



# A Level Further Maths

## Summer bridging work

We hope you are looking forward to starting Further Maths in September.

Please complete the questions below. To help you you may need to complete the free course on the Advanced Maths Support Programme website

<https://mymei.powerappsportals.com/Learner-Transition-to-A-Levels-and-Core-Maths-Skills>.

You will need to create a free account first.

### Task

1) Simplify these expressions as far as possible.

a)  $\frac{x^2 - 2x - 3}{x^2 + 2x + 1}$  (3 marks)

b)  $\frac{x^2 - 25}{x^2 + 6x + 8} \div \frac{x^2 - 2x - 15}{x^2 - 16}$  (4 marks)

2) The line  $l$  is a tangent to the circle  $x^2 + y^2 = 20$  at the point  $P(2, 4)$ .  
The tangent intersects the  $y$ -axis at point  $A$ . Find the area of the triangle  $OPA$ .  
(5 marks)

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

4) a) Write  $3x^2 - 12x + 7$  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  $y = 3x^2 - 12x + 7$  (1 mark)

5) Prove algebraically that the product of three consecutive **odd** numbers is always an odd number. (4 marks)

6) The functions  $g$  and  $f$  are defined as  $g(x) = \frac{2x}{4-x}$  and  $f(x) = 3x - 1$

Given that  $x \neq 4$ , 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  $y = -\frac{1}{2}x + 3$  and intersects the  $x$ - and  $y$ -axes at the 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  $P(-1, -2)$ . (2 marks)

The line  $l_2$  intersects  $l_1$  at the point  $C$ .

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

8) A triangle  $ABC$  has side lengths  $AB = 10\text{cm}$ ,  $BC = 15\text{cm}$  and  $AC = 8\text{cm}$ .

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  $y = \cos x$  for  $-180 \leq x \leq 360^\circ$ , showing the points where the graph cuts the axes. (2 marks)

b) Hence find the exact values of  $x$  in the interval  $-180 \leq x \leq 360^\circ$  for which  $\cos x = -\frac{\sqrt{3}}{2}$  (3 marks)