

2. Graphical methods

1. $x^2 + 4x + y^2 = 5$
 $x^2 + 4x + (\frac{1}{2} \times 4)^2 + y^2 = 5 + (\frac{1}{2} \times 4)^2$

$$(x + 2)^2 + (y + 0)^2 = 5 + 4$$

$$(x + 2)^2 + (y + 0)^2 = 9$$

Centre (-2,0)

Radius $\sqrt{9}$

$r = 3$ units

2. $x^2 + 6x + (3)^2 + y^2 - 10y + (-5) = 2 + 9 +$

$$25(x + 3)^2 + (y - 5)^2 = 36$$

$$(x - -3)^2 + (y - +5)^2 = 6^2$$

\therefore centre (-3, 5)

Radius 6 units

Completing of sq. for expression in x and y.

✓ **Expression.**

✓ **Centre**

✓ **Radius**

3. $CBE = 40^0$ (alt.segment theorem)
 $\angle BCE = 120^0$ (Suppl. To $BCD = 60^0$ alt. seg.)
 $\therefore (40 + 120 + E) = 180^0$ (Angle sum of Δ)
 $\angle BEC = 20^0$

4. $X^2 + Y^2 - 10Y + 25 = 25 - 16$
 $(X - 0)^2 + (Y - 5)^2 = 9$
 $(X - 0)^2 + (Y - 5)^2 = 3^2$
 Centre (0, 5)
 Radius = 3

5.

x	-5	-4	-3	-2	-1	0	1
x^3	-125	-64	-27	-8	-1	0	1
$6x^2$	150	96	54	24	6	0	6
$8x$	-40	-32	-24	-16	-8	0	8
y	-15	0	3	0	-3	0	15

$$x^3 + 6x^2 + 8x > 1$$

Between

(i) $x = -3.85 \pm 0.1$ and $x = -2.15 \pm 0.1$

(ii) $x > 0.5 \pm 0.1$

6. $y = x^3 - 3x + 2$
 $x = 0, y = 2$
 $(0, 2) \Rightarrow y$ - intercept.

