



Immanuel College

Specimen paper for entry into Year 12

Further Mathematics

NON-CALCULATOR

Time allowed: 1 hour

Total Marks: 48

Answer ALL questions

on lined paper

1. Simplify these expressions as far as possible.

a $\frac{x^2 - 3x - 10}{x^2 + 4x + 4}$ (3 marks)

b $\frac{x^2 - 36}{x^2 + x - 12} \div \frac{x^2 - 4x - 12}{x^2 - 9}$ (4 marks)

2. The line l is a tangent to the circle $x^2 + y^2 = 13$ at the point $P(3, 2)$.

The tangent intersects the y -axis at point A . Find the area of the triangle OPA . (5 marks)

3. Expand and simplify $(2\sqrt{p} - 3\sqrt{q})(2\sqrt{p} + \sqrt{q})$ (3 marks)

4. a Write $3x^2 - 9x + 5$ in the form $a(x + b)^2 + c$ (3 marks)

b Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 3x^2 - 9x + 5$. (1 mark)

5. Prove algebraically that the sum of the squares of two consecutive odd integers is always an even number. (4 marks)

6. The functions g and f are defined as $g(x) = \frac{3x}{3+x}$ and $f(x) = 2x - 5$

Given that $x \neq -3$, find the value(s) of x such that $g(x) = f(x)$, giving your answer(s) to 2 decimal places. (6 marks)

7. The line l_1 has equation $y = -\frac{1}{4}x + 5$ and intersects the x - and y -axes at points A and B respectively.

a Find the exact length of the line segment AB . (3 marks)

b Find the equation of the line l_2 perpendicular to l_1 which passes through the point $P(1, -3)$.

The line l_2 intersects l_1 at the point C . (2 marks)

c Find the midpoint of the line segment AC . (4 marks)

8. A triangle ABC has side lengths $AB = 12$ cm, $BC = 7$ cm and $AC = 9$ cm.

a Find the size of the largest angle, giving your answer to 2 decimal places. (3 marks)

b Find the area of the triangle, giving your answer to 2 decimal places. (2 marks)

9.

a Sketch the graph of $y = \sin x$ for $0 \leq x \leq 540^\circ$, showing the points where the graph cuts the axes. (2 marks)

b Hence find the exact values of x in the interval $0 \leq x \leq 540^\circ$ for which

$\sin x = \frac{1}{\sqrt{2}}$ (3 marks)