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

$x^2 + y^2 + 4y = 12$ ... (1)

$x = 4 - 3y$ ... (2)

Putting value of x in (1)

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

$16 + 9y^2 - 24y - 4y + y^2 = 12$

$5y^2 - 14y + 2 = 0$

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

$y = 2.6488$ // or $y = 0.15$ //

4) a) $(3.5)^2 - 16(3.5) + 34$

$d = 2.5$ Ans

[millions of particles per cubic foot]

b) $\frac{d}{dx}(d) = 4x - 16$

$x = 4$ when $\frac{d}{dx} = 0$

$\frac{d^2}{dx^2}(d) = 4$

∴ minimum $x = 4$ per minute in hundred.

c) $100 = 2x^2 - 16x + 34$

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

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

$\boxed{x = 11}$ or $x \neq -3$

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

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

i) $(-1, 0)$

$x_1 = 0$

$$x_{n+1} = x_0 - \frac{f(x_0)}{f'(x_0)}$$

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

$$= -0.0407 //$$

$x_3 = -0.0409 //$

$x_4 = -0.0406 //$

5) a) Company 1 :- $1500 + 25n > 0$

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

c) $1500 + 25n < 2100 + 22n$

$3n < 600$

$\boxed{n < 200}$

Hence $n < 200$.

8) a) $70 + \frac{88 + 81 + 83 + n}{5}$

= Mean

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

c) $450 > 320 + n \geq 400$

Subtracting 320 on both sides

$450 - 320 > n \geq 400 - 80$

$130 > n \geq 80$

9) $x_1 = 4\%$ $\quad x_2 = 20\%$

$y_1 = 8.54$ $\quad y_2 = -11.81$

IRR $\quad y = 0$

$$\frac{x-4}{20-4} = \frac{0-8.54}{-11.81-8.54}$$

$$\boxed{x = 10.7\%}$$

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

$C(x) = 195 + 12x$

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

Revenue − Cost.

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

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

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

$$x = \frac{20 \pm \sqrt{(-20)^2 - 4(0.21)(195)}}{2 \cdot 0.21}$$

$x = 11.02$ $\quad$ or $\quad x = 84.21$

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

$$0.42x > 20$$

$$x > 47.61 \;//$$

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

a) (0, 1)

a	b	t	f(t)
0	1	1.5	2.62
0	1.5	0.75	0.984
0	0.75	0.375	-1.68
0.375	0.75	0.5625	0.161
0.5625	0.75	0.655	0.456

So, 0.655 is the answer.

b) (1, 3.2)

a	b	t	f(t)
3.2	1	2.1	1.79
3.2	2.1	2.65	0.552
3.2	2.65	2.92	0.858
3.2	2.92	3.062	-0.053

So, 3.062 is the answer.

c) (3.2, 4)

a	b	t	f(t)
3.2	4	3.6	0.336
3.2	3.6	3.4	-0.016
3.4	3.6	3.5	0.125
3.4	3.5	3.45	10.046
3.4	3.45	3.425	0.013
3.4	3.425	3.4125	-1.99×10^{-3}
3.4125	3.4125	3.4125	5.35×10^{-3}

So, 3.4125 is the answer

Numerical Methods & Algebra

Mansi Mandaliya, 19

Q.1) $\sqrt{7+\sqrt{7+\sqrt{7+\cdots}}}$

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

Squaring both sides:

$$7+\sqrt{7+x} = x^2$$
$$\sqrt{7+x} = x^2-7$$
$$7+x = (x^2-7)^2$$
$$7+x = x^4-7x^2+49$$

$$\boxed{x^4-7x^2+42=0}$$

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

$$7x^2+11x^2 = -4y^2+6y^2$$
$$18x^2 = 2y^2$$
$$\frac{x^2}{y^2} = \frac{2}{18}$$

$$\left(\frac{x}{y}\right)^2 = \frac{1}{9}$$

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