

Calculus assignment 1

Somyak zaveri - 41

Q.1. $\sqrt{7+\sqrt{7+\sqrt{7+\dots}}}$

→ let $\sqrt{7+\sqrt{7}} = x$

Squaring both sides

$$7 + \sqrt{7+x} = x^2$$

$$\sqrt{7+x} = x^2 - 7$$

$$7+x = (x^2-7)^2$$

$$x^4 - 7x^2 + 49 = 7+x$$

$$x^4 - 7x^2 - x + 42 = 0$$

Q.2. $7x^2 - 6y^2 = -11x^2 - 4y^2$

$$7x^2 + 11x^2 = -4y^2 + 6y^2$$

$$18x^2 = 2y^2$$

$$\frac{x^2}{y^2} = \frac{2}{18}$$

$$\frac{x}{y} = \pm \frac{1}{3}$$

Q.3. $x + 3y = 4$

$$x^2 + y^2 - 4y = 12 \quad \text{--- (1)}$$

$$x = 4 - 3y \quad \text{--- (2)}$$

Putting value of x in (1)

$$(4-3y)^2 + y^2 - 4y = 12$$

$$16 + 9y^2 + y^2 - 4y = 12$$

$$10y^2 - 4y + 4 = 0$$

$$5y^2 - 2y + 2 = 0$$

$$y = 14 \pm \frac{\sqrt{196 - (4 \times 5 \times 2)}}{10}$$

$$y = 0.65 \text{ or } y = 0.151$$

Q.14. a) $(3.5)^2 - 16(3.5) + 34 = d$
 $d = 2.5$ (magnions)

b) $\frac{d}{dr} d = 4r - 16$

$$r = 4 \text{ when } \frac{d}{dr} d = 0$$

$$\frac{d^2}{dr^2} d = 4$$

$\therefore$ minimum $r = 4$ per min.

$$d(100) = 2r^2 - 16r + 34$$

$$0 = 2r^2 - 16r - 66$$

$$r = \frac{16 \pm \sqrt{256 + 528}}{4}$$

$$r = 11 \text{ or } r = -3$$

$r = 11$ ($\because$ r can't be negative)

be negative)

Q.5. a) Company 1: $-1500 + 25x > 0$

b) Company 2: $-2100 + 22y > 0$

c) $1500 + 25x < 2100 + 22y$

$$3x < 600$$

$$x < 200$$

Q.6. $x^3 - 7x^2 + 14x - 8 = 0$

a) [0, 1]

a	b	t	f(t)
---	---	---	------

0	1	15	2.625
---	---	----	-------

0	15	0.75	0.9375
---	----	------	--------

0	0.75	0.375	-1.81875
---	------	-------	----------

0.375	0.875	0.5625	0.151875
-------	-------	--------	----------

0.5625	0.75	0.45875	0.40547
--------	------	---------	---------

b) [1, 3.2]

a	b	t	f(t)
---	---	---	------

3.2	1	2.1	1.791
-----	---	-----	-------

3.2	2.1	2.65	0.55215
-----	-----	------	---------

3.2	2.65	2.925	0.8582
-----	------	-------	--------

3.2	2.925	3.0625	-0.0644
-----	-------	--------	---------

[3.2, 4]

a	b	t	f(t)
---	---	---	------

3.2	4	3.6	0.836
-----	---	-----	-------

3.2	3.6	3.4	-0.016
-----	-----	-----	--------

3.4	3.6	3.5	0.125
-----	-----	-----	-------

3.4	3.5	3.45	0.046125
-----	-----	------	----------

3.4	3.45	3.425	0.01302
-----	------	-------	---------

3.4	3.425	3.4125	-1.99 x 10 ⁻³
-----	-------	--------	--------------------------

3.4125	3.4125	3.4125	5.35 x 10 ⁻³
--------	--------	--------	-------------------------

3.4125	3.4125	3.4125	3.4125
--------	--------	--------	--------

$$Q.7. f(x) = 230x^4 + 18x^3 + 9x^2 - 221x - 9$$

$$f'(x) = 920x^3 + 54x^2 + 18x - 221$$

$$1) [-1, 0]$$

$$x_1 = 0.21$$

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$x_2 = 0 - \frac{f(0)}{f'(0)} = -0.040723$$

$$-221$$

$$x_3 = -0.040 \Rightarrow -0.0409288$$

$$x_4 = -0.04065 \Rightarrow -0.04065988$$

ii) Same as above.

$$Q.8) a) 70 + 86 + 81 + 83 + x = \frac{320 + x}{5}$$

$$5$$

$$b) 90 > \frac{320 + x}{5} \geq 80$$

$$450 > 320 + x \geq 400$$

$$130 > x \geq 80$$

$$Q.9) x_1 = 4\%$$

$$y_1 = 8.54$$

@ IRR, $y = 0$.

$$x_2 = 20\% \quad y_2 = -11.81$$

$$\frac{x-y}{20-y} = \frac{0-8.54}{-11.81-8.54}$$

$$-11.81 - 8.54$$

$$x = 10.71\%$$

$$Q.10. f(x) = 32x - 0.21x^2$$

$$C(x) = 195 + 12x$$

$$as \quad R(x) = P(x) - C(x) = \text{Profit}$$

$$f(x) = 32x - 0.21x^2 - 195 - 12x$$

$$0 = -0.21x^2 + 20x - 195$$

$$0.21x^2 - 20x + 195 = 0$$

$$x = 20 \pm \sqrt{400 - 4 \times 0.21 \times 195}$$

$$2 \times 0.21$$

$$x = 84.2114 \quad or \quad x = 11.0266$$

$$f'(x) = 0.42x - 20 > 0$$

$$0.42x > 20$$

$$x > 47.61$$

as order should be more than 47.61

$$x = 84.2114$$