GCSE Mathematics Higher Tier

Practice Paper (Thematic) - 24 Questions

Time allowed: 1 hour 45 minutes
Answer all questions. Show all working out. Calculators may be used.

Section A: Number and Algebra

1. Simplify:
$$\frac{3x^2y}{6xy^2}.$$

2. Solve for x:
$$2x^2 - 5x - 3 = 0.$$

3. Rationalise the denominator:
$$\frac{5}{\sqrt{7}}.$$

4. Write the recurring decimal $0.\overline{36}$ as a fraction in simplest form.

5. The nth term of a sequence is $a_n = 2n^2 - 3$. Find the first 4 terms and determine whether 51 is a term in the sequence.

6. Solve the inequality:
$$3x - 7 < 2x + 5.$$

7. Expand and simplify: $(x + 2)(x - 5)(x + 1)$.

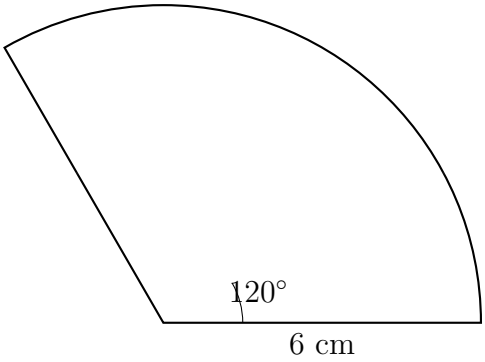
8. Solve simultaneously:
$$2x + 3y = 12, \quad y = x^2.$$

Section B: Geometry and Trigonometry

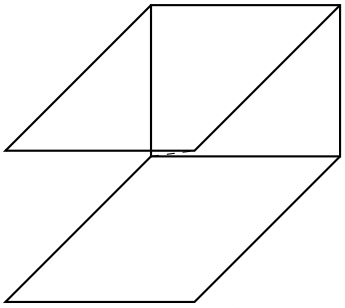
9. A triangle has sides 7 cm, 8 cm, and 9 cm. Use Heron's formula to find its area.

10. Solve for x where $0° \leq x \leq 360°$:
$$2\sin x = 1$$

11. The diagram shows a sector of a circle with radius 6 cm and angle 120°. Find the area of the sector and the length of the arc.

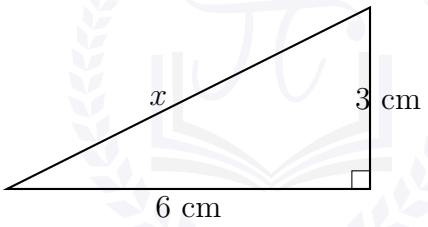


12. A cuboid has dimensions $4 \times 5 \times 10$ cm. Work out the length of the diagonal across the cuboid. (Diagram not to scale.)



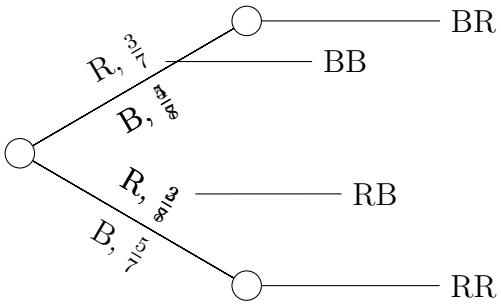
13. Vectors $\mathbf{a} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$. Calculate $3\mathbf{a} - 2\mathbf{b}$ and find its magnitude.

14. The diagram shows a right-angled triangle. Calculate x.



Section C: Probability and Statistics

15. A box contains 3 red balls and 5 blue balls. Two balls are taken without replacement. Draw a probability tree and find the probability of (i) two reds, (ii) one of each colour.



16. The grouped frequency table below shows marks of 40 students in a test.

Mark interval	Frequency
0-10	6
10-20	8
20-30	12
30-40	10
40-50	4

Estimate the mean mark.

17. A biased coin has probability 0.6 of landing heads. It is tossed 200 times. Estimate the number of heads expected and comment on variation in results.

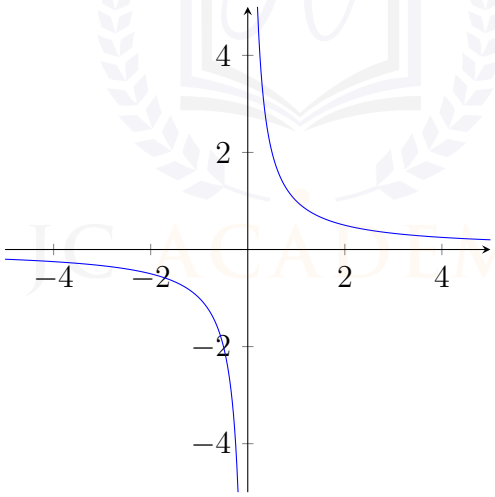
Section D: Functions and Extended Problems

18. The function is $f(x) = x^2 - 4x + 3$. Find the turning point and state whether it is a maximum or minimum.

19. Solve the inequality:
$$\frac{2x - 3}{x + 1} > 1.$$

20. A car travels 150 km in 2 h 30 min. Calculate its average speed in km/h. If fuel efficiency is 12 km per litre, how many litres are used?

21. Sketch the graph of $y = \dfrac{1}{x}$. Show asymptotes.



22. The probability of winning a game is p. A player plays 5 independent games. Write an expression for the probability of (i) winning all 5, (ii) winning at least 1.

23. A solid metal sphere of radius 3 cm is melted and recast into small cubes of side 1 cm. How many cubes are made?

24. Show that the equation

$$x^3 - 2x - 5 = 0$$

has a root between $x = 2$ and $x = 3$.