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| Mac Pro HD:Users:BruceH:Box Sync:01 Bruce.Darby@Ed:01a Daily Data:MRSHS Logo.png | **Mathematics Methods Unit 3 Year 12**  **Test 3**  **Exponential functions; 3.1.1, 3.1.2, 3.1.3, 3.1.4**  **Fundamental theorem; 3.2.15, 3.2.15, 3.2.17**  **Applications of integration; 3.2.18, 3.2.19, 3.2.20**  **Calculus of Trignometric Functions 3.1.5, 3.1.6, 3.1.9, 3.2.5** |

**Section 1: Calculator-free: 25 marks** Maximum **Time 25 minutes** **Total marks: 54**

**1. (20 marks; 2,2,3,2,2,2,2,3,2)**

Determine

a) given ****

b)

c) *dx*

d) 

e)  given 

f) *dt*

g) 

h)  given  (you do not need to simplify)

(i)  given y = 8 e4x cos (2x-7)

**2. [5 marks]**

Find the equation of the tangent to the curve

y = xe2x at the point (2, 2e4), giving your answer in terms of e

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

**Section 2: Calculator-assumed: 29 marks Minimum Time 30 minutes** **Total marks: 54**

**3. [3 marks]**

Determine the value of  (show justification).

**4. (5 marks; 3,2)**

**Darby Bank** offers a savings account, for people under 25 years of age, which attracts interest at a rate of 7% per annum compounded continuously. Fin starts up an account by depositing $600. If no more money is put into his account:

a) How much interest will he have accrued after 4 years?

b) How many years (to the nearest **day)** will it take for the balance in the account to be double the initial deposit?

**5. (5 marks; 1,2,2)**

A heated metal ball is dropped into a liquid. As the ball cools, its temperature, *T* °C, *t* minutes after it enters the liquid, is given by

*T=* 400 e–0.05*t* + 25, where *t* ≥ 0.

a) Find the temperature of the ball as it enters the liquid.

b) Find the value of *t* for which *T=* 300, giving your answer to 3 significant figures.

c) Find the rate at which the temperature of the ball is decreasing at the instant when

*t =* 50. Give your answer in °C per minute to 3 significant figures.

**6. (8 marks; 2,1,2,3)**

The size of a population of birds is changing according to the rule = -0.08*P,* where *P* is the number of birds in the population and *t* is the time in years from the initial population measurement. There are initially 1000 birds in the population.

a) State an equation for *P* in terms of *t*.

b) Determine

i) the number of birds in the population after 10 years.

ii) the time taken(to the nearest month) for the population of birds to drop below 800.

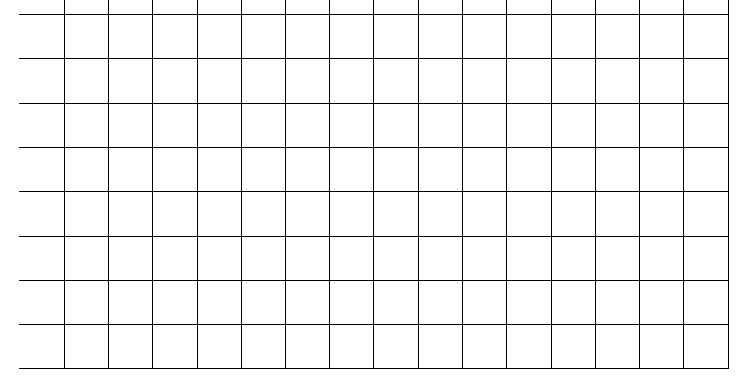
c) What is the value of when t = 10.

Interpret this answer in terms of the bird population

**7. [4, 2, 2 = 8 marks]**

We will investigate the area enclosed by the functions y = cos (1.5x) and y = sin (3x) over the domain 0 ≤ x ≤ π (Give all numerical answers to 2 decimal place accuracy)

a) Do a sketch graph of these two functions, clearly indicating the x coordinate of the points of intersection of the graphs and shading the area enclosed.



b) Write an expression for finding the individual areas enclosed by the curves (you can not use the absolute value function in your expression).

c) Determine the total area enclosed by the curves.