FOUNDED 1900

THE ENGLISH SCHOOL
A SECOND CENTURY OF EXCELLENCE

YEAR 3 MID-PROGRAMME ENTRY EXAMINATIONS 2021

MATHEMATICS   **SATURDAY 5ᵗʰ JUNE 2021**

Time allowed: 2 hours

Instructions to candidates

Answer all the questions in the spaces provided.

Without sufficient working, correct answers may be awarded no marks.

Information to candidates

This paper has 25 questions.

There are 18 pages in this question paper.

Full marks may be obtained for answers to all questions.

The total marks for this paper is 120.

The marks for each question is shown in round brackets, e.g. (**2**)

Calculator may be used.

Advice for candidates

Write your answers neatly and in good English.

Work steadily through the paper.

Do not spend too long on one question.

Show all stages in any calculations.

Materials required for the paper

Calculator, ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser. Tracing paper may be used.

1. The diagram shows four triangles.
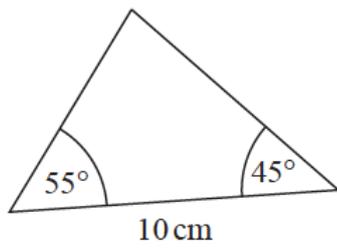
Triangle **A**
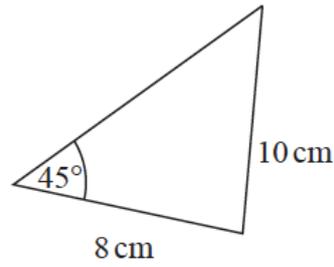
Triangle **B**
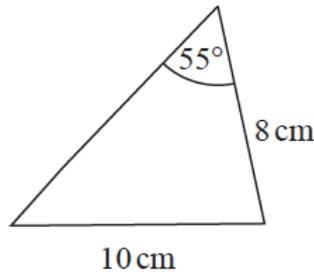
Triangle **C**
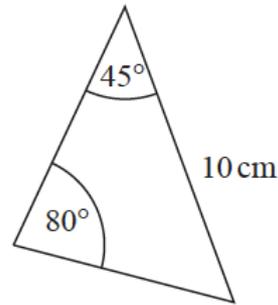
Triangle **D**

Two of these triangles are congruent.

Write down the letters of these two triangles.

.... and..

(1)

2. Amy invests £800 for three years at 2% simple interest per annum.
   (a) Work out the total interest of the investment after three years.

£ ....

(2)

   (b) What percentage of the original investment is the total interest found in part (a)?

.... %

(2)

2

3. Write these numbers in order of size.
   Start with the smallest number.

$$6.72 \times 10^5 \qquad 67.2 \times 10^{-4} \qquad 672 \times 10^4 \qquad 0.000\,672$$

....

(2)

(b) A person's heart beats approximately 10^5 times each day.
   A person lives for approximately 81 years.

   Work out an estimate for the number of times a person's heart beats in their lifetime.
   Give your answer in standard form correct to 2 significant figures.

....

(3)

4. (a)
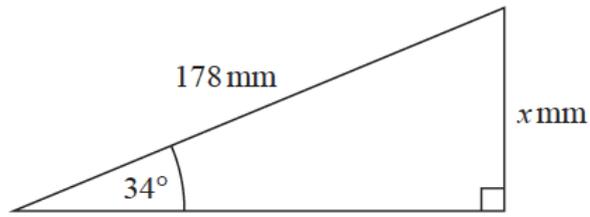
Work out the value of x.
Give your answer correct to 1 decimal place.

.... mm

(2)

(b) PQR is a right-angled triangle.

13 cm   diagram not drawn accurately
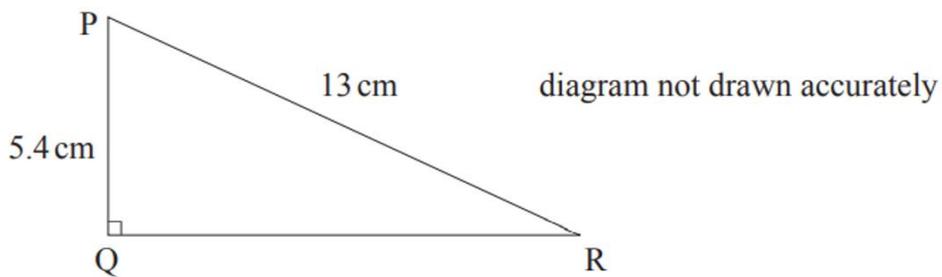
Find angle QPR. Give your answer to the nearest degree.

