OCR
Oxford Cambridge and RSA

Friday 19 May 2023 – Morning

GCSE (9–1) Mathematics

J560/04 Paper 4 (Higher Tier)

Time allowed: 1 hour 30 minutes

You must have:
- the Formulae Sheet for Higher Tier (inside this document)

You can use:
- a scientific or graphical calculator
- geometrical instruments
- tracing paper

H

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question numbers.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Use the π button on your calculator or take π to be 3.142 unless the question says something different.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

1 Calculate.

$$\sqrt{5.2^2 - 4.8 \times {}^{-}6.3}$$

Give your answer correct to **3** significant figures.

..... **[2]**

2 The price of petrol decreases from £1.32 per litre to £1.02 per litre.

Calculate the percentage decrease in the price.

..... % **[3]**

3 **(a)** Eve, Jack and Ling share some money in the ratio 2 : 3 : 4.
Jack gets £720.

Work out how much Ling gets.

(a) £ ..... **[2]**

(b) Amir, Beth and Casey share some money in the ratio 3 : 5 : c.
Casey's share is $\frac{2}{3}$ of the total.

Find the value of c.

(b) $c =$ ..... **[3]**

4 Alex invests £4500 at a rate of 7.5% per year simple interest.

(a) Find the value of the investment at the end of 4 years.

(a) £ ..... **[3]**

(b) At the end of t years, the value of the investment is over £13 500 for the first time.

Find the value of t.

(b) $t =$ ..... **[3]**

5 **(a)** Write 0.003 86 in standard form.

(a) ..... **[1]**

(b) The speed of sound is 3.43×10^{-1} km/s.
An object is travelling at the speed of sound.

Work out how far the object travels in one day.

(b) ..... km **[2]**

(c) In a science fiction story, a spacecraft travelling faster than the speed of light is said to be travelling at 'warp *n*' where *n* is an integer.

Warp *n* is defined as $n^3 \times$ the speed of light.

In the story, a spacecraft needs to travel from Earth to Neptune in less than 2 minutes.

- The speed of light is 3.00×10^5 km/s.
- The distance from Earth to Neptune is 4.41×10^9 km.

Find the smallest possible warp *n* at which the spacecraft can travel.
You must show your working.

(c) $n =$ ..... **[3]**

6 A six-sided numbered spinner is thrown 50 times.
The score for each throw is recorded.
Some of the results are shown in the table.

An 8 was thrown f times.
An unknown number on the spinner is represented by n.

Score	Frequency
1	12
3	2
5	9
6	16
8	f
n	4
Total	50

The mean score of the 50 throws is 5.5 .

Find the value of f and the value of n.

$f =$.....

