

1) a) 23.78°

(for triangles)

(for triangles)

$$\text{Degrees} \times \frac{\pi}{180} = \text{Radians}$$

$$23.78^\circ \times \frac{\pi}{180} = 0.4150393$$

b) 191.25°

$$191.25 \times \frac{\pi}{180} = 3.33794219$$

2) a) $\pi/2.64$ radians

$$\text{Radians} \times \frac{180}{\pi} = \text{Degrees}$$

$$\frac{\pi}{2.64} = 1.18999721727$$

$$1.18999721727 \times \frac{180}{\pi} = 68.18181818$$

b) 1.863π radians

$$5.85218711 \times \frac{180}{\pi} = 335.339999$$

$$180^\circ + 90^\circ - 108^\circ = 62^\circ$$

$$108^\circ = d + 45^\circ + 45^\circ$$

$$45^\circ = d$$

3) a) Supplement of $57^\circ 28'$

$$57^\circ 28' + x = 180^\circ$$

$$\begin{array}{r} 179 \\ - 57^\circ 28' \\ \hline 122^\circ 32' \end{array}$$

$^{\circ} 87.82$

Supplement - 180

Complement - 90

$$\text{EPR} \rightarrow 87.82 = \frac{\pi}{180} \times 157.28$$

b) Complement of $43^\circ 47'$

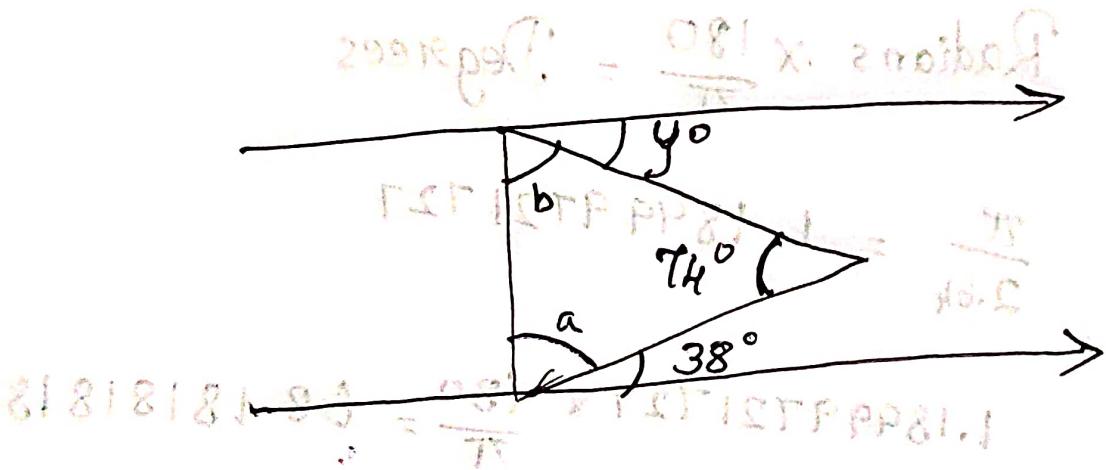
$$43^\circ 47' + x = 90^\circ$$

$$\begin{array}{r} 89 \\ - 43^\circ 47' \\ \hline 46^\circ 13' \end{array}$$

$^{\circ} 46.18$

$$\begin{array}{r} 43^\circ 47' \\ - 46^\circ 13' \\ \hline \end{array}$$

4) a)



