

Please write clearly, in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

GCSE MATHEMATICS

H

Higher Tier Paper 3

Exam Date

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- 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.
- 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.

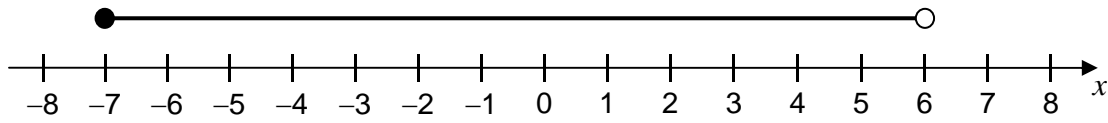
Advice

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

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

- 1 Circle the inequality shown by the diagram.

[1 mark]



$-7 < x < 6$

$-7 \leq x < 6$

$-7 < x \leq 6$

$-7 \leq x \leq 6$

- 2 The probability that a biased coin lands on heads is $\frac{2}{3}$

The coin is spun twice.

Circle the probability of two heads.

[1 mark]

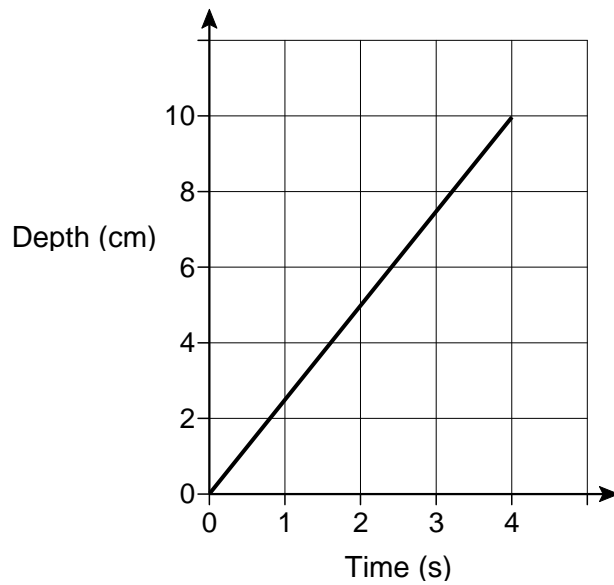
$\frac{2}{9}$

$\frac{4}{6}$

$\frac{4}{9}$

$\frac{4}{3}$

- 3 Water is poured into a glass for 4 seconds.
The graph shows the depth of the water in the glass.



What is the rate of change of the depth of the water?
Circle your answer.

[1 mark]

0.4 cm/s

1.25 cm/s

2.5 cm/s

10 cm/s

- 4 The ratio of $x : y$ is $2 : 3$

Circle the correct statement.

[1 mark]

x is $\frac{2}{3}$ of y

y is $\frac{2}{3}$ of x

x is $\frac{2}{5}$ of y

y is $\frac{3}{5}$ of x

5 Factorise fully $9a^2 - 6a$

[2 marks]

Answer _____

6 Work out the next term of this quadratic sequence.

[2 marks]

4 12 24 40 _____

Answer _____

7 Here is an ordinary dice.



7 (a) Ali is going to throw the dice six times.

He says,

“I will get one of each number.”

Give a reason why he could be wrong.

[1 mark]

7 (b) Lucy throws the dice 50 times.

Her results are shown.

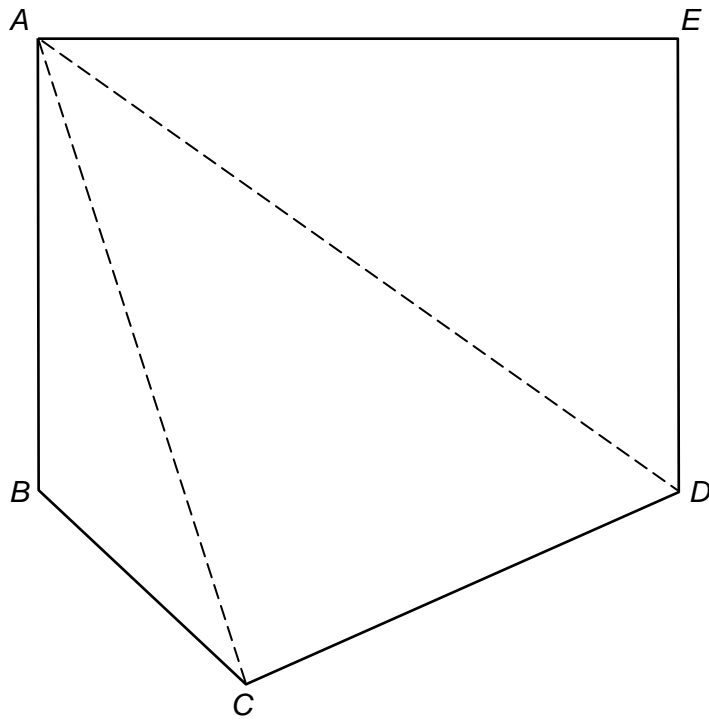
Number thrown	1	2	3	4	5	6
Frequency	7	4	12	5	9	13

Work out the relative frequency of throwing an odd number.