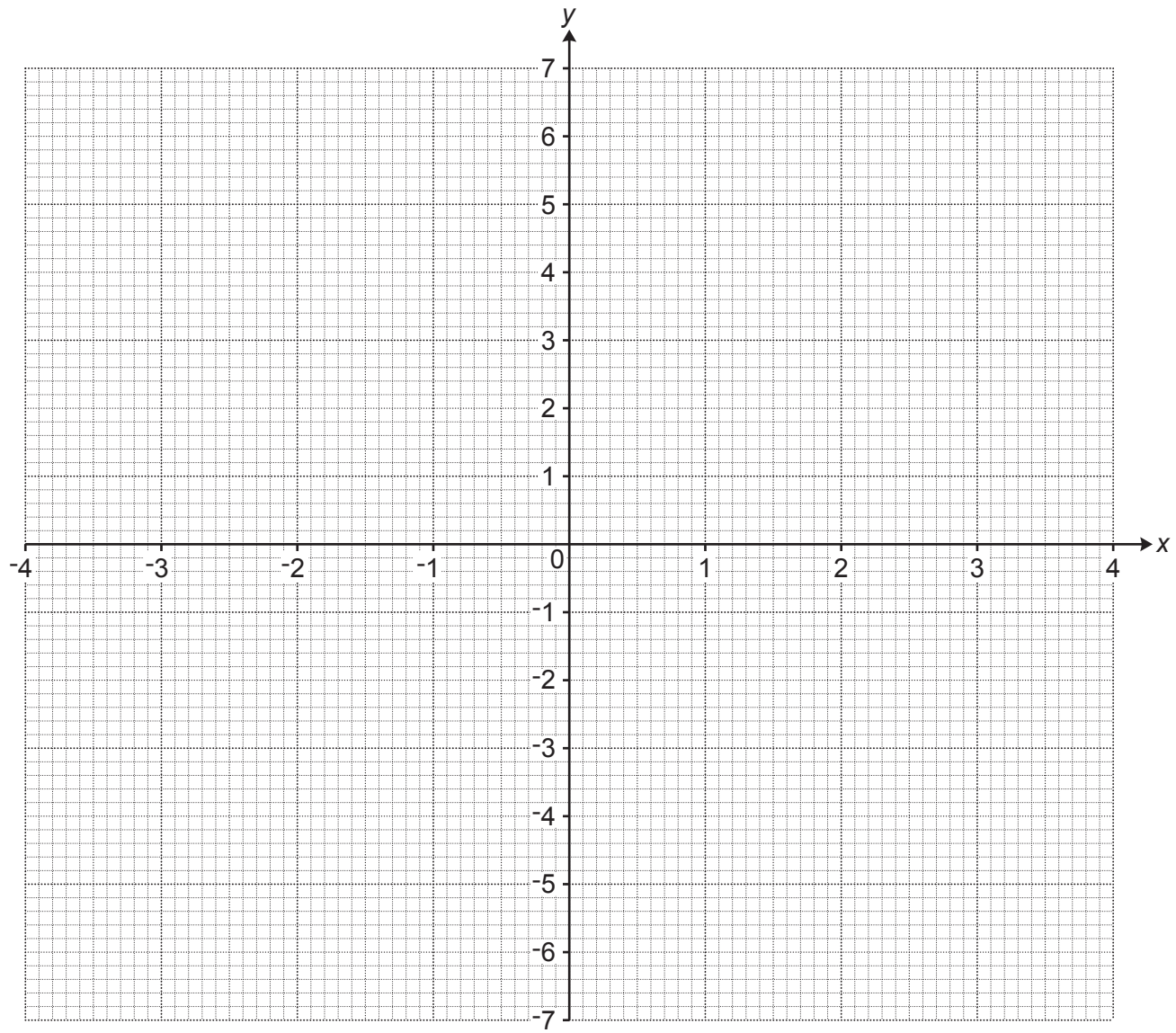
$n =$.....

[4]

7 Here is a table of values for $y = \frac{6}{x} - 2x$.

x	$^-4$	$^-3$	$^-2$	$^-1$	1	2	3	4
y	6.5	4	1	$^-4$	4	$^-1$	$^-4$	$^-6.5$

(a) Draw the graph of $y = \frac{6}{x} - 2x$ for $^-4 \leqslant x \leqslant 4, x \neq 0$.



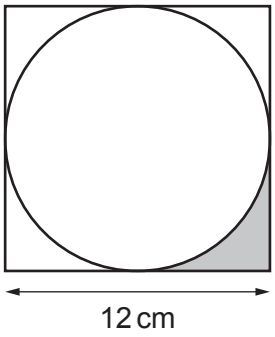
[3]

(b) Use your graph to find the positive solution of $\frac{6}{x} - 2x = 0$.

Give your answer to **1** decimal place.

(b) $x =$ ..... **[1]**

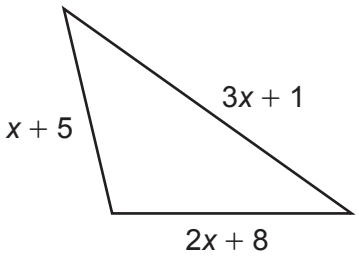
8 The diagram shows a circle inside a square of side 12 cm.



