1 a) (iv)

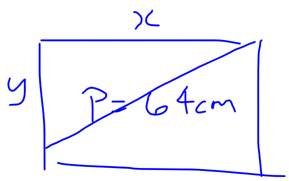
$$y = 2x^2 + 5x - 3$$

$$y = 2\left(x^2 + \frac{5}{2}x\right) - 3$$

$$= 2\left(x + \frac{5}{4}\right)^2 - \frac{49}{8}$$

$\therefore$ minimum is $\underline{-\frac{49}{8}}$

9a)



$d^2 = x^2 + y^2$ $\qquad x + y = 32$

$= x^2 + (32 - x)^2$ $\qquad y = 32 - x$

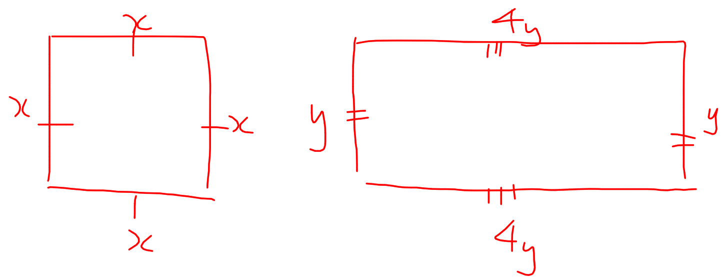
$= 2x^2 - 64x + 1024$

b)

$x = \frac{64}{4}$

$= 16$ $\qquad \therefore$ dimensions $16cm \times 16cm$

12



$4x + 10y = 80$

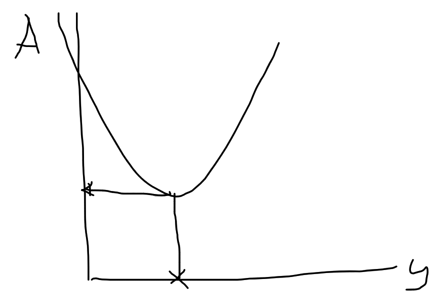
$2x + 5y = 40$

$x = 20 - \frac{5}{2}y$

$A = x^2 + 4y^2$

$A = \left(20 - \frac{5}{2}y\right)^2 + 4y^2$

$= 400 - 100y + \frac{41}{4}y^2$



maximum A occurs at AOS

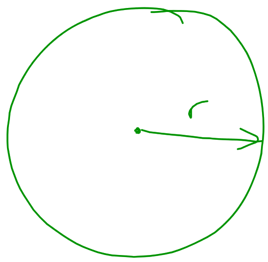
$y = \dfrac{100}{\frac{41}{2}}$

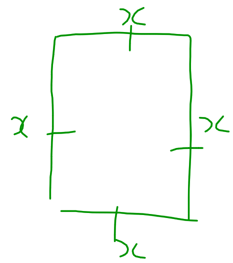
$y = \frac{200}{41}$, $x = 20 - \frac{5}{2} \times \frac{200}{41}$

$x = \frac{320}{41}$

Wire is cut $\frac{1280}{41}$ cm and $\frac{2000}{41}$ cm

15





$C = 2\pi r$ $\qquad$ $P = 4x$

$$A = \pi r^2 + x^2$$
$$= \pi r^2 + \left(\frac{36-\pi r}{2}\right)^2$$
$$= \frac{4\pi r^2 + 36^2 - 72\pi r + \pi^2 r^2}{4}$$

