THE GC SCHOOL OF CAREERS

DEPARTMENT OF MATHEMATICS

EXTRA PRACTICE

CORE MATHEMATICS 4

DIFFERENTIATION

EXERCISES

1. **a)** Find $\frac{dy}{dx}$ when $y = e^x \sin 2x$.

Hence find the equation of the tangent to the curve $y = e^x \sin 2x$ at the origin.

b) Show that the equation of the normal to the curve $y = e^x \sin 2x$ at the point where $x = \pi$ is

$$2e^{\pi} y + x = \pi .$$

2. A curve is given by the parametric equations

$$x = 2 - t^2, \qquad y = 4t .$$

a) Find $\frac{dy}{dx}$ in terms of t.

b) Hence find the equation of the normal to the curve at the point $(-14,16)$, giving your answer in the form

$$y = mx + c .$$

3. A curve is defined by the parametric equations

$$x = 3 - 4t \qquad y = 1 + \frac{2}{t}$$

a) Find $\frac{dy}{dx}$ in terms of t.

b) Find the equation of the tangent to the curve at the point where $t = 2$, giving your answer in the form $ax + by + c = 0$, where *a*, *b* and *c* are integers.

c) Verify that the Cartesian equation of the curve can be written as

$$(x-3)(y-1)+8=0$$

4. A curve C is described by the equation

$$3x^2 + 4y^2 - 2x + 6xy - 5 = 0\,.$$

Find an equation of the tangent to C at the point (1, -2), giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

5. A curve has equation $7x^2 + 48xy - 7y^2 + 75 = 0$.

a) Use implicit differentiation to find an expression for $\frac{dy}{dx}$.

A and *B* are two distinct points on the curve. At each of these points the gradient of the curve is equal to $\frac{2}{11}$.

b) Show that $x + 2y = 0$ at the points *A* and *B*.

c) Find the coordinates of the points *A* and *B.*