)Figure shows the graph of $y = 25x - x^3$ for $0 \leqslant x \leqslant 5$. By adding a suitable straight line to the graph, solve the equation

$$30 = 25x - x^3,$$

where $0 \leqslant x \leqslant 5$. Give your answers correct to 2 significant figures.

Figure shows a right pyramid with a square base $ABCD$. $AB = b$ units and $AE = 5$ units. The height of the pyramid is h units and its volume is V cubic units.

(i) Express b in terms of h.
Hence show that $V = \frac{2}{3}(25h - h^3)$. (3 marks)

(ii) Using (a), find the two values of h such that $V = 20$.
(Your answers should be correct to 2 significant figures.) (2 marks)

(iii) Use the "method of magnification" to find the smaller value of h in (b) (ii) correct to 3 significant figures. (3 marks)

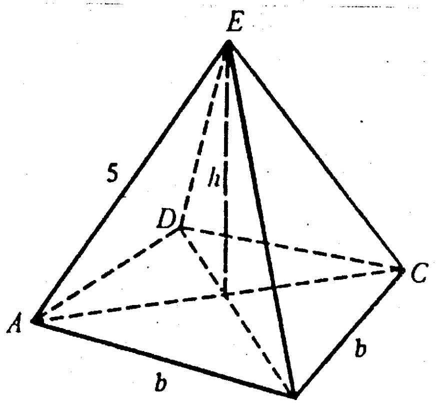
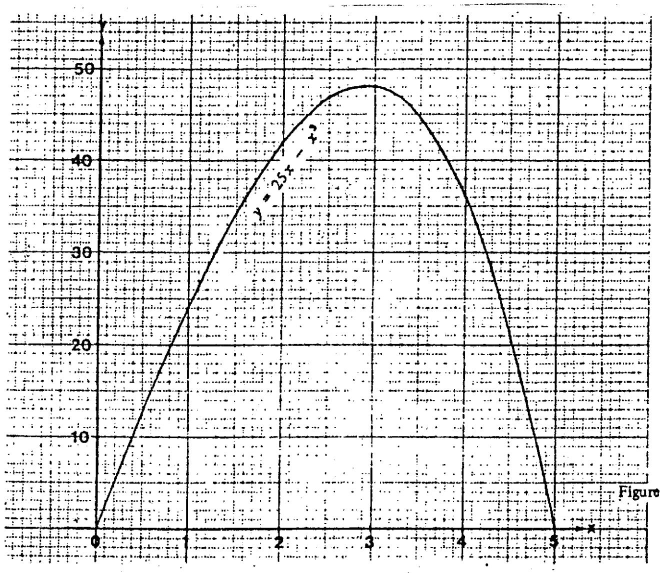


Figure 8



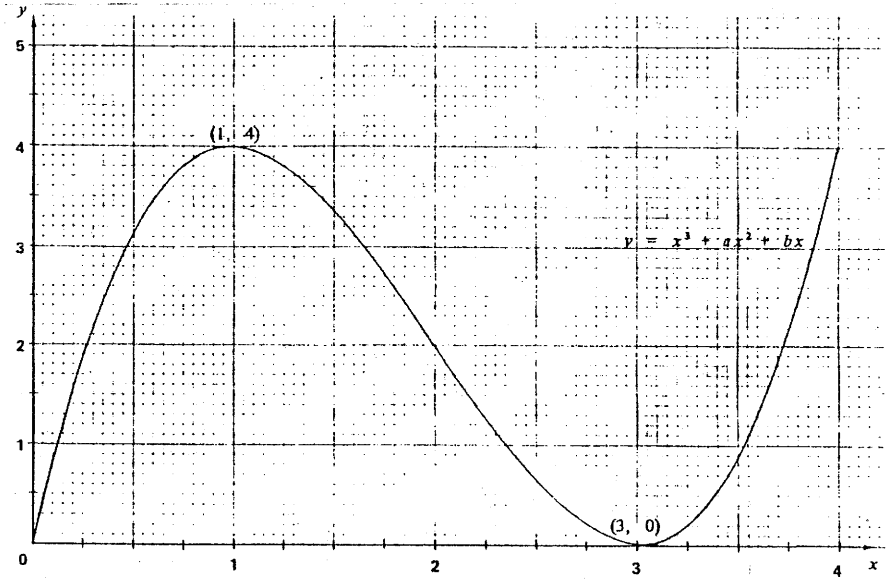
2(81) The relationship between the height y of a flying object and time x is given by

$$y = x^3 + ax^2 + bx,$$

P.1

where y is in kilometres above sea-level and x is the number of hours after 12 : 00 noon.

Figure 5 shows the graph of $y = x^3 + ax^2 + bx$.



Using Figure

(i) find the values of a and b,

(ii) write down the time interval in which the flying object is descending.

At 1:00 p.m., a balloon rises vertically from sea-level with a constant speed of 4 km/h.

(i) Add a straight line to Figure 5 to show the relationship between the height of the balloon and time x.

(ii) Hence, write down the value of x to 2 significant figures, for which the balloon and the flying object are at the same height.

Use the method of magnification to find the value of x in (b) (ii) to 3 significant figures.