Work out the percentage of the square that is shaded.
You must show your working.

..... % **[6]**

9 The sides of this triangle are given in centimetres.
The perimeter of the triangle is 80 cm.



Not to scale

(a) Find the length of each side of the triangle.
You must show your working.

(a) ..... cm, ... cm and ..... cm **[5]**

(b) Is the triangle above a right-angled triangle?
Use calculations to show how you decide.

..... because .....

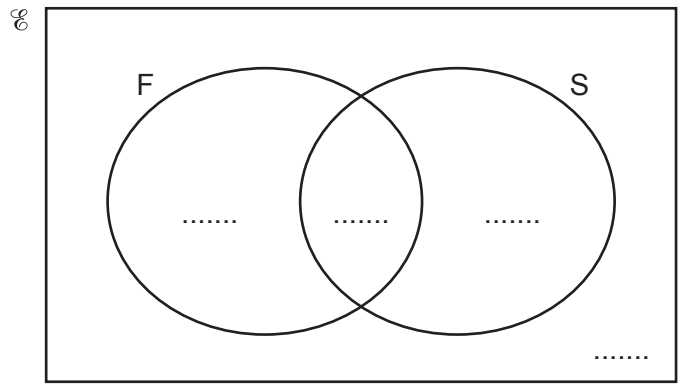
.....

..... **[3]**

10 100 people were asked whether they had visited France (F) or Spain (S).

- 55 had visited France
- 60 had visited Spain
- 4 had not visited either country.

(a) Complete the Venn diagram.



[3]

(b) One of these 100 people is chosen at random.

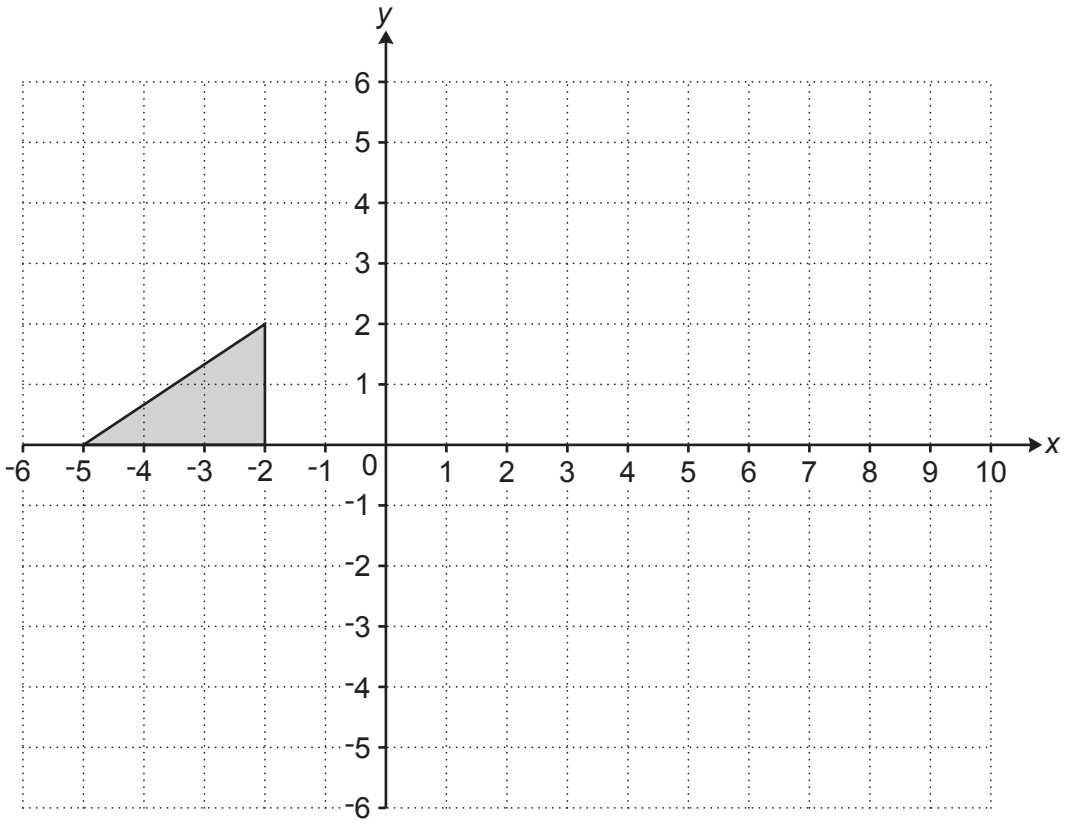
(i) Write down the probability that this person had visited exactly **one** of the countries.

