

**CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

Semester 2 Examinations 2011

Module Title: Mathematics for Construction/Architecture

Module Code: MATH6023

School: Building and Civil

**Programme Title: Bachelor of Science in Architectural Technology
Bachelor of Science (Honours) in Architectural Technology**

Programme Code: TARCH_7_Y1/ CARCT_8_Y1

External Examiner(s): Dr. P Kirwan

Internal Examiner: Ms. Mary Quirke

Instructions: Answer any THREE questions. Each question Carries 20 Marks.

Duration: 2 Hours

Sitting: Semester 2 2010

Requirements for this examination: Mathematics Tables (new) and Graph Paper

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination.

If in doubt please contact an Invigilator.

Q1. (a) Use your calculator to evaluate correct to 3 decimal places

$$\sqrt[4]{\frac{28.62^2 + 2.156^{-4}}{\sqrt{29.21\sqrt{10.52} - 4.814^{3/2}}}}$$

(3 marks)

(b) Using the laws of indices to simplify the following expression

$$\sqrt{\frac{49a^2b^{-1}c^4}{36a^{-2}b^5c^2}}$$

(4 marks)

(c) If P is the safe load which may be carried by a steel plate weakened by rivet holes then

$$P = f(b - nd)t.$$

Make f , the safe working stress in the steel, the subject of the formula

(3 marks)

(d) The velocity, v , of water in a pipe appears in the formula

$$h = \frac{0.03 Lv^2}{2dg}$$

(5 marks)

Express v as the subject of the formula and evaluate v when $h = 0.562$,
 $L = 150$, $d = 0.3$ and $g = 9.81$.

(e) A designer plans the top of a rectangular work bench to be four times as long as it is wide. Then he determines that if the width is 72 cm greater and the length is 1.41 m less, it would be a square. What are the dimensions of the bench?

(5 marks)

Q2. (a) Show, by plotting a suitable straight line graph that the following values of p and q obey a law of the form

$$p = m\sqrt{q} + n, \text{ where } m \text{ and } n \text{ are constants.}$$

| | | | | | | | |
|---|------|------|----|------|------|------|------|
| p | 5.6 | 8 | 10 | 12.8 | 14.9 | 16.7 | 18.8 |
| q | 0.64 | 3.61 | 9 | 18.5 | 30.3 | 39.7 | 54.8 |

From the graph determine an approximate value of the constants m and n . (10 marks)

Q2.(b) Find the derivative of y in each of the following functions.

(i) $y = 5x^{3.1} - 8x^2 - \sqrt[4]{x} + \frac{3}{x^2} + 4$ (4 marks)

(ii) $y = (4x^2 + 2)(3 - 2x^3)$ (3 marks)

(iii) $y = \sqrt{x^2 + 1}$ (3 marks)

Q3.(a) A hot water tank is in the shape of a cylinder surmounted by a hemisphere as shown in Figure 1.

- (i) How many litres does the tank hold? (4 marks)
- (ii) Calculate the total surface area of the tank. (4 marks)
- (iii) If the tank needs to be insulated calculate the cost of insulating the tank if the 80 mm thick insulation material is €23.50 per square metre. (2 marks)

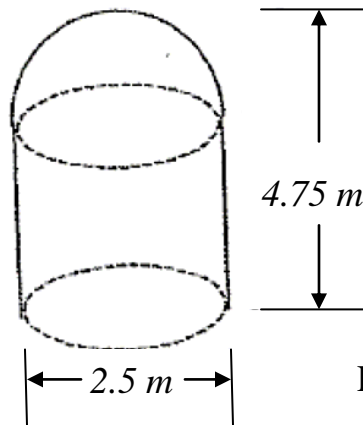


Figure 1

Q3. (b) Soundings taken across a river channel give the following depths with the corresponding distances from one shore.

| | | | | | | | | | | |
|------------------------|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|
| Distance from bank (m) | 0 | 1.5 | 3 | 4.5 | 6 | 7.5 | 9 | 10.5 | 12 | 13 |
| Depth (m) | 1.6 | 4 | 5.6 | 6.8 | 7.7 | 8.1 | 8.3 | 5.2 | 3.4 | 2.6 |

- (i) Construct a graph to show the cross section of the river. (3 marks)
- (ii) Use Simpson's Rule to calculate this cross sectional area. (6 marks)
- (iii) Why might your answer differ if the area was calculated using the trapezoidal rule? (1 marks)

- Q4.(a) Using a laser, a surveyor makes the measurements shown in Figure 2, where points B and C are in a marsh. Find the distance between B and C.

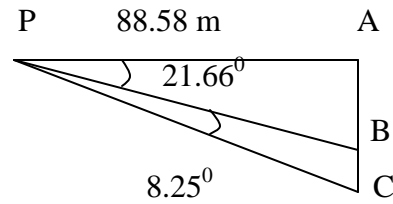


Figure 2 (6 marks)

- Q4.(b) A park is in the form of a quadrilateral ABCD as shown in Figure 3 and its area is 2791 m^2 . Determine the length of :

- (i) the short-cut BD across the park. (6 marks)
(ii) the perimeter of the fencing. (8 marks)

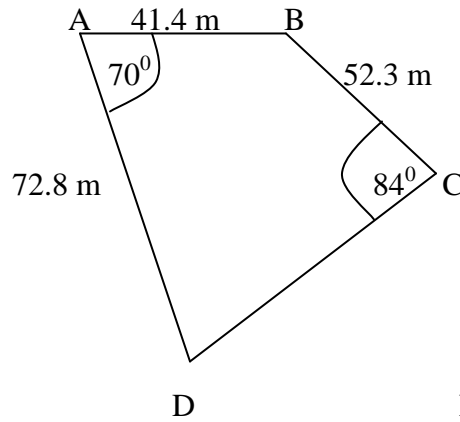


Figure 3