For **AQA**

GCSE
Mathematics
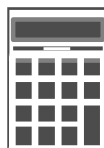# Specification
Paper 3 Higher Tier

H

Churchill Paper 3E

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.
- Write your name and class in the box at the top of the 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.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.

Churchill Maths

Written by Shaun Armstrong

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1   70% of the animals that visit a pet grooming salon are dogs.

75% of the dogs that visit come back within one month.

40% of the other animals that visit come back within one month.

Circle the percentage of all the animals that visit the salon that come back within one month.

[1 mark]

55.5%   64.5%   65.5%   67.5%

2   Circle the equation of a straight line that does **not** intersect the curve $y = x^2$.

[1 mark]

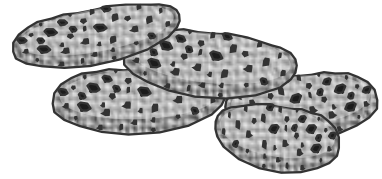$y = 5$ $x = -3$ $y = 2x - 5$ $y = -3x + 1$

3   Here are the ingredients for a recipe to make 30 cookies.

        225 g butter
        110 g caster sugar
        270 g plain flour
        85 g chocolate chips

3   **(a)**   Circle the weight of the raw ingredients in one cookie.

[1 mark]

        15g   17g   19g   23g

3   **(b)**   Jack has 180 g of plain flour and plenty of the other ingredients.

        Circle the number of cookies that Jack could make.

[1 mark]

        15   18   20   24

Here are the prices for the cookie ingredients in Jill's local supermarket.

        Butter   85 p for 250 g
        Caster sugar   £2.45 for 2 kg
        Plain flour   £1 for 1.5 kg
        Chocolate chips   80 p for 100 g

3   **(c)**   Jill is going to make cookies every week. That means she will never waste any of the ingredients that she buys.

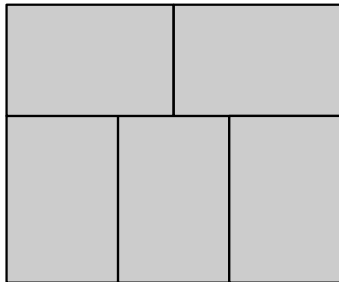   Work out how much the ingredients cost Jill for each cookie she makes.

        Give your answer in pence to 1 decimal place.

[3 marks]

Answer _____ pence

4 Bobby is playing with plastic rectangles.
Each rectangle measures 6 cm by 4 cm.

He takes 5 of the rectangles and arranges them into a larger rectangle like this.

Not drawn
accurately

Bobby then moves two of the rectangles to make a different large rectangle like this.
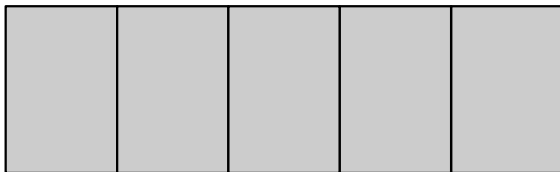
The two larger rectangles have different perimeters.

Work out the percentage change in the perimeter as a result of the change Bobby made.

State clearly whether the change is an increase or decrease.

[3 marks]