$$40^\circ + 74^\circ + a = 180^\circ$$

$$40^\circ + 74^\circ + a = 180^\circ$$

$$a = 90^\circ - 38^\circ$$

$$a = 52^\circ = \frac{52}{180} \times 180^\circ = 28.2^\circ$$

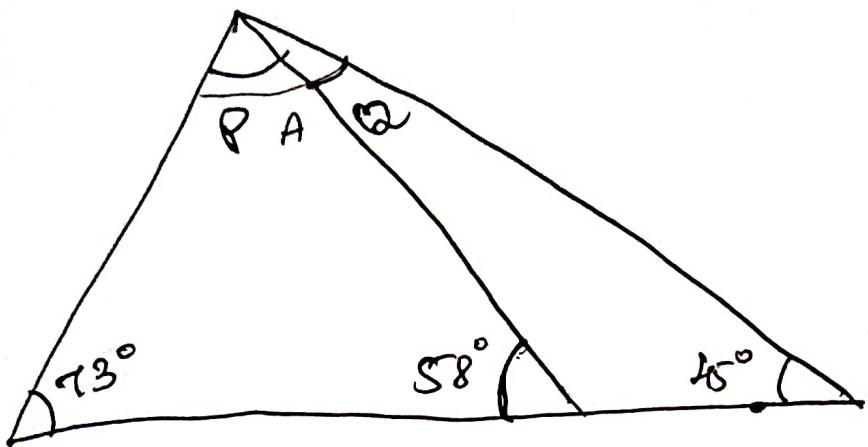
$$74^\circ + 52^\circ + b = 180^\circ$$

$$b = 54^\circ$$

$$\text{So, } 90^\circ - 54^\circ = y^\circ$$

$$y = 36^\circ$$

a) b)



$$180^\circ = P + 73^\circ + 58^\circ$$

$$180^\circ = P + 131^\circ$$

$$\boxed{P = 49^\circ}$$

$$180^\circ = A + 73^\circ + 45^\circ$$

$$180^\circ = A + 118^\circ$$

$$A = 62^\circ$$

To find Q, minus P from A

$$A - P = Q$$

$$62^\circ - 49^\circ = 13^\circ \quad \boxed{Q = 13^\circ}$$

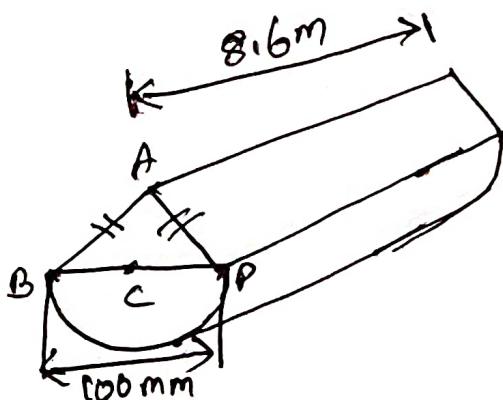
5) a) The length of AB in mm

$$n^2 + n^2 = 100^2$$

$$2n^2 = 100 \times 100$$

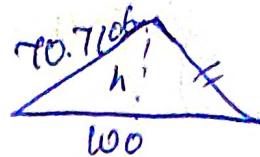
$$n^2 = 5000$$

$$n =$$



⑤ a) The length of AB in mm

$$AB = AD$$



$$n^2 + n^2 = 100^2$$

$$2n^2 = 10000$$

$$n^2 = \frac{10000}{2}$$

$$n^2 = \frac{10000}{2} = 70.7106 \text{ mm}$$

$$\boxed{AB = 70.7106 \text{ mm}}$$

$$70.7106^2 = h^2 + 150^2$$

$$\boxed{h = 49.999}$$

$$\text{Area of } \triangle ABD = \frac{1}{2} \times 100 \times 49.999$$

$$= \frac{1}{2} \times 100 \times 49.999$$

$$\boxed{\text{Area} = 2499.95}$$

$$\text{Area of Semicircle} = \frac{1}{2} \pi r^2$$

$$= \frac{1}{2} \times 3.14 \times 50^2$$

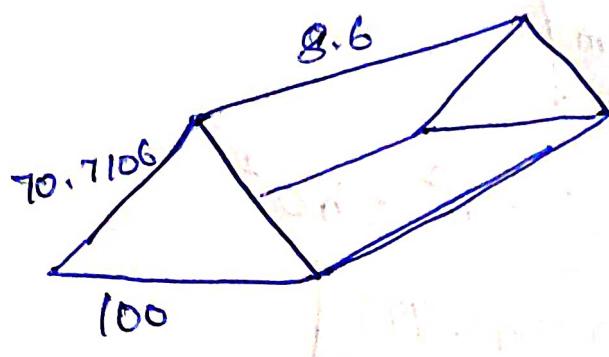
$$\boxed{\text{Area} = 3927 \text{ mm}^2}$$

