THE ENGLISH SCHOOL NICOSIA

MID-PROGRAM EXAM FOR ENTRY INTO YEAR 3

MATHEMATICS

SATURDAY 1st June 2024

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 24 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.

Total Marks:

.....%

1. (a) Write 2 840 000 000 in standard form.

.....

(1)

(b) Write 2.5×10^{-4} as an ordinary number.

.....

(1)

(Total for Question 1 is 2 marks)

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2. (a) Factorise fully $6x^2 + 15x$.

.....

(2)

(b) Factorise completely $3a^2b + 6ab^2$.

.....

(2)

(Total for question 2 is 4 marks)

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3. (a) Simplify $(2x^3y^5)^4$

.....

(2)

(b) **(i)** Factorise $x^2 + 5x - 36$

.....

(2)

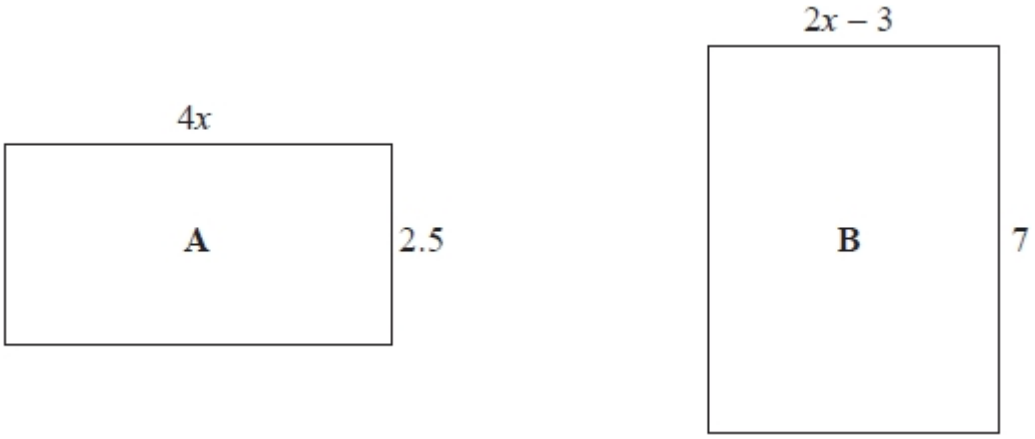
(ii) Hence, solve $x^2 + 5x - 36 = 0$

.....

(1)

(Total for Question 3 is 5 marks)

4. Here are two rectangles.



All measurements are in centimetres.

The area of rectangle **A** is equal to the area of rectangle **B**.

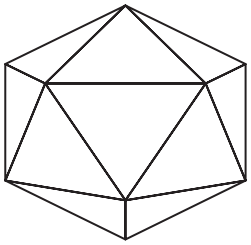
Work out the perimeter of rectangle **B**.

..... cm

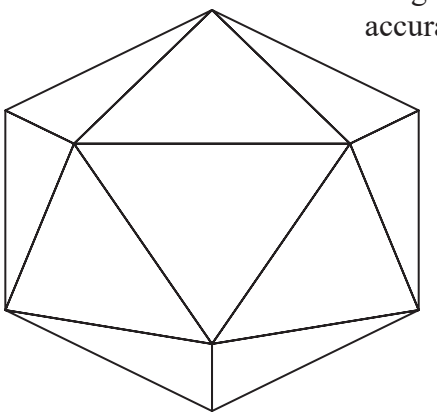
(Total for question 4 is 5 marks)

5. **A** and **B** are two similar solids.

Diagram **NOT** accurately drawn



A



B

A has a volume of 1836 cm^3

B has a volume of 4352 cm^3

B has a total surface area of 1120 cm^2

Work out the total surface area of **A**.

