AQA

Please write clearly, in block capitals.

Centre number [ ][ ][ ][ ][ ]   Candidate number [ ][ ][ ][ ]

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
MATHEMATICS

H

Higher Tier   Paper 3 Calculator

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- mathematical instruments
- a calculator.

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.

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	
TOTAL	

1 The ratio of $x : y$ is $3 : 4$

What fraction of y is x?

[1 mark]

Answer _____

2 The probability that a biased coin lands on heads is $\dfrac{2}{5}$

The coin is spun twice.

Work out the probability of two heads.

[2 marks]

Answer _____

3 Work out the next term of this quadratic sequence.

[2 marks]

5   6   9   14   _____
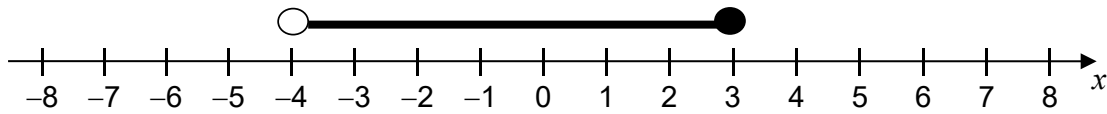
Answer _____

4 Circle the inequality shown by the diagram.

[1 mark]

$-4 < x < 3$ $\qquad$ $-4 \leqslant x < 3$ $\qquad$ $-4 < x \leqslant 3$ $\qquad$ $-4 \leqslant x \leqslant 3$

5 Factorise fully $10a^2 + 25a$

[2 marks]

Answer _____

6 In a school, 60% of the students are senior.

45% of the seniors have school meals.

75% of the juniors have school meals.

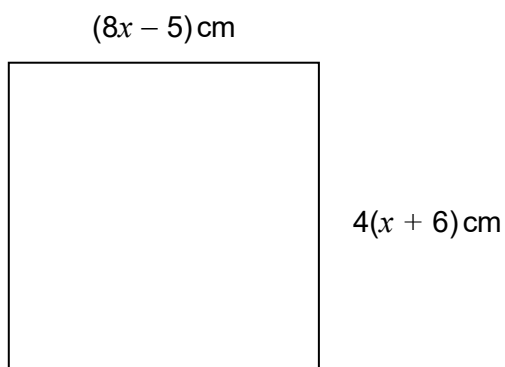What percentage of the students (seniors and juniors) have school meals?

[3 marks]

Answer _____ %

11

Turn over ▶

7 The diagram shows a square.

$(8x - 5)\,\text{cm}$

$4(x + 6)\,\text{cm}$
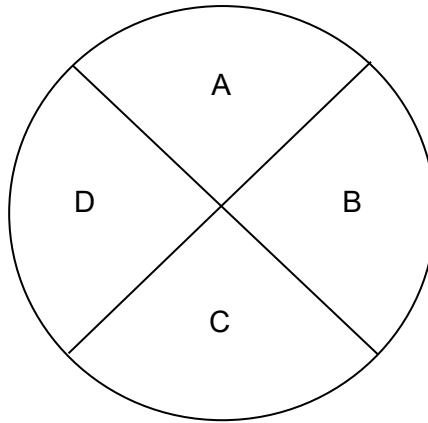
Work out the length of one side of the square.

[4 marks]

Answer _____ cm

8 Here is a fair 4 section spinner.

8 (a) Steven is going to spin the spinner eight times.

He says,

"I will get two of each letter."

Give a reason why he could be wrong.

[1 mark]

_____

_____

8 (b) Charlotte spins the spinner 50 times.
Her results are shown below.

Letter	A	B	C	D
Frequency	20	13	10	7

Work out the relative frequency of not spinning a vowel.

[2 marks]

