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

→ Let

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

squaring both sides

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

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

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

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

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

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

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

$18x^2 = 2y^2$

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

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

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

Q.3 $x+3y = 4$

$x^2+y^2-4y = 12 \cdots (1)$

$x = 4-3y \cdots (2)$

putting value of x in (1)

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

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

$10y^2 - 28y + 4 = 0$

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

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

$y = 2.6489 \quad$ or $\quad y = 0.1510$

Q.4

a) $d = 2(3.5)^2 - 16(3.5) + 34$

$d = 2.5$ (millions of particles per cubic foot)

b) $\frac{d}{dr}(d) = 4r - 16 \Rightarrow r = 4$ when $\frac{d}{dr} = 0$

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

$\therefore$ minimum $r = 4$ per min. (in hundred)

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

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

~~$r = \frac{16 \pm \sqrt{256 + 528}}{2}$~~

~~$r = 2200 \quad$ or $\quad r =$~~

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

$r = 11 \quad$ or $\quad r \neq -3$

$\therefore r = 11$ as speed cannot be negative.

Q.5

a) company 1 :- $1500 + 25x > 0$

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

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

$3x < 600$

$x < 200$

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

a) $[0, 1]$

a	b	t	f(t)
0	1	1.5	2.625
0	1.5	0.75	0.984375
0	0.75	0.375	-1.68164
0.375	0.75	0.5625	0.16186
0.5625	0.75	0.65625	0.45547

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	-0.0544

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	0.046125
3.4	3.45	3.425	0.01302
3.4	3.425	3.4125	-1.99×10^{-3}
3.4125	3.4125	3.4125	5.35×10^{-3}
3.4125	3.41875		

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

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

i) [-1, 0]

$x_1 = 0$

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

$x_2 = 0 - \frac{(-9)}{-221} \Rightarrow -0.040723$

$x_3 = -0.040 \Rightarrow -0.04069288$

$x_4 = -0.04065 \Rightarrow -0.04065988$

ii) Same as above

Q.8

a) $\frac{70+86+81+83+x}{5} = \frac{320+x}{5} = u$ (mean)

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

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

$130 > x \geq 80$

Q.9 $x_1 = 4\%$, $y_1 = 8.54$ @ IRR, $y = 0$

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

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

$\Rightarrow \boxed{x = 10.71\%}$

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

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

AS, $R(x) - C(x) =$ Profit, i.e $f(x)$

~~$R(x) = 32x$~~

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

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

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

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

$x = 84.2114$ or $x = 11.0266$

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

$0.42x > 20$

$x > 47.61$

as order should be more than 47.61

$x = 84.2114$.