

# Practice paper 1

*Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided written working shows this. You are therefore advised to show all working.*

## Section A

- 1** The first 3 terms in a geometric sequence are 64, 32 and 16.
  - a** Write down the value of  $r$ .
  - b** Find  $u_6$ .
  - c** Find the sum to infinity of the sequence.

[1 mark]

[2 marks]

[2 marks]

[illegible]

**2** Let  $f(x) = 2x \cos x$

**a** Find  $f'(x)$ .

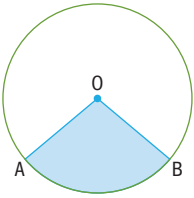
*[4 marks]*

**b** Find the gradient of the graph of  $f$  at  $x = \pi$ .

[3 marks]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 3** O is the centre of the circle that has a radius of 6 cm.



The area of the shaded sector OAB is  $27 \text{ cm}^2$ .

- Find the size of angle AOB in radians.
- Hence find the length of the minor arc AB.

[4 marks]

[3 marks]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- for school is  $\frac{1}{10}$  if he travels by car and  $\frac{1}{5}$  if he travels by bus.

On any particular day he is equally likely to travel by car or by bus.

- a** Draw a probability tree diagram to illustrate this information. [3 marks]
- b** Find the probability that Top will be late for school. [2 marks]
- c** Given that Top is late for school, find the probability that he travelled by bus. [2 marks]

[illegible]

**5** Solve the equation  $\cos 2\theta + 3\sin\theta = 2$  where  $0 \leq \theta \leq \frac{\pi}{2}$ .

[7 marks]

[illegible]

- [6 marks]

[illegible]

- a** Find the vector  $\overrightarrow{AB}$ .

[4 marks]

- [4 marks]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.



## Section B

- 8** Let  $f(x) = \frac{x+2}{x}$  and  $g(x) = x-1$ .

- a** Find  $(f \circ g)(x)$  [2 marks]  
**b** Write down the equation of the vertical asymptote of  $(f \circ g)(x)$ . [1 mark]

The vector  $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$  translates the graph of  $(f \circ g)$  to the graph of  $h$ .

- c** Find the vertical asymptote of  $h$ . [2 marks]

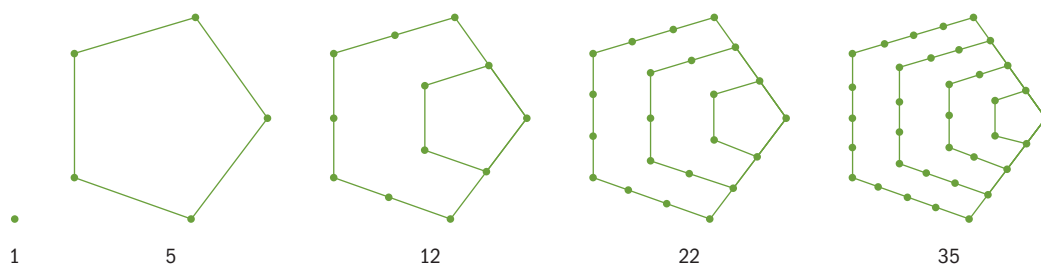
- d** Show that  $h(x) = \frac{x-2}{x-4} - 2$ . [3 marks]

- e** Find the gradient of  $h$  at the point  $(2, -2)$ . *[5 marks]*

[illegible]

Handwriting practice lines consisting of 40 horizontal dotted lines.

- 9** A sequence can be formed by counting the number of dots in consecutive nested polygons, as shown in the figure below.



The numbers in the sequence 1, 5, 12, 22, 35, ... are called pentagonal numbers.

- a** Write down the 6th and 7th pentagonal numbers.

[2 marks]

The table below shows the number of dots in successive shapes.

<b>Shape (s)</b>	1	2	3	4	5
<b>Number of dots (n)</b>	1	5	12	22	35

- b** There is an expression for  $n$  in the form  $as^2 + bs + c$  where  $s$  is the shape number and  $n$  represents the number of dots. Given  $c = 0$ , show that the model is  $n = 1.5s^2 - 0.5s$ .

[5 marks]

- c** Use your expression for  $n$  to check your answers to part **a**.

[3 marks]

- d** Use your expression to explain why 100 is not a pentagonal number.

[3 marks]

- e** Write down the scope and limitations of your domain over the real numbers.

[2 marks]

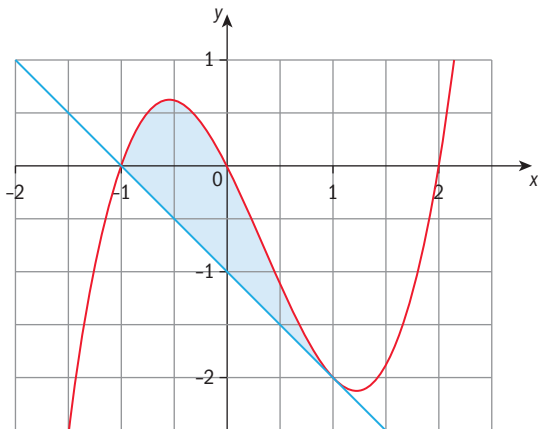
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[illegible]

**10** Let  $f(x) = x^3 - x^2 - 2x$ .

[7 marks]

**a** Show that the equation of the tangent to  $f$  where  $x = 1$  is  $y = -x - 1$ . The tangent crosses the graph of  $f$  for the second time where  $x = -1$ , as shown in the diagram below.



**b** Find the shaded area enclosed between the graph of  $f$  and the tangent line  $y = -x - 1$ .

[9 marks]

[illegible]

[illegible]