[2 marks]

Answer _____

- 8 Polygon $ABCDE$ is divided into triangles as shown.



Not drawn
accurately

Use the triangles to work out the sum of the interior angles of polygon $ABCDE$.
You **must** show your working.

[2 marks]

Answer _____ degrees

9 In a school, 60% of the students are girls.

50% of the girls walk to school.

20% of the boys walk to school.

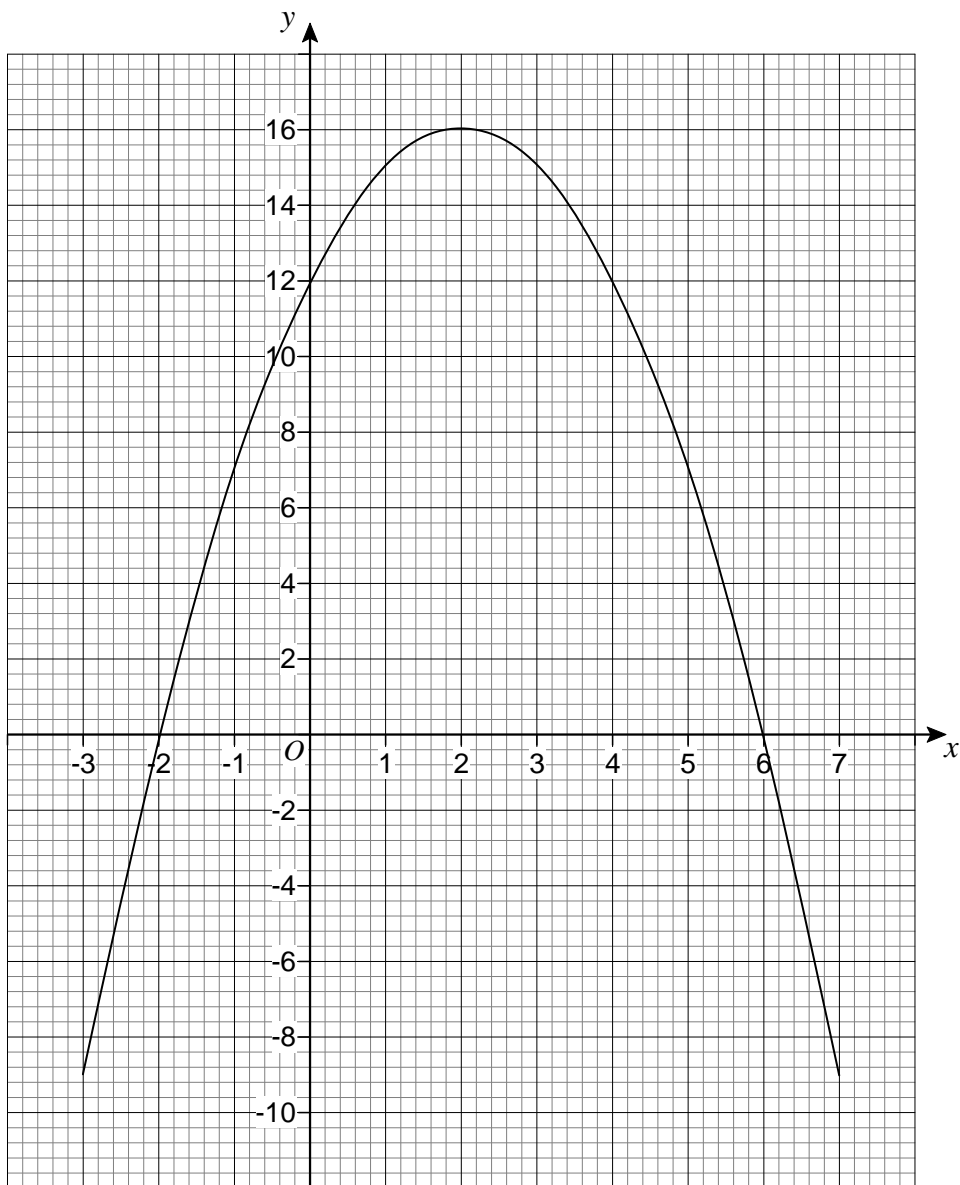
What percentage of the students walk to school?