Volume of Prism = $\frac{1}{2} \times \text{Base} \times \text{length} \times \text{height}$

$$= \frac{1}{2} \times 100 \times 8.$$

$$= \frac{1}{2} \times 10 \times 860 \times 4.9$$

Volume of prism = 21,070 cm²



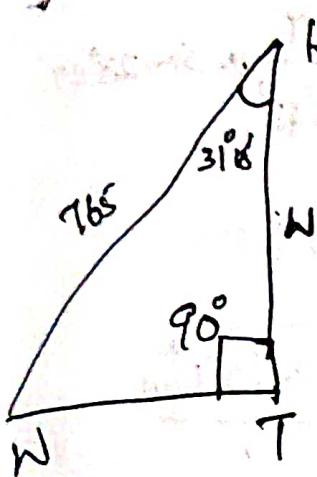
$$70.7106(70.7106) + 241.4212(8.6 \times 100)$$

Change in meters $\div 100$

$$0.707(0.707) + 2.412(8.6)$$

TSA of Prism = 21.24 m²

6) a) In ΔKTW : $\angle T = 90^\circ$, $\angle K = 31^\circ 18'$ & $t = 765\text{m}$; evaluate W .



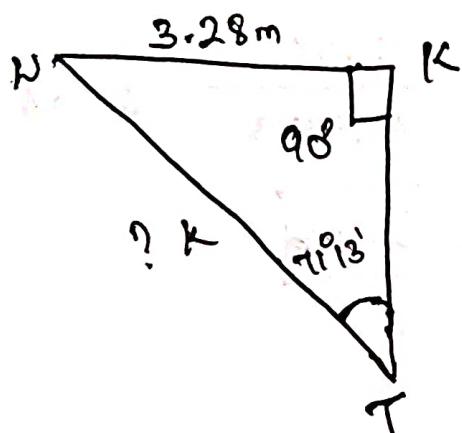
$$\sin \theta = \frac{W}{765}$$

$$\sin 31^\circ 18' = \frac{W}{765}$$

$$W = \sin 31^\circ 18' \times 765 \\ = 0.5195 \times 765$$

$$W = 397.415 \text{ m.}$$

b) In ΔKTW : $\angle K = 90^\circ$, $\angle T = 71^\circ 13'$ & $t = 3.28\text{m}$; evaluate K .



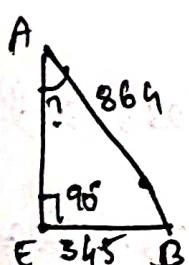
$$\cos \theta = \frac{3.28}{K} \Rightarrow K = \frac{3.28}{\cos 71^\circ 13'}$$

$$\cos 71^\circ 13' =$$

$$K = \frac{3.28}{0.3220}$$

$$K = 10.186 \text{ m}$$

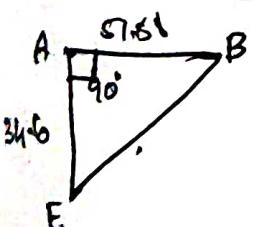
c) In ΔABE : $\angle E = 90^\circ$, $a = 345\text{m}$, and $e = 864\text{m}$; evaluate $\angle A$.



$$\frac{864}{\sin 90^\circ} = \frac{345}{\sin \theta} \Rightarrow \sin \theta = \frac{345}{864} \times \sin 90^\circ$$

$$\theta = 23.547^\circ$$

d) In ΔABE : $\angle A = 90^\circ$; $b = 34.6\text{mm}$ & $e = 51.8\text{mm}$; evaluate $\angle B$.



$$\frac{51.8}{\sin 90^\circ} = \frac{34.6}{\sin \theta}$$

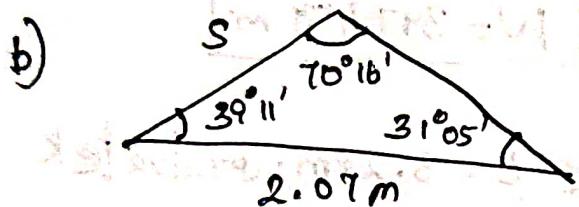
$$\sin \theta = \frac{34.6}{51.8} \sin 90^\circ$$

$$\theta = 41.9^\circ$$

7) a)

$$\frac{14.7}{\sin 18^\circ 43'} = \frac{S}{\sin 28^\circ 27'} \Rightarrow \frac{14.7}{\sin 18^\circ 43'} \times \sin 28^\circ 27'$$

