# MATHEMATICS DEPARTMENT

## Year 12 Methods - Test Number 1 - 2017
## Differentiation of Exponential and Trigonometric Functions
## Resource Free

**Name:** ________________________________ **Teacher:** ____________________

**Marks:** **18**

**Time Allowed:** **20 minutes**

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

You will be supplied with a formula sheet.

---

1. Find $\dfrac{dy}{dx}$ *for*

   a) $y = \dfrac{16e^x}{4e^{5x}}$

   b) $y = 2\sin(e^{2x})$

c) $y = 3x^2e^{2x}$ [simplify your answer]

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

**[3,3,3,3 = 12 Marks]**

2. Find the equation of the tangent to the curve defined by $h = (e^{2t})(e^t + 1)^2$ at the point (0,4).

# MATHEMATICS DEPARTMENT

## Year 12 Methods - Test Number 1 - 2017

## Differentiation of Exponential and Trigonometric Functions

[6 Marks]

## Resource Rich

**Name:** ___________________________________________ **Teacher:** ____________________

**Marks:** **26**

**Time Allowed:** **25 minutes**

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

You will be supplied with a formula sheet.

---

1) It is known that the amount of a dangerous 'recreational drug' (in mg) left unabsorbed in the bloodstream after t hours is given by

$$\mathbf{U = 100e^{-0.05t}}$$

a) Show that the rate of change of U with respect to time is proportional to the amount of the drug remaining.

b) Find the time taken for 90% of the initial amount of the drug to be absorbed by the bloodstream. Give your answer to the nearest hour.

c) Find an expression that describes the amount of the drug absorbed by the bloodstream after t hours.

**[3,2,1 = 6 Marks]**

2) a) The normal to a given curve at a point is defined as the perpendicular to the tangent at that point. Find the equation of the normal to the curve $y = \frac{e^x}{2 - x}$ at the point where $x = 1$.

b) $y = x + 1$ is a tangent to the curve $y = ax + b \sin x$ at the point $(\frac{\pi}{2}, 1 + \frac{\pi}{2})$. Find $a$ and $b$.

**[4,4 = 8 Marks]**

3) Fishermen monitored the growth of the population of sardines in a particular location over a 30 year period from 1985 when the population was estimated to be 2 000 000 . They found that the population was continuously growing with the instantaneous rate of increase in the population per year $\frac{dP}{dt}$, always close to $\frac{P}{20}$.

a) Estimate the population of sardines at the end of the 30 year period.

b) If this pattern of growth continues estimate the population of sardines in 2040.

**[3,3 = 6 marks]**

4) The displacement, x cm, of a particle from a fixed point O, *t* seconds after it is released is modelled by the equation x = $-5\cos\frac{\pi t}{4}$ . Use a calculus method to determine:

a) The velocity of the particle after 2 seconds,

b) When during the interval $0 \le t \le 8,$ the particle travels with a speed of 1 $cms^{-1}$ .

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

**End of Test**