[3 marks]

Answer _____ %

Turn over for the next question

- 10 The graph $y = a + bx - x^2$ is shown.



- 10 (a) Circle the coordinates of the turning point of the curve.

[1 mark]

(-2, 0)

(0, 12)

(2, 16)

(6, 0)

- 10 (b) Circle the value of a .

[1 mark]

-2

12

16

6

10 (c) Circle the two roots of $a + bx - x^2 = 0$

[1 mark]

-2 and 6

2 and -6

2 and 6

-2 and -6

11 Adam and six other men ran a race.

The times, in seconds, of the six other men are shown.

9.75

9.79

9.80

9.88

9.94

9.98

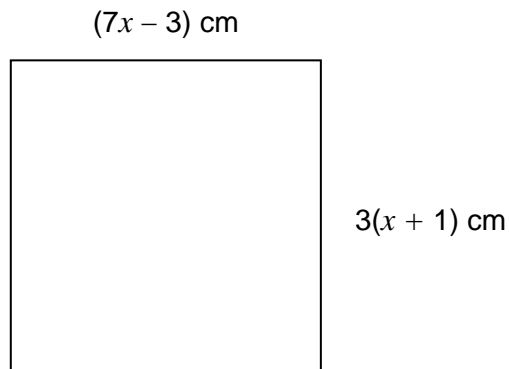
The mean time for **all** seven men was 9.83 seconds.

Did Adam win the race?

You **must** show your working.

[3 marks]

- 12 The diagram shows a square.



Work out the length of one side of the square.

[4 marks]

Answer _____ cm

- 13 A circle has equation $x^2 + y^2 = 4$

Circle the length of its radius.

[1 mark]

2

4

8

16

- 14 a , b and c are **different** prime numbers less than 20

$$a = \sqrt{4b + c}$$

Work out **two** possible sets of values of a , b and c .

[3 marks]

Set 1 $a =$ _____ $b =$ _____ $c =$ _____

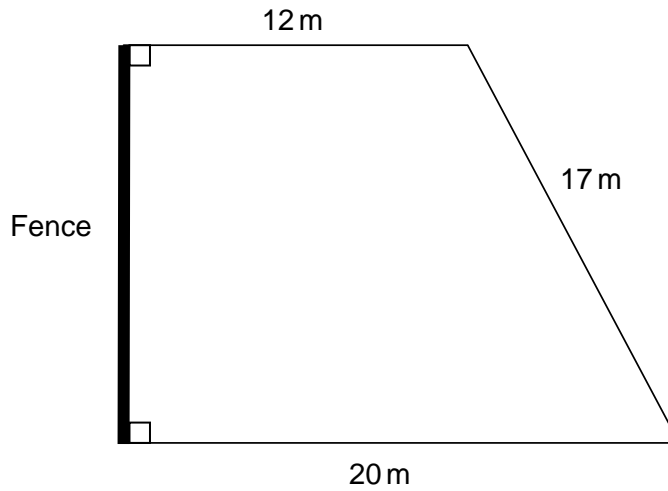
Set 2 $a =$ _____ $b =$ _____ $c =$ _____

- 15 Simplify fully $(8x^3y^5)^2$

[2 marks]

Answer _____

- 16 The diagram shows a lawn with a fence along one edge.



Not drawn accurately

One can of weedkiller covers 90 square metres.

Each can costs £19.25

Work out the total cost of the cans of weedkiller needed to cover the lawn.

[5 marks]

Answer £ _____

17 Expand and simplify $(2x + 5y)(3x - 8y)$

[3 marks]

Answer _____

18 The ratio of the number of boys to girls at a party is 3 : 4
Six boys leave the party.
The ratio of the number of boys to girls at the party is now 5 : 8
Work out the number of girls at the party.