$$\frac{dy}{dx} = 3x^2 - 3 = 0$$

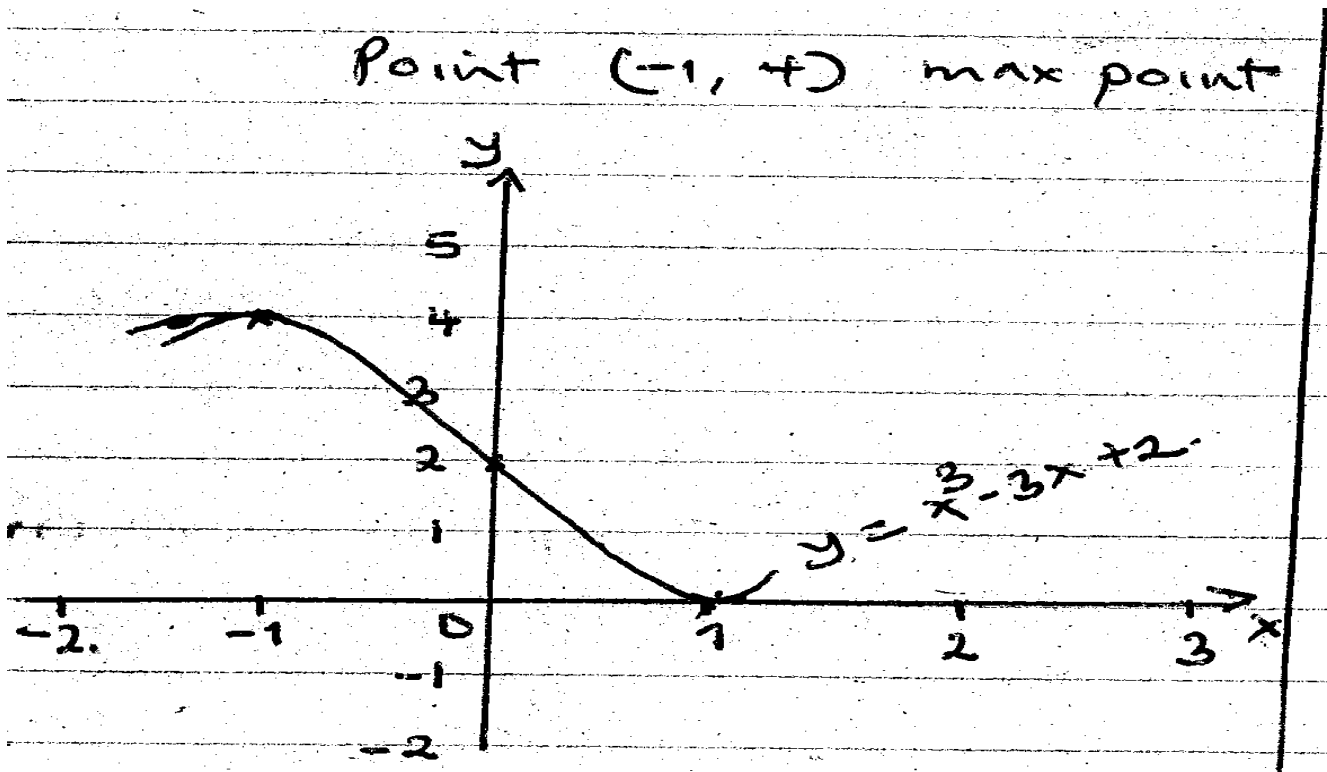
$$x^2 = 1$$

$$x = \mp 1$$

$$x = 1 \quad y = 0$$

Point (1, 0) min point
 $x = -1, y = 4$

Point (-1, 4) max point.



7. $4x^2 - 12x + 4y^2 + 12y = 7$
 $x^2 - 3x + y^2 + 3y = 7/4$
 $x^2 - 3x + (3/2)^2 + y^2 + 3y + (3/2)^2 = 7/4 + 9/4 + 9/4 = 25/4$
 $(x - 3/2)^2 + (y + 3/2)^2 = 25/4$
 \therefore Centre $(1.5, -1.5)$ Radius 2.5units

8. $\log R = n \log p + \log K$

Log P	0.48	0.54	0.60	0.65	0.70
Log R	1.56	1.69	1.81	1.91	2.00

Gradient = $\frac{2 - 0.6}{0.7}$
 $= \frac{1.4}{0.7} = 2$

Log R intercepts = 0.6 = log k
 $K = 4$

The law connecting R and P is $R = 4P^2$
 $900 = 4P^2$
 $P^2 = \frac{900}{4}$

$225 = P^2$

9. $(x+2)^2 (y-3)^2 = 3^2$
 $X^2 + 4x + 4 + y^2 - 6y + 9 = 3^2$
 $X^2 + y^2 + 4x - 6y + 4 = 0$

10.

V	0	2	4	6	8	10
$\frac{1}{T}$	2.04	3.33	4.17	5	6.25	7.30

$T = a$

$$b + V$$

$$\frac{I}{T} = \frac{b + V}{a}$$

$$\frac{I}{T} = \frac{IV}{a} + \frac{b}{a}$$

$$y = mx + C$$

$$\frac{b}{a} \text{ (i) } = \frac{\text{Grad}}{\Delta x} \Rightarrow \frac{\Delta y}{10 - 6} = \frac{7.3 - 5}{4} = 2.3 = 0.575$$

$$a = 1.739$$

$$\frac{b}{a} = y - \text{Intercept} \Rightarrow 2.04$$

$$\frac{b}{1.739} = 2.04 \quad b = 2.04 \times 1.739$$

$$= 3.547556$$

$$b \simeq 3.548$$

$$\text{(ii) } T = 0.38$$

$$\frac{I}{T} = 2.63 \text{ shown on graph}$$

$$V = 1$$

$$\text{(iii) } \frac{I}{T} = 4.45$$

$$T = (4.45)$$

$$= 0.2247$$

$$\simeq 0.22$$

$$11. \quad y = 2x^3 + x^2 + 3x - 1$$

$$\frac{dy}{dx} = 6x^2 + 2x + 3$$

gradeindent at (1, -5)

$$= 6 + 2 + 3 = 11$$

$$\frac{y - (-5)}{x - 1} = 11$$

$$y + 5 = 11x - 11$$

$$y = 11x - 16$$

$$12. \quad 3^5 = 3^{-4} \times 3^{-x}$$

$$3^5 = 3^{-4-x}$$

$$-4 - x = 5$$

$$-x = 9$$

$$x = -9$$

13. $x^2 + 2x + 1 + y^2 - 4y + 4 = 4 + 1 + 1$
 $(x+1)^2 + (y-2)^2 = 9$
Centre $(-1, 2)$
Radius 3units

