



# KINGSWAY CHRISTIAN COLLEGE

## MATHS DEPARTMENT

**Course:** Mathematics Methods Year 12

**Assessment Task:** Test 1 – Exponential Functions & Differentiation

**Student Name:** \_\_\_\_\_

**Date:** 16<sup>th</sup> February 2017

**Assessment Score:** \_\_\_\_\_ / 40

**Year Score:** \_\_\_\_\_

**Comments:** \_\_\_\_\_

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**Teacher signature:** \_\_\_\_\_

**Parent/ Guardian signature:** \_\_\_\_\_

**Comments:** \_\_\_\_\_

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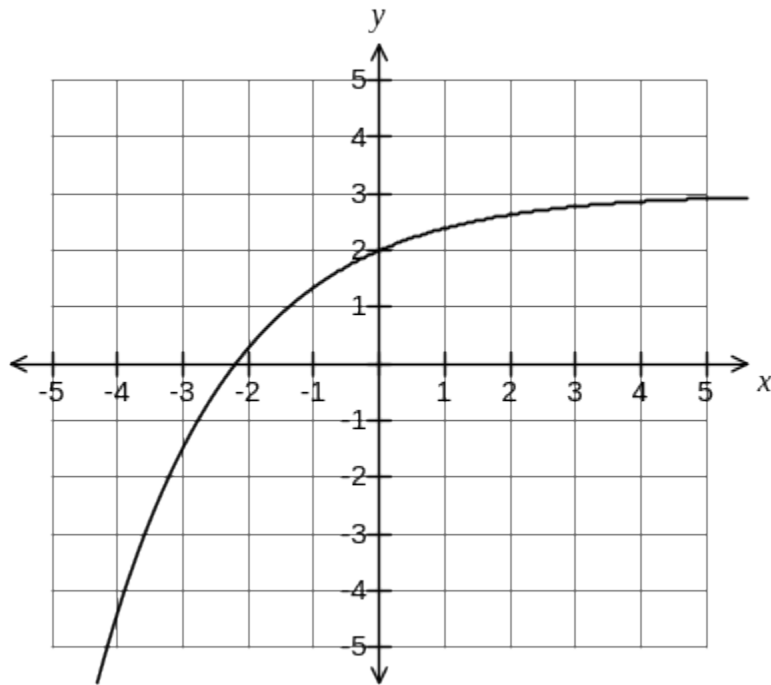
**Question 1: [3 Marks]**

The population of a certain fish in the Ningaloo Reef grows continuously at a rate of 5% per year. The number of fish on 1<sup>st</sup> January, 2016 was estimated at 2500.

- Find an expression to model  $P$ , the number of fish,  $t$  years into the study.
- Find the population at 1<sup>st</sup> January, 2020. Give your answer in terms of  $e$ .
- Give the calculator algorithm you would use to calculate the time,  $t$ , when the population will quadruple in size.

**Question 2:** [2,2 = 4 Marks]

The graph of  $y = ae^{bx} + c$  is shown below. The graph passes through the point  $(0, 2)$ , and  $y \rightarrow 3$  as  $x \rightarrow \infty$ .



a) Is  $b$  positive or negative? Justify your answer.

b) Evaluate  $a$  and  $c$ .

**Question 3: [3, 2 = 5 Marks]**

Find  $\frac{dy}{dx}$  if:

a)  $y = \frac{\sqrt[3]{x^2} - 6x^2}{2x}$

b)  $y = 2ax^a - 4a^2$ , where  $a$  is constant and  $a > 0$

**Question 4: [2, 2, 3, 3, 3 = 13 Marks]**

Find the derivative of each of the following. Simplify all answers.

a)  $y = (2x - 5)(x^2 - 3x + 4)$

b)  $y = \frac{3x - 2}{3x^2 + 1}$

c)  $\left(\sqrt[4]{x^2+4}\right)^3$

d)  $y = \frac{3x^5}{e^{2x}}$

e)  $y = \frac{3}{\sqrt{1+e^{5x}}}$

**Question 5: [3,2 = 5 Marks]**

Differentiate the following, without simplifying:

a)  $y = \frac{x-1}{x^2+4}$

b)  $y = e^{2x-x^2}$

**Question 6: [4 Marks]**

Show that  $y = \frac{1+e^{3x-1}}{2e^{-x^2}}$  can be differentiated **without** using the product **or** quotient rule.

**Question 7: [2, 4 = 6 Marks]**

- a) Simplify  $y = \frac{4x+12}{x^2-9}$ , stating any exclusions from the domain.

Hence, make use of the chain rule with Leibnitz notation, to determine:

- b)  $\frac{dz}{dy}$ , if  $z = \frac{1}{3x}$  and  $y = \frac{4x+12}{x^2-9}$



## EXTRA WORK SPACE