$$2\pi r + 4x = 72$$
$$4x = 72 - 2\pi r$$
$$x = \frac{36 - \pi r}{2}$$

$$A = \frac{4\pi + \pi^2}{4} r^2 - 18\pi r + 324$$

minimum will occur at AOS

$$r = \frac{18\pi}{\frac{4\pi + \pi^2}{2}} = \frac{36}{4+\pi}$$

$$P = 72 - 2\pi\left(\frac{36}{4+\pi}\right)$$
$$= 72 - \frac{72\pi}{4+\pi}$$

$\therefore$ square $P = \dfrac{288}{4+\pi}$ cm

18 $C(x) = x^2 + 10 \Rightarrow$ cost to produce x/hr

$x = 16 - p \Rightarrow$ # sold/hr at \$p

a) $R = px$

$= (16 - x)x$

$\underline{R = 16x - x^2}$

b) $P = R - C$

$= 16x - x^2 - (x^2 + 10)$

$\underline{= -2x^2 + 16x - 10}$

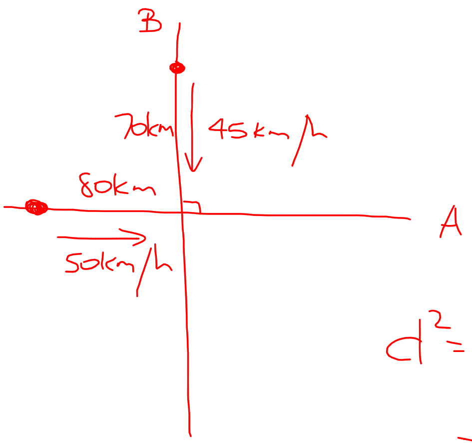
c) $x = \dfrac{-16}{-4}$

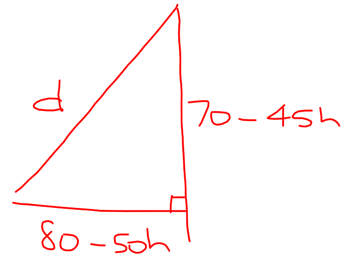
$\underline{x = 4}$

d) $P = -2(4)^2 + 16(4) - 10$

$= \underline{22}$

21





$$d^2 = (80-50h)^2 + (70-45h)^2$$

$$= 6400 - 8000h + 2500h^2$$

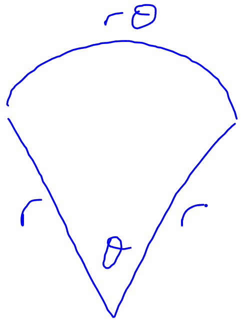
$$+ 4900 - 6300h + 2025h^2$$

$$d^2 = 11300 - 14300h + 4525h^2$$

minimum will occur $h = \dfrac{143\cancel{0}0}{905\cancel{0}} \times 60$

$$= 94.8 \text{ min}$$

23.



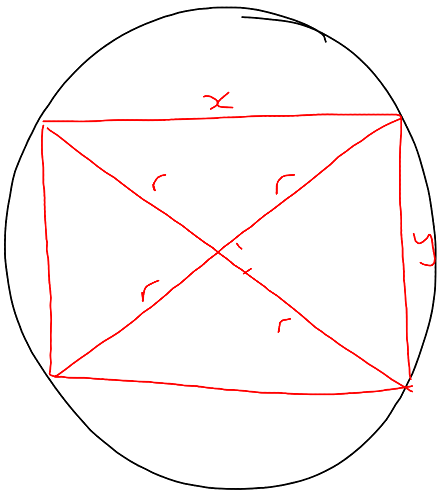
$$l = 2r + r\theta$$
$$= r(2+\theta)$$
$$r = \frac{l}{2+\theta}$$

$$A = \frac{1}{2} r^2 \theta$$
$$A = \frac{1}{2} \times \frac{l^2}{(2+\theta)^2} \times \theta$$
$$= \frac{l^2 \theta}{2(2+\theta)^2}$$

$$l = 2r + r\theta$$
$$r\theta = l - 2r$$
$$\theta = \frac{l-2r}{r}$$

$$A = \frac{1}{2}r^2\theta$$
$$= \frac{r^2}{2} \times \frac{l-2r}{r}$$
$$= \frac{1}{2}rl - r^2$$