_____

_____

Answer _____

7

Turn over ▶

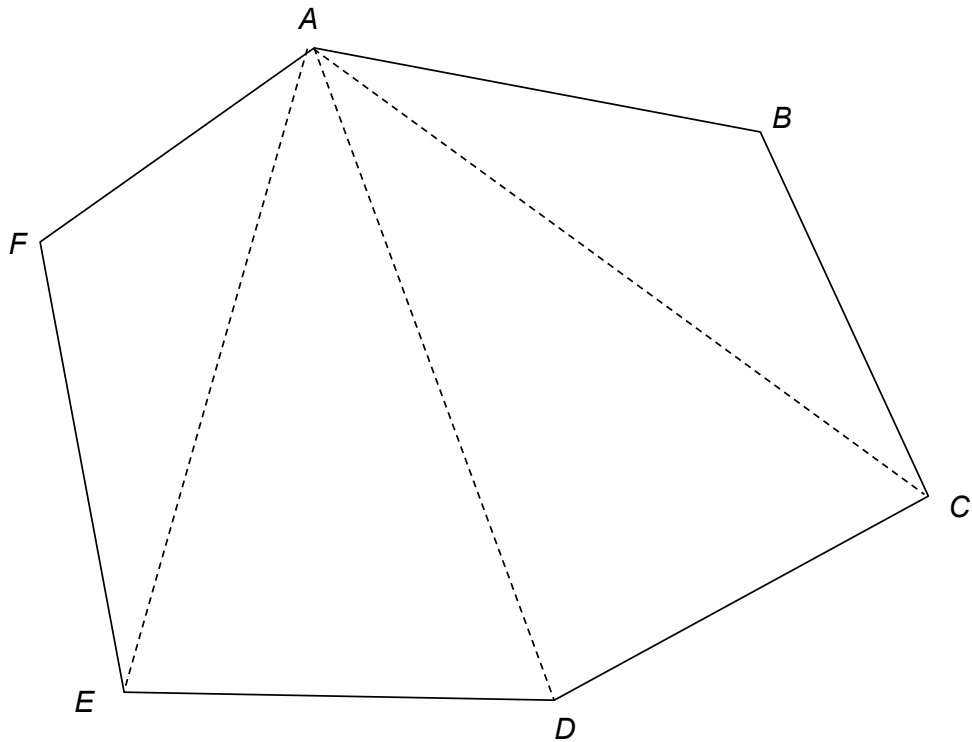**9**   Polygon *ABCDEF* is divided into triangles as shown.

Use the triangles to work out the sum of the interior angles of polygon *ABCDEF*.

You **must** show your working.

[2 marks]
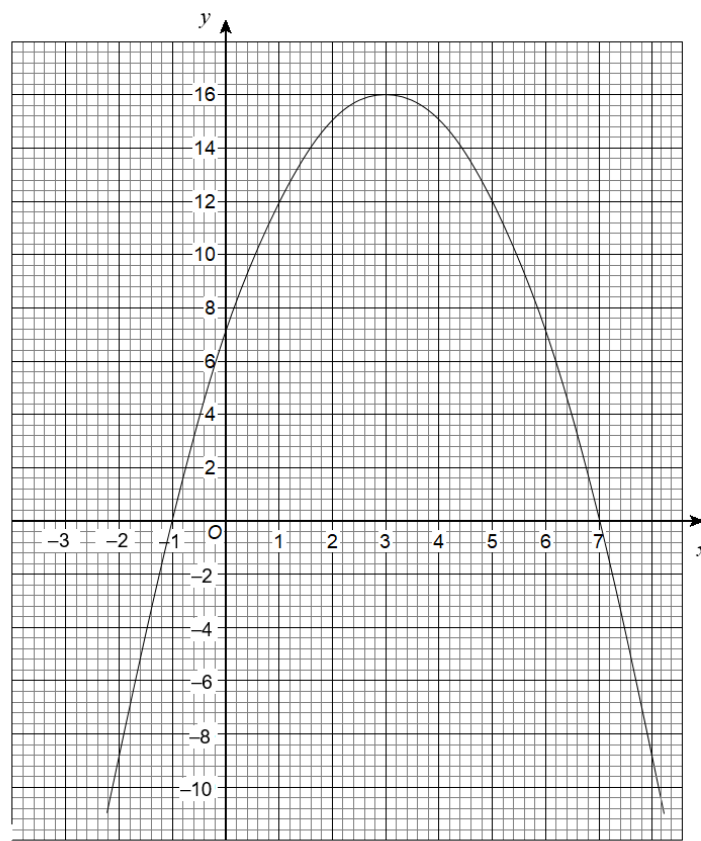
Answer _____ °

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

10 (a) Write down the coordinates of the turning point of the curve.

[1 mark]

Answer (_____ , _____)

10 (b) Write down the value of a

[1 mark]

$a =$ _____

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

[1 mark]

−1 and 7   1 and −7   1 and 7   −1 and −7

5

Turn over ▶

11 Fatimah and four other women threw javelins in a competition.

The distances, in metres, of the four other women are shown.