[3 marks]

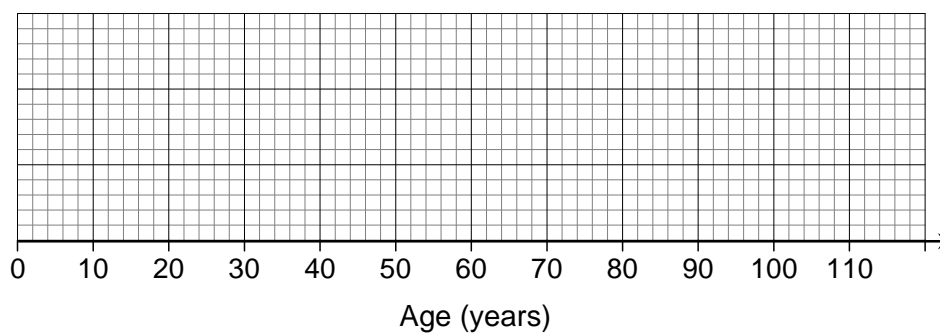
Answer _____

19 In the UK in 2000

25% of the population were under 24 years old
50% of the population were under 37 years old
the inter-quartile range of the ages was 32 years
the oldest person was 107 years old.

19 (a) Show the information on a box plot.

[3 marks]



19 (b) It is predicted that in 2050 the age distribution in the UK will have

lower quartile 26 years

median 44 years

upper quartile 66 years

Make **two** comments about the predicted change in the age distribution in the UK from 2000 to 2050

[2 marks]

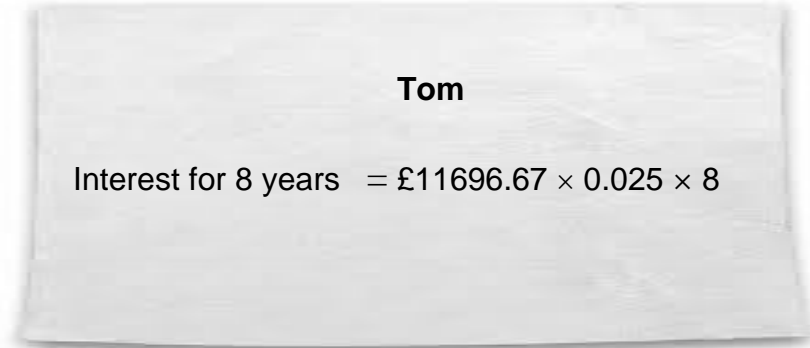
Comment 1 _____

Comment 2 _____

Turn over for the next question

- 20** An amount of money was invested for 8 years.
It earned **compound** interest at 2.5% per year.
After 8 years the total value of the investment was £11 696.67

- 20 (a)** Tom is trying to work out the total interest earned.



State what is wrong with Tom's method.

[1 mark]

- 20 (b)** Work out the total interest earned.

[3 marks]

Answer £ _____

21 Mersenne primes are prime numbers that can be written in the form

$$2^n - 1 \quad \text{where } n \text{ is a whole number.}$$

For example, 3 can be written as $2^2 - 1$

21 (a) Prove that $2^9 - 1$ is **not** a Mersenne prime.

[2 marks]

21 (b) There are Mersenne primes when $n = 5$ and when $n = 7$

Ama says,

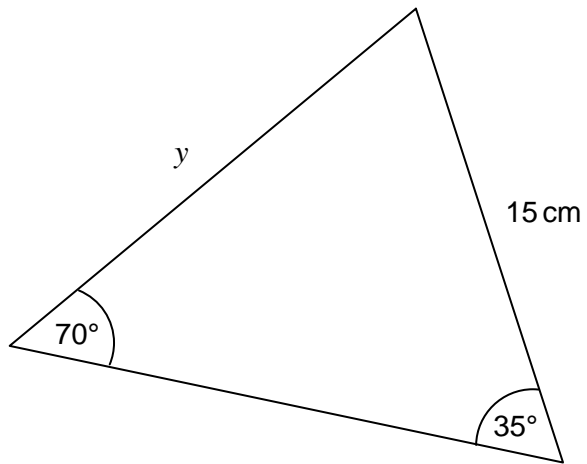
“The ratio of the indices is 5 : 7

This means the ratio of the Mersenne primes is 5 : 7”

Show that Ama is wrong.

[1 mark]

22

Not drawn
accuratelyWork out the value of y .**[2 marks]**

Answer _____ cm

23 $2x^2 - 20x + c \equiv a(x - b)^2 + 3b$

Work out the value of c .