.... °

(4)

4

5. (a) Tariq buys a laptop.
   He gets a discount of 5% off the normal price.
   Tariq pays £551 for the laptop.

   Work out the normal price of the laptop.

   £...
   (2)

   (b) Sian thinks of a number. Its value is increased by 25%.
   Express the original number as a percentage of the increased number.

   .... %
   (3)

6. Work out $4\dfrac{1}{4} - 2\dfrac{7}{12}$, giving your answer as simply as possible. You must show all steps in your workings.

   ....
   (2)

5

7. A company makes Welsh flags in mathematically similar sizes.
   Two of their similar flags are shown.
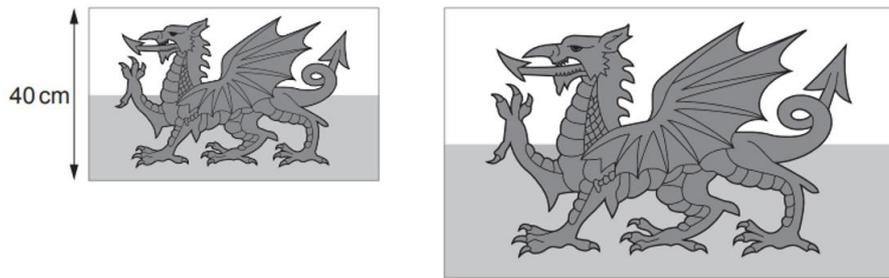
Diagrams not drawn to scale

The ratio of the area of the larger flag to the area of the smaller flag is 49:25
The height of the smaller flag is 40cm.
Calculate the height of the larger flag.

.... cm

(3)

8. The diagram shows triangle **P** and triangle **Q** on the grid.
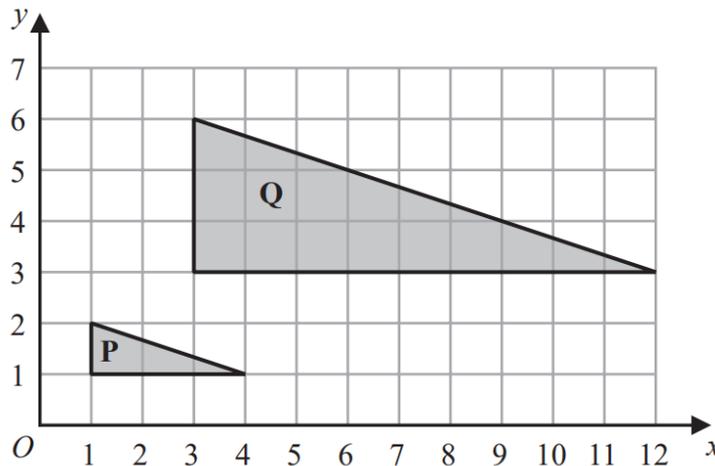
Describe the single transformation that maps triangle **Q** onto triangle **P**.

....

....

(3)

9. Solve the following algebraic equations for x.
Show all your steps. Give your answers as simplified fractions, where necessary.

(a) $3(x+1) = 5x - 3$

....

(3)

(b) $2x^2 - 7 = 11$

....

(3)

10. The voltage, V volts, of an electric circuit is given by the formula

$$V = IR$$

where I is the current measured in amps, and R is the resistance measured in ohms.
During an experiment,
V was measured at 280 volts, correct to the nearest 10 volts,
I was measured at 0·2 amps, correct to the nearest 0·1 amps.
Calculate the greatest possible value of the resistance R.

.... volts

(4)

11. The right-angled triangle ABC has an area of 84 cm^2.
    $AB = 24$ cm.

C
Area = 84 cm²
A
24 cm
B
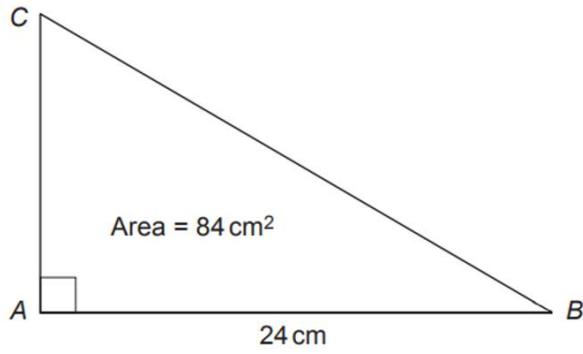
Diagram not drawn to scale

Calculate the perimeter of the triangle ABC.

