can be written as
a cube number **multiplied** by a prime number between 10 and 20

[2 marks]

prime number : 11, 13, 17, 19

2125 is only divisible by 17.

$$2125 \div 17 = 125$$

$$\sqrt[3]{125} = 5 \quad (2)$$

$$\therefore 5^3 \times 17 = 2125$$

- 7 Sam types a constant number of words per minute.
He takes 8 minutes to type a report of 416 words.
How long does it take him to type an essay of 1534 words?
Give your answer in minutes and seconds.

[3 marks]

$$\frac{416}{8} = 52 \text{ words per minutes} \quad (1)$$

$$\frac{1534}{52} = 29.5 \text{ minutes} \quad (1)$$

$$= 29 \text{ mins } 30 \text{ seconds}$$

(1)

Answer 29 minutes 30 seconds



- 8 A school play takes place each day from Monday to Friday.
Here are the attendances on four of the days.

Monday	Tuesday	Wednesday	Thursday
72	83	88	97

For all **five** days, the mean attendance is 90

Work out the attendance on Friday.

[3 marks]

$$\text{Total attendance} = 90 \times 5 = 450 \quad (1)$$

$$\text{Friday} = 450 - (72 + 83 + 88 + 97)$$

$$= 450 - 340 \quad (1)$$

$$= 110 \quad (1)$$

Answer 110

Turn over for the next question



- 9 Rosie makes phone calls to try to sell broadband.
Today, she made 120 calls.
The table shows the results.

Result of call	Frequency
Not answered	33
Answered but sale not made	81
Answered and sale made	6

- 9 (a) Write down the relative frequency that a call was **not answered**.

[1 mark]

Answer $\frac{33}{120}$ (1)

- 9 (b) During the **rest of the week**, Rosie will make 500 calls.

Using the results in the table, how many sales does she expect to make during the **rest of the week**?

[2 marks]

$\frac{6}{120} \times 500 = 25$ (1)

Answer 25



10

Harry and Ellie each bought a printer and a hard drive.

Here is some information about how much they paid.

	Printer	Hard drive
Harry	£80	£25
Ellie	10% less than Harry	20% more than Harry

Ellie says,

“In total, I paid more than Harry because 20% is greater than 10%”

Is she correct?

Tick a box.

Yes

No



Show calculations to support your answer.

[2 marks]

Ellie :

$$\text{printer} = \frac{90}{100} \times 80 = 72$$

$$\text{hard drive} = \frac{120}{100} \times 25 = 30$$

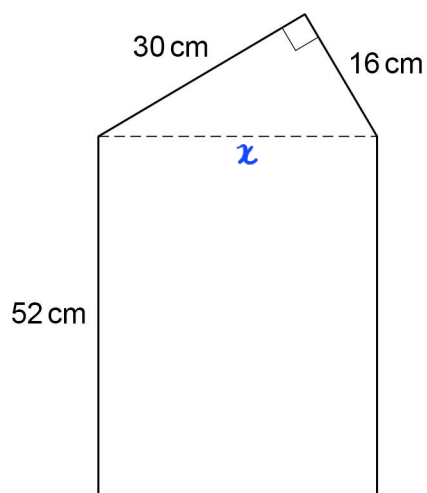
$$\text{Total} = 72 + 30 = 102$$



$$\text{Harry} : 80 + 25 = 105$$



- 11 A shape is made by joining a right-angled triangle to a rectangle.



Not drawn
accurately

Work out the area of the shape.

[5 marks]

$$x^2 = 30^2 + 16^2$$

$$= 900 + 256 \quad (1)$$

$$= 1156$$

$$x = \sqrt{1156} = 34 \quad (1)$$

$$\text{Area of triangle} : \frac{1}{2} \times 30 \times 16 = 240 \quad (1)$$

$$\text{Area of rectangle} : 52 \times 34 = 1768 \quad (1)$$

$$\text{Total} : 240 + 1768 = 2008 \quad (1)$$

Answer 2008 cm²



12

$$4y = 5x$$

Which statement is correct?

Tick **one** box.

$$y = \frac{5}{4}x$$

$$x = \frac{4}{5}y$$

[1 mark]

 y is 80% of x

①

 y is 125% of x x is 20% of y x is 400% of y

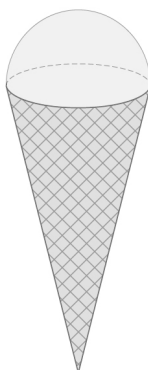
Turn over for the next question

6

Turn over ►



- 13 Outside a cafe there is a large plastic ice cream cornet.
The cornet is a hemisphere on top of a cone.