Answer _____ %

5
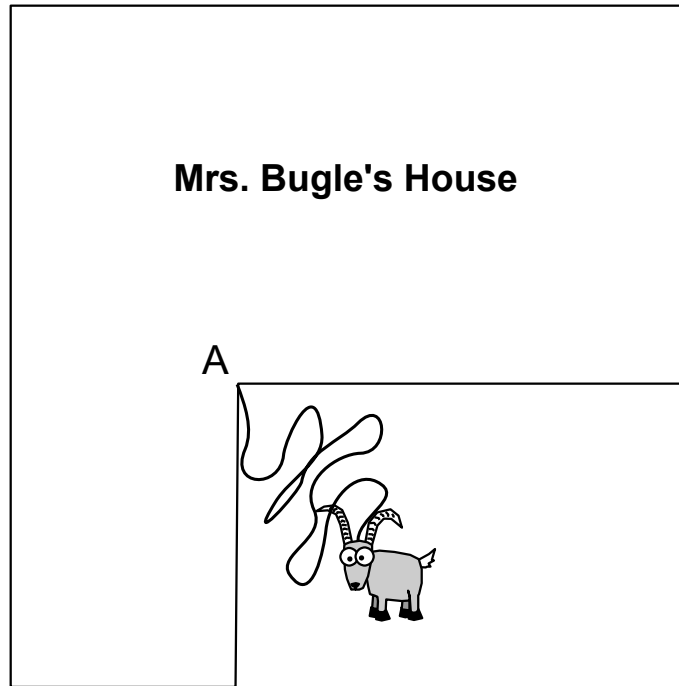
Scale: 1 : 100

The map shows Mrs Bugle's house using a scale of 1 : 100

Mrs. Bugle owns a goat called Billy.
There is grass all around the house which Billy likes to graze on.
However, he is tethered to the corner of the house labelled A by a 10 metre long rope.

Construct the region of grass that Billy is able to reach.

[4 marks]

6 Circle the area that is the same as 20 cm^2

[1 mark]

0.2 m^2 0.02 m^2 0.002 m^2 0.0002 m^2

7 75 students from Year 10 and Year 11 go on a camping trip.

33 of the students are in Year 11.
37 of the students are boys.
13 of the students are boys are in Year 11.

One of the students is chosen at random to be camp leader.

Work out the probability that the student is a Year 10 girl.

[3 marks]

Answer _____

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8 Marketing Fund (£)

The graph shows the amount of money in a charity's marketing fund and the number of days since it launched an appeal.

8 **(a)** How much money was in the marketing fund at the start of the appeal?

[1 mark]

_____

Answer £ _____

8 **(b)** Find the gradient of the graph.

[2 marks]

_____

_____

_____

Answer _____

8 **(c)** Explain what this gradient represents.

[1 mark]

_____

_____

9   Three friends, Ayyub, Bran and Curtis, each have some mini chocolate eggs.

Bran has 1 more egg than Ayyub.
Curtis has 50% more eggs than Bran.

Altogether, Ayyub, Bran and Curtis have 48 chocolate eggs.

Curtis gives eggs to each of Ayyub and Bran so that they all have the same number of eggs.

Work out how many eggs Curtis gives away in total.

[4 marks]

Answer _____

10   Circle the 8th term of this geometric progression.

                16   8   4   2

[1 mark]

        0.25   0.125   0.0625   0.0001

11 Circle the expression that is equivalent to $\dfrac{x^2 - 6x + 9}{2x - 6}$

[1 mark]

$\dfrac{x^2 + 9}{2}$ $x^2 - 8x + 15$ $\dfrac{x - 15}{2}$ $\dfrac{x - 3}{2}$

12 (a) Explain why the median of five odd numbers will always be an odd number.

[1 mark]

_____

_____

_____

_____

12 (b) Pat says

   "The mean of five even numbers is always an even number."

Is she correct?

You must justify your answer.

[2 marks]

_____

_____

_____

_____

Answer _____

13 John and Gemma are asked to solve the equation $x(x + 4) = x + 10$

13 **(a)** Here is John's working.

$$x(x + 4) = x + 10$$

$$x = \frac{x + 10}{x + 4}$$

$$x = \frac{\cancel{x} + 10}{\cancel{x} + 4}$$

$$x = \frac{10}{4}$$

$$x = 2.5$$

John has made a mistake.

Circle his mistake and **explain why** it is a mistake.

[2 marks]

13 **(b)** Here is Gemma's working.

$$x(x + 4) = x + 10$$

$$x^2 + 4 = x + 10$$

$$x^2 - x - 6 = 0$$

$$(x + 3)(x - 2) = 0$$

$$x = -3 \text{ or } 2$$

Describe the mistake or mistakes in her working.

[2 marks]

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13 **(c)** Solve the equation $x(x + 4) = x + 10$

[2 marks]

Answer _____

14 p and q are both prime numbers.

14 **(a)** Faruq says "$2p + 1$ will always be a prime number".