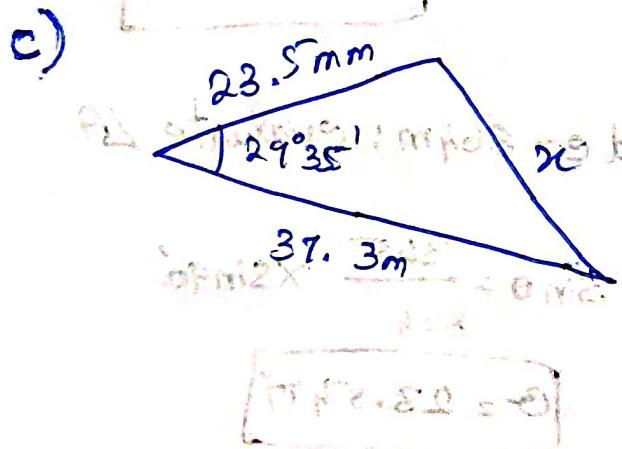
$$S = \frac{14.7}{\sin 18^\circ 43'} \times 0.8979 \quad 0.8979$$
 ~~$S = 18.227$~~
 $S = 30.751 \text{ mm}$



$$\frac{2.07}{\sin 70^\circ 16'} = \frac{S}{\sin 31^\circ 05'}$$

~~$S = \frac{2.07}{\sin 70^\circ 16'} \times 0.5163$~~

$S = 1.135 \text{ m}$



The Law of Cosines

$c^2 = a^2 + b^2 - 2ab \cos C$

$x^2 = (23.5)^2 + (37.3)^2 - 2(23.5)(37.3)\cos 29^\circ 35'$

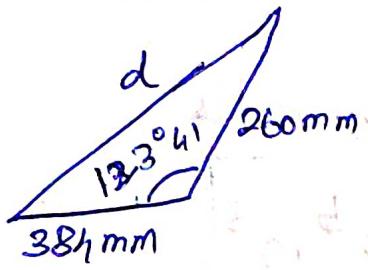
$= 552.25 + 1391.29 - 1753.1 \cos 29^\circ 35'$

$= 552.25 + 1391.29 - 1524.49576$

$x^2 = 419.04424$

$x = 20.47 \text{ mm}$

e)

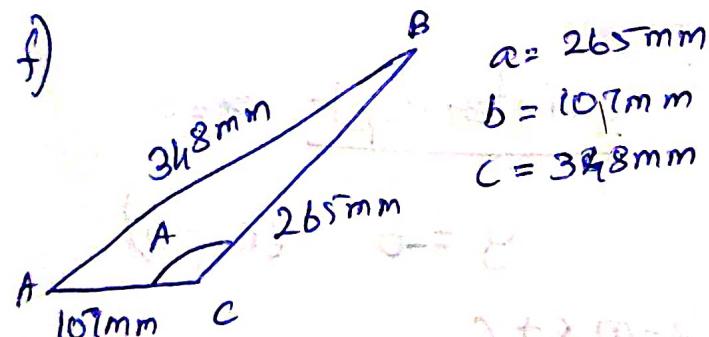


$$\begin{aligned}
 d^2 &= 384^2 + 260^2 - 2(384)(260) \cos(123^\circ 41') \\
 &= 147456 + 67600 - 199680 \cos A (-0.5526) \\
 &= 215056 + 110742.528
 \end{aligned}$$

$$d^2 = 325798.528$$

$$\boxed{d \approx 570 \text{ mm}}$$

f)



$$\begin{aligned}
 a &= 265 \text{ mm} \\
 b &= 107 \text{ mm} \\
 c &= 348 \text{ mm}
 \end{aligned}$$

$$348^2 = 265^2 + 107^2 - 2(265)(107) \cos A$$

$$121104 = 70225 + 11449 - 56710 \cos A$$

$$33430 = 56710 \cos A$$

$$\begin{aligned}
 0.589 &= \cos^{-1} \left(\frac{33430}{56710} \right) \\
 A &= \cos^{-1} \left(\frac{33430}{56710} \right)
 \end{aligned}$$

$$\boxed{A = 53.879^\circ}$$

d)