15.2   15.9   16.1   16.8

The mean distance for **all** five women was 16.04 metres.

Did Fatimah throw the javelin the furthest?

You **must** show your working.

[3 marks]

Yes ☐   No ☐

_____

_____

_____

_____

_____

_____

_____

12 A circle has equation $x^2 + y^2 = 25$

Work out the length of its radius.

[1 mark]

_____

Answer _____

13 (a)   Simplify fully $(2x^4y^{-3})^4$

[2 marks]

Answer _____

13 (b)   Expand and simplify $(3x + 6y)(2x - 7y)$

[3 marks]

Answer _____

14 b and c are **different** prime numbers between 15 and 30. a is an integer.

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

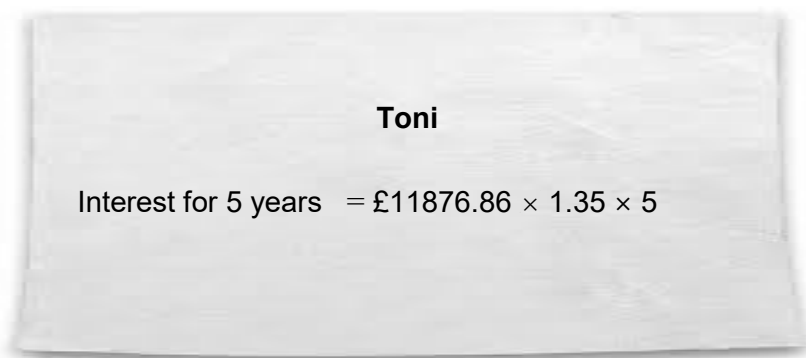Work out a possible set of values for a, b and c

[3 marks]

$a =$ _____ $b =$ _____ $c =$ _____

12

Turn over ▶

15 An amount of money was invested for 5 years.

It earned **compound** interest at 3.5% per year.

After 5 years the total value of the investment was £11876.86

15 (a) Toni is trying to work out the total interest earned.

> **Toni**
>
> Interest for 5 years = £11876.86 × 1.35 × 5

State what is wrong with Toni's method.

[1 mark]

_____

_____

_____

15 (b) Work out the total interest earned.

[3 marks]

_____

_____

_____

_____

_____

Answer £ _____

16 The diagram shows a lawn with a patio along one edge.

16 m

Not drawn accurately

40 m

32 m

1 kg of grass seed covers $2.5\,m^2$ of lawn.
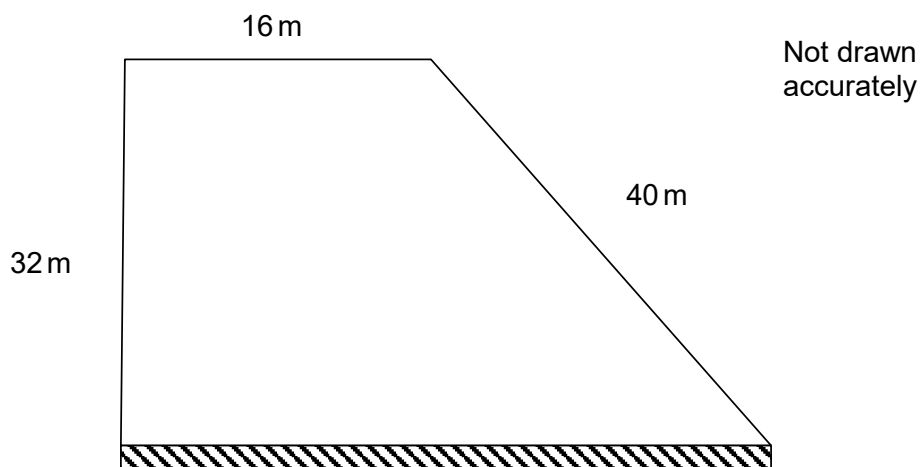
Each 1 kg of grass seed costs £1.20

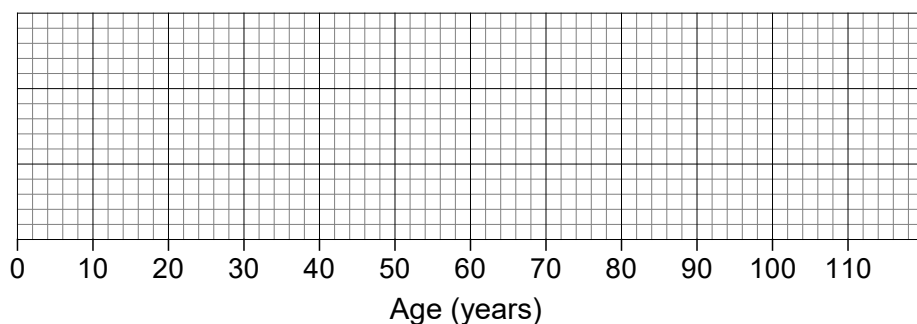Work out the total cost of grass seed needed to cover the lawn.