14. c)

X	-4	-3	-2	-1	0	1	2
-6	-6	-6	-6	-6	-6	-6	-6
X	-4	-3	-2	-1	0	1	2
4x ²	64	36	16	4	0	4	16
X ³	-64	-27	-8	-1	0	1	8
Y=-6+x+4x ² +x ²	-10	0	0	-4	-6	0	20

$$y = x^3 + 4x^2 + x - 6$$

$$0 = x^3 + 4x^2 + x - 4$$

$$y = -2$$

(iii)

$$y = x^3 + 4x^2 + x - 6$$

$$0 = x^3 + 4x^2 + 0 - 2$$

$$y = \quad \quad \quad x - 4$$

$$x \quad 1 \quad 0 \quad -2$$

$$y \quad -3 \quad -4 \quad -8$$

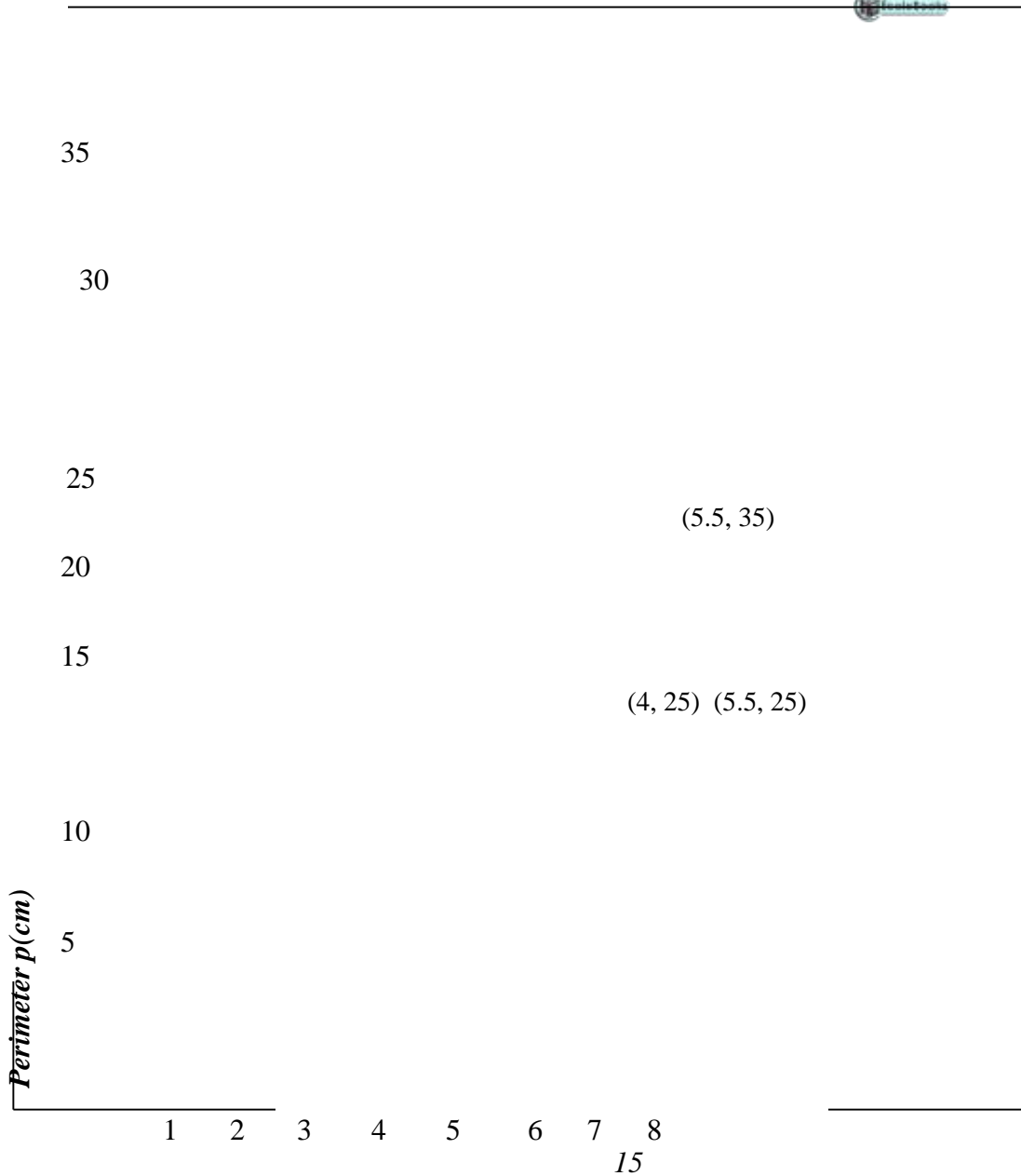