.... cm

(6)

12. Expand each of the following, simplifying where possible.

(a) $(x-4)(12-x)$

....

(2)

(b) $(x-3)(x+8)(x-2) =$

....

(3)

13. (a) Find the gradient and the *y*-intercept of the following lines with equations

    (i) $y = -x + 7$

Gradient = ... , *y*-intercept = ...

    (ii) $3y + 6 = 5x$

Gradient = ... , *y*-intercept = ...

(5)

(b) The line *L* passes through the points $A(-2, -2)$ and $B(-3, 0)$,

    (i) work out the gradient of the line *L*.

....

(2)

    (ii) Hence, write the equation of the line *L*.

....

(2)

    (iii) Write down the equation of a line parallel to line *L*
        passing through the point $(1, 5)$.

....

(2)

14. A water tank is in the shape of a right circular cylinder with <u>no lid</u>. The base of the cylinder is a circle of radius r cm and the height is h cm.

The volume of the tank is $50\,000\pi$ cm^3.

(a) Express the volume in litres, giving your answer to the nearest whole number.

.... L

(2)

(b) Show that the height of the cylinder, h can be expressed as $h = \dfrac{50000}{r^2}$.

.... cm

(2)

(c) Given that $r = 25$ cm, find the total surface area of the water tank, in terms of π .

.... cm^2

(3)

15. Factorise each of the following completely:

(a) $6y^3 - 2y^2$

....
(2)

(b) $x^2 - 6x - 72$

....
(2)

(c) $x^2 - 225$

....
(2)

16. In the diagram AB, BC, CD, DE, EF, FG and GH are seven sides of a regular 16-sided polygon. ABP and HGP are straight lines.
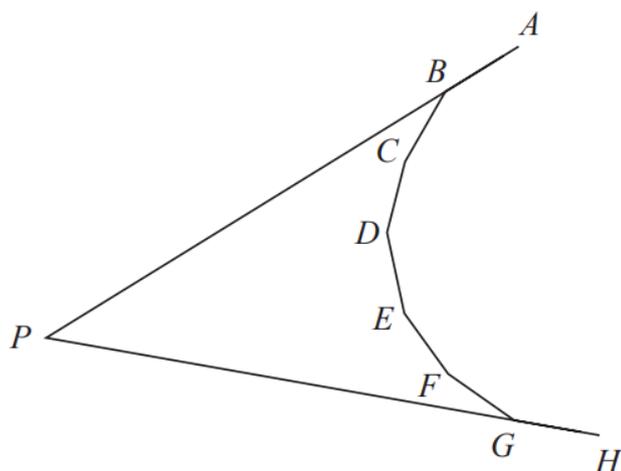
Diagram **NOT** accurately drawn

Calculate the size of $\angle GPB$. Show your working clearly.

....
(6)

11

17. Simplify the following expressions:

(a) $6x + 7 - 2x^2 + x^2 - x - 5x^2$

....
(2)

(b) $\dfrac{x-1}{4} - \dfrac{3}{5}$

....
(2)

18. A map has a scale of 8cm to 1km

(a) Write this scale as a ratio in its simplest form

....
(2)

The distance between two lakes is 4.5km
(b) How far will this be on the map? Give your answer in cm.

.... cm
(2)

