

Assignment - 1

Numerical methods Algebra

$$1) \sqrt{7 + \sqrt{7 + \sqrt{7 + \dots}}}$$

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

Squaring both sides

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

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

again Squaring both sides

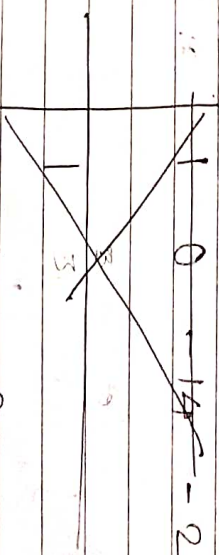
$$7 = (x^2 - 7)^2$$

$$7 = x^4 - 2x^2 \times 7 + 7^2$$

$$7 = x^4 - 14x^2 + 49$$

$$x^4 - 14x^2 - 49 + 7 = 0$$

$$x^4 - 14x^2 - 42 = 0$$



$$\text{So, } x^2 = t$$

$$t^2 - 14t - 42 = 0$$

$$t^2 - 14t - 42 = 0$$

$$-42 \pm 2$$

$$Q2. \quad 7x^2 - 6y^2 = -11x^2 - 4y^2$$

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

$$-4x^2 = 2y^2$$

$$\frac{x^2}{y^2} = -\frac{2}{4}$$

$$\frac{x}{y} = -\frac{1}{2}$$

$$Q.3. \quad i) \quad x + 3y = 4$$

x	y	Point
0	$4/3$	$(0, 4/3)$
1	1	$(1, 1)$

$(1, 1)$ is the solution of the equation where, $x=1$ & $y=1$

$$ii) \quad x^2 + y^2 - 4y = 12$$

x	y	Point
0	14 or 10	$(0, 14)$ or $(0, 10)$

$$x^2 + y^2 - 4y = 12 \quad x=0$$

$$y^2 - 4y = 12$$

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

$$(y-2)^2 = 16$$

$$\begin{aligned}
 x &= 0 \\
 0^2 + 11^2 - 11y &= 12 \\
 0^2 - 2y + 2y - 11y &= 12 \\
 y(y-2) + 2(y-2) &= 12 \\
 (y-2)(y+2) &= 12 \\
 y-2 &= 12 \quad \text{or} \quad y+2 = 12 \\
 y &= 14 \quad \text{or} \quad y = 10
 \end{aligned}$$

$$\begin{aligned}
 x &= 1 \\
 1 + y^2 - 11y &= 12 \\
 y^2 - 11y - 11 &= 0
 \end{aligned}$$

$$\begin{aligned}
 \text{ii)} \quad x^2 + y^2 - 11y &= 12 \\
 y^2 - 11y - 12 &= 0 \\
 y^2 - 6y + 2y - 12 &= 0 \\
 y(y-6) + 2(y-6) &= 0 \\
 (y-6)(y+2) &= 0 \\
 y &= 6, \quad y = -2
 \end{aligned}$$

x	y	Co-ordinates
0	6	(0, 6)

(0, 6) satisfied the conditions
where $x=0$ & $y=6$.

Q4. $d = 2r^2 - 16r + 34$

d = density.
 r = speed of engine.
 100 revolution per minute.
 $\frac{100}{60}$

a) density of the smoke

$$d = 2r^2 - 16r + 34$$

$$= 2 \times \left(\frac{3.5 \times \frac{350}{60}}{60} \right)^2 - 16 \times \left(\frac{350}{60} \right) + 34$$

$$= 974.35$$

b) for minimum smoke.

$$d = 2r^2 - 16r + 34$$

$$\frac{dd}{dr} = 2 \times 2r - 16 + 0$$

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

$$4r - 16 = 0$$

$$4r = 16$$

$$\boxed{r = 4}$$

$$\frac{d^2}{dx^2} = 4 > 0$$

$\therefore$ is minimum.

So,

$$d = 2x^2 - 16x + 34$$

$$774.35 = 2x \left(4x - \frac{16}{60} \right)^2 - 16 \left(\frac{x}{60} \right) + 34$$

$$774.35 = 2 \left(\frac{x}{15} \right)^2 - \frac{16}{60} x + 34$$

$$774.35 = \frac{2}{225} x^2 - \frac{16}{60} x + 34$$

3) $n = \text{No. of km.}$

g) $-10.141 \cos t C$
Company - 2. - bend for 1 day.

$$1500 + 257n = C$$

b) ~~per unit company - 2~~

2100

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

a	b	$f(a)$	$f(b)$	$\frac{a+b}{2}$	$f\left(\frac{a+b}{2}\right)$
0	1	-0.625	0.096	0.5	-0.625
0.5	0.61	-0.625	0		
0.58	0.59	-0.039	0.0286	0.585	-5.373

b) $[1, 3.2]$

a	b	$f(a)$	$f(b)$	$\frac{a+b}{2}$	$f\left(\frac{a+b}{2}\right)$
1	3.2	2	-0.112	2.1	1.791
2.1	3.2	1.791	-0.112	2.65	0.552

c) $[3.2, 4]$

a	b	$f(a)$	$f(b)$	$\frac{a+b}{2}$	$f\left(\frac{a+b}{2}\right)$
3.2	4	-0.112	2	3.6	0.336
3.4	3.5	-0.016	0.125	3.45	0.0461

10^{-3}

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

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

$$x_1 = 0$$

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

Q8 x = grade on final exam.

Optimistic mean

$$\bar{x} = \frac{\sum x_i}{n}$$

$$\bar{x} = \frac{70+86+91+83+x}{5}$$

$$= \frac{330+x}{5}$$

$$80 \leq \bar{x} < 90$$

$$80 \leq \frac{330+x}{5} < 90$$

$$400 \leq 330+x < 450$$

$$100 \leq 330+x \leq 450$$

$$20 \leq x \leq 120$$

$$P(x) = 32x - 0.21x^2 \rightarrow \text{Revenue}$$

$$C(x) = 195 + 12x \rightarrow \text{Cost}$$

$$P(x) - C(x) = \text{profit}$$

$$32x - 0.21x^2 - (195 + 12x) = 0$$

$$32x - 0.21x^2 - 195 - 12x = 0$$

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

$$a = 0.21, b = -20, c = 195$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = 84.2114 \quad | \quad x = 11.0266$$

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

$$\begin{aligned} & \underline{0} \\ & 0.42x > 20 \\ & x > 47.61 \end{aligned}$$

Order should be more than 47.61
to remain profitable.

$$S. 7 \quad f(x) = 230x^4 + 15x^3 + 9x^2 + 221x - 9$$

$$f'(x) = 920x^3 + 45x^2 + 18x - 2$$

$$[-1, 0]$$

$$x_1 = 0$$

$g:$

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

$$x_2 = 0 - \frac{(-9)}{-221} = -0.0410423$$

$$x_3 = -0.0440 - 0.0410$$

$$x_4 = -0.041065989$$

$$\frac{y_2 - y_1}{y - y_1} = \frac{xf_2 - x_1}{x - x_1}$$

$$0.3829 = \frac{0.04}{x - 0.04}$$

$$x = 5.67889$$

Days
Date