FOUNDED 1900
THE ENGLISH SCHOOL
A SECOND CENTURY OF EXCELLENCE

YEAR 3 MID-PROGRAMME ENTRY EXAMINATIONS 2022

MATHEMATICS **SATURDAY 4th JUNE 2022**

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.

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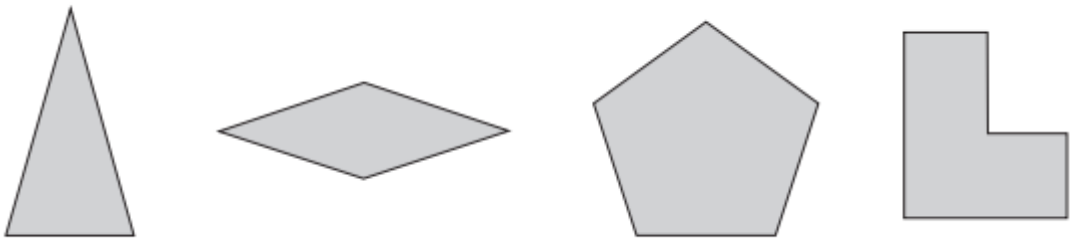
1. Which shape below is a regular polygon? Circle your answer.



(1)

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

(a) $(n-6)(n+4)$

.....

(2)

(b) $(2n+1)(n+3)(n-3)$

.....

(3)

---

3. Work out $\frac{3}{5} - 2\frac{2}{5} \div 4$

You must show all steps in your workings.

.....

(3)

Leave blank

4. (a) Write 1.63×10^{-3} as an ordinary number.

.....

(1)

(b) Write 438 000 in standard form.

.....

(1)

(c) Work out $(4 \times 10^{3}) \times (6 \times 10^{-5})$

You must show all your workings. Give your answer in standard form.

.....

(2)

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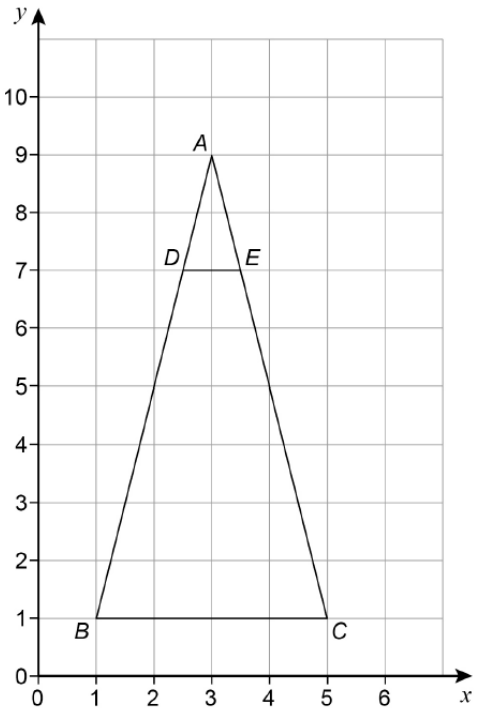
5. Describe fully the single transformation that maps triangle *ABC* to triangle *ADE*.



……...

……...

(3)