P.2

Three gold cubes have sides of length $(x + 1)$ cm, x cm and $(x - 1)$ cm respectively (see Figure 8(a)).

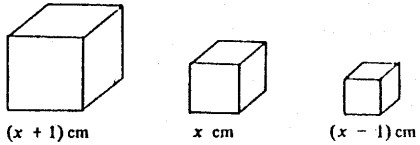


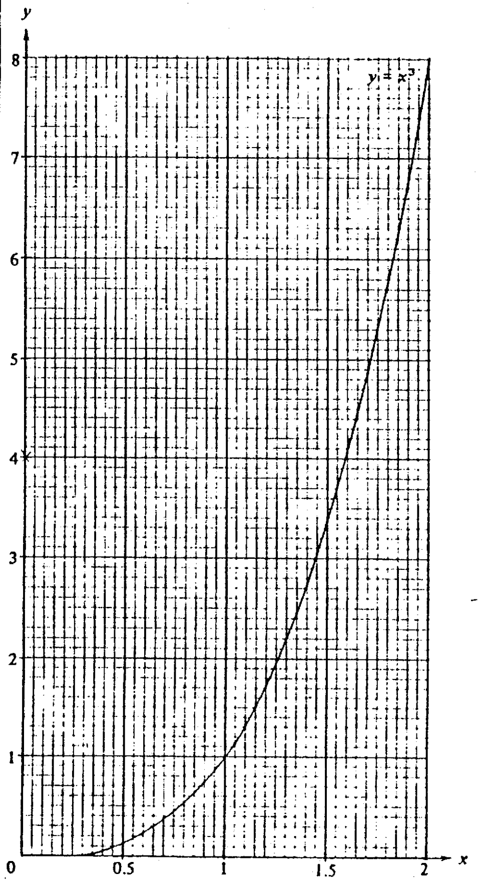
Figure 8(a)

(a) (i) Find, in terms of x, the total volume of these three cubes.

(ii) If the total volume of these three cubes is 12 cm^3, show that $x^3 + 2x - 4 = 0$.

(5 marks)

(b) Figure 8(b) shows the graph of $y = x^3$ for $0 \leqslant x \leqslant 2$.



(i) Draw a suitable straight line in Figure 8(b) to solve the equation

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

for $0 \leqslant x \leqslant 2$. Give the root of the equation correct to 2 significant figures.

(ii) Use the method of magnification to find the root in (b)(i) correct to 3 significant figures.

(7 marks)

4(83) Equal squares each of side k cm are cut from the four corners of a square sheet of paper of side 7 cm (see Figure 7(a)). The remaining part is folded along the dotted lines to form a rectangular box as shown in Figure 7(b).

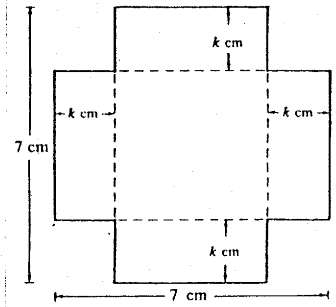


Figure 7(a)

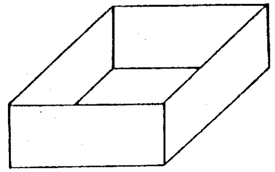


Figure 7(b)

(a) Show that the volume V of the rectangular box, in cm^3, is $V = 4k^3 - 28k^2 + 49k$.

(3 marks)

(b) Figure 7(c) shows the graph of $y = 4x^3 - 28x^2 + 49x$ for $0 \leqslant x \leqslant 5$. Draw a suitable straight line in Figure 7(c) and use it to find all the possible values of x such that $4x^3 - 28x^2 + 49x - 20 = 0$. (Give the answers to 1 decimal place.)

(4 marks)

(c) Using the results of (a) and (b), deduce the values of k such that the volume of the box is 20 cm^3. (Give the answers to 1 decimal place.)

(2 marks)

(d) By the method of magnification, find the smaller value of k in (c) to two decimal places.

(3 marks)

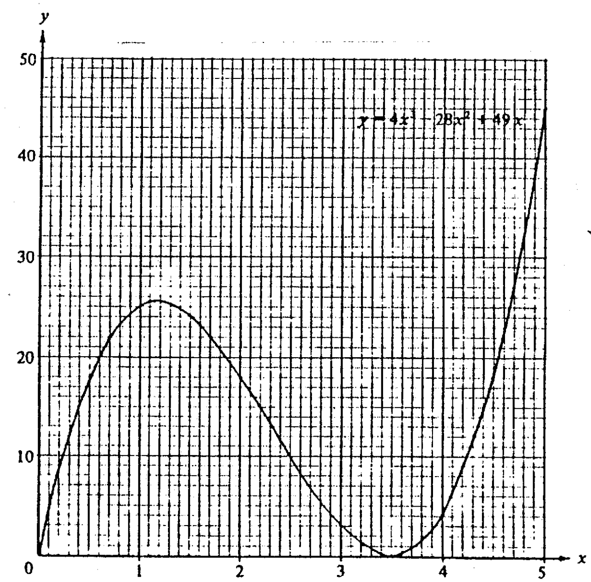


Figure 7(c)

4)(a) Figure 5 shows the graph of $y = x^3 + x^2$ for $-1 \leqslant x \leqslant 2$.