The cone and the hemisphere each have radius 24 cm

The cone has perpendicular height 117 cm

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

r is the radius

h is the perpendicular height

$$\text{Volume of a hemisphere} = \frac{2}{3} \pi r^3$$

r is the radius

- 13 (a) Work out the total volume of the cornet.

[4 marks]

$$\text{Volume of a cone} = \frac{1}{3} \times \pi \times 24^2 \times 117 = 22\,464 \pi$$

(1)

$$\text{Volume of a hemisphere} = \frac{2}{3} \times \pi \times 24^3 = 9\,216 \pi$$

(1)

$$\text{Total volume} : 22\,464 \pi + 9\,216 \pi = 31\,680 \pi$$

(1)

$$31\,680 \times 3.142 \dots = 99\,538 \dots$$

Answer 99 538 (1) cm³



- 13 (b) The actual cornets that the cafe sells are **similar** to the plastic one.
For the actual cornets, the cone and the hemisphere each have radius 2 cm

How many times greater is the volume of the plastic cornet than an actual cornet?

[3 marks]

$$\text{Scale factor of radius : } \frac{24}{2} = 12$$

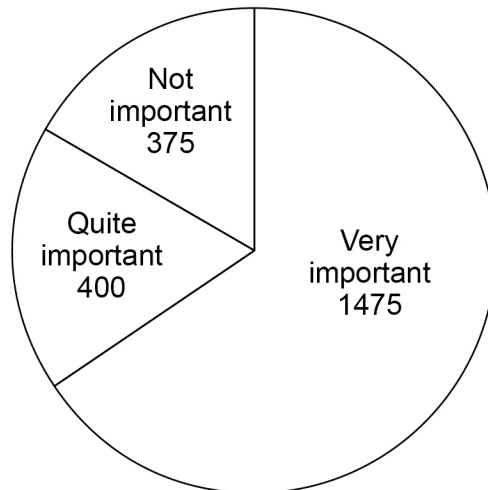
$$\text{Scale factor of volume : } 12^3 = 1728$$

Answer 1728

Turn over for the next question



- 14 A survey was held in a football stadium.
A sample of the crowd was asked about the importance of a family area.
The pie chart represents the answers.



- 14 (a) The total number of people in the crowd was 29 250
Estimate how many people in the crowd think that a family area is **very important**.
Assume that the sample is representative of the crowd.

[3 marks]

$$\text{Total sample} = 375 + 400 + 1475 = 2250 \quad (1)$$

$$\frac{1475}{2250} \times 29\,250 = 19\,175 \quad (1)$$

Answer 19 175 (1)



14 (b) In fact,

50% of the **sample** were sitting in the family area

10% of the **crowd** were sitting in the family area.

What is this likely to mean about the actual number of people in the crowd who think that a family area is very important?

Tick **one** box.

[1 mark]

It is larger than the answer to part (a)

It is the same as the answer to part (a)



It is lower than the answer to part (a)

15 In the grid, the **product** of each row, column and diagonal is 1

8	$\frac{1}{4}$	$\frac{1}{2}$
$\frac{1}{16}$	1	16
2	4	$\frac{1}{8}$

Complete the grid.

[2 marks]



- 16** Amol owns a sandwich shop.
The shop is open from Monday to Saturday.
In June, Amol sold 3000 sandwiches.

- 16 (a)** Amol wants to work out the mean number of sandwiches he sold per day in June.
His method is $3000 \div 30 = 100$
Make **one** criticism of Amol's method.

[1 mark]

The shop is open less than 30 days.

- 16 (b)** Amol received £6660 from selling the 3000 sandwiches in June.
The numbers of sandwiches sold were in the ratio
meat : cheese : vegan = 9 : 4 : 7

The price of a meat sandwich is £2.39

The price of a cheese sandwich is £1.89

Work out the price of a vegan sandwich.

[4 marks]

$$\text{Total ratio} : 9 + 4 + 7 = 20$$

$$\text{Meat sold} : \frac{9}{20} \times 3000 = 1350$$

$$\text{cheese sold} : \frac{4}{20} \times 3000 = 600$$

$$\text{vegan sold} : \frac{7}{20} \times 3000 = 1050$$

$$\text{Sales from meat} = 1350 \times 2.39 = 3226.50$$

$$\text{Sales from cheese} = 600 \times 1.89 = 1134$$

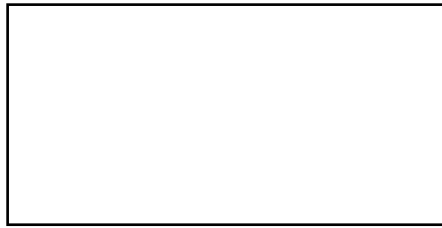
$$\text{Sales from vegan} = 6660 - 3226.50 - 1134 = 2299.50$$

$$\begin{aligned} \text{Price of a vegan sandwich} &= 2299.50 \div 1050 \\ &= 2.19 \end{aligned}$$

Answer £ 2.19



17 Here is the plan of a solid.



Circle the solid that it could be.