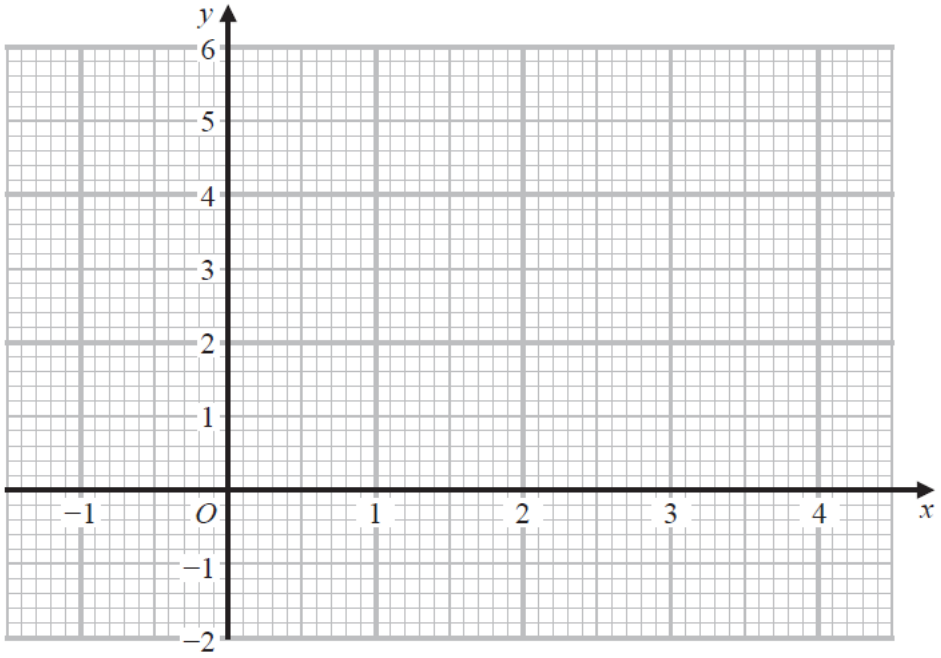
Leave blank

6. (a) Complete the table of values for $y = x^2 - 3x + 1$

x	-1	0	1	2	3	4
y		1	-1			

(2)

(b) On the grid, draw the graph of $y = x^2 - 3x + 1$ for values of x from -1 to 4



(1)

(c) Using your graph, find estimates for the solutions of the equation $x^2 - 3x + 1 = 0$

.....

(2)

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

x = ...

x = ...

(2)

(e) Use your graph to find the minimum value of y.

y = ...

(1)

Leave blank

7. (a) Solve $\frac{3x-5}{4} = 2x-3$

$x =$ .....

(3)

(b) $\frac{a}{b} = 3c$

$\frac{b}{c} = 2$

Work out the value of a when $c = 8$

.....

(3)

(c) Make x the subject of the formula $y = \frac{5x+9}{x}$

.....

(3)

Leave blank

8. (a) Here are the equations of four straight lines.
Two of the lines are parallel, which two?

A) $2y = x + 1$

B) $y = 4 + 2x$

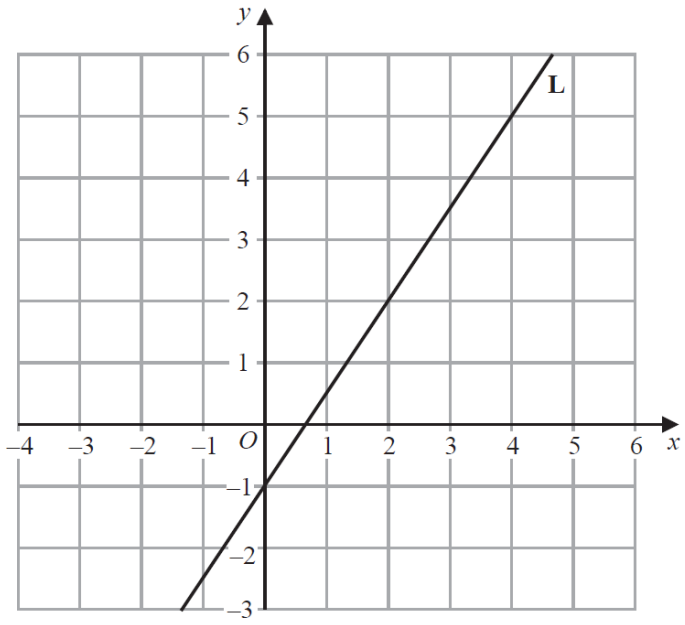
C) $3y = 6x + 5$

D) $y + 2x = 3$

.....

(2)

(b) The line **L** is drawn on the grid.



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

.....

(3)

Leave blank

9. (a) A machine takes 4 seconds to fill a packet of crisps.
(i) In total, how many packets can one machine fill in 8 hours?

..... packets
(3)

(ii) Each packet of crisps contains 32.5 grams of crisps.
At what rate does a machine put the crisps into the packets?
Give your answer in grams per second.

..... grams/second
(2)

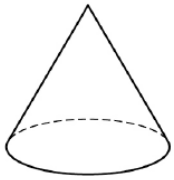
(b) Fifteen workers can complete a job in 8 days.
How many more workers are needed to complete the job in 6 days?
Assume that all of the workers work at the same rate.

