

Cork Institute of Technology
Bachelor of Science in Applied BioSciences – Stage 1
(NFQ Level 7)
Autumn 2007
Mathematics & Computing
(Time: 3 Hours)

Instructions

Answer **FIVE** questions.

Answer **FOUR** questions from Section A and
ONE question from Section B.

Use separate answer books for each Section.

All questions carry equal marks.

Examiners: Dr. K. Murphy

Ms. I. Foley

Ms. H. Lordan

Section A

Q1 (a) Using the laws of indices, simplify

(i)
$$\sqrt{\frac{8x^5y^4z^{-6}}{2xy^{-2}z^3}} \div \frac{\sqrt[3]{x^{-6}y^{-3}}}{2(yz)^2}.$$

(ii)
$$\frac{18^{3n+1}}{8^{n-1}} \times \frac{3^{-n}}{27^{2-3n}}.$$

(8 marks)

(b) Solve for x :

(i) $2\log_3(x-1) = 1$

(ii) $3^{5x+1} = 7^{1-x}.$

(6 marks)

(c) (i) Transpose the formula $Z = \sqrt{R^2 + W^2L^2}$ to make L the subject, given that L is a non-negative quantity.

(ii) Calculate the value of L when
 $W = 4.25 \times 10^{-3}, Z = 2.48 \times 10^{-3}, R = 2.06 \times 10^{-4}.$

(6 marks)

- Q2. (a) When $x = 2$ the expression $ax^3 + bx^2 - 7$ is equal to 37 and when $x = -3$ it is equal to -43. Find the values of a and b . (6 marks)
- (b) The height s metres of a mass thrown vertically upwards at time t seconds is given by $s = 90t - 17t^2$. Determine how long the mass will take, after being thrown, to reach a height of 40m
- (i) on the way up,
- (ii) on the way down.
- (iii) When will it reach its maximum height? (9 marks)
- (c) Using the remainder theorem find the roots of $x^3 + x^2 - 10x + 8 = 0$. (5 marks)

- Q3 (a) Write each of the following in linear form where a and b are constants in all cases. State what is to be plotted on each axis and what the constants represent.

- (i) $p = at^3 + bt^2$
- (ii) $h = ae^{bg}$
- (iii) $w = (at^3 + bt)^2$. (9 marks)

(b)

T	0.994	0.935	0.891	0.878	0.885
D	0.8	1	1.3	1.6	2

Show by plotting DT^2 against D^2 that these values obey a law of the form

$$T^2 = aD + \frac{b}{D}. \text{ Solve for } a \text{ and } b. \quad (11 \text{ marks})$$

- Q4 (a) Write down the amplitude, frequency and phase shift of

$$y = 10 \sin(2\theta - 30^\circ).$$

Draw a rough sketch over one cycle. (6 marks)

- (b) Show that a triangle of sides 9cm, 40cm and 41cm is right angled. Calculate the other two angles, expressing your answers in radians. (8 marks)
- (c) Solve the equation: $3 \sin(2A - 45^\circ) = 0.9$, for $0^\circ \leq A \leq 360^\circ$. (6 marks)

- Q5 The marks awarded to 40 students in an examination were recorded to the nearest percentage and tabulated as follows:

% marks awarded	34 - 40	41-47	48 -54	55 - 61	62 - 68	69 – 75
Number of students	2	9	13	8	5	3

- (a) Taking the mid-interval value of each class, calculate the mean (\bar{x}) and standard deviation (σ) from the mean. (8 marks)
- (b) Represent information on a cumulative frequency table. Hence draw the cumulative frequency polygon(ogive). (8 marks)
- (c) From the ogive estimate the number of students who obtained marks in the range $\bar{x} \pm \sigma$. (4 marks)

$$\bar{x} = \frac{\sum fx}{\sum f} \quad \sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}}$$

- Q6 (a) Differentiate from first principles: $y = 4x^2 + 5x$. (5 marks)
- (b) Differentiate each of the following with respect to the variable:
- (i) $\sqrt{x^3} + 5x^2 - 7e^{3x} + 2x$
- (ii) $e^{-3x} \sin x$
- (iii) $\frac{(3x^4 - 7)}{\sqrt{x^2 + 5}}$. (9 marks)
- (c) The distance s metres moved by a body after a time t seconds is given by $s = 6t^2 - 2t + 3$. Find
- (i) its velocity and acceleration,
- (ii) its initial velocity and
- (iii) the time when the body comes to rest. (6 marks)

Q7 (a) Determine any three of the following:

(i) $\int \frac{x^2 - 4x}{x} dx$

(ii) $\int_2^4 \left(x + \frac{1}{x}\right)^2 dx$

(iii) $\int_2^3 (2x - 1)^4 dx$

(iv) $\int_0^3 (x^2 - 4x)^2 (2x - 4) dx$

(12 marks)

(b) Find the area between the curve $y = x^2 + 3x + 2$, the x - axis, the lines $x = 0$ and $x = 4$. Sketch the curve.

(8 marks)

Section B

Answer only one question from this section

Q8. (a) Explain four of the following terms:

- i. System Software
- ii. Peripherals
- iii. Software Suite
- iv. WWW
- v. Kernel
- vi. URL

(8 marks)

(b) What is a Warm Boot? List the steps involved in a Warm Boot.

(6 marks)

(c) What is the CPU? Name two of the main components of a CPU and list their main functions.

(6 marks)

Q9. (a) Explain four of the following terms:

- i. ROM
- ii. Computer Virus
- iii. Solid State Storage Devices
- iv. RAM
- v. System Requirements
- vi. Shareware

(8 marks)

(b) A computer needs storage. What is storage and why is it necessary?

What is the primary storage device on a computer and give a sample value for this device, as it may be listed in the specifications of a computer.

(6 marks)

(c) What is a computer network? List the advantages and disadvantages of networks.

(6 marks)