19. Bhavik left his home at 12 00 to cycle to Sam's house.
    On the way Bhavik stopped for a rest, and then continued his journey.
    The distance-time graph shows his journey.
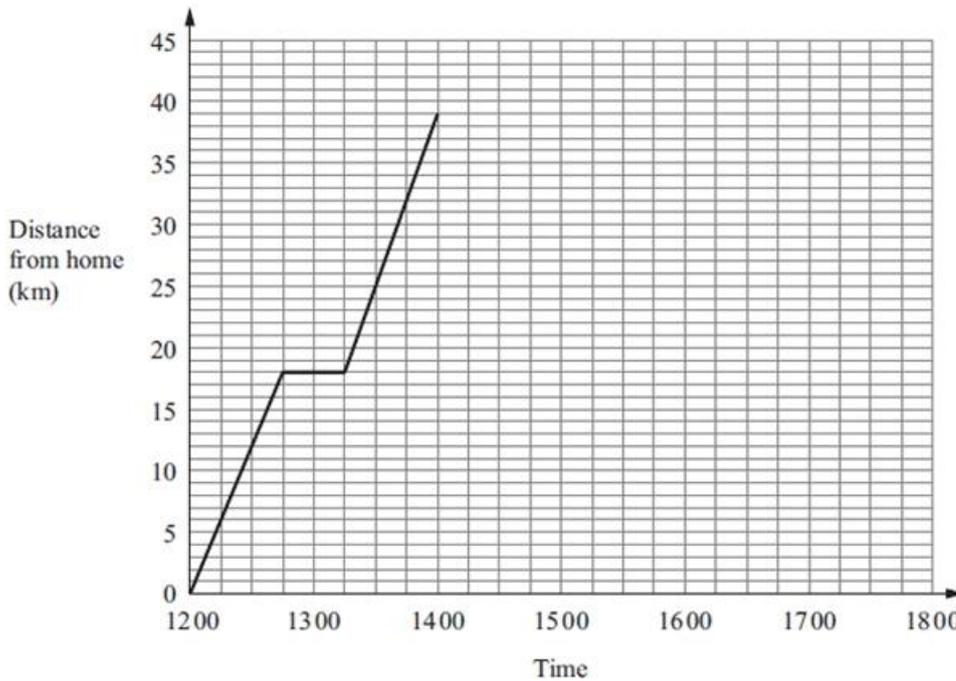
(a) (i) For how many minutes did Bhavik stop for a rest?

....minutes

(ii) After his rest, how many more kilometres did Bhavik cycle to Sam's house?

....km

(2)

(b) Bhavik stayed at Sam's house for 2 hours.
    He then cycled back to his home.
    He arrived home at 17 15.
    Show all this information on the graph.

(2)

(c) Write down the times at which Bhavik was 24 kilometres from his home.

....

....

(2)

(d) Work out the average speed, in kilometres per hour, of Bhavik's journey from Sam's
    house back to his home.
    Give your answer correct to 1 decimal place.

....km/h

(2)

13

20. Two unbiased spinners are used in a game. One spinner is numbered from 1 to 6 and the other is numbered from 1 to 3. The scores on each spinner are multiplied together. The table below shows some of the possible outcomes.

First Spinner

	1	2	3	4	5	6
1	1	2			5	
2	2	4			10	
3	3	6		12	15	18

Second Spinner

(a) Complete the table above.

(1)

(b) Find the probability that the outcome is:
   (i)   even

   ....
(1)

   (ii)   at least 10

   ....
(1)

   (iii)   a prime number

   ....
(1)

21. (a) Solve $\dfrac{3x+3}{x} = 2$

....
(2)

   (b) $y = p^2 + qr$
       Find y when $p = -5$, $q = 3$ and $r = -7$.

....
(2)

(c) Make *x* the subject of the formula $y = tx + 4y^2$

....

(2)

22. The diagram below shows triangles *ABC* and *DEC*. Lines *AB* and *DE* are parallel.
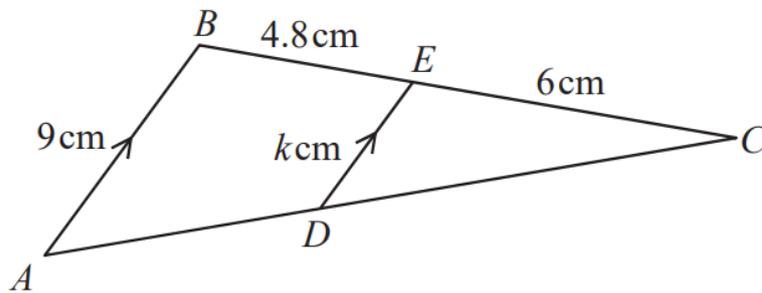
NOT TO
SCALE

(a) Prove that triangles *ABC* and *DEC* are similar.

(4)

(b) *AB* = 9cm, *BE* = 4.8cm, *EC* = 6cm and *ED* = *k* cm. Work out the value of *k*.

....