[1 mark]

sphere

cone

hemisphere

cylinder

(1)

18 Solve $x^2 + 7x - 11 = 0$

Give your solutions as decimals.

[2 marks]

$$x = \frac{-7 \pm \sqrt{7^2 - 4(1)(-11)}}{2(1)}$$

(1)

$$= \frac{-7 \pm \sqrt{93}}{2}$$

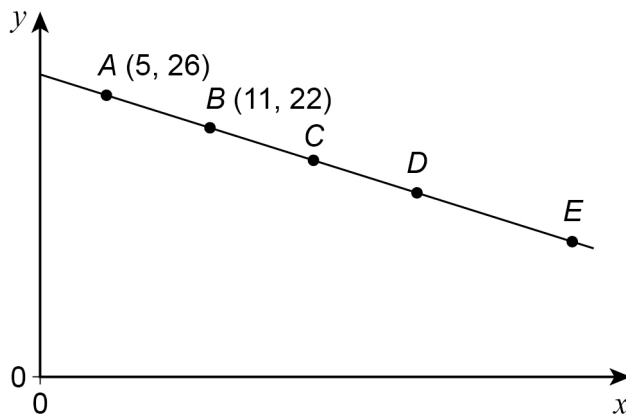
$$= 1.32\dots \text{ or } -8.32\dots$$

(1)

Answer 1.32... and -8.32...



- 19 A, B, C, D and E are points on a straight line.



Not drawn
accurately

A, B, C and D are equally spaced.

$$AD : DE = 2 : 1$$

Work out the coordinates of E.

[3 marks]

$$C : (11+6, 22-4) = (17, 18)$$

$$D : (17+6, 18-4) = (23, 14)$$

$$A \text{ to } D : x = +18$$

$$y = -12$$

$$D \text{ to } E : x = +9$$

$$y = -6$$

$$E : (23+9, 14-6) = (32, 8)$$

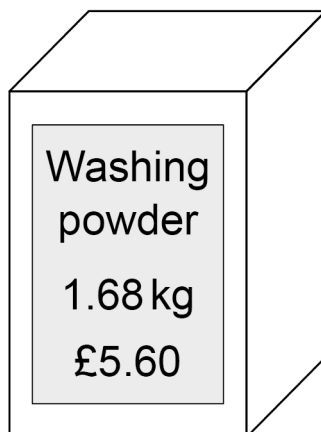
Answer (32 , 8)

(3)



20

A company makes and sells boxes of washing powder.



The company wants to increase the amount of money it receives **per kg** of powder.

To get the required increase it can

increase the price to £5.88

or

reduce the mass of powder in the box by $x\%$

Work out the value of x to 2 decimal places.

[4 marks]

$$\text{increased price per kg} : \frac{5.88}{1.68} = \text{£}3.5 \text{ per kg} \quad (1)$$

$$\text{reduced mass} : \frac{\text{£}5.60}{\text{£}3.50/\text{kg}} = 1.6 \text{ kg} \quad (1)$$

$$\frac{1.68 - 1.60}{1.68} \times 100\% \quad (1)$$

$$= \frac{0.08}{1.68} \times 100\%$$

$$= 4.76\% \quad (1)$$

$$x = \underline{\quad 4.76 \quad}$$



- 21 Which of these is the equation of a circle?
Circle your answer.

[1 mark]

$x^2 - y^2 = 6$

$x^2 + y^2 = 6$

$y = x^2 - 6$

$y = x^2 + 6$

①

- 22 Circle the reciprocal of 8^5

[1 mark]

8^{-5}

①

5^{-8}

-8^5

5^8

- 23 Factorise $3x^2 - 16x - 12$

[2 marks]

$$x = \frac{16 \pm \sqrt{(-16)^2 - 4(3)(-12)}}{2(3)}$$

$$= \frac{16 \pm \sqrt{400}}{6} = \frac{16 \pm 20}{6} = 6 \text{ or } -\frac{2}{3}$$

$$\cdot (x - 6)(3x + 2)$$

Answer _____

$$(3x + 2)(x - 6)$$

②



24

A straight line \rightarrow line 1
is perpendicular to the straight line through (2, 8) and (6, 15) \rightarrow line 2
and
passes through (0, 9) and (x, 17)

Work out the value of x.

