

School of Mathematics & Applied Statistics  
**MATH151: Mathematics 1A**  
**Assignment Week 13**  
**Autumn 2009**

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

FULL WORKING is to be shown for all solutions.  
Untidy or badly set out work will not be marked.  
Not all the questions on the assignment will be marked.  
You will receive a mark out of ten for this assignment.  
This assignment is to be handed in during your tutorial in Week 15

This optional assignment has been written to give you extra questions to use for revision purposes. You can discuss the questions on this sheet by posting to the web-forum and/or by attending one of the revision classes that are run during STUVAC.

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**Assignment Week 13**  
**Autumn 2009 Submission Receipt**

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

*Tutorial Class:* \_\_\_\_\_ *Date Submitted:* \_\_\_\_\_ *Tutor Initials:* \_\_\_\_\_

1. Consider

$$p(t) = \frac{L}{1 + Ce^{-kt}}, \quad k = 0.03.$$

- (a) If  $p(0) = 5$  and  $p(100) = 45$  find the values for  $C$  and  $L$ .  
 (b) Using your answer to the previous part of this question predict the value  $p(150)$ .

2. The formula for radioactive decay is

$$R(t) = r_0 e^{-kt}$$

where  $k$  is the radioactive decay constant and  $r_0$  is the initial mass.

- (a) Show that the half-life ( $t_{1/2}$ ) is given by

$$kt_{1/2} = \ln 2.$$

- (b) Find the value for  $k$  if the half-life of Loftusium is 90 days.  
 (c) How long will it take for 50g of Loftusium to decay to 10g?

3. Re-arrange the formula

$$S = 10 \log(10^{12} \times I)$$

to make  $I$  the subject.

4. Rearrange the formula

$$7.9K = 2P - 13.9$$

to make it in the form  $K = mP + c$ .

- (a) what is the gradient  $m$ .  
 (b) Find the intercepts.  
 (c) Sketch the graph.

5. A certain bacteria initially weighs 0.5g and it triples every 7 hours.

- (a) What is the formula  $w(t)$  for the weight after  $t$  hours.  
 (b) What will its weight be after 3 days?  
 (c) When will it weigh 10g?

6. Find  $\frac{dy}{dx}$  for the following functions.

- (a)  $y = 9 + 2x^2 + 7x^3$   
 (b)  $y = x^2 \cos x$   
 (c)  $y = \frac{x^2 + 2}{e^x - 1}$

7. Evaluate the following integrals.

- (a)  $\int (3x - x^2) dx$ .  
 (b)  $\int_0^{\frac{\pi}{2}} (4e^{3x} - \sin(x)) dx$ .  
 (c)  $\int x^2 (x^3 - 2)^4 dx$ .

Hint. First let  $x^3 - 2 = u$ .