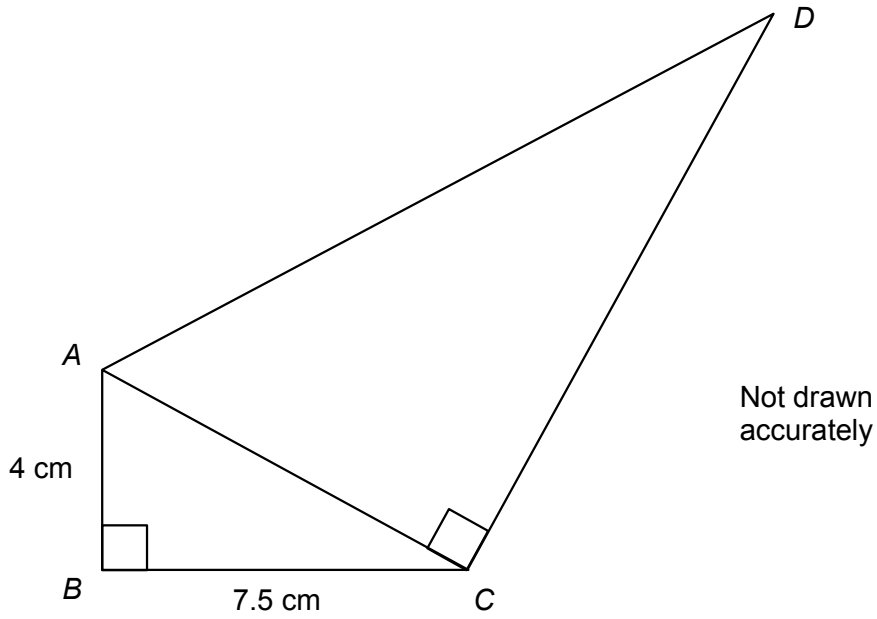Show that Faruq is not correct.

[2 marks]

14 **(b)** Graham says "If p and q are both greater than 2 then $pq + 1$ cannot be a prime number".

Prove that Graham is correct.

[3 marks]

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15

Not drawn accurately

A

4 cm

B

7.5 cm

C

D

Triangle *ACD* is similar to triangle *ABC*.

Angle *ACD* = angle *ABC* = 90º.

AB = 4 cm and *BC* = 7.5 cm.

Work out the area of quadrilateral *ABCD*, giving your answer correct to 3 significant figures.

[4 marks]

Answer _____ cm^2

16 $f(x) = 8 - 3 \sin x°$

Circle the maximum value of $f(x)$ in the interval $0 \le x < 360$.

[1 mark]

3   5   8   11

17   In a TV gameshow, a contestant starts with a pot of money containing £8000.
The contestant has to complete a task to win some or all of this money.

If the contestant completes the task in less than a minute, they keep all £8000.
After each full minute spent doing the task, the money in the pot decreases by 20%.

17   **(a)**   James says

"If they take longer than 5 minutes they don't win any money."
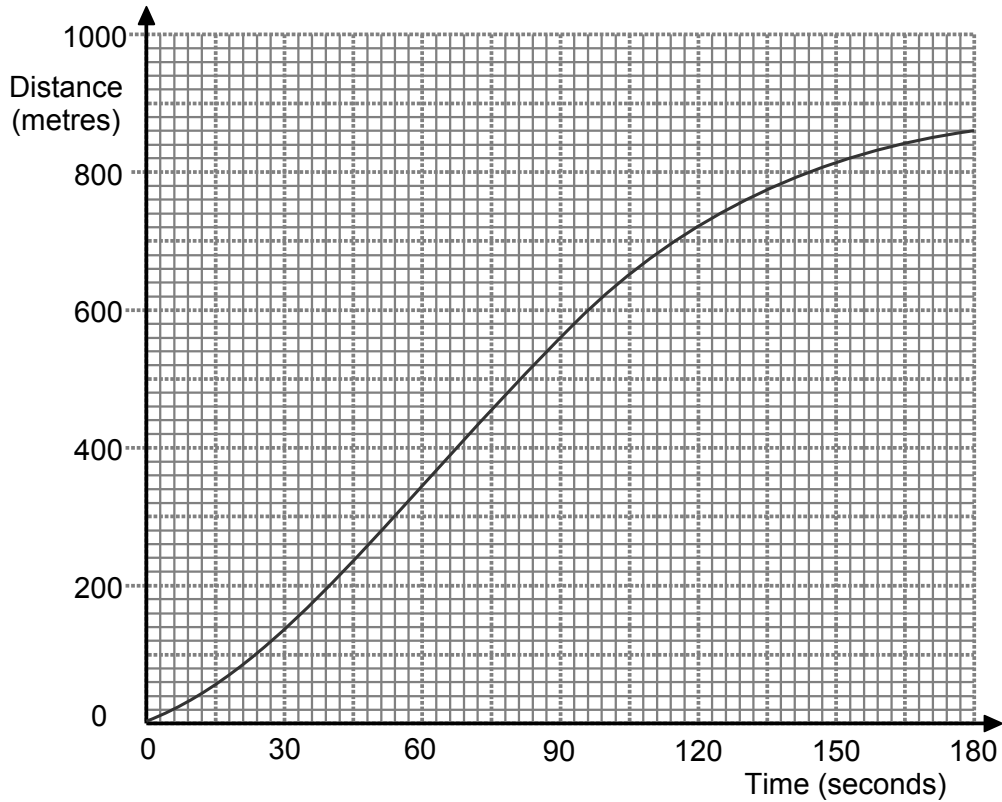
Explain why James is not correct.

