

## Higher Homework 1

1. Evaluate  $\log_5 2 + \log_5 50 - \log_5 20$  3
  
2. Given that  $\log_3(2x-1) + \log_3(3x) = \log_3 45$ ,  
find the value of  $x$ . 5
  
3. A radioactive substance decays according to the formula  $M_t = 120e^{-0.005t}$ ,  
where  $M_t$  is the mass (in micrograms) remaining after  $t$  years.
  - (a) What is the initial mass of the substance 1
  
  - (b) Calculate, **to the nearest year**, how long a sample would take to  
lose half of its original mass. 4
  
4. Carbon dating is used to determine the age of fossil remains, where the formula  
 $N(t) = N_0e^{kt}$  calculates the amount of carbon ( $N(t)$ ) at any given time.
  - (a) This formula is based upon the decay of  $^{14}\text{C}$ , a radioactive isotope of  
carbon with a half-life 5700 years.  
Use this information to calculate a value for  $k$  (the constant of decay)  
Give your answer to 4 significant figures 3
  
  - (b) A museum has a wooden wheel which is claimed to be over 1000  
years old. After carbon dating it is found that the wheel contains 88%  
of the amount of carbon of a living tree.  
Does this mean that the claim is true? 4

**20 MARKS**