24/



$x^2 + y^2 = 4r^2$

$A_R = xy$

$A_R^2 = x^2 y^2$

$= x^2(4r^2 - x^2)$

$= 4r^2x^2 - x^4$

max A_R^2 will be when

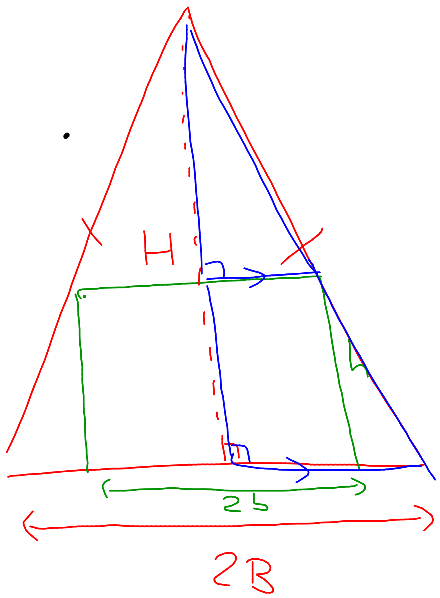
$x^2 = \dfrac{-4r^2}{-2}$

$= 2r^2 \quad \therefore y^2 = 2r^2$

$x = \sqrt{2}r, \; y = \sqrt{2}r$

ie square

27



$$A_\Delta = BH$$

$$A_R = 2bh$$

$$\frac{B}{H} = \frac{b}{H-h}$$

$$b = \frac{B}{H}(H-h)$$

$$A_R = \frac{2B}{H}(H-h)h$$

$$= 2Bh - \frac{2B}{H}h^2$$

$$\Delta = 4B^2$$

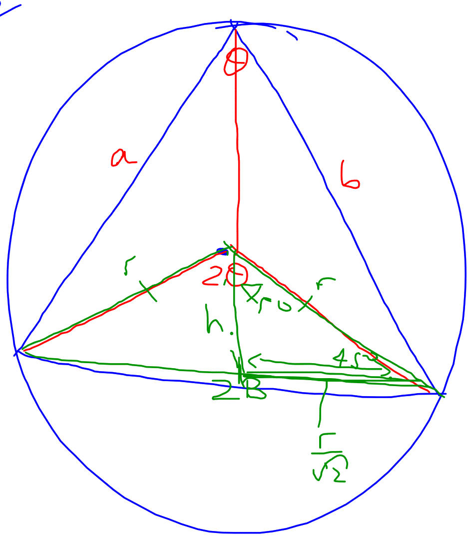
Greatest $A_R = \frac{-\Delta}{4a}$

$$= \frac{-4B^2}{-\frac{8B}{H}}$$

$$= \frac{BH}{2}$$

$$= \frac{1}{2}A_\Delta$$

28/



$$A_\Delta = \frac{1}{2} \times 2B \times h$$

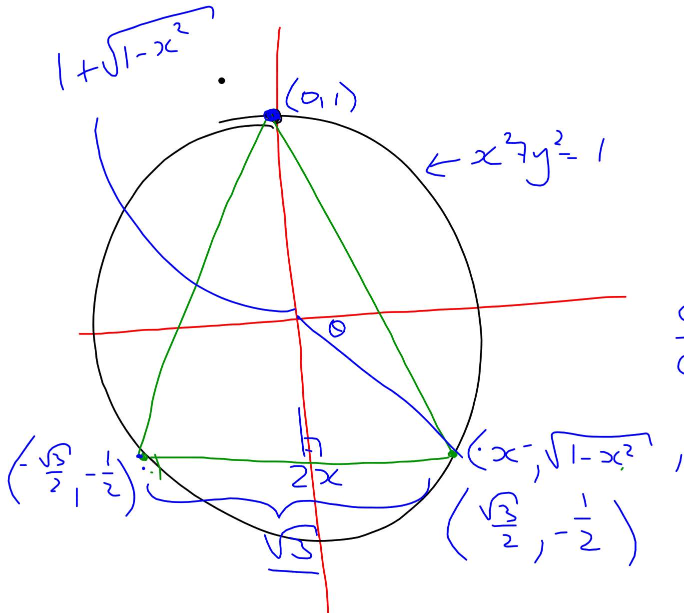
$$= \frac{1}{2} \times 2\sqrt{r^2 - B^2} \times B.$$

$$= B\sqrt{r^2 - B^2}$$

$$A_\Delta^2 = B^2 r^2 - B^4$$

$$B^2 = \frac{-r^2}{-2}$$

$$B = \frac{r}{\sqrt{2}}$$



$$A_\Delta = \frac{1}{2}(2x)\left(1+\sqrt{1-x^2}\right)$$
$$= x\left(1+\sqrt{1-x^2}\right)$$
$$= x + x\sqrt{1-x^2}$$

$$\frac{dA}{dx} = 1 + (x)\left[\frac{1}{2}(1-x^2)^{-\frac{1}{2}}(-2x)\right] + \sqrt{1-x^2}$$
$$= 1 - \frac{x^2}{\sqrt{1-x^2}} + \sqrt{1-x^2}$$
$$= \frac{\sqrt{1-x^2}\ -x^2+1-x^2}{\sqrt{1-x^2}}$$
$$= \frac{-2x^2+\sqrt{1-x^2}+1}{\sqrt{1-x^2}}$$

$$2x^2-1 = \sqrt{1-x^2}$$
$$4x^4-4x^2+1 = 1-x^2$$
$$4x^4-3x^2=0$$
$$x^2(4x^2-3)=0$$
$$x=0 \text{ or } x=\pm\frac{\sqrt{3}}{2}$$