[3 marks]

Answer _____

Turn over for the next question

24

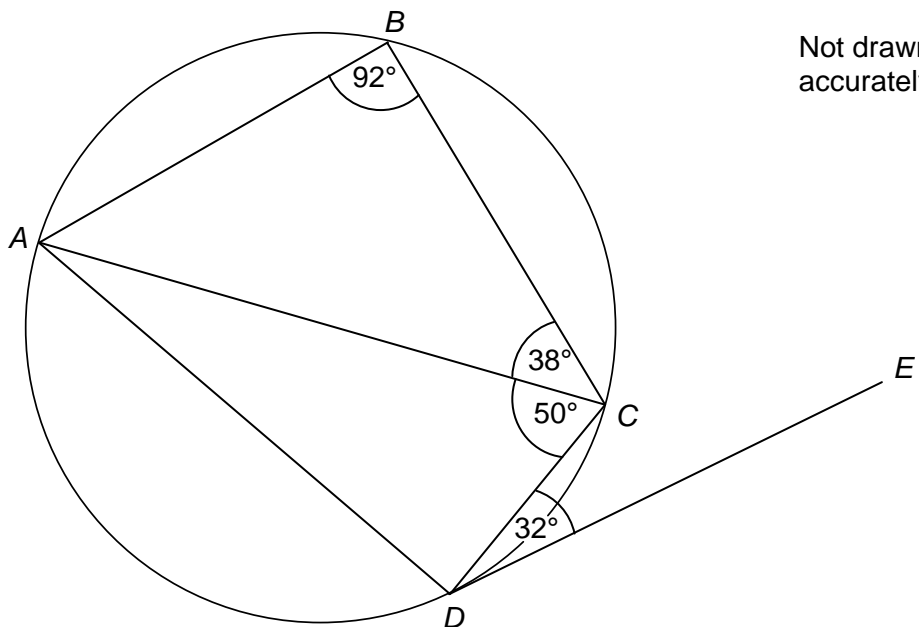
A , B , C and D are points on a circle.

$$\text{Angle } ABC = 92^\circ$$

$$\text{Angle } ACB = 38^\circ$$

$$\text{Angle } ACD = 50^\circ$$

$$\text{Angle } CDE = 32^\circ$$



Tick whether each statement is true or false.

Give a reason for each answer.

[4 marks]

Statement

True

False

AC is a diameter

Reason _____

Statement**True****False**Angle $ADC = 88^\circ$

Reason _____

Statement**True****False** $ABCD$ is a trapezium

Reason _____

Statement**True****False** DE is a tangent to the circle

Reason _____

25 A formula connecting speed (s), distance (d) and time (t) is

$$s = \frac{d}{t}$$

$d = 160$ to 2 significant figures

$t = 7.2$ to 2 significant figures

Work out the upper and lower bounds for s .

Give your answers to 3 significant figures.

[4 marks]

Upper bound _____

Lower bound _____

26 For all values of x , $f(x) = x^2 + 1$ $g(x) = x - 5$

26 (a) Show that $fg(x) = x^2 - 10x + 26$

[2 marks]

26 (b) Solve $fg(x) = gf(x)$

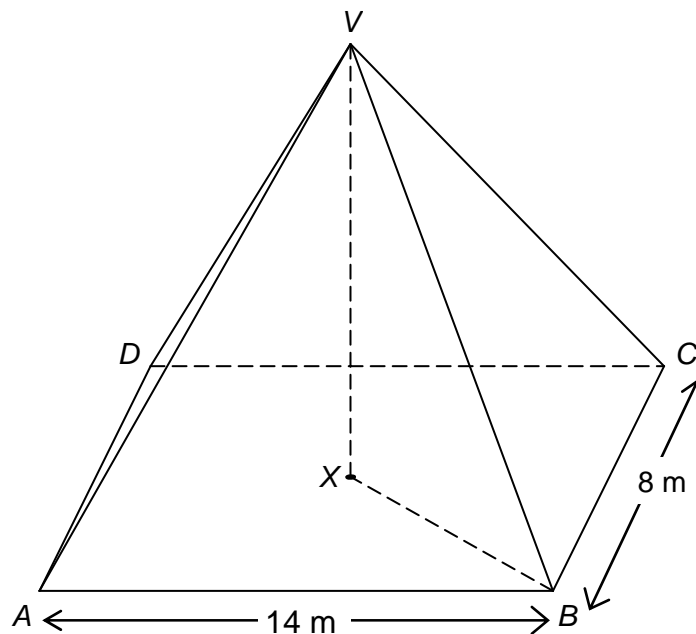
[4 marks]

$x =$ _____

27 Volume of a pyramid = $\frac{1}{3} \times$ area of base \times perpendicular height

$VABCD$ is a rectangular-based pyramid with volume 336 m^3

X is the centre of the horizontal base, directly below V .



Work out the angle between VB and the base.

[6 marks]

Answer _____ degrees

END OF QUESTIONS

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