(b)(i) ..... **[2]**

(ii) Write down the probability that this person had visited France given that they had also visited Spain.

(ii) ..... **[2]**

11 You may use this coordinate grid to help you answer the following question.



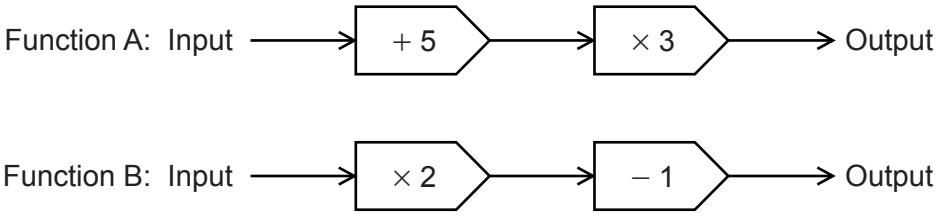
Describe fully the **single** transformation that is equivalent to:

- a rotation of 180° with centre (0, 1), followed by
- a translation of $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$.

.....

..... **[3]**

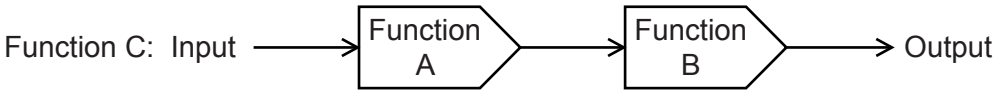
12 Here are two functions.



(a) Write an algebraic expression for the output of function A when the input is x.

(a) ..... **[1]**

(b) Here is a composite function C.



The input to function C is x.
The output from function C is $2x + 1$.

Find the value of x.
You must show your working.

(b) $x =$ ..... **[5]**

13 Here are two pieces of work.

Each shows a question and the **first line** of an incorrect solution.

For each part, describe the error made in the first line of the solution.
You do **not** need to complete the solution.

(a)

Question:
Simplify. $\frac{2}{x-1} + \frac{3}{x+4}$

Solution:
$\frac{2}{x-1} + \frac{3}{x+4} = \frac{2(x-1)+3(x+4)}{(x-1)(x+4)}$

.....

..... **[1]**

(b)

Question:
Solve. $x^2 + 7x + 5 = 0$

Solution:
$x = -\frac{7 \pm \sqrt{7^2 - 4 \times 1 \times 5}}{2 \times 1}$

.....

..... **[1]**

14 A college offers 41 different subjects including 9 different languages.
Students are asked to choose one subject from Option A, one subject from Option B and one subject from Option C.

Each of the 41 different subjects appears only once, either in Option A, or in Option B or in Option C.

Option A : 14 subjects including 2 languages
Option B : 12 subjects including 3 languages
Option C : 15 subjects including 4 languages

Work out the proportion of all the possible subject combinations that include **at least one** language.
You must show your working.