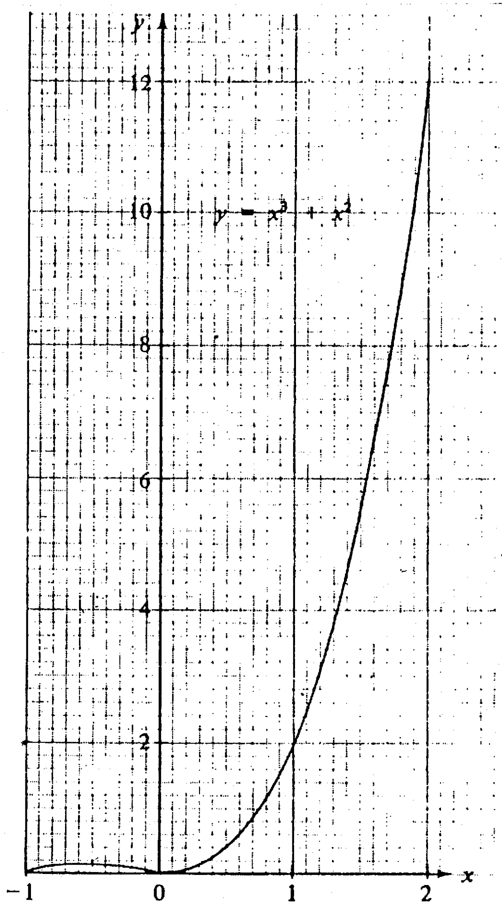
(i) Draw a suitable straight line in Figure 5 and use it to find a root of the equation

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

(Give your answer correct to 1 decimal place.)

(ii) By the method of magnification, find the root obtained in (i) correct to 2 decimal places.

(7 marks)



6(85) Figure 6 shows the graph of

$$y = x^3 + x \quad \text{for } -1 \leqslant x \leqslant 2 .$$

(a) (i) Draw a suitable straight line in Figure 6 and hence find, correct to 1 decimal place, the real root of the equation

$$x^3 + x - 1 = 0 .$$

(ii) By the method of magnification, find the real root of the equation in (i), correct to 2 decimal places.

(7 marks)

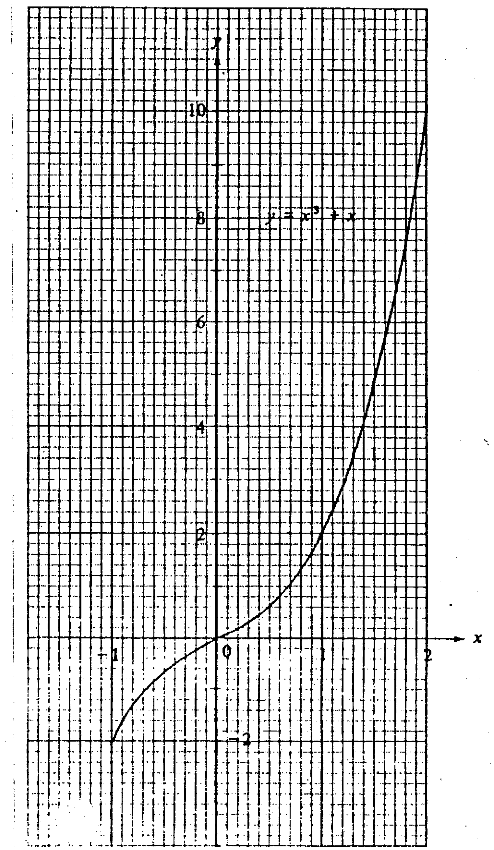
(b) (i) Expand and simplify the expression

$$(x + 1)^4 - (x - 1)^4 .$$

(ii) Using the result in (a)(ii), find, correct to 2 decimal places, the real root of the equation

$$(x + 1)^4 - (x - 1)^4 = 8 .$$

(5 marks)



1(06)

Figure 6 shows the graph of $y = x^4 + x$ for $0 \leqslant x \leqslant 2$.

(a) Draw a suitable straight line on the figure and use it to find the approximate value of the root of the equation

$$x^4 - x - 1 = 0$$

in the interval $0 \leqslant x \leqslant 2$, correct to 1 decimal place.

(4 marks)

(b) By the method of magnification, find the approximate value of the root in (a), correct to two decimal places.

(4 marks)