[4 marks]

$$\text{gradient of line 2} : \frac{15-8}{6-2} = \frac{7}{4} \quad (1)$$

$$\text{gradient of line 1} : (-1) \frac{1}{\frac{7}{4}} = -\frac{4}{7} \quad (1)$$

$$\frac{17-9}{x} = -\frac{4}{7}$$

$$8(7) = -4x$$

$$56 = -4x \quad (1)$$

$$x = -14 \quad (1)$$

$$x = \underline{\quad -14 \quad}$$



25

$$f(x) = 2x + 5$$

Show that $3f(x) - 12f^{-1}(x)$ simplifies to an integer.

[4 marks]

$$\text{let } f(x) = y$$

$$y = 2x + 5$$

$$y - 5 = 2x \quad (1)$$

$$x = \frac{y - 5}{2}$$

$$f^{-1}(x) = \frac{x - 5}{2} \quad (1)$$

$$\therefore 3(2x + 5) - 12\left(\frac{x - 5}{2}\right) \quad (1)$$

$$= 6x + 15 - 6x + 30$$

$$= 45 \quad (1)$$



26 Two objects, J and K, are applying pressure to areas of ground.

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

For J, the force is 18.9 newtons and the area is 0.45 m^2

$$\text{pressure for J} : \text{pressure for K} = 7 : 8$$

$$\text{area for J} : \text{area for K} = 9 : 5$$

Work out the force for K.

[4 marks]

$$\text{pressure of J} : \frac{18.9}{0.45} = 42 \quad (1)$$

$$\text{pressure of K} : \frac{42}{7} \times 8 = 48 \quad (1)$$

$$\text{Area of K} : \frac{0.45}{9} \times 5 = 0.25 \quad (1)$$

$$\text{Force of K} : 48 \times 0.25$$

$$= 12 \quad (1)$$

Answer 12 newtons



27

To be rented, a bedroom must have a floor area of at least 6.51 m^2

A bedroom has a rectangular floor.

The floor measures 2.4 m by 2.9 m , each correct to 2 significant figures.

Show that the bedroom can be rented.

[3 marks]

$$L_B = 2.35 \text{ and } 2.85 \quad (1)$$

$$U_B = 2.45 \text{ and } 2.95$$

$$\text{lowest possible area} = 2.35 \times 2.85 \quad (1)$$

$$= 6.6975 \quad (1)$$

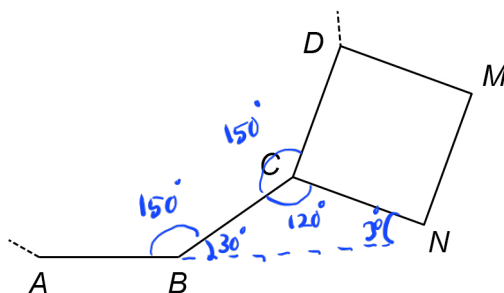


28

AB , BC and CD are sides of a regular 12-sided polygon.

$CDMN$ is a square.

Not drawn
accurately



Prove that points A , B and N lie on a straight line.

[4 marks]

$$\text{Interior angle} = 180 - \frac{360}{12} = 150^\circ \quad (1)$$

$$ABC + CBN = 180^\circ$$

$$CBN = 180^\circ - 150^\circ = 30^\circ$$

$$DCN = 90^\circ \quad (\text{square has 4 } 90^\circ \text{ angle})$$

$$BCN = 360^\circ - 90^\circ - 150^\circ \quad (1)$$

$$= 120^\circ \quad (\text{angles at a point add up to } 360^\circ)$$

$$BNC = 180^\circ - 120^\circ - 30^\circ \quad (1)$$

$$= 30^\circ \quad (\text{angles in a triangle add up to } 180^\circ)$$

since BCN is an isosceles triangle, $BC = CN = 30^\circ$

ABN is a straight line because $150^\circ + 30^\circ = 180^\circ \quad (1)$

(angles on a straight
line).



29

The equation of a curve is $y = x^2 - 18x + 70$

By completing the square, work out the coordinates of the turning point.

You **must** show your working.**[3 marks]**

$$y = (x-9)^2 - 9^2 + 70$$

$$= (x-9)^2 - 81 + 70$$

$$= (x-9)^2 - 11$$

Answer (9 , -11)**END OF QUESTIONS**

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ANSWER IN THE SPACES PROVIDED**



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Question number	Additional page, if required. Write the question numbers in the left-hand margin.