..... **[5]**

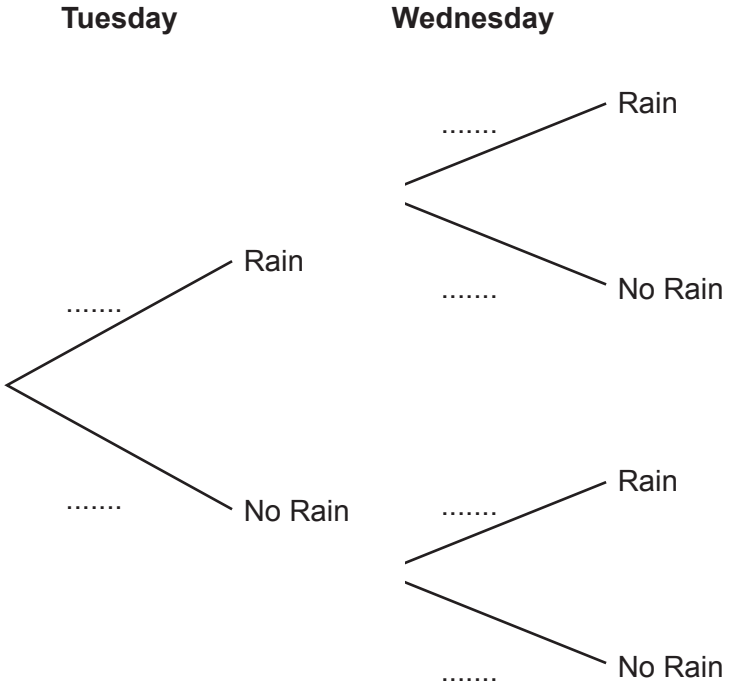
15 y is inversely proportional to the square root of x.
$y = 7$ when $x = 144$.

Find the value of y when $x = 16$.

$y =$ ..... **[3]**

16 If it rains on a given day the probability that it will rain the next day is 0.65.
If it does **not** rain on a given day the probability that it will rain the next day is 0.3.
It rained on Monday.

(a) Complete the tree diagram.

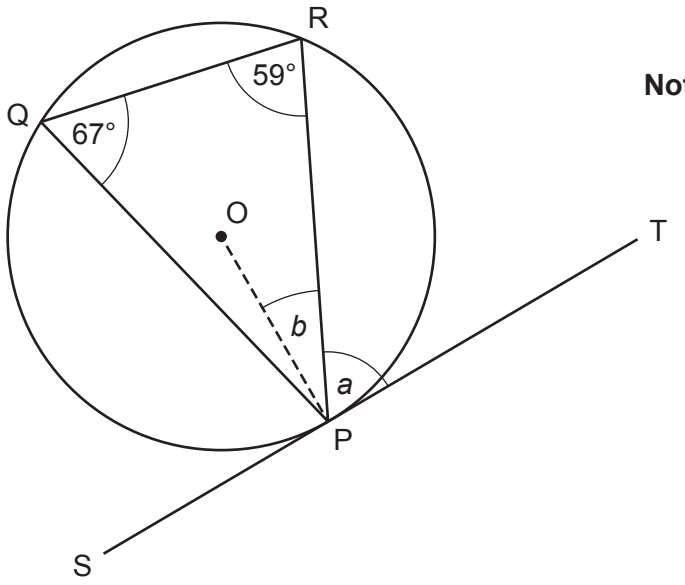


[2]

(b) Find the probability that it rains on Wednesday.

(b) ..... **[3]**

17 **(a)** P, Q and R are points on the circumference of a circle, centre O.



Not to scale

Angle PRQ = 59° and angle PQR = 67°.
Line SPT is a tangent to the circle.

(i) Work out angle *a*.
Give a reason for your answer.

Angle *a* = ...° because .....

.....