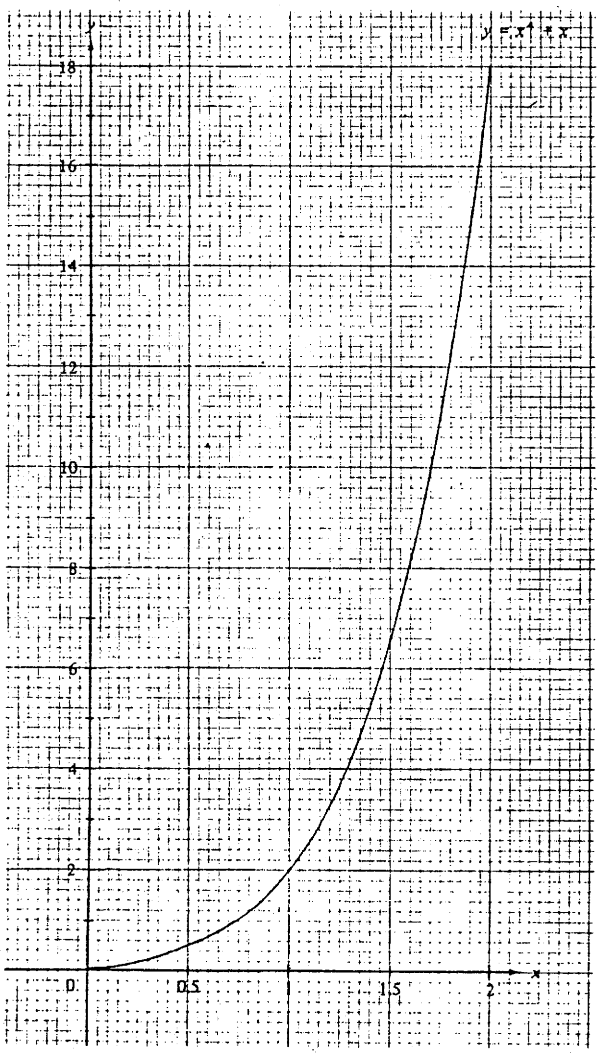
(c) Use the result in (b) to find the approximate value of the root of the equation

$$(x-1)^4 = x$$

in the interval $1 \leqslant x \leqslant 3$, correct to two decimal places.

[Hint: Put $x = y + 1$]

(4 marks)



8(07) K4

Figure 7 shows the graph of $y = x^3 - 6x^2 + 9x$.

(a) By adding suitable straight lines to the figure, find, correct to 1 decimal place, the real roots of the following equations:

(i) $x^3 - 6x^2 + 9x - 1 = 0$,

(ii) $x^3 - 6x^2 + 10x - 6 = 0$.

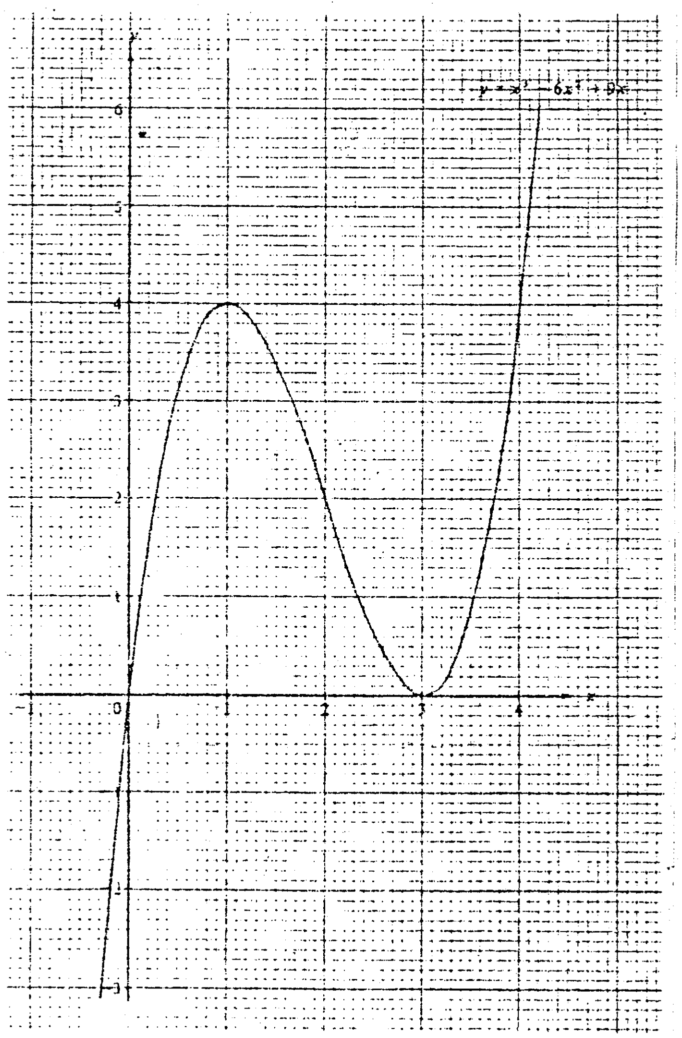
(6 marks)

(b) By using the method of magnification, find, correct to 2 decimal places, the real root(s) of (a)(ii).

(3 marks)

(c) From the graph in Figure 7, find the range of values of k such that the equation $x^3 - 6x^2 + 9x - k = 0$ has three distinct real roots.

(3 marks)



(88) Figure 7 shows the graph of $y = x^3$ for $x \geqslant 0$.

(a) Let r be the real root of the equation $x^3 - \frac{4}{3}x - 6 = 0$.