$$207^2 = 324^2 + 235^2 - 2(324)(235) \cos \theta$$

$$42849 = 104976 + 55225 - 152280 \cos \theta$$

$$-\left(\frac{117352}{152280}\right) \cos^{-1} \theta = 0$$

$$\theta = 39.5^\circ$$

g) $d = 4.0 \text{ mm}$ $l = 12.0 \text{ mm}$

$r = 2.0 \text{ mm}$ $l = 0.012 \text{ m}$

$r = 0.002 \text{ m}$ $\pi r^2 h = 3.14 \times (0.002)^2 \times 0.012$

The total volume of liquid metal required is

~~0.0002~~ $3.01 \times 10^{-5} \text{ m}^3$

8) g) $y = 3x - 6$

$m = \frac{3}{1} = 3$ Slope (m) $\Rightarrow 3$

1 x-intercept $\Rightarrow y = 0$

$$3x - 6 = 0$$

$$3x = 6$$

$x = 2$

(2, 0)

y-intercept $x = 0$

$y = -6$ $(0, -6)$

$$y = mx + c$$

$$y = 3x - 6$$

$$b) 5x + 2y + 4 = 0$$

$$y = mx + b$$

$$2y = -4 - 5x$$

$\div -2$

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

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

$$\boxed{m = -\frac{5}{2}}$$

x-intercept

$$y=0$$

$$5x + 4 = 0$$

$$\boxed{x = -\frac{4}{5}}$$

$$\left(-\frac{4}{5}, 0\right)$$

y-intercept

$$x=0$$

$$2y = -4$$

$$\boxed{y = -2}$$

$$(0, -2)$$

$$c) \frac{x-1}{2} = \frac{y+1}{5}$$

$$y = mx + b$$

$$-2y = 7 - 5x$$

$\div -2$

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

$$\frac{-2y}{-2} = \frac{7}{-2} + \frac{-5x}{-2}$$

$$5x - 2y - 7 = 0$$

$$\cancel{-2y}$$

$$y = \frac{7}{-2} + \frac{-5x}{-2}$$

x-intercept, $y=0$

$$5x = 7$$

$$\boxed{x = \frac{7}{5}} \quad \left(\frac{7}{5}, 0\right)$$

$$\boxed{y = \frac{5}{2}}$$

y-intercept, $x=0$

$$-2y = 7$$

$$\boxed{y = -\frac{7}{2}}$$

$$(0, -\frac{7}{2})$$

$$d) \frac{x+1}{y-1} = 5 \quad | \cdot (y-1)$$
$$x+1 = 5y - 5$$
$$x - 5y = -6$$

$$-5y = -6 - x$$
$$5y = x + 6$$

$$y = \frac{1}{5}x + \frac{6}{5} \quad | :5$$

$$\boxed{m = \frac{1}{5}}$$

y-intercept $x=0$

$$+5y = 6$$

$$\boxed{y = \frac{6}{5}}$$

$$(0, \frac{6}{5})$$

x-intercept $y=0$

$$\boxed{x = -6}$$

9) a) The gradient is 2 and the line contains the point (-1,

$$y - y_1 = m(x - x_1)$$

$$y - 3 = 2(x + 1)$$

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

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

b) The x intercept is 4 & the gradient is -3

$$y - y_1 = m(x - x_1)$$

$$y - 0 = -3(x - 4)$$

$$y - 0 = -3x + 12$$

$$3x + y - 12 = 0$$

c) The line contains the point (2, -5) & the y intercept is -2

$$\cancel{y - y_1 = m(x - x_1)}$$

$$\cancel{y + 5 = -2(x - 2)}$$

$$\cancel{y + 5 = -2x + 4}$$

$$\cancel{2x + y + 1 = 0}$$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 + 5}{0 - 2} = \frac{3}{-2}$$

