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|  | **YEAR 12 MATHEMATICS SPECIALIST**  **SEMESTER TWO 2017**  **QUESTIONS OF REVIEW 5: Differentiation  with Applications** |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Thursday 29th June Time: 35 minutes Mark /30

CAS free, scientific calculator allowed.

### [7 marks – 1, 3 and 3]

A curve is defined by the equation 

#### Verify that lies on the curve

#### Develop an expression for the gradient function

#### Determine an equation for the normal to the curve at .

### [4 marks]

A particle with displacement  has velocity .

Show that the acceleration is constant and evaluate this constant.

### [6 marks – 3, 2 and 1]

A second charged particle in a magnetic field has velocity  cm/sec when it has travelled *x* cm from rest.

#### Show that, if and represent small changes in *x* and *v* respectively,

#### Estimate the percentage change in *x* needed to reduce *v* by 4%.

#### Explain whether this is a valid method to estimate the effect of a 50% change in *x*.

### [8 marks – 4, 1, 1 and 2]

A damaged oil tanker is leaking oil into the sea. A current pushes the spreading oil into the shape of a sector of a circle, with radius  and sector angle . Both  and  change with time.

The area of a sector is given by .

#### Show that

#### The radius of the oil spill is increasing at 2 m per minute and the area at 2π m2 per minute.

#### When the oil spill has a radius of 6 m:

#### determine the area at this instant

#### find the exact value of at this instant

#### calculate the rate of change of at this instant.

### [5 marks]

A small boat is being hauled towards a wharf by a winch mounted 2.5 m above water level. The winch is pulling the connecting rope at a rate of 0.06 m per second.

How fast is the boat moving horizontally when there is 6.5 of rope between the boat and the winch?