[5 marks]

Answer £ _____

Turn over ▶

9

17 In the USA in 2020

25% of the population were over 76 years old

50% of the population were under 40 years old

the inter-quartile range of the ages was 51 years

the oldest person was 98 years old.

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

[3 marks]

Age (years)

17 (b) It is predicted that in 2050 the age distribution in the USA will have:

lower quartile	30 years
median	45 years
upper quartile	70 years

Make two comments about the predicted change in the age distribution in the USA from 2020 to 2050

[2 marks]

Comment 1 _____

_____

_____
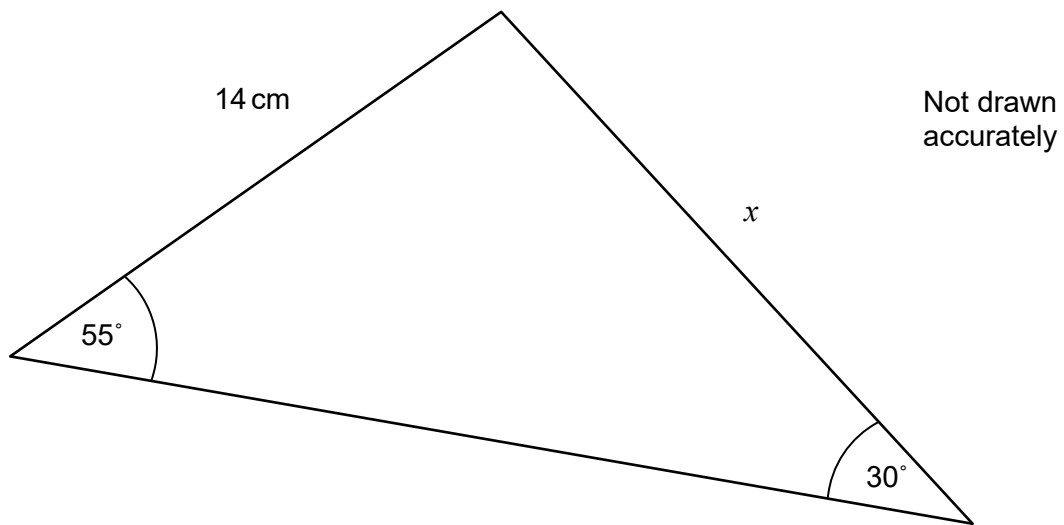
Comment 2 _____

_____

_____

18

14 cm

Not drawn accurately

x

55˚

30˚

Work out the value of x

[2 marks]

Answer _____ cm

Turn over for the next question

Turn over ▶

19 The ratio of the number of adult to junior members at a gym is 7 : 6

Fourteen more juniors join the gym.

The ratio of the number of adults to juniors at the gym is now 7 : 8

Work out the total number of people at the gym.

[3 marks]

Answer _____

20 $3x^2 - 18x + c \equiv a(x - b)^2 - 4b$

Work out the value of c

[3 marks]

$c =$ _____

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

$2^n - 1$ where n is a whole number.

21 (a) Prove that $2^{10} - 1$ is not a Mersenne prime.

[2 marks]

_____

_____

_____

_____

21 (b) There are Mersenne primes when $n = 2$ and when $n = 3$

Joseph says,

    "The ratio of the indices is 2 : 3

     This means the ratio of the Mersenne primes is 2 : 3"

Show that Joseph is wrong.

[1 mark]

_____

_____

_____

_____

_____

Turn over ▶

22 For all values of x, $\quad$ f$(x) = 2x^2 + 3$ $\quad$ g$(x) = x + 4$

22 (a) Show that $\quad$ fg$(x) = 2x^2 + 16x + 35$

[2 marks]

_____

_____

_____

_____

_____

22 (b) Solve $\quad$ fg$(x) = $ gf(x)

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

$x = $ _____

23 A formula connecting density (d), mass (m) and volume (v) is

$$d = m / v$$

d = 200 g/m^3 to 2 significant figures

v = 7.15 m^3 to 3 significant figures

Work out the upper and lower bounds for m

Give your answers to the nearest integer.