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

$$2y + 10 = -3x + 6$$

$$3x + 2y + 4 = 0$$

d) The line passes through the points $(2, -1)$ & $(-2, 3)$

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} \Rightarrow \frac{3 + 1}{-2 - 2} = \frac{4}{-4} = -1$$

$$y = mx + c$$

$$(2, -1) \quad y = -x + c \Rightarrow -1 = -2 + c \\ -1 = c$$

$$(y + 1) = -1(x - 2)$$

$$y + 1 = -x + 2$$

$$\boxed{x + y - 1 = 0}$$

e) The gradient is -3 & the line contains the point $(-1, -3)$

$$y + 3 = -3(x + 1)$$

$$y + 3 = -3x - 3$$

$$3x + y + 6 = 0$$

f) The x -intercept is -2 & the y -intercept is 5

$$\frac{x}{a} + \frac{y}{b} = 1 \Rightarrow \frac{x}{-2} + \frac{y}{5} = 1 \Rightarrow \frac{5x + 2y}{-10} = 1$$

$$5x + 2y = -10$$

$$\boxed{5x - 2y + 10 = 0}$$

$$10) \quad y = 12x + 20 \quad ; \quad y = 80 - 16x$$

$$12x - y = -20 \quad \textcircled{1} \quad 16x + y = 80 \quad \textcircled{2}$$

$$y = mx + b$$

$$y = y$$

Table for $12x - y = -20$

0	1	2	3	4	5
20	32	44	56	68	80

Table for $16x + y = 80$

0	1	2	3	4	5
80	64	48	32	16	0

$$x=0$$

$$16(0) + y = 80$$

$$\boxed{y = 80}$$

$$x=1$$

$$16 + y = 80$$

$$\boxed{y = 64}$$

$$x=2$$

$$32 + y = 80$$

$$\boxed{y = 48}$$

$$x=3$$

$$48 + y = 80$$

$$\boxed{y = 32}$$

$$x=4$$

$$64 + y = 80$$

$$\boxed{y = 16}$$

$$x=5$$

$$80 + y = 80$$

$$\boxed{y = 0}$$

$$x=5$$

$$12(5) - y = -20$$

$$60 - y = -20$$

$$\boxed{y = 80}$$

$$x=0$$

$$12(0) - y = -20$$

$$\boxed{y = 20}$$

$$x=1$$

$$12(1) - y = -20$$

$$-y = -20 - 12$$

$$-y = -32$$

$$\boxed{y = 32}$$

$$x=2$$

$$12(2) - y = -20$$

$$24 - y = -20$$

$$-y = -44$$

$$\boxed{y = 44}$$

$$x=3$$

$$12(3) - y = -20$$

$$36 - y = -20$$

$$-y = -56$$

$$\boxed{y = 56}$$

$$x=4$$

$$12(4) - y = -20$$

$$-y = -68$$

$$\boxed{y = 68}$$

ii) b) Solve using elimination method.

$$7F - 5m + 39 = 0 \quad \text{--- (1)}$$

$$14F + 3m + 13 = 0 \quad \text{--- (2)}$$

Sub m in (1)

$$-14F + 10m = +78$$

$$\begin{array}{r} 14F + 3m = -13 \\ \hline 13m = 65 \end{array}$$

$$7F - 25 = -39$$

$$7F = -14$$

$$F = -2$$

$$m = 5$$

12) a) A(2, 3) and B(5, 7)

(i) the distance b/w the two points

$$\text{distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(5-2)^2 + (7-3)^2} = \sqrt{(3)^2 + (4)^2} = \sqrt{9+16} = \sqrt{25}$$

$$d = 5$$

$$(ii) (x_m, y_m) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right) \Rightarrow \left(\frac{2+5}{2}, \frac{3+7}{2} \right)$$

$$(x_m, y_m) = \left(\frac{7}{2}, \frac{10}{2} \right) = (3.5, 5)$$

(b) P(3,4) and Q(8,16)

$$(i) d = \sqrt{(8-3)^2 + (16-4)^2} = \sqrt{5^2 + 12^2} = \sqrt{25+144} = \sqrt{169}$$

$$d = 13$$

$$(ii) (x_m, y_m) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right) \Rightarrow \left(\frac{3+8}{2}, \frac{4+16}{2} \right) \\ (x_m, y_m) = \left(\frac{11}{2}, \frac{20}{2} \right) \Rightarrow (5.5, 10)$$