..... **[2]**

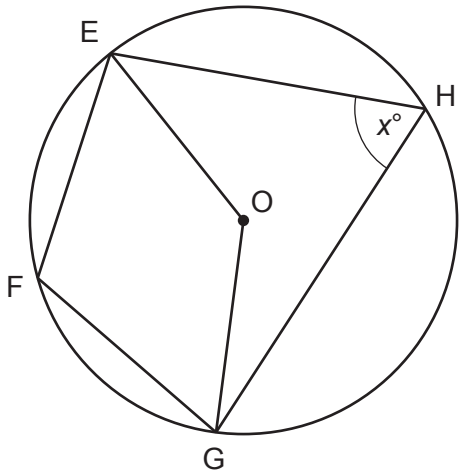
(ii) Work out angle *b*.
Give a reason for your answer.

Angle *b* = ...° because .....

.....

..... **[2]**

(b) E, F, G and H are points on the circumference of a circle, centre O.
Acute angle EHG = $x°$.



Not to scale

(i) Complete the following, giving the values of the angles in terms of x.

Obtuse angle EOG = ... ° because .....

.....

.....

Therefore, reflex angle EOG = ... °

Therefore, angle EFG = ... ° **[3]**

(ii) Write down what your working in part **(b)(i)** has proved.

.....

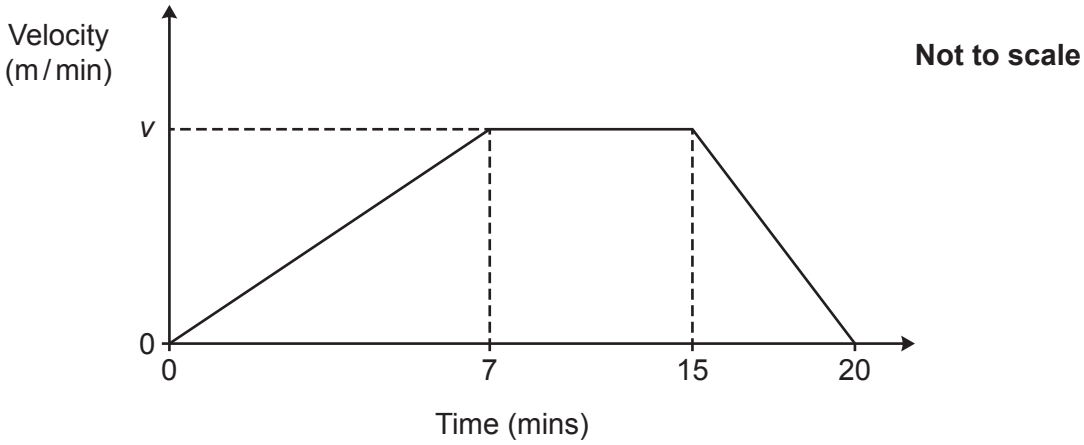
..... **[1]**

18 **(a)** Show that the equation $x^3 + x^2 - 5 = 0$ has a solution between $x = 1$ and $x = 2$. **[3]**

(b) Find this solution correct to **1** decimal place.
You must show calculations to support your answer.

(b) $x =$ ..... **[4]**

19 The graph shows the velocity of a particle over the first 20 minutes of its motion.



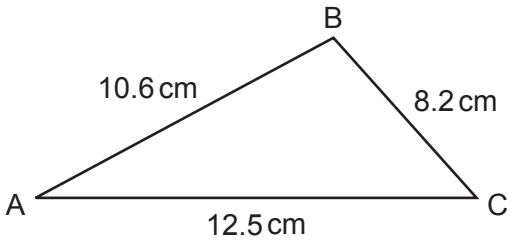
Between 7 minutes and 15 minutes the velocity of the particle is v metres per minute.
The average velocity of the particle over the 20 minutes is 11.55 metres per minute.

Find the value of v.
You must show your working.

$v =$ ..... **[5]**

TURN OVER FOR QUESTION 20

20 The diagram shows triangle ABC.



Not to scale

AB = 10.6 cm, BC = 8.2 cm and AC = 12.5 cm.

(a) Show that angle BAC = 40.5°, correct to **1** decimal place. **[3]**

(b) Work out the area of triangle ABC.

(b) ..... cm^2 **[2]**

END OF QUESTION PAPER