**Kingsway Christian College**

**Maths Department**

**Course**: Mathematics Methods Year 12

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

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

**Date**: 16th February 2017

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

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

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

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

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

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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 1st January, 2016 was estimated at 2500.

1. Find an expression to model P, the number of fish, t years into the study.
2. Find the population at 1st January, 2020. Give your answer in terms of *e.*
3. 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:

1. $y=\frac{\sqrt[3]{x^{2} }- 6x²}{2x}$

b) $y=2ax^{a}-4a²$, 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.

1. $y=(2x-5)(x^{2}-3x+4)$
2. $y=\frac{3x-2}{3x^{2}+1}$
3. $\left(\sqrt[4]{x^{2}+4}\right)³$
4. ****
5. $y=\frac{3}{\sqrt{1+e^{5x}}}$

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

Differentiate the following, without simplifying:

1. $y=\frac{x-1}{x^{2}+4}$
2. $y=e^{2x-x²}$

**Question 6: [4 Marks]**

 Show that $y=\frac{1+e^{3x-1}}{2e^{-x²}}$ can be differentiated **without** using the product **or** quotient rule.

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

1. 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:

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

**EXTRA WORK SPACE**