



Iqra National University, Peshawar  
Department of Electrical Engineering

**INU**  
IQRA NATIONAL UNIVERSITY

Mid - Term Examinations Spring 2020

Date: \_\_\_\_\_

|                      |         |                      |                                |
|----------------------|---------|----------------------|--------------------------------|
| <b>Course Code:</b>  | MTH 102 | <b>Course Title:</b> | Calculus and analytic geometry |
| <b>Prerequisite:</b> | _____   | <b>Instructor:</b>   | HIMAYATULLAH                   |
| <b>Module:</b>       | 3       | <b>Program:</b>      | BEE                            |
|                      |         | <b>Total Marks:</b>  | 30                             |
|                      |         | <b>Time Allowed:</b> | 90 min                         |

Note: Attempt all questions. PLO: program learning outcome C: Cognitive

|     |     |   |             |
|-----|-----|---|-------------|
| Q1. | (a) | . Identify $\lim_{h \rightarrow 0} \frac{\sqrt{2+h} - \sqrt{2}}{h}$   | Marks<br>5  |
|     |     |   | CLO1<br>C1  |
|     | (b) | Find the first order derivatives of the function $y = \frac{x+1}{x} \left( \frac{x-1}{x} + 1 \right)$   | Marks<br>5  |
|     |     |   | CLO1<br>C1  |
| Q2  | (a) | . A dynamite blast blows up a heavy rock with launch velocity of 160m/sec reaches a height of $s = 160t - 16t^2$ ft after t sec,<br><br>(i) How high does the rock go<br>(ii) Find the velocity and speed of the rock when it is 256 ft above the ground on the way up and down<br>(iii) find the acceleration of the rock at time 5sec | Marks<br>10 |
|     |     |   | CLO2<br>C2  |

|    |     |   |             |
|----|-----|---|-------------|
| Q3 | (a) | Does the curve $y=x^4 - 2x^2 + 2$ have any horizontal tangent if so where ? | Marks<br>10 |
|    |     |   | CLO1<br>C1  |
|    |     |   |             |

Question NO: 1

Identify  $\lim_{h \rightarrow 0} \frac{\sqrt{a+h} - \sqrt{a}}{h}$

Solution: As

$$\lim_{h \rightarrow 0} (2+h-2h)$$

So

$$2+0-2(0)$$

$$= 2$$

$$2+1-2(1)$$

$$3-2 = 1$$

$$2+(-1)-2(-1)$$

$$1+2 = 3$$

$$2+2-2(2)$$

$$4-4 = 0$$

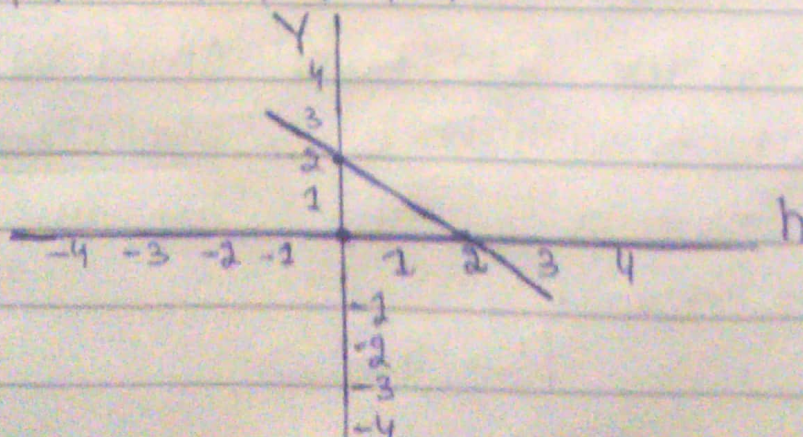
$$2+(-2)-2(-2)$$

$$0+4 = 4$$

$$2+3-2(3)$$

$$5-6 = -1$$

|   |   |   |    |   |    |    |
|---|---|---|----|---|----|----|
| h | 0 | 1 | -1 | 2 | -2 | 3  |
| Y | 2 | 1 | 3  | 0 | 4  | -1 |



Question NO: 2

A dynamite blast blows up a heavy rock with launch velocity of 160 m/sec reaches a height of  $s = 160t - 16t^2$  ft after 1 sec

(i) How does the rock go

Sol: As  $U(t) = 160 \text{ m/sec}$ 

$$U(t) = 160t + 2ft$$

So

$$U(t) = 0$$

$$\text{As } U(t) = 160$$

$$\text{So } 160 = 0$$

$$U(t) = 160t + 2ft$$

$$2 = 160t$$

$$t = \frac{160}{2} = 80 \text{ sec}$$

$$\text{Height} = 160t = 160(80)$$

$$= \frac{2800}{16} \quad \div \text{ by } 16$$

$$= 175$$

(ii) Find the velocity & speed of the rock when it is 256 ft above the ground on the way up & down.

P-T-O

Sols 256

$$256 = 160t$$

$$\frac{256}{16} = \frac{160t}{10}$$

$$16 = 16t$$

$$16 - 16t = 0$$

$$+16t = +16$$

$$t = \frac{16}{10} = 1.6 \text{ sec}$$

$$v(t) = 160t$$

$$v(1.6) = 160(1.6)$$

$$= 256 \text{ m/sec}$$

(iii) Find the acceleration of the rock at time  $S$  sec.

Sols 
$$a'(t) = 160t$$

$$= 160$$

$$a''(t) = 0$$

Question No: 3

Does the curve  $y = x^4 - 2x^2 + 2$  have any horizontal tangent if so where?

Solution: A horizontal tangent line is a mathematical features on a graph located where a function

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derivatives is zero because derivatives gives slope of tangent line. Horizontal line have slope of zero therefore when derivatives are zero, the tangent line is horizontal.

$$f(x) = x^3 - 6x^2 + 15$$

$$\text{we need } f'(x) = 0$$

$$f'(x) = 3x^2 - 6(2x)$$

$$f'(x) = 3x^2 - 12x = 0$$

$$= 3x(x - 4) = 0$$

$$3x = 0 \quad x - 4 = 0$$

$$\frac{3}{3} x = 0 \quad x = 4$$

Put in eq

$$f(0) = 0^3 - 6(0)^2 + 15 = 15$$

$$f(4) = 4^3 - 6(4)^2 + 15$$

$$= 64 - 6(16) + 15$$

$$= 79 - 96 = -17$$

$$(0, 15) \quad (4, -17)$$

Locations