..... cm^2

(Total for Question 5 is 3 marks)

6. $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{\text{multiples of } 2\}$

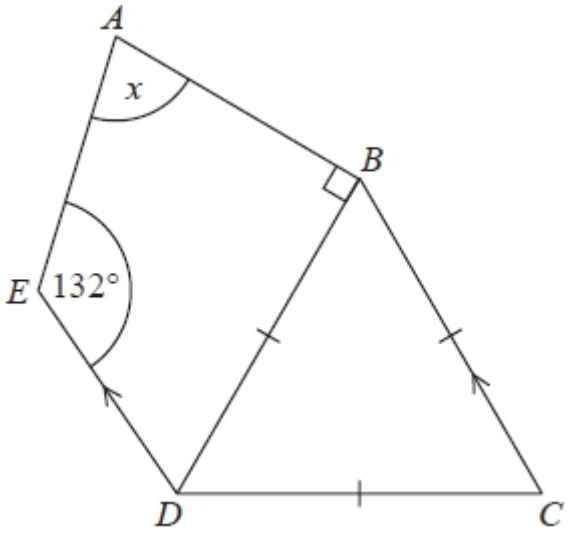
$A \cap B = \{2, 6\}$

$A \cup B = \{1, 2, 3, 4, 6, 8, 9, 10\}$

Draw a Venn diagram for this information.

(Total for question 6 is 4 marks)

7. The diagram shows a quadrilateral *ABDE* and an equilateral triangle *BCD*.



CB is parallel to *DE*.

Angle $AED = 132°$

Work out the size of the angle marked x .
You must give a reason for each stage of your working.

..... °

(Total for question 7 is 4 marks)

8. Here is an empty pool in the shape of a cuboid.

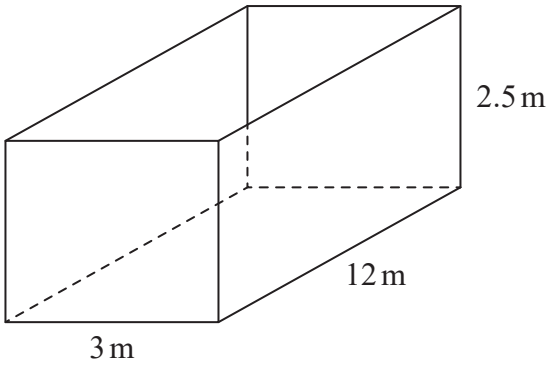


Diagram **NOT** accurately drawn

The width of the pool is 3 m.
The length of the pool is 12 m.
The top of the pool is 2.5 m above the base of the pool.

Jeb is going to put water in the pool.
The level of the surface of the water will be 60 cm below the top of the pool.

Water flows into the pool at 400 litres per minute.
$1\ m^3 = 1000$ litres

How long will it take to fill the pool to 60 cm below the top of the pool?
Give your answer in hours and minutes.

..... hours ..... minutes

(Total for Question 8 is 4 marks)

9. A company makes cars.

In 2016, the company made 350 cars.

In the first 6 months of 2017, the company made 25 cars each month.
In the last 6 months of 2017, the company made 45 cars each month.

(a) Work out the percentage increase in the number of cars the company made from 2016 to 2017

..... %
(**4**)

The company's income in 2017 was $500 000 more than the company's income in 2016.

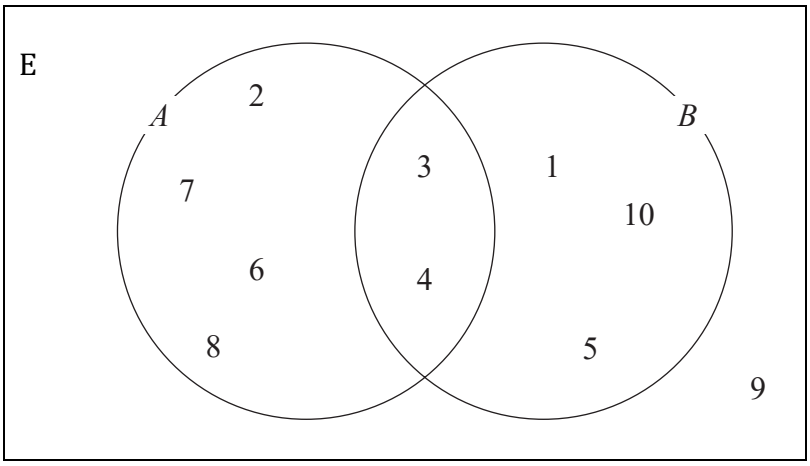
The company's income in 2017 was 8% more than the company's income in 2016.