(2)

23. Which of the following pairs of events is mutually exclusive?

A: Cards: Aces and Spades
B: One dice: Odd and six
C: Two dice: Odd and even

....
(1)

24. Robert hangs masses on a spring and measures the extension of the spring.
He shows his results on this graph.
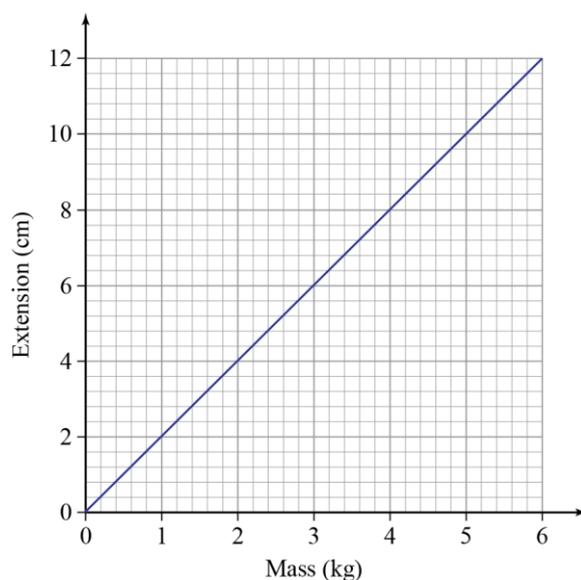
(a) What extension is caused by a mass of 3.6 kg?

....
(1)

(b) What mass causes an extension of 8.8 cm?

....
(1)

(c) Circle the correct formula for the extension, e in terms of the mass, m.

$e = m$ $\qquad\qquad$ $e = 2m$ $\qquad\qquad$ $e = 0.5m$ $\qquad\qquad$ $e = m + 1$

(1)

25. (a) Complete the table of values for $y = x^2 - 3$

x	-2	-1	0	1	2	3
y	1		-3	-2		

(1)

(b) On the grid, draw the graph of $y = x^2 - 3$

(1)
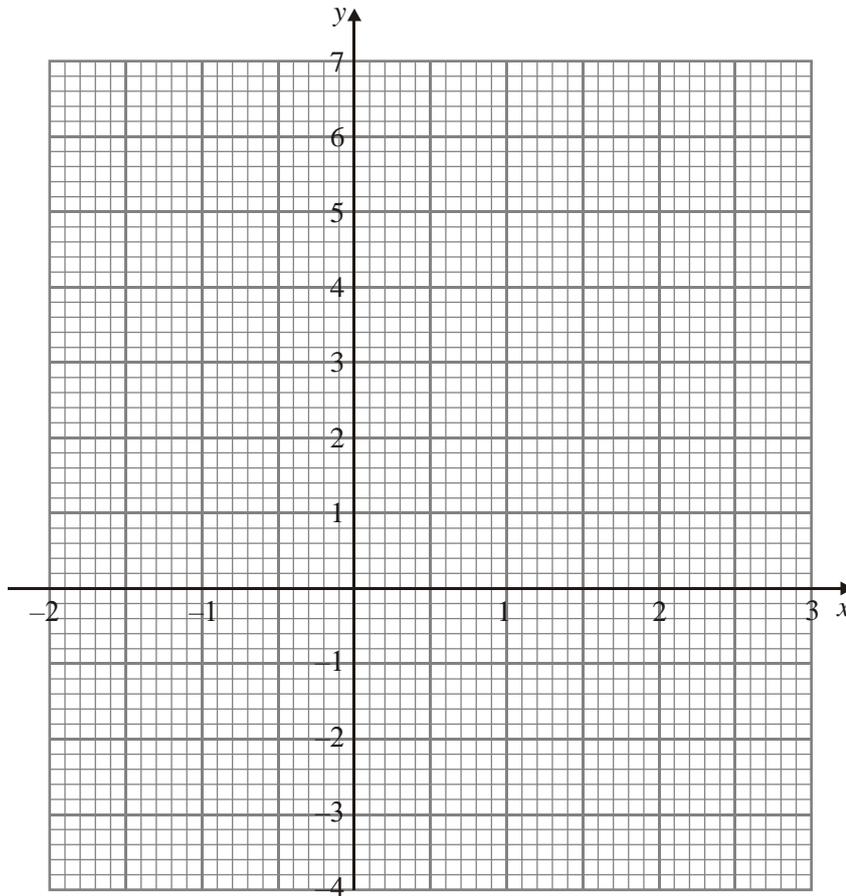
(c) Use your graph to estimate the values of x for which $y = -1$.

$x = $ ....

$x = $ ....

(2)

(d) Use your graph to find the solutions of the equation $x^2 - 3 = 0$.

$x = $ ....

$x = $ ....

(2)

TOTAL FOR PAPER IS 120 MARKS

END OF PAPER