

Cork Institute of Technology  
Bachelor of Science in Applied BioSciences – Stage 1  
(NFQ Level 7)  
Summer 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:

(i) Simplify  $\frac{(2x^2y^{-3})^3}{4x^{-1}y^2} \times \frac{(8xy)^2}{(2x^{-2}y^{-1})^{-1}}$

(ii) Solve for  $x$ :  $32^{x-1} \times 8^{x+3} = 2^{2x+2}$ .

(8 marks)

(b) Evaluate  $x$  using the laws of logs:

(i)  $\log_2(x^2 - 9) - \log_2(x + 3) = \log_2 3$ .

(ii)  $12^{x+1} = 5$ .

(6 marks)

(c) Given

$$v = c\sqrt{2gh}$$

(i) Make  $g$  the subject of the formula.

(ii) Find the value of  $g$  given  $c = 1.35$ ,  $v = 4.12$  and  $h = 0.42$ .

(6 marks)

- Q2 (a) Plot  $y = 3.2e^{-1.4x}$  from  $x = 0$  to  $x = 1$  using intervals of 0.2. From your graph, determine the value of  $x$  for which  $y = 1.5$  and the value of  $y$  for which  $x = 0.9$ .  
(7 marks)
- (b) A chemical substance decays according to the law  $N = N_0e^{-kt}$ .  $N$  is the mass present at any time  $t$  in minutes and  $N_0$  is the initial mass at  $t = 0$  and  $k$  is a constant. If the initial mass  $N_0$  is 2.34mg and the mass present after 10 minutes is 1.4mg. Calculate
- the constant  $k$ ,
  - the mass present after two hours, and
  - the time  $t$  when the mass is 0.5mg.
- (8 marks)
- (c) Solve for  $x$ :  $9e^{2x} - 36e^x = 108$ .  
(5 marks)

- Q3 (a) It is believed that  $p$  and  $q$  are related by the law  $p = ab^q$  where  $a$  and  $b$  are constants. When  $p = 7.4$ ,  $q = 1.3$  and when  $p = 271.5$ ,  $q = 6.5$ , solve for constants  $a$  and  $b$ .  
(8 marks)
- (b) A liquid is cooling according to the law  $y = ae^{kt}$ , where  $a$  and  $k$  are constants. The table shows values of  $t$  and corresponding values of  $y$ .

$t$ (in minutes)	16	25	33	40	44	50
$y$ $^{\circ}\text{C}$	67.4	43.0	28.8	20.3	16.6	12.3

- Write the equation in linear form.
  - Plot a suitable graph to show that the relationship is true.
  - Find approximate values for the constants  $a$  and  $k$ .
  - State the law.
- (12 marks)

- Q4 (a) Given that  $\sin A = \frac{4}{5}$ , write down the  $\cos A$  and  $\tan A$ . Evaluate  $\frac{4 \sin A + 3 \cos A}{8 \tan A}$  without solving for  $A$ . (6 marks)
- (b) Sketch  $y = 3 \sin(2x + 30^\circ)$ ,  $0^\circ \leq x \leq 360^\circ$ . Indicate clearly the amplitude, period and phase shift. (8 marks)
- (c) Solve for  $x$ :  $\cos^2 x + 3 \sin x - 3 = 0$ ,  $(0^\circ \leq x \leq 360^\circ)$ . (6 marks)

- Q5 In an examination fifty students obtained the following marks recorded to the nearest percentage.

46	63	38	47	48	51	55	63	69	59
72	38	43	67	55	55	48	47	58	63
52	53	66	52	51	61	42	78	51	63
40	49	48	50	58	51	67	45	48	63
67	49	46	54	52	47	53	47	53	60

- (a) Write down the range. Arrange the data into classes (34-40, 41-47, etc.) (3 marks)
- (b) Taking the mid-interval values, calculate the mean ( $\bar{x}$ ) and standard deviation ( $\sigma$ ) from the mean. (8 marks)
- (c) Represent this information on a histogram. Estimate the median and the mode. (7 marks)
- (d) How many students achieved higher than 63%? (2 marks)

$$\text{Mean } \bar{x} = \frac{\sum fx}{\sum f}$$

$$\text{Standard Deviation } \sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}}$$

Q6 (a) Differentiate from first principles:  $y = 3x^2 - 4x$ . (5 marks)

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

(i)  $4\sqrt{x^5} + 3x^4 - \sin(7x) + 10 - \frac{1}{3x^2}$

(ii)  $(x+5)^3 \sqrt{2x^2 - 3x}$

(iii)  $\frac{2e^{-5x}}{(3x-7)}$

(9 marks)

(c) Find the maximum and minimum values of  $y = x^3 - 3x^2 - 9x + 4$ . Use differentiation to distinguish between them. Sketch the curve.

(6 marks)

Q7 (a) Determine each of the following:

(i)  $\int (x^3 + 3\sqrt{x} + \cos 2x - 4e^{-2x}) dx$

(ii)  $\int_0^3 (2-x)^3 dx$

(iii)  $\int_1^2 \frac{(x^2 - x - 6)}{x} dx$ .

(12 marks)

(b) Find  $y$  given  $\frac{dy}{dx} = 3x^2 + 4x$  and that  $y = 2$  when  $x = 1$ .

(4 marks)

(c) If velocity  $v = 20 - 2t$  m sec<sup>-1</sup>, find the general expression for distance,  $s$ , if  $s = 40$  m, when  $t = 3$  seconds.

(4 marks)

## Section B

### Answer Q8 or Q9

Q8 (a) Explain four of the following terms:

- i. System Software
- ii. URL
- iii. Peripherals
- iv. GUI
- v. Kernel
- vi. CPU

(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 capacity of this device, as it may be listed in the specifications of a computer.

(6 marks)

(c) What is a Cold Boot? List the six steps involved in a Cold Boot.

(6 marks)

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

- i. ROM
- ii. FTP
- iii. Solid State Storage Devices
- iv. RAM
- v. Software Upgrade
- vi. Shareware

(8 marks)

(b) What is the Internet? What is the difference between the Internet and the World Wide Web? What are the essential items you need to access the Internet and Web?

(6 marks)

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

(6 marks)