(b) Work out the company's income in 2016.

$.....
(**3**)

(**Total for Question 9 is 7 marks**)

10. The Venn diagram shows the numbers in the universal set, E, and two sets A and B.



(a) List the members of the set

(i) A

.....

(ii) $A \cap B$

.....

(iii) A'

.....

(3)

A number is picked at random from the universal set.

(b) Find the probability that this number is in set B but not in set A.

.....

(2)

(**Total for Question 10 is 5 marks**)

11. (a) Expand and simplify $3(c-7)-2(3c+4)$

.....

(2)

(b) Expand and simplify $(2x-7)^2$

.....

(2)

(c) Factorise fully $50y^3-18y$

.....

(3)

(d) Solve $3(2x-5)=\frac{9-x}{2}$

Show clear algebraic working.

$x=$ .....

(4)

(Total for Question 11 is 11 marks)

12 **(a)** Simplify $g^7 \times g^3$

.....

(1)

(b) Simplify $(k^3)^5$

.....

(1)

(c) Simplify fully $\dfrac{20x^2y^6}{4x^2y^2}$

.....

(2)

(d) Make e the subject of the formula $h = 3e^2 - f$.

.....

(3)

(Total for Question 12 is 7 marks)

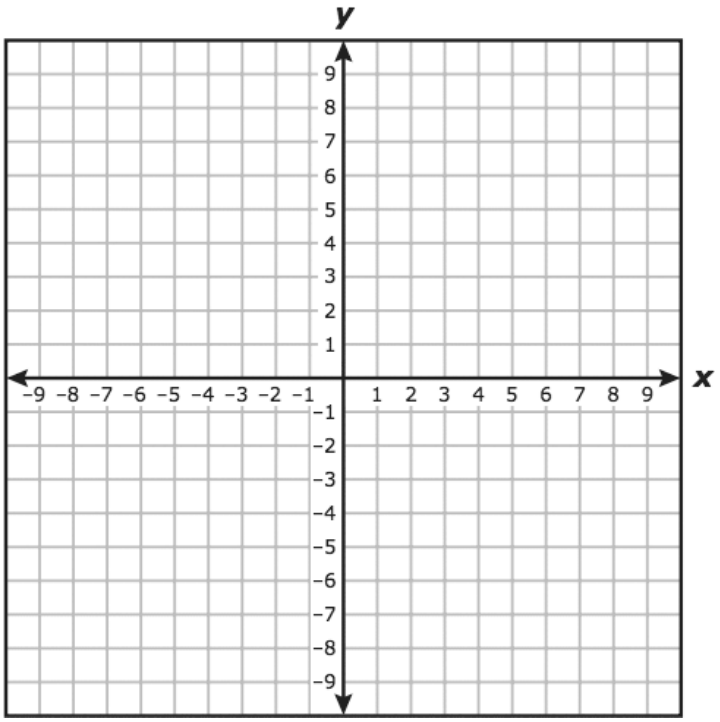
13. A straight line passes through the points (1, -4) and (3, 4).

(a) Find the equation of the straight line. You must show all steps in your working.

.....

(4)

(b) By plotting both points on the coordinate grid, draw the graph of the straight line.



(1)

(c) Find the y-intercept of the straight line.

.....

(1)

(Total for Question 13 is 6 marks)

14. (a) The line with equation $y = 5x + k$ passes through the point $(2, 11)$. Find the value of k.

.....