$$-y = -6 + 4x^2 + x^3$$

$$-y = x - 4$$

c (i) solution 0.8

-1.5
And -3.2
(c) 1, -2, -3

15.



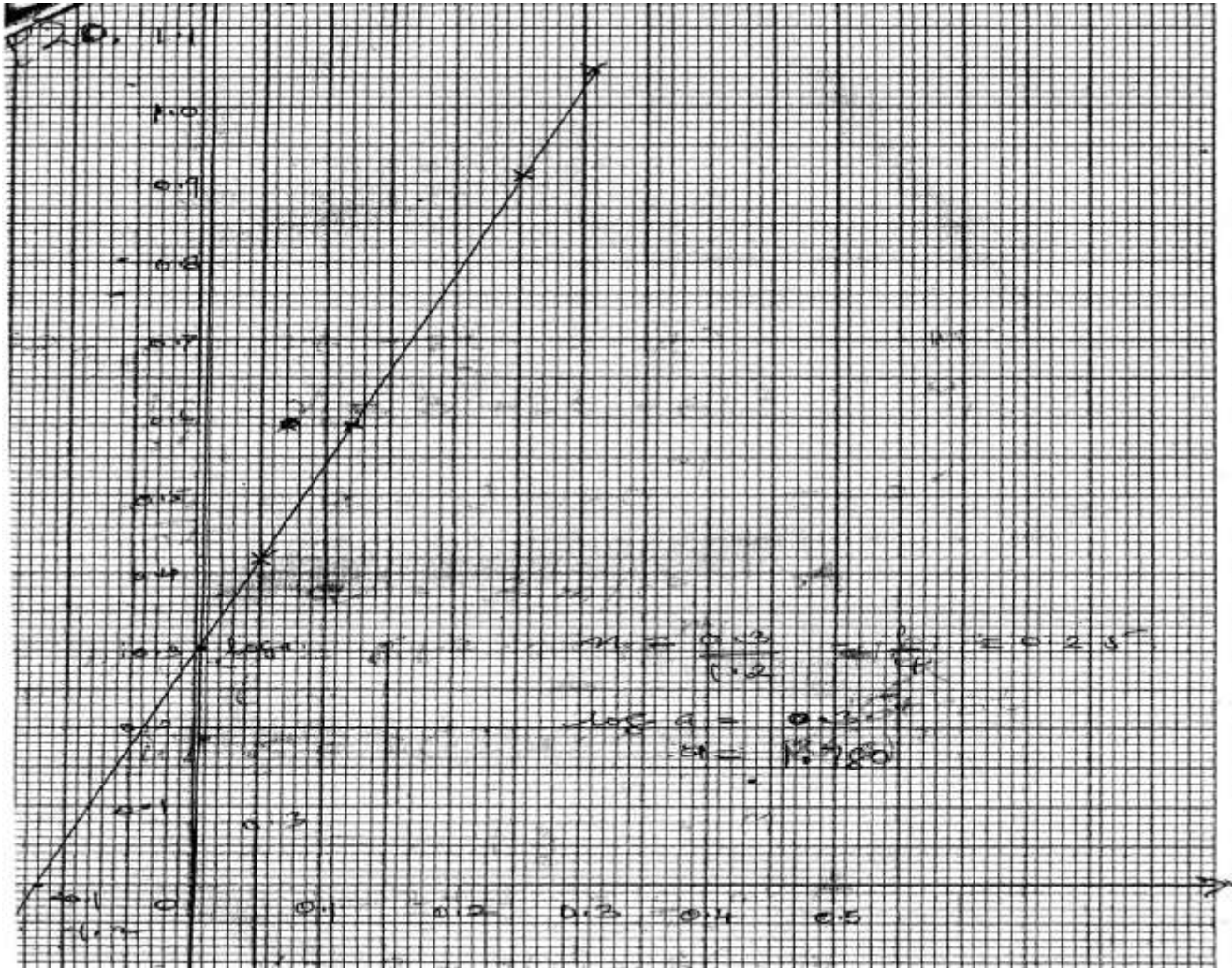
$$\begin{aligned}
 (i) P &= 15.75 \text{ cm} & k &= \frac{100}{15} = 3.33 \\
 (ii) l &= 1.5 \text{ cm} & 2 \times 15 \text{ c} &= 1.93 \\
 (iii) m &= \frac{35 - 25}{5.5 - 4.0} = \frac{10}{1.5} = 6.667 & 0.6 &= ar^h & \text{Log}(P + 0.6) &= \log a + n \log R
 \end{aligned}$$

