

Springburn Academy : Mathematics Department

Higher Mathematics : Lesson Starters

Block 1 (Differentiation 3)

Without using a calculator:

Task 11

- 1 A curve has equation $y = x^3 - 6x$. There are two tangents to this curve with gradient 6.
Find the equation of each of these tangents.
- 2 Differentiate $y = 3\sin x$
- 3 In triangle ABC, A is (-2,-3), B is (2,-2) and C is (-4,4).
Find the equation of AD the altitude from A.
- 4 $4^x = \sqrt[3]{32}$. Find x.

Task 12

- 1 A curve has equation $f(x) = (x - 6)(x + 3)^2$. Find the stationary points of the curve and determine their nature.
- 2 $y = \sqrt{6x - 2}$. Find the rate of change of the function.
- 3 $f(x) = x^3 + nx + 48$. Find n given 2 is a solution to the equation $f(x) = 0$.
- 4 What is the equation of the line perpendicular to $x = 2y + 3$ which passes through the point (-1, -2)

Task 13

- 1 The distance a rocket travels is calculated using the formula $d(t) = 4t^3$, where t is the time in seconds after lift-off. Calculate the speed of the rocket after 8 seconds.
- 2 A curve has equation $f(x) = x^3 + 2x^2 - 4x - 8$. Find the stationary points of $f(x)$ and determine their nature.
- 3 For what value of k does the equation $2x^2 - 7x + k + 5 = 0$ have equal roots?
- 4 Differentiate $f(x) = \frac{2}{5x + 2}$

Task 14

- 1 The circumference, C centimetres, of the largest ripple on the surface of a pond after a stone hits it is given by the formula $C(t) = 4\pi\sqrt{t}$ where t is the time in seconds after the stone hits the water. Calculate the rate of change of the circumference of the largest ripple 9 seconds after the stone hits the water. Leave your answer as a multiple of π .
- 2 $f(x) = \cos^2 x + 2\sin 4x$. Find $f'(x)$.
- 3 Show that the line $y = 3x - 2$ and the curve $y = x^3 + 5x + 10$ intersect at the point $(-2, -8)$.
Prove that there are no other points of intersection between the curve and the line.
- 4 Find the gradient of the curve $h(x) = 4x^3 + x^2 - 7$ at $x = -2$

Task 15

The diagram shows part of the graph of the curve with equation $y = 2x^3 - 7x^2 + 4x + 4$.

- (a) Find the x -coordinate of the maximum turning point.
- (b) Factorise $2x^3 - 7x^2 + 4x + 4$.
- (c) State the coordinates of the point A and hence find the values of x for which $2x^3 - 7x^2 + 4x + 4 < 0$.