(2)

(b) A parallel line passes through $(4, 11)$. Find the equation of the line.

.....

(3)

(Total for Question 14 is 5 marks)

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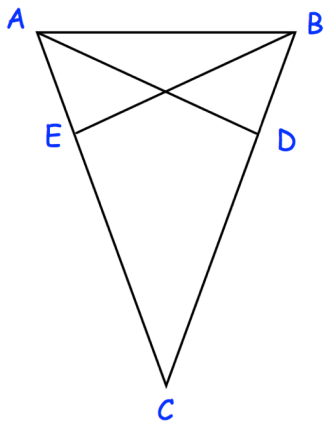
15. ABC is an isosceles triangle in which AC = BC.
D and E are points on BC and AC such that CE = CD.

Prove triangles ACD and BCE are congruent.
You must give reasons for each stage of your proof.



(Total for question 15 is 4 marks)

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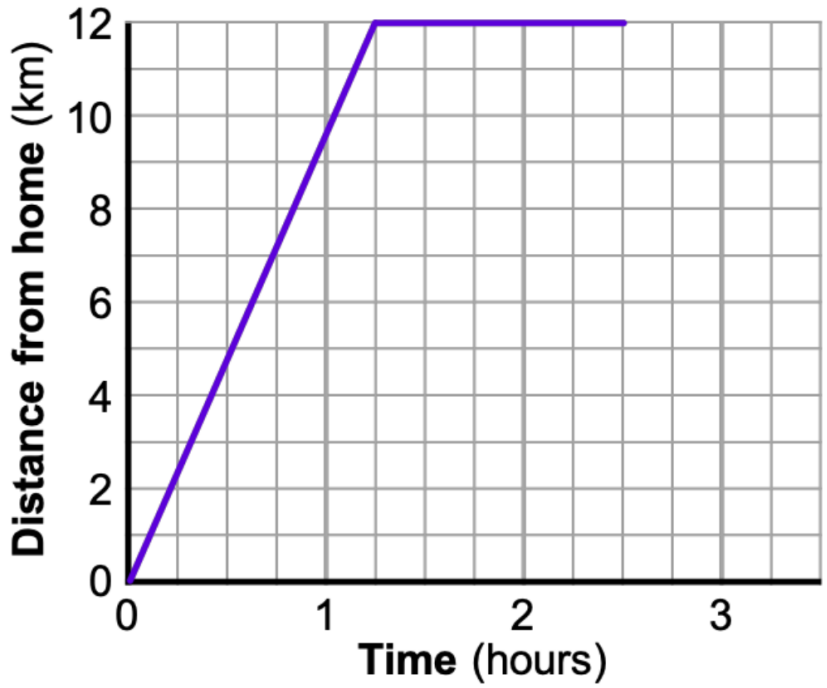
16. The graph shows part of Matthew's journey from his house to the gym and back.



(a) Work out Matthew's average speed on his way to the gym. Give your answer in km/h.

.....km/h
(2)

(b) Matthew stayed at the gym for some time before travelling home at a steady speed of 16 km/h.

(i) For how many minutes did he stay at the gym?

.....minutes
(1)

(ii) Complete the travel graph showing Matthew's journey home.

(1)

(iii) What time did he arrive home?

.....
(1)

(Total for Question 16 is 5 marks)

17. (a) Write down the value of y^0.

.....

(1)

(b) Work out $\dfrac{9.6\times10^{141}+6.4\times10^{140}}{3.2\times10^{16}}$

Give your answer in standard form.

.....

