

# Springburn Academy : Mathematics Department

## Higher Mathematics : Lesson Starters

### Block 1 (Differentiation 1)

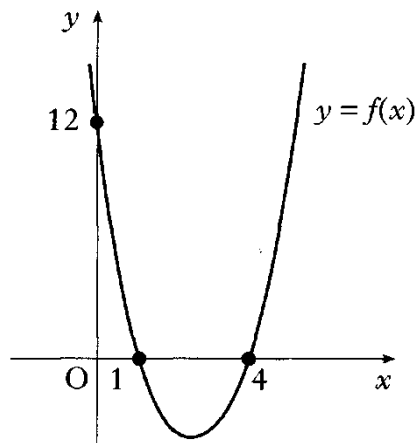
Without using a calculator:

#### Task 1

- 1  $f(x) = 3x^3 + 2x$ , find  $f'(x)$
- 2 Differentiate  $f(x) = 15x^{\frac{4}{3}}$
- 3 Factorise  $x^4 - x^3 - 6x^2$  fully.
- 4  $g = i + 2j - 8k$  and  $h = 2i - 3j$ . Calculate  $g \cdot h$

#### Task 2

- 1 Differentiate  $y = 2x^{-\frac{2}{5}} + 4\sqrt{x^5}$
- 2  $f(x) = (1 - 4x)(2 + x)$ . Find  $f'(x)$ .
- 3 The vertices of a triangle are  $K(2,2)$ ,  $L(10,4)$  and  $M(6,-1)$ . Find the equation of the median  $MN$ .
- 4 Find the equation of the function shown.



#### Task 3

- 1 Find the derivative of  $y = \frac{6}{\sqrt[3]{x^5}} + x^3\sqrt{x}$
- 2  $y = \frac{x^2 - x^3}{\sqrt{x}}$ . Find the value of  $\frac{dy}{dx}$  when  $x = 4$ .
- 3 A line passes through the points  $(1,3)$  and  $(6,2)$ . Find the equation of the line which is parallel to the given line and passes through  $(-3,7)$ .
- 4 Show that  $x = 4$  is the only real solution to the equation  $3x^3 - 11x^2 - 16 = 0$

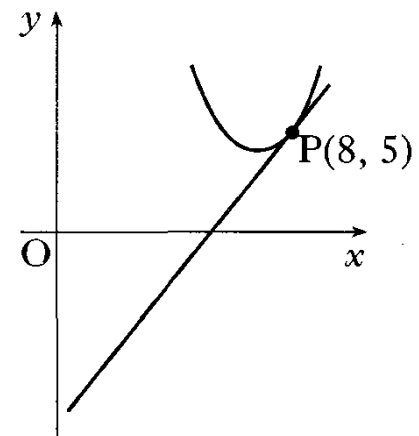
#### Task 4

- 1 Find the equation of the tangent to the curve  $y = x^3 + 6$  at the point  $(1,7)$ .
- 2  $f(x) = \frac{x^2 + 32}{\sqrt{x}}$ . Find  $f'(16)$
- 3  $A(-2,2)$  and  $C(3,-1)$  are opposite vertices of a kite ABCD. Find the gradient of diagonal BD.
- 4 The vectors  $\mathbf{u} = \begin{pmatrix} k \\ -1 \\ 1 \end{pmatrix}$  and  $\mathbf{v} = \begin{pmatrix} 0 \\ 4 \\ k \end{pmatrix}$  are perpendicular. What is the value of  $k$ ?

#### Task 5

The parabola with equation  $y = x^2 - 14x + 53$  has a tangent at the point  $P(8, 5)$ .

(a) Find the equation of this tangent.



(b) Show that the tangent found in (a) is also a tangent to the parabola with equation  $y = -x^2 + 10x - 27$  and find the coordinates of the point of contact Q.