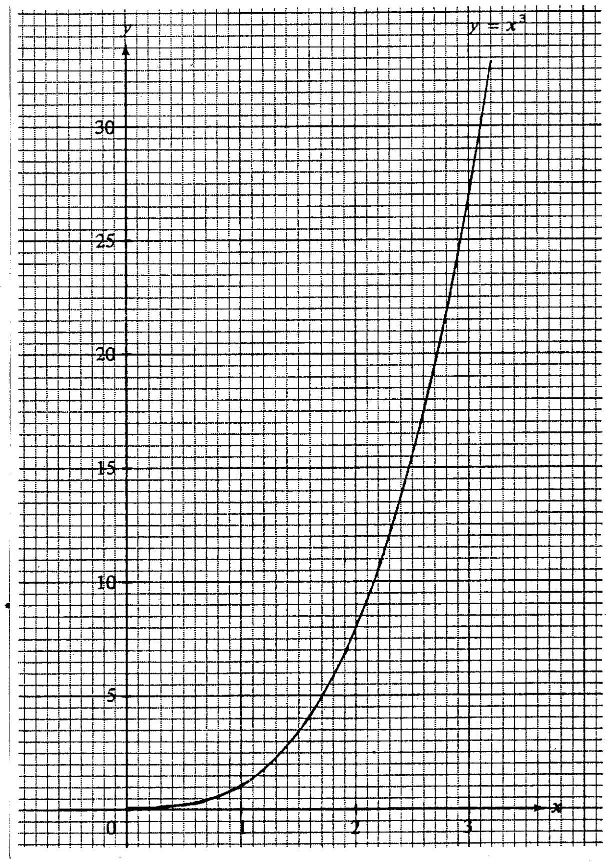
(i) By adding a suitable straight line to the figure, find an interval of width 0.1 which contains r.

(ii) Use the method of bisection to find the value of r correct to two decimal places. Show your working in the form of a table.

(9 marks)

(b) Use (a) to find, correct to two decimal places, the real root of the equation $3(t + 1)^3 - 4(t + 1) - 18 = 0$.

(3 marks)



10(89)

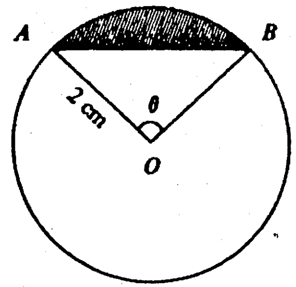


Figure 5

In Figure 5, O is the centre of a circle of radius 2 cm. A and B are two points on the circle such that $\angle AOB = \theta$ radians, where $0 < \theta < \pi$.

(a) (i) Find the area of ΔOAB in terms of θ.

(ii) Find the value of θ for which the area of ΔOAB is the greatest.

(2 marks)

(b) If the area of the shaded segment is 2 cm², show that

$$\theta - \sin\theta - 1 = 0 .$$

(3 marks)

(c) Let $f(\theta) = \theta - \sin\theta - 1$ and α be the root of $f(\theta) = 0$. Show that α lies between 0 and 3.

(2 marks)

(d) Using the method of bisection, find the value of α correct to one decimal place.

(5 marks)

(90) A solid right circular cylinder has radius r and height h. The volume of the cylinder is V and the total surface area is S.

(a) (i) Express S in terms of r and h.

(ii) Show that $S = 2\pi r^2 + \frac{2V}{r}$.

(3 marks)

(b) Given that $V = 2\pi$ and $S = 6\pi$, show that $r^3 - 3r + 2 = 0$.

Hence find the radius r by factorization.

(4 marks)

(c) Given that $V = 3\pi$ and $S = 10\pi$, find the radius r $(1 < r < 2)$ by the method of bisection, correct to 1 decimal place.

(5 marks)

HKCEE Problem

Method of Bisection.

(80) 1. $y = 25x - x^3$. — ①

$30 = 25x - x^3$. — ②

① − ②

$\therefore\ y - 30 = 0$

which is the line added on the graph,

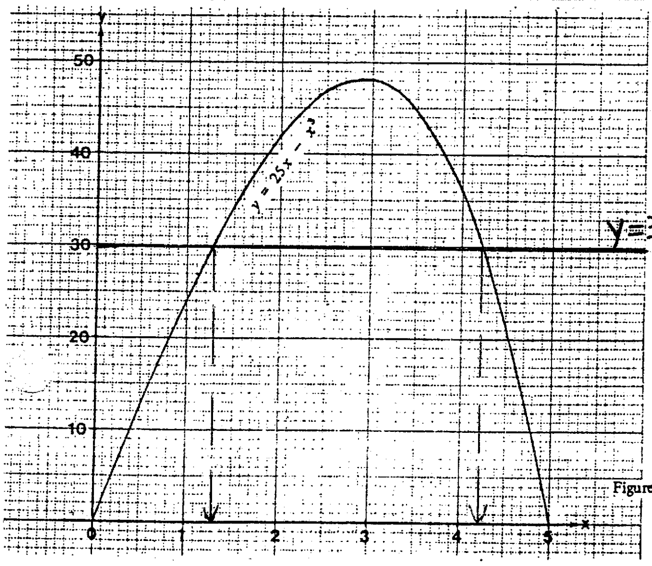


Figure 7

From the graph, the soln. of eqt.