(3)

(Total for Question 17 is 4 marks)

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18. $a=\dfrac{p-q}{t}$

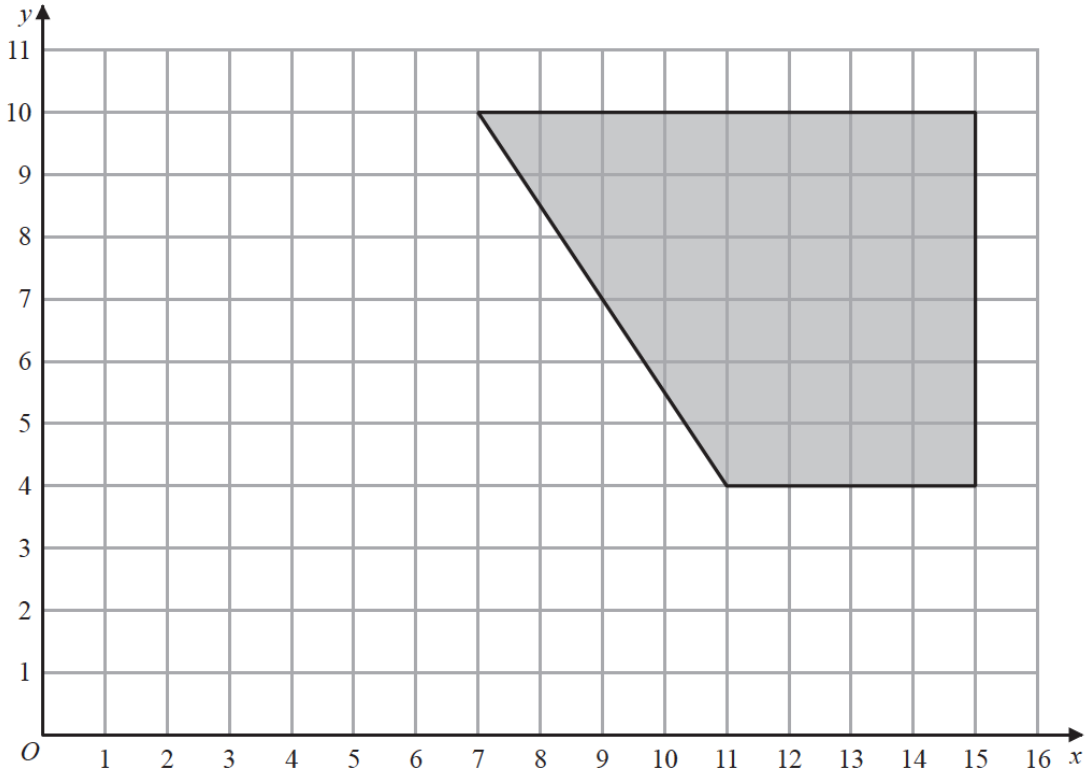
$p=8.4$ correct to 2 significant figures.
$q=6.3$ correct to 2 significant figures.
$t=0.27$ correct to 2 significant figures.

Work out the upper bound for the value of a.
Show your working clearly.
Give your answer correct to 1 decimal place.

.....

(Total for Question 18 is 3 marks)

19.



On the grid, enlarge the shaded shape with scale factor $\frac{1}{2}$ and centre (1, 2)

(Total for Question 19 is 2 marks)

20. *A, B* and *C* are points on a circle with centre *O*.

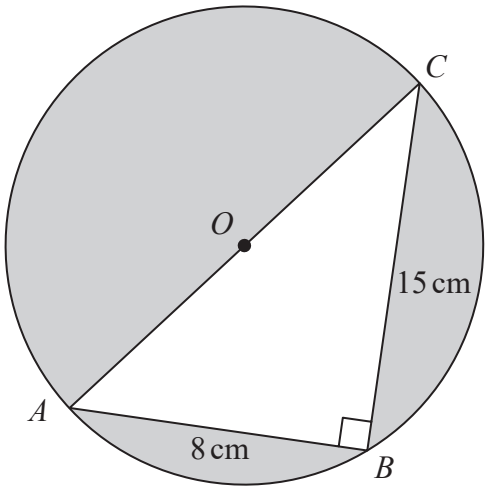


Diagram **NOT** accurately drawn

AOC is a diameter of the circle.