[1 mark]

17   **(b)**   Show that a contestant who completes the task in 2 minutes and 21 seconds
wins £5120.

[2 marks]

18

The distance-time graph above is for a runner from the start of an 800 m race.

18 **(a)** How long did this runner take to complete the race?

[1 mark]

Answer _____ s

18 **(b)** Gill says   "At the end of the race, the runner's speed was less than half of his speed at the halfway point of the race."

Is Gill correct?

Show how you decide.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

Answer _____

19 A sketch of the graph $y = f(x)$ is shown on each diagram below.

19 (a)
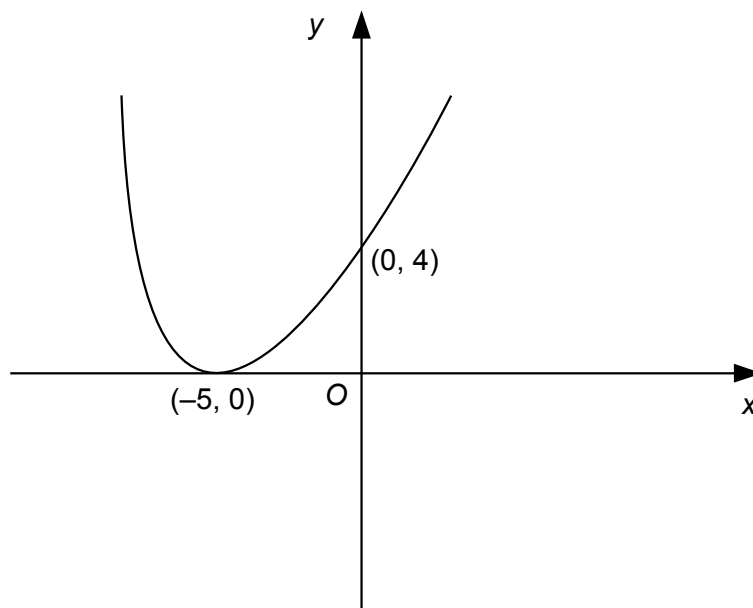
On the diagram above, sketch the graph of $y = f(x - 5)$.

[2 marks]

19 (b)

On the diagram above, sketch the graph of $y = f(-x)$.

[1 mark]

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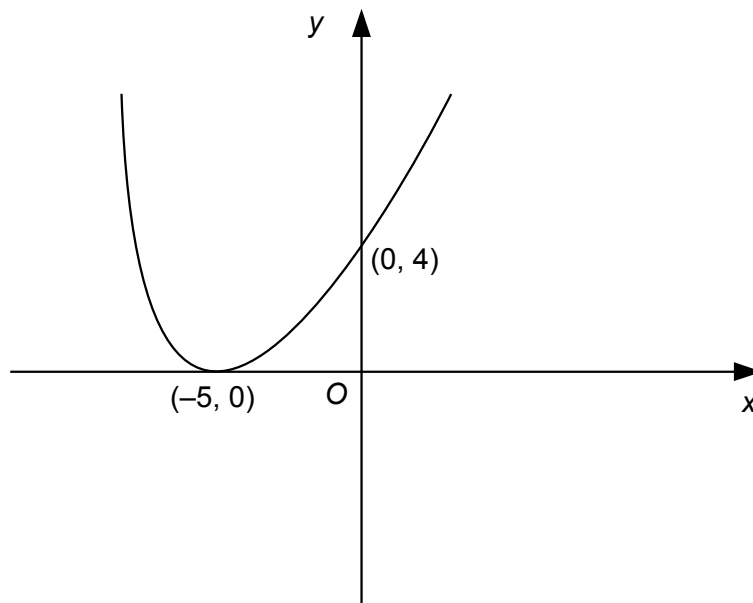
20 T is directly proportional to m^2.

