



PERTH MODERN SCHOOL  
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**Test 2**  
**Area Under Curve, F.T.O.C. Exponential Functions**  
**Semester One 2018**  
**Year 12 Mathematics Methods**  
**Calculator Assumed**

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

Date: Friday 16<sup>th</sup> March 7.45am

You may have a formula sheet for this section of the test.

- Teacher: \_\_\_\_\_
- Mr McCalland \_\_\_\_\_
- Mrs. Carter \_\_\_\_\_
- Mr Cannon \_\_\_\_\_
- Ms Cheng \_\_\_\_\_
- Mr Staffe \_\_\_\_\_
- Mr Strain \_\_\_\_\_

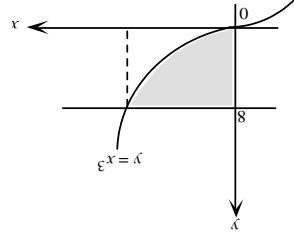
Total \_\_\_\_\_/40

45 minutes +5 minutes READING

**Question 1**

**(2 marks)**

The graphs with equations  $y = x^3$  and  $y = 8$  are shown. Write an expression that shows what the area of the shaded region is equal to:



**Question 2**

- (a) Calculate  $f'(0)$  when  $f(x) = e^{2x}(1+5x)^3$ .

**(5 marks)**

(3 marks)

- (b) Determine  $\frac{d}{dx} \int_x^5 \sqrt{t^2+1} dt$ .

(2 marks)

**Question 8****(4 marks)**

The population of mice in a closed habitat is known to increase according to the function:

$P'(t) = \frac{t}{3} + 6$ , where  $P'(t)$  is measured in hundreds of mice per month and  $t$  is measured in months. The measurement of the population commences at  $t=0$ ,

- (a) What is the total change in the population in the first 3 months after measuring commenced?  
(2 marks)

- (b) How long will it take for the increase in the population of mice to reach 4200? (2 marks)

(f) Explain why the answers to (c) and (e) are different. (1 mark)

(e) What is the area between  $f(x)=x^3-6x^2+12x-8$  and the  $x$ -axis from  $x=0$  to  $x=4$ ? (2 marks)

(d) Find  $\int_2^0 (x^3-6x^2+12x-8)dx$ . (2 mark)

(c) Find  $\int_4^0 (x^3-6x^2+12x-8)dx$ . (2 mark)

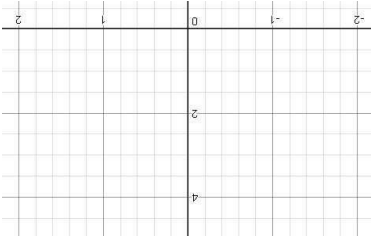
(b) What is the sign of  $f(x)=x^3-6x^2+12x-8$  from  $x=2$  to  $x=4$ ? (1 mark)

(a) What is the sign of  $f(x)=x^3-6x^2+12x-8$  from  $x=0$  to  $x=2$ ? (1 mark)

(9 marks)

Question 7

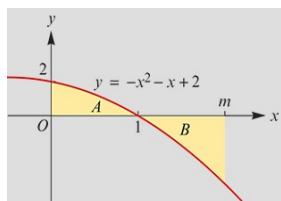
**Question 3**  
Show how to calculate the area of the region enclosed by the curves with equations  $y=x^2+1$  and  $y=4-x^2$  and the lines  $x=-1$  and  $x=1$ .  
Draw a sketch to help show your solution. Show your working. (4 marks)



**Question 4**

The graph of  $y = -x^2 - x + 2$  is shown.

Find the value of  $m$  such that  $A$  and  $B$  have the same area.

**(4 marks)****Question 5**

Given  $\frac{dy}{dx} = ae^{-x} + 2$  and that when  $x=0$ ,  $\frac{dy}{dx} = 5$  and  $y=1$ ,

Find the value of  $y$  when  $x=2$ .

**(4 marks)****Question 6****(8 marks)**

A group of biologists has decided that colonies of a native Australian animal are in danger if their populations are less than 1000. One such colony had a population of 2300 at the start of 2011. The population was growing continuously such that  $P = P_0 e^{0.065t}$  where  $P$  is the number of animals in the colony  $t$  years after the start of 2011.

(a) Determine, to the nearest 10 animals, the population of the colony at the start of 2014.

**(2 marks)**

(b) Determine the rate of change of the colony's population when  $t=2.5$  years.

**(2 marks)**

(c) At the beginning of 2017, a disease caused the colony's population to decrease continuously at the rate of 8.25% of the population per year. If this rate continues, when will the colony become "in danger"? Give your answer to the nearest month.

**(4 marks)**