..... workers
(3)

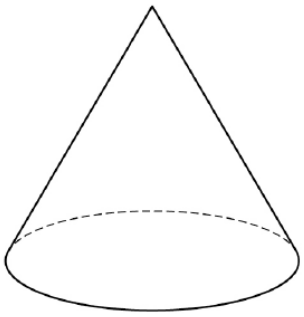
Leave blank

10. Here are two similar cones.

Cone A



Cone B



The surface area of cone A is 2 m^2

The surface area of cone B is 4.5 m^2

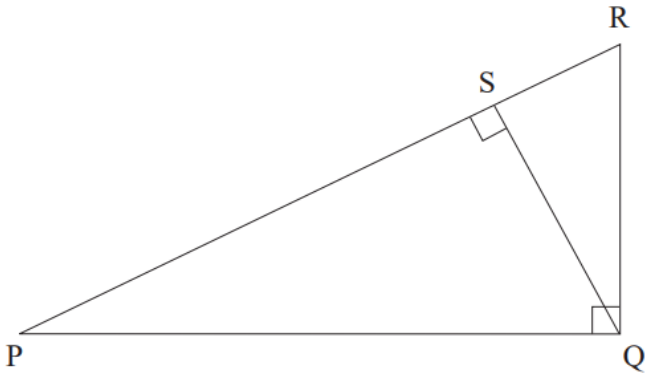
Work out the ratio

volume of cone A : volume of cone B

.....

(3)

11. PQR is a right-angled triangle and QS is the perpendicular line from Q to PR.
Prove that the triangles PQR and QSR are similar.



(4)

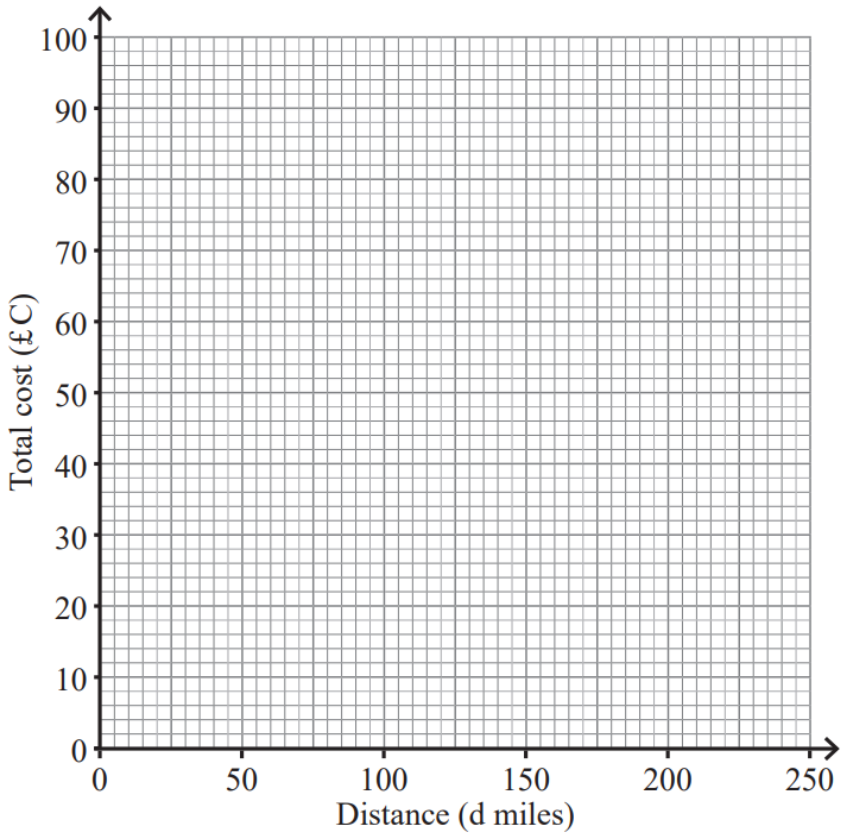
Leave blank

12. Martine wants to hire a van.
The table shows the costs for hiring the van.

Distance (d miles)	50	100	150	200	250
Total cost (£C)	50	60	70	80	90

(a) Draw a straight line graph to illustrate this information.

(1)



(b) Use the graph to find

(i) the initial fixed charge for hiring the van,

£ .....

(1)

(ii) the cost per mile, in pence, for using the van.

.....