$30 = 25x - x^3$

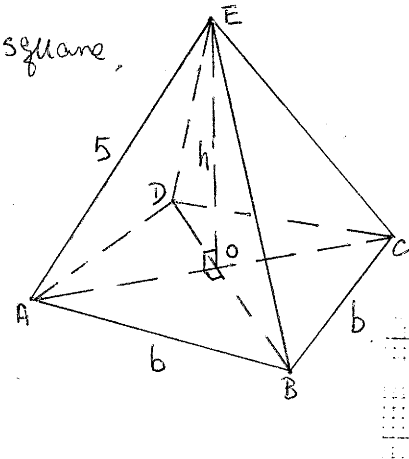
are 1.3 and 4.2 (2 sig. fig.)

bi) since ABCD is a square,

$\therefore \angle AOB = 90°$

$OA = \sqrt{AE^2 - OE^2}$

$= \sqrt{25 - h^2}$



In ΔOAB

$AB^2 = AO^2 + OB^2$

$b = \sqrt{2(25-h^2)}$

$V = \frac{1}{3} \times h \times$ base area.

$V = \frac{1}{3}(h)(2(25-h^2))$

$V = \frac{2}{3}(25h - h^3)$

bii). For $V = 20$.

$\therefore\ 20 = \frac{2}{3}(25h - h^3)$

$\Rightarrow 30 = 25h - h^3$.

By (a) $h = 1.3$ or 4.2 (2 sig. fig.)

biii). For the value of $h = 1.3$

Let. $f(h) = h^3 - 25h + 30$.

$f(1.2) = 1.728 > 0$.

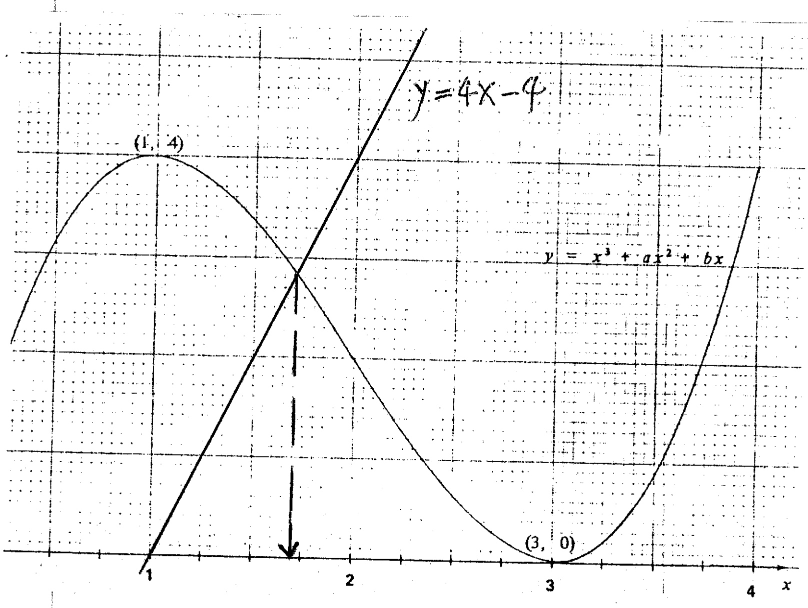
$f(1.4) = -2.256 < 0$.

By method of Bisection.

interval of x.	mid-value	sign of f(x).
$1.2 \le x \le 1.4$	1.3	−
$1.2 \le x \le 1.3$	1.25	+
$1.25 \le x \le 1.3$	1.275	+
$1.275 \le x \le 1.3$	1.2875	−
$1.275 \le x \le 1.2875$	1.28125	+
$1.28125 \le x \le 1.2875$	1.284375	+
$1.284375 \le x \le 1.2875$	1.2859375	−
$1.284375 \le x \le 1.2859375$	1.28515625	−
$1.284375 \le x \le 1.28515625$	1.284765625	+
$1.28476625 \le x \le 1.28515625$	1.284960938	−
$1.28476562 \le x \le 1.284960938$		

$\therefore\ h \approx 1.28$ (3 sig. fig.).

2(81).



a) i) $y = x^3 + ax^2 + bx$

From the graph,

For $(1,4)$

$4 = (1)^3 + a(1)^2 + b(1)$

$\therefore a + b - 3 = 0$ — ①

For $(3,0)$

$0 = 3^3 + a(3)^2 + b(3)$

$3a + b + 9 = 0$ — ②

② − ① $2a = -12$

$a = -6$

$\therefore b = 9$

out. of syllabus!

bi) Let h be height of the balloon.

$\therefore h = 4x \Leftarrow$ (distance = speed × time)

~~Let~~ $y = mx + c$ ~~be~~ added the line ~~the~~ graph.

At 1:00 p.m., $h = 0$, $x = 1$.

$0 = m(1) + c$

$m + c = 0$ — ①

At 2:00 p.m. $h = 4 = x = 2$.

$4 = m(2) + c$

$2m + c = 4$ — ②

② − ① $\therefore m = 4$

$c = -4$

$\therefore y = 4x - 4$ is the line added on the graph.

From the graph,

the balloon and the flying object are at the same height at $x = 1.7$ (2 sig. fig.)

$\begin{cases} y = x^3 - 6x^2 + 9x & \text{— ①} \\ y = 4x - 4 & \text{— ②} \end{cases}$

① − ② $\therefore x^3 - 6x^2 + 5x + 4 = 0$.

Let $f(x) = x^3 - 6x^2 + 5x + 4$.

