

Test Four

This is a self-diagnostic test. Every pair of questions relates to a worksheet in a series available in the MUMS the WORD series. For example question 5 relates to worksheet 4.5 *Binomial Coefficients*. If you score 100% on this test and test 3 then we feel you are adequately prepared for your first year mathematics course. For those of you who had trouble with a few of the questions, we recommend working through the appropriate worksheets and associated computer aided learning packages in this series.

1. (a) Differentiate $y = \log(3x + 2)$
(b) Find $\frac{dy}{dx}$ if $y = x^2 \cos x$
2. (a) Given the following monotonically increasing function, find an upper and lower limit for the area under the curve between 0 and 4.

x	0	1	2	3	4
$g(x)$	2	3	5	6.5	7

- (b) Find the area under the curve $y = x^2 + 1$ between $x = 1$ and $x = 3$.
3. Evaluate the following indefinite integrals:
 - (a) $\int \frac{1}{x} dx$
 - (b) $\int \sec^2 x dx$
4. (a) Given $\frac{d^2x}{dt^2} = 9$ for all x and when $t = 0$ we have $\frac{dx}{dt} = 4$ and $x = 3$. What is x as a function of t ?
(b) A population $P(t)$ is given by the following formula:

$$P(t) = P(0)e^{kt}$$

If the initial population is 1000, and the growth rate is 0.01, what is the population at $t = 100$? (You can leave the answer in terms of the natural exponential)

5. Divide $6x^3 + x^2 - x + 4$ by $x + 1$.
6. (a) What is the coefficient of x^2 in the expansion of $(5x - 1)^5$?
(b) Evaluate $\frac{6!}{4!2!}$.