AB = 8 cm *BC* = 15 cm

Angle *ABC* = 90°

Work out the total area of the regions shown shaded in the diagram.

Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 20 is 5 marks)

21. *ABCDE* is a regular pentagon.

DEFGHI is a regular hexagon.

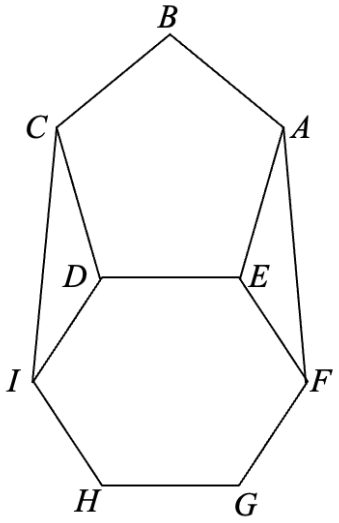


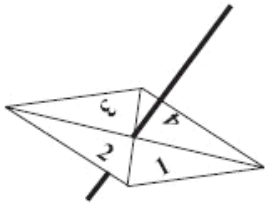
Diagram **NOT** accurately drawn

Work out the size of angle *EAF*.

.....°

(Total for question 21 is 4 marks)

22. Here is a 4-sided spinner.



The sides of the spinner are labelled 1, 2, 3 and 4

The spinner is biased.

The probability that the spinner will land on 1 and the probability that the spinner will land on 3 is given in the table.

Number	**1**	**2**	**3**	**4**
Probability	0.32		0.23	

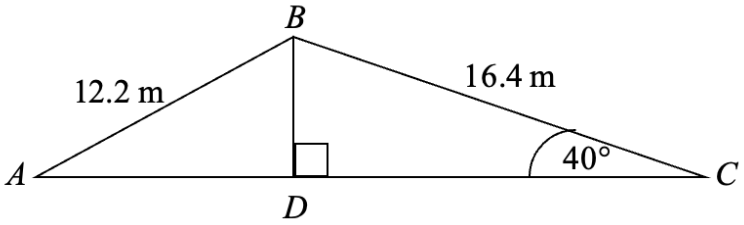
The probability that the spinner will land on 2 is **twice** the probability that it will land on 4

Sandeep is going to spin the spinner 400 times.

Work out an estimate for the number of times it will land on 2

(Total for question 22 is 4 marks)

23. The diagram shows two triangles, *ABD* and *BCD*.



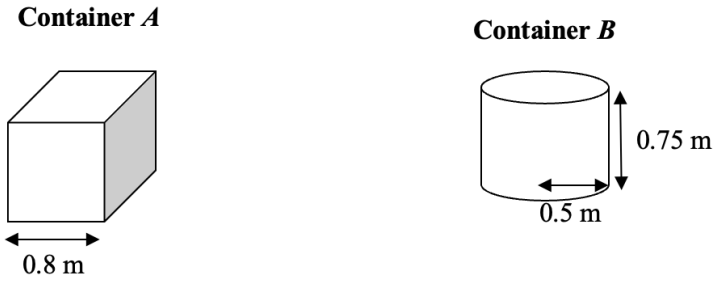
ADC is a straight line.

Work out the length of *AD*.

Give your answer correct to 3 significant figures.

(Total for question 23 is 3 marks)

24. The diagram shows two water containers.



Container *A* is in the shape of a cube and empties at a rate of 0.016m^3 per minute.

Container *B* is in the shape of a cylinder with radius 0.5 m and empties at a rate of 0.017 m^3 per minute.

Which water container, *A* or *B*, will empty the fastest?

You must show your working.

(Total for question 24 is 4 marks)

25. Solve the equations below:

(a) $3x^2 + 4 = 31$

…… **(4)**

(b) $\frac{2}{5}x - 6 = 8$

…… **(2)**

(c) $\frac{2}{3}(x - 1) = 3(x - 8)$

…… **(4)**

(Total for question 25 is 10 marks)

THE END

EXTRA PAPER