[4 marks]

Upper bound _____

Lower bound _____

Turn over for the next question

10

Turn over ▶

24   *A*, *B*, *C* and *D* are points on a circle.
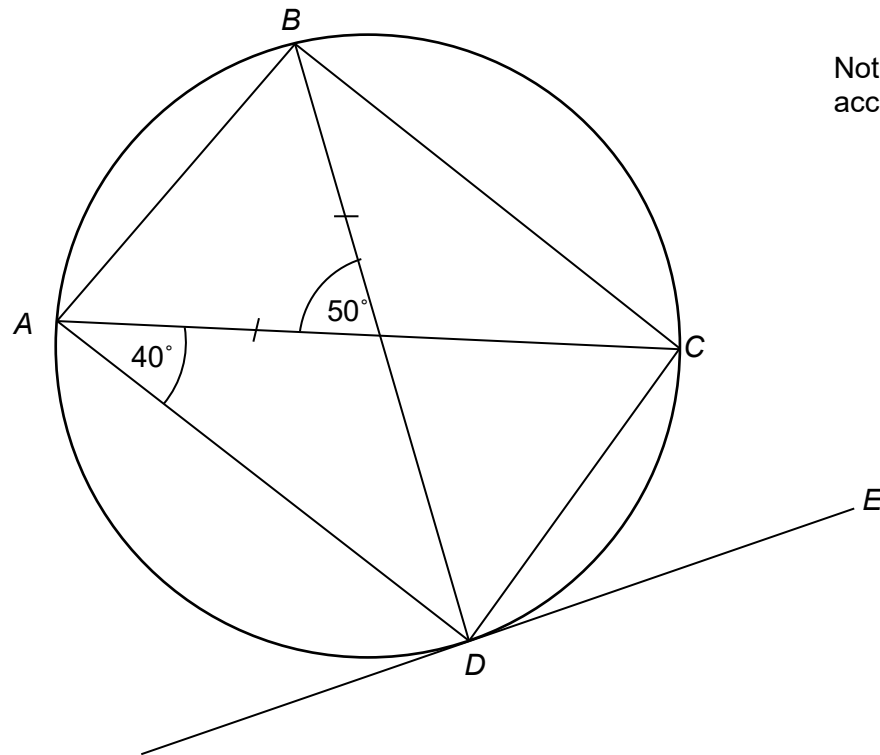
Not drawn
accurately

Tick whether each statement is true or false.

Give a reason for your answer.

[4 marks]

Statement	True	False
AC is a diameter		

Reason
_____

_____

_____

Statement	**True**	**False**
Angle $ADC = 75°$		

Reason _____

_____

_____

Statement	**True**	**False**
Angle $CDE = 40°$		

Reason _____

_____

_____

Turn over for the next question

4

Turn over ▶

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

VABCD is a rectangular-based pyramid with volume 640 cm³

X is the centre of the horizontal base, directly below *V*.
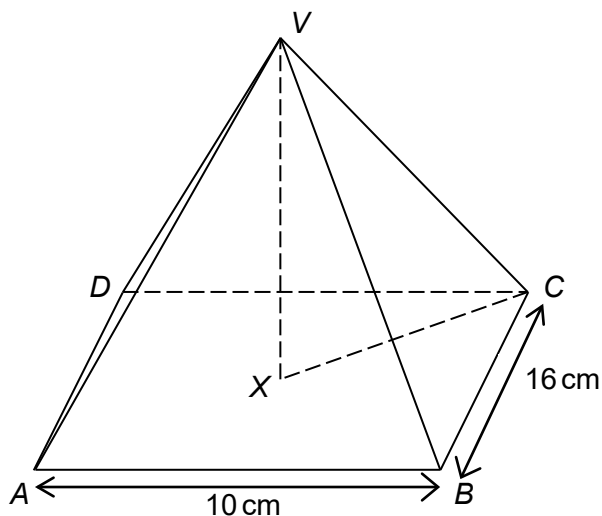
Work out the angle between *VC* and the base.

[6 marks]

Answer _____ °

END OF QUESTIONS

6