$$\begin{aligned}
 (c) \text{ choose } P(5, 31.4) \\
 \frac{p - 31.4}{l - 5} &= \frac{10}{1.5} \\
 \frac{p - 31.4}{l - 5} &= \frac{100}{1.5} \\
 15p - 471 &= 100l - 500 \\
 15p &= 100l - 29 \\
 15 \quad 15 \\
 2k &= 100
 \end{aligned}$$

Length l (cm)

$$= n \log R + \log 9$$

$P + 0.6$	1.33	2.65	3.85	8.04	11.22
$\log (P + 0.6)$	-0.13	0.42	0.59	0.91	1.05
$\log R$	-0.05	0.05	0.12	0.25	0.30



$\log 0.3 = \frac{1}{4} = 0.25$
 $\log a = 0.3$

17. $x^2 + y^2 - 6x = 3 - 4y$
 $x^2 - 6x + (\frac{-6}{2})^2 + y^2 + 4y + (\frac{4}{2})^2 = 3 + (\frac{-6}{2})^2 + (\frac{4}{2})^2$
 $(x - 3)^2 (y + 2)^2 = 3 + 9 = 4$
 $(x - 3)^2 (y + 2)^2 = 16$
 $C(3, -2)$

$$\text{Gradient } \frac{\Delta y}{\Delta x} = \frac{7 - -2}{6 - 3} = 3$$

18.

x	-3	-2	-1	0	1	2	3	4
$-x^3$	27	8	1	0	-1	-8	-27	-64
$2x^2$	18	8	2	0	2	8	18	32
$-4x$	12	8	4	0	-4	-8	-12	-16
2	2	2	2	2	2	2	2	2
y	59	26	9	2	-1	-6	-19	-46

b) Check on the graph paper.

c) $x = 0.5 \pm 0.1$

d) $-x^3 + 2x^2 - 5x + 3 = 0$

Line to allow: $y = x - 1$

$$\begin{array}{c|c|c} x & 0 & 1 \\ \hline y & -1 & 0 \end{array}$$

$x = 0.65$

19. $\frac{Dy}{dx} = 12x^2 - 12$

$12x^2 - 12 = 0$

$12(x^2 - 1) = 0$

$x = 1$

$x = -1$

<i>At x = 1</i>			<i>At x = -1</i>		
0	1	2	-2	-1	0
GRD = 12	0	36	36	0	-12
	-	0	+	+	0
		(1, 7)			(-1, 9)
	<i>Minimum</i>		<i>maximum</i>		

20. (a) table
 (b) plotting
 scale
 smooth curve

(c) (i) $-0.5 < x < 1$ and $x > 1$

(iii) $x = 2.5 \pm 0.1$

21. $2x^2 + 2y^2 - 6x + 10y + 9 = 0$
 $x^2 + y^2 - 3x + 5y + 9/2 = 0$
 $x^2 + y^2 - 3x + 5y = -9/2$
 $x^2 - 3x + \underline{9} + y^2 + 5y + \underline{25} = 8.5 - 4.5$
 $\frac{4}{2} \qquad \qquad \frac{4}{2}$
 $(x - \underline{3})^2 + (y + \underline{5})^2 = 4$
 Radius = 2 units
 Centre = (1.5, -2.5)