(2)

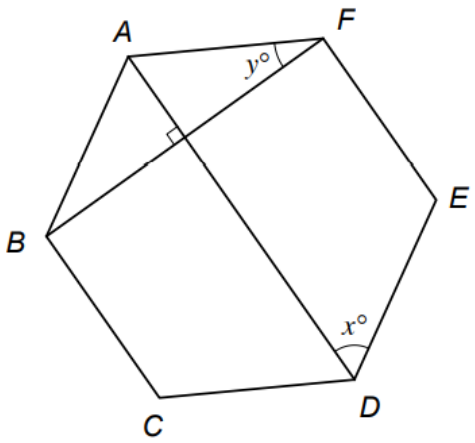
(c) Work out the total cost if the van travels 450 miles.

£ .....

(2)

Leave blank

13. The diagram below shows a regular hexagon ABCDEF.



Not drawn accurately

The angle $ADE = x°$
The angle $AFB = y°$

(a) Find the value of x.

..... °

(2)

(b) Find the value of y.

..... °

(1)

(c) Given that $AF = 10$ cm, find the length of BF .
Give your answer to 3 significant figures.

..... cm

(3)

Leave blank

14. Two measurements, x and y, are made, where

x = 2.1 rounded to 1 decimal place and

y = 46 correct to 2 significant figures

(a) Complete the following statements giving the bounds for x and y

..... $\leq x <$ .....

..... $\leq y <$ .....

(2)

(b) Find the upper bound of $x + y$

.....

(2)

(c) The quantity S is given by $S = \dfrac{3x - 2}{y}$

Find the lower bound of S.

.....

(2)

Leave blank

15. (a) Calculate the value of x.

Give your answer correct to 3 significant figures.

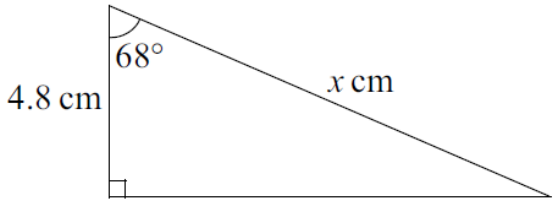


Diagram **NOT** accurately drawn

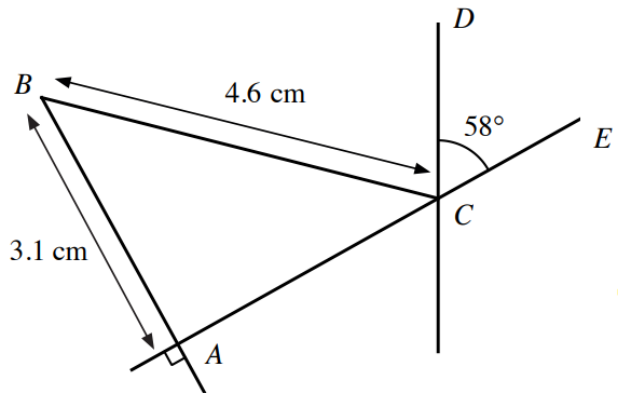
x = ... cm

(3)

(b) ABC is a triangle with AB = 3.1 cm and BC = 4.6 cm.

ACE is a straight line. The angle DCE = 58° .

Find the size of the angle BCD. Give your answer correct to 3 significant figures.



NOT TO SCALE

..... °

(4)

Leave blank

16. Phil sells ties.
He increases the original price of each tie by 10% to £13.20
A month later he announces a sale.

Phil says,

"The ties will now be the same as the original price"

Is he correct? Show working to support your answer.

Tick a box.

☐ Yes ☐ No

(3)

17. Convert the scale 4 cm to 1 km to a map ratio in the form 1 : *n*.

.....

(2)

Leave blank

18. Solve the following equations:

(a) $\frac{1}{2}(2+4x)=12(2x-1)$

x = ...

(2)

(b) $66=2x^2-62$

x = ...

(3)

(c) $\frac{6x}{x-1}=2$

x = ...

(2)

---

19. Two fair dice are rolled, and the following events are defined:

A: {Sum of the numbers showing on the two dice is odd}

B: {Sum of the numbers showing on the two dice is 8, 9, 11, or 12}

Are events **A** and **B** mutually exclusive? Give a reason for you answer.

.....

.....

.....

(2)

Leave blank

20. (a) The population of butterflies in a park is 4200.
Assume that the population increases by 12% each day.
Show that after 20 days the population would be greater than 40 000.