$f(1.65) = 0.407 > 0$

$f(1.75) = -0.266 < 0$.

interval	mid-value	sign of $f(x)$
$1.65 \le x \le 1.75$	1.7	+
$1.7 \le x \le 1.75$	1.725	−
$1.7 \le x \le 1.725$	1.7125	−
$1.7 \le x \le 1.7125$	1.70625	+
$1.70625 \le x \le 1.7125$		

By method of Bisection,

$x = 1.71$ (3 sig. fig.)

3(82)

ai) the total volume of the cubes.

$V = (x+1)^3 + x^3 + (x-1)^3$

$V = x^3 + \cancel{3x^2} + 3x + \cancel{1} + x^3 + x^3 - \cancel{3x^2} + 3x - \cancel{1}$

$V = 3x^3 + 6x$

ii) For $V = 12$.

$\therefore 3x^3 + 6x = 12$.

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

bi) $\begin{cases} y = x^3 \\ x^3 + 2x - 4 = 0 \end{cases}$

$\begin{cases} x^3 = y & \text{— ①} \\ x^3 + 2x - 4 = 0 & \text{— ②} \end{cases}$

② − ① $\therefore 2x + y - 4 = 0$ is the line added on the graph.

b i) From the graph,
the soln. of eqt. is 1.2.

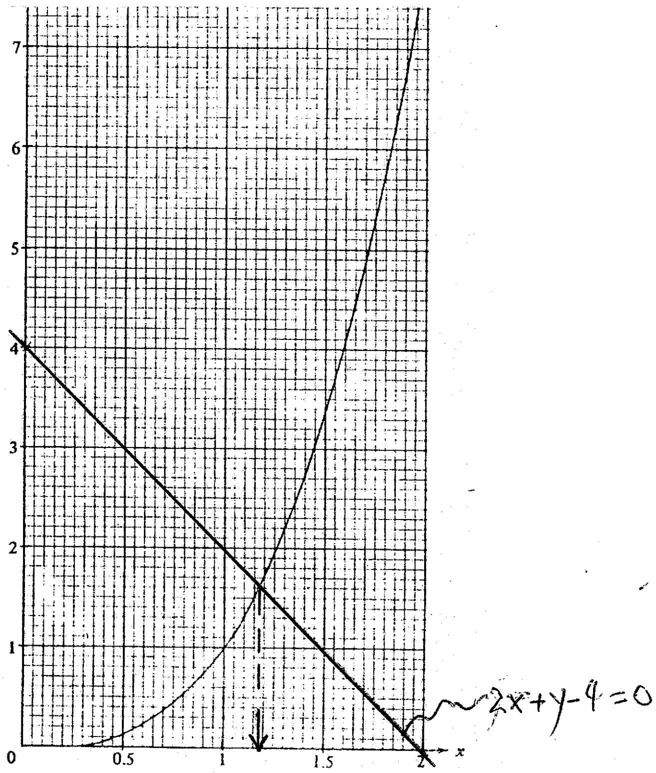
b ii) Let. $f(x) = x^3 + 2x - 4$.

$f(1.15) = -0.179 < 0$

$f(1.25) = 0.453 > 0$.

interval	mid-value	sign of $f(x)$
$1.15 \leq x \leq 1.25$	1.2	+
$1.15 \leq x \leq 1.2$	1.175	−
$1.175 \leq x \leq 1.2$	1.1875	+
$1.175 \leq x \leq 1.1875$	1.18125	+
$1.175 \leq x \leq 1.18125$		

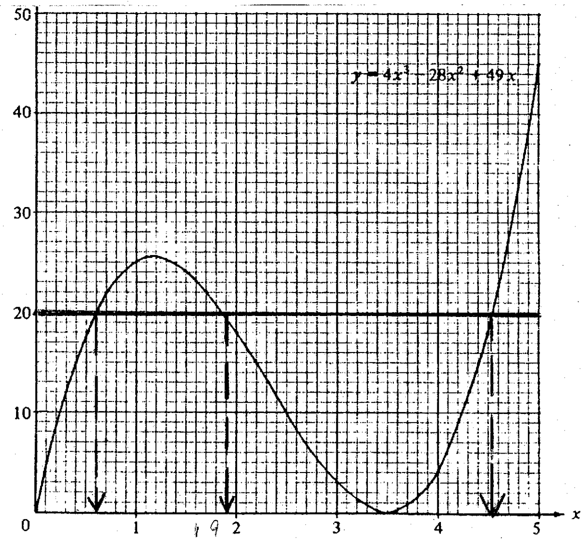
By method of Bisection,
$x = 1.18$ (3 sig. fig.).



4(83). a) the length & the width of the box
$= 7 - 2k$.
$\therefore$ the volume of the box
$V = (7-2k)^2 k$.
$V = 4k^3 - 28k^2 + 49k$.

b) $\begin{cases} y = 4x^3 - 28x^2 + 49x & \text{— ①} \\ 0 = 4x^3 - 28x^2 + 49x - 20 & \text{— ②} \end{cases}$

① − ②
$y = 20$ is the line added on the graph.



From the graph, the roots of eqt.
are 0.6, 1.9 or 4.5. (1 dec. pl.)

c) For $V = 20$.

From (a) $20 = 4k^3 - 28k^2 + 49k$.

$\therefore 4k^3 - 28k^2 + 49k - 20 = 0$.