When $m = 2$, $T = 15$.

20 **(a)** Show that when $m = 6$, $T = 135$.

[3 marks]

20 **(b)** Jacob says

"So whenever m increases by 4, T increases by 120."

Show that Jacob is not correct.

[2 marks]

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21 Will and Grace want to find an approximate solution to the equation $x^2 - \sqrt{x} = 4$.

Will uses the iterative process $x_{n+1} = \dfrac{\sqrt{x_n} + 4}{x_n}$ and $x_0 = 2$.

Grace uses the iterative process $x_{n+1} = \sqrt{\left(\sqrt{x_n} + 4\right)}$ and $x_0 = 2$.

21 **(a)** Find out which of these two iterative processes will be most useful to them?

Give a reason for your answer.

[3 marks]

Answer _____

21 **(b)** Find the solution to the equation $x^2 - \sqrt{x} = 4$ correct to 4 decimal places.

[1 mark]

Answer _____

22

Not drawn accurately

The diagram shows a box in the shape of a square prism.

Inside the box is a glass paperweight in the shape of a hemisphere.
The paperweight fits tightly and touches each side of the box.

The mass of the paperweight is 400g.
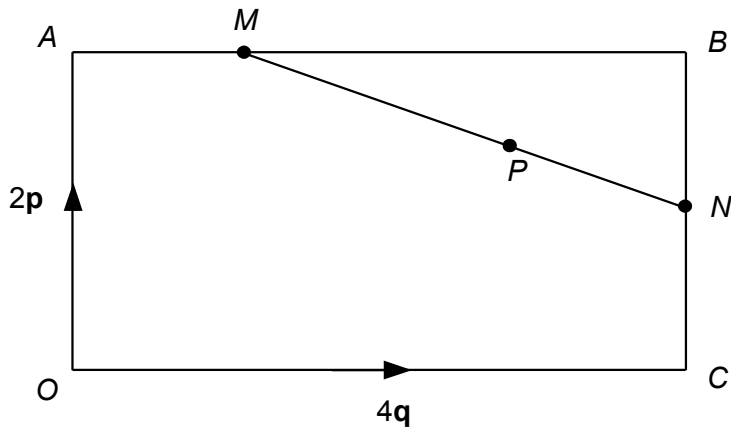The density of the glass is 3 g/cm^3.

Work out the volume of the box.

[The volume of a sphere of radius r is $\frac{4}{3}\pi r^3$]

[4 marks]

Answer _____ cm^3

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23   Kelli has a bottle containing 12 tablets.

There are 3 different types of tablet in the bottle.

The bottle contains 4 of tablet A, 4 of tablet B and 4 of tablet C.

Kelli tips the bottle until 3 tablets come out into her hand.

23   **(a)**   Work out the probability that Kelli has one of each type of tablet in her hand.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____

23   **(b)**   State an assumption you have made in working out your answer to part **(a)**.

[1 mark]

_____

_____

24

Not drawn accurately

OABC is a rectangle.

M is the point on *AB* such that *AM* : *MB* = 1 : 3

N is the midpoint of *BC*.

P is the point on *MN* such that *MP* : *PN* = 3 : 2

$\overrightarrow{OA}$ = 2**p** and $\overrightarrow{OC}$ = 4**q**.

24 **(a)** Show that $\overrightarrow{MN}$ = −**p** + 3**q**.

[3 marks]

Dinesh says that *P* lies on *OB*.

24 **(b)** Is Dinesh correct?

Justify your answer.

[3 marks]

Answer _____

END OF QUESTIONS