..... butterflies
(2)

(b) In fact, the population increases by 13% each day for 19 days then decreases by 8% for 1 day.

Find the actual population after 20 days.

..... butterflies
(3)

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21. Jude borrows £400. He pays simple interest each month for a year.

After a year he has paid £81.60 interest. What is the monthly rate of interest?

..... %
(3)

Leave blank

22. Factorise each of the following completely:

(a) $17x^2 + 17x$

.....
(2)

(b) $x^2 - 10x + 25$

.....
(2)

(c) $4x^2 - 64$

.....
(2)

---

23. The capacity of a cylindrical bucket is 10 litres.
The area of the circular cross-section is 200 cm^2.

What is the height of the cylinder, in centimetres?

..... cm
(3)

Leave blank

24. Simplify as much as possible.

(a) $3 \times 4x \times 3x^2$

.....

(2)

(b) $3x - 2xy + 3y^2 + 2xy + 7x - y^2$

.....

(2)

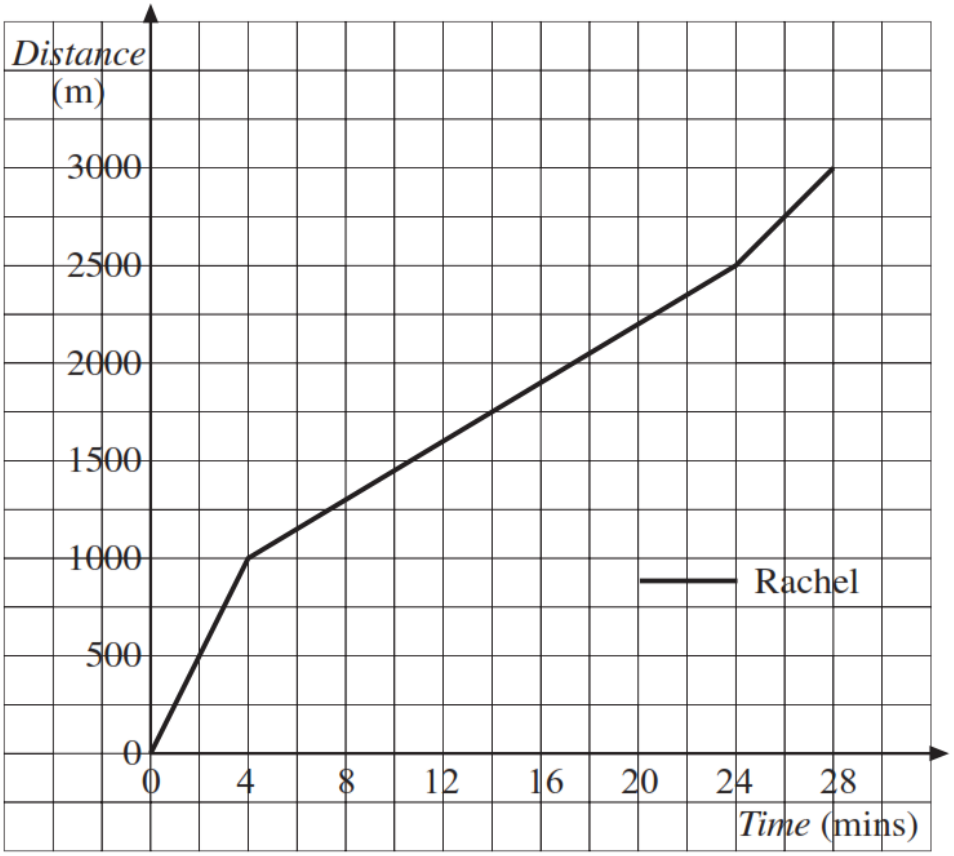
(c) $\frac{4}{7} + \frac{2x-1}{3}$

.....

(2)

Leave blank

25. The distance-time graph shown is for a 3000 metres (m) cross-country race, run by Rachel.



(a) Calculate the speed with which Rachel runs in the first 4 minutes of the race.

..... m/min

(2)

Sally also runs in the same race. Her speed is constant and she finishes the race after 24 min.

(b) Complete the graph to show Sally's run in the race on the graph above.

(1)

(c) When, and how far from the start, does Sally catch up with Rachel?

……

(2)

TOTAL FOR PAPER IS 120 MARKS

END OF PAPER