

**CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

Semester 2 Examinations 2007/08

Module Title: Calculus & Statistics

Module Code: MATH 6002

School: School of Science

Programme Title:

B.Sc. in Applied Biosciences – Year 1

B.Sc. in Analytical & Pharmaceutical Chemistry – Year 1

Programme Code:

SBIOS_7_Y1

SCHEM_7_Y1

External Examiner(s): Dr. P. Robinson

Internal Examiner(s): Ms. H. Lordan, Ms. F. Wood

Instructions: Answer QUESTION 1 (worth 30 points) and
TWO other questions (worth 35 points each)

Duration: 2 HOURS

Sitting: Summer 2008

Requirements for this examination: Mathematics Tables

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you are attempting the correct examination paper.
If in doubt please contact an Invigilator.

Q.1(a) A curve is described by $y = \frac{1}{2x-5}$. Find $\frac{dy}{dx}$ and hence find two values of x at which the slope of the tangent to the curve is $-\frac{1}{8}$.

(5 marks)

(b) The mass (M) in g of bacteria t seconds after starting an experiment is given by

$$M = 80e^{0.03t}.$$

(i) Find the mass present when time $t = 120$ s

(ii) Find the rate at which the mass is increasing when $t = 5$ mins.

(5 marks)

(c) Find $\int \left(\frac{p^3 + 3p^2 - 11}{p} \right) dp$

(5 marks)

(d) Evaluate $\int_1^2 (\sin 3x + \cos 4x) dx$

(5 marks)

(e) Find the mean, median and mode of the following distribution:

x	f
0	4
1	3
2	1
3	0
4	1

Give a *sketch* of a frequency curve and comment on the shape of the distribution.

(5 marks)

(f) The mean \bar{x} of five numbers is 10.8. Four of the numbers are: 3, 14, 9 and 6.

Find the fifth number and find $\sum (x - \bar{x})$.

(5 marks)

Q.2(a) Differentiate $y = x^2 + 7$ from first principles.

(7 marks)

(b) Differentiate each of the following with respect to the variable:

(i) $y = 5x^2 - \frac{1}{5x^2} + \ln(x^5)$

(ii) $A = e^{-4t} \cdot \sin(2t)$

(iii) $y = \frac{\sqrt{x^3 + 4}}{x^2 - 9}$ (16 marks)

(c) Examine the function $y = 2x^3 + 9x^2 - 60x$ for stationary points. Identify the nature of each and hence sketch the function.

(12 marks)

Q.3(a) Determine each of the following integrals:

(i) $\int_1^3 (2x + 3)(x - 4) dx$

(ii) $\int_1^2 \frac{dx}{(2x - 1)^3}$

(iii) $\int \frac{4x + 3}{\sqrt{2x^2 + 3x - 7}} dx$

(21 marks)

(b) A curve $y = x^2 + 1$ is crossed by the line $y = 7 - x$. Show that the line intersects the curve at $x = 2$ and $x = -3$.

Find the area bounded by the line and the curve.

(14 marks)

- Q.4 The activity of an enzyme (units/gram protein) in samples of liver tissues infected with hepatitis was examined and the following results reported:

Enzyme Activity	No. of Tissues
3.00 - 3.24	4
3.25 - 3.49	14
3.50 - 3.74	19
3.75 - 3.99	15
4.00 - 4.24	6
4.25 - 4.99	7

- (a) Calculate the mean enzyme activity (\bar{x}) and the standard deviation (s) from the mean.
(16 marks)
- (b) Represent the data on an ogive and use your graph to estimate:
- (i) the median of the distribution
 - (ii) the proportion of activities falling in the range $(\bar{x} - s)$ to $(\bar{x} + s)$.
- (16 marks)
- (c) Do you consider the distribution to be a normal distribution? Justify your answer.
(3 marks)