13) Solve the pronumerical:

$$a) 0.3R - 0.06R^2 = 0$$

Mul both sides by 100

$$30R - 6R^2 = 0$$

Standard form $ax^2 + bx + c = 0$

$$-6R^2 + 30R = 0 \quad R_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$R_{1,2} = \frac{-30 \pm \sqrt{30^2 - 4(-6) \cdot 0}}{2(-6)}$$

$$= \frac{-30 \pm \sqrt{30^2}}{-12}$$

$$= \frac{-30 \pm 30}{-12}$$

$$R_1 = \frac{-30+30}{-12}$$

$$R_2 = \frac{-30-30}{-12}$$

$$R_1 = 0 \quad R_2 = 5$$

14) a) $y = x^2 - 4x - 12$ & $y = -3x + 5$

$$5 - 3x = x^2 - 4x - 12$$

$$x^2 - x - 17 = 0$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-17)}}{2(1)} = \frac{1 \pm \sqrt{1} + 68}{2} \Rightarrow \frac{1 \pm \sqrt{69}}{2}$$

$$x = \frac{1 \pm 8.3}{2} \Rightarrow x_1 = \frac{1 + 8.3}{2}, x_2 = \frac{1 - 8.3}{2}$$

$$x_1 = 4.65, x_2 = -3.65$$

if $x = 4.65 \Rightarrow y = (4.65)^2 - 4(4.65) - 12 = 21.6225 - 18.6 - 12$
 $y = -8.9725$

if $x = -3.65 \Rightarrow y = (-3.65)^2 - 4(-3.65) - 12 = 13.3225 + 14.6 - 12$

$$y = 15.9225$$

$$A(x, y) = (4.65, -8.9725)$$

$$B(x, y) = (-3.65, 15.9225)$$

$$\boxed{\text{Area} = 31}$$

$$b) y = x^2 - 2x - 3 \quad \& \quad dy - x + 2 = 0$$

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

$$\frac{x-2}{2} = x^2 - 2x - 3$$

$$x-2 = 2x^2 - 4x - 6$$

$$2x^2 - 5x - 4 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \Rightarrow \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-4)}}{2(2)}$$

$$x = \frac{5 \pm \sqrt{25 + 32}}{4} \Rightarrow \frac{5 \pm \sqrt{57}}{4} \Rightarrow \frac{5 \pm 7.58}{4}$$

$$x = \frac{5 + 7.55}{4}, \quad \frac{5 - 7.55}{4}$$

$$\boxed{x = 3.13}, \quad \boxed{y = -0.63745}$$

$$\text{if } x = 3.13 \Rightarrow y = (3.13)^2 - 2(3.13) - 3$$

$$= 9.7969 - 6.26 - 3 \Rightarrow 0.5369$$

$$\text{if } x = -0.63745 \Rightarrow y = (-0.63745)^2 - 2(-0.63745) - 3$$

$$= 0.406342 + 1.2749 - 3 \Rightarrow -1.318758$$

$$A(x, y) \Rightarrow (3.13, 0.5369)$$

$$B(x, y) \Rightarrow (-0.63745, -1.318758)$$

15) a) Range of diameters provided:

22.1, 22, 19.5, 19.2, 20, 22

① Mean

$$\frac{22.1 + 22 + 19.5 + 19.2 + 20 + 22}{6} = 20.8$$

② Mode

The mode is the number that is repeated more often than any other, 22

③ Median

19.2, 19.5, 20, 22, 22, 22.1

$$\frac{20 + 22}{2} = \frac{42}{2} = 21$$

④ Range

Large value - Small value

$$22.1 - 19.2 = 2.9$$

⑤ Variance

x	Mean	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$
22.1	20.8	1.3	$1.3^2 = 1.69$
22	20.8	1.2	$1.2^2 = 1.44$
19.5	20.8	-0.3	0.09 $\cancel{1.69}$
19.2	20.8	-0.6	0.6^2 $\cancel{2.56}$
20	20.8	-0.8	$0.8^2 = 0.64$
22	20.8	-1.2	$1.2^2 = 1.44$
		0	9.46

$$S^2 = \frac{\sum (x_i - \bar{x})^2}{n-1} = \frac{9.46}{6-1} = \frac{9.46}{5} = 1.892$$

$$S^2 = 1.892$$

⑥ Standard Deviation

$$S = 1.375$$

$$\leftarrow S^2 = 1.892$$

$$\sqrt{1.892} = 1.375$$

$$(20.8 - 19.2) \text{ and } 1.375$$