



# MATHEMATICS DEPARTMENT

## Year 12 Methods - Test Number 1 - 2016

### Differentiation of Exponential and Trigonometric Functions

### Resource Free

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

Marks: 17

Time Allowed: 15 minutes

**Instructions:** You are NOT allowed any Calculators or notes.

You will be supplied with a formula sheet.

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1. Find  $\frac{dy}{dx}$  for

a)  $y = \frac{1}{2e^{3x}}$

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b)  $y = \cos(e^x)$

c)  $y = 3x^2 e^{2x}$

d)  $3 \tan(1+e)^2$

**[3,3,3,2 = 11 Marks]**

2. Find the equation of the tangent to the curve defined by  $h = (t^2 - 1)(t + 1)^8$  at the point (1,0).



**ALL SAINTS'**  
**COLLEGE**

# **MATHEMATICS DEPARTMENT**

**Year 12 Methods - Test Number 1 - 2016**

**Differentiation of Exponential and  
Trigonometric Functions**

**[6 Marks]**

**Resource Rich**

**Name:** \_\_\_\_\_ **Teacher:** \_\_\_\_\_

**Marks:** 28

**Time Allowed:** 30 minutes

**Instructions:** You are allowed a ClassPad and 1 page of notes (both sides).

You will be supplied with a formula sheet.

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- 1) The population of a colony of numbats is being monitored by a group of scientists from Murdoch University. The population,  $P$ , after  $t$  years is modelled by the equation

$$P = 4000e^{-0.01t}$$

- a) What was the initial population of this colony of numbats?

b) Find the exponential growth/decay of this colony?

c) Find the population after 5 years?

d) After how many years will the population of numbats be half the size of the original population?

**[1,2,2,2 = 7 Marks]**

2) An Olympic Ski Jumping slope has been designed so that it follows the curve:

$$y = 3\cos\left(\frac{\pi x}{4}\right) + 8 \text{ for } 0 \leq x \leq 5, \text{ where } x \text{ and } y \text{ are both in metres.}$$

a) What is the take-off angle at the end of the jump (to the nearest degree) remembering that  $m = \tan \theta$ ?

b) Sketch the curve below:

**[4,2 = 6 Marks]**

3) Western Australia is suffering from a decrease in average annual

rainfall over time,  $t$  years, according to the formula  $\frac{dR}{dt} = -.00975R$ .  
The first average annual rainfall measured in WA was 880mm.

a) Find a formula for the average annual rainfall in this region.

b) Find the average annual rainfall after:

i) 20 years

ii) 100 years

c) What is the rate at which the rainfall is decreasing after 100 years.

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**[2,2,2,3 = 9 marks]**

4) Differentiate each of the following with respect to x:

a)  $3x^2\sin(3x)$

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b)  $[1+\cos(2x)]^4$

$$\text{c) } \frac{e^{3x}}{(1-5x^2)}$$

**[2,2,2 = 6 marks]**

**\*\*End of Test\*\***

**\*\*\*Extra space for working out\*\*\***