From (b)
$\therefore k = 0.6, 1.9$ or 4.5 (1 dec. pl.)

d) Let. $f(k) = 4k^3 - 28k^2 + 49k - 20$.

For $k \approx 0.6$.

$f(0.5) = -2 < 0$
$f(0.7) = 1.95 > 0$.

Interval	mid-value	sign of $f(k)$
$0.5 \leq k \leq 0.7$	0.6	+
$0.5 \leq k \leq 0.6$	0.55	−
$0.55 \leq k \leq 0.6$	0.575	−
$0.575 \leq k \leq 0.6$	0.5875	−
$0.5875 \leq k \leq 0.6$	0.59375	+
$0.5875 \leq k \leq 0.59375$		

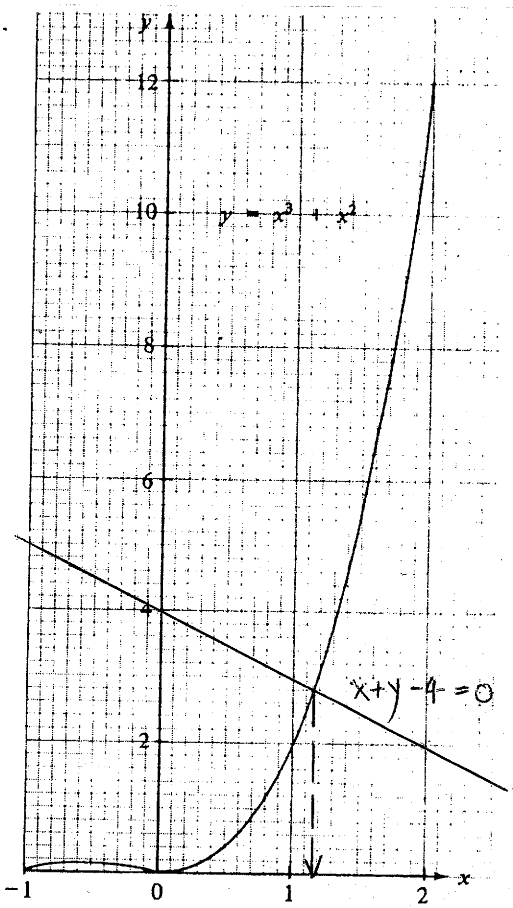
$\therefore k \approx 0.59$ (2 dec. pl.)

5(84).a) i) $\begin{cases} y = x^3 + x^2 \\ x^3 + x^2 + x - 4 = 0 \end{cases}$

$\begin{cases} y = x^3 + x^2 & — ① \\ 0 = x^3 + x^2 + x - 4 & — ② \end{cases}$

① − ② $y = -x + 4$.

$\therefore$ $x + y - 4 = 0$ is the line added on the graph.



$\therefore$ the root of the eqt. is 1.2 (1 dec. pl.)

Let. $f(x) = x^3 + x^2 + x - 4$.

$f(1.1) = -0.359 < 0$

$f(1.2) = 0.368 > 0$.

interval	mid-value	sign of f(x)
$1.1 \le x \le 1.2$	1.15	−
$1.15 \le x \le 1.2$	1.175	+
$1.15 \le x \le 1.175$	1.1625	+
$1.15 \le x \le 1.1625$	1.15625	+
$1.15 \le x \le 1.15625$	1.153125	+
$1.15 \le x \le 1.153125$		

By method of bisection, the root is 1.15. (2 dec. pl.)

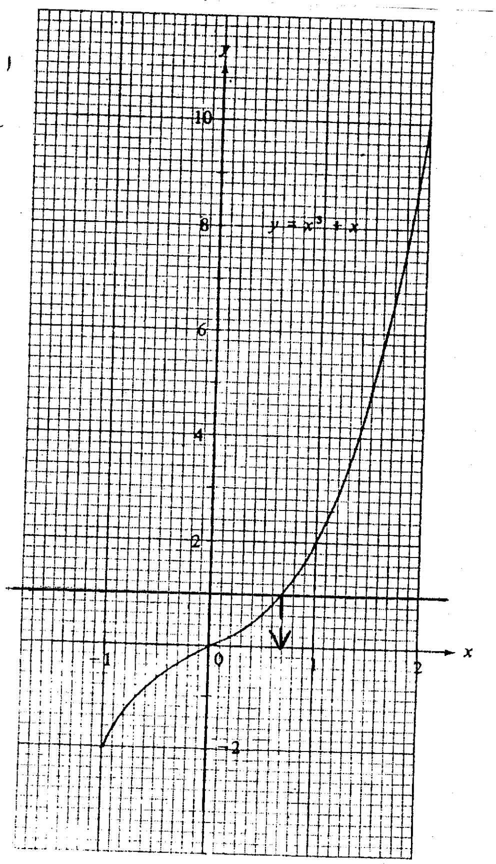
6(35)a i) $\begin{cases} y = x^3 + x \\ x^3 + x - 1 = 0 \end{cases}$

$\begin{cases} y = x^3 + x & — ① \\ 0 = x^3 + x - 1 & — ② \end{cases}$

① − ②. $y = 1$. is the line added on the graph.

From the graph, the root of the eqt. is 0.7 (1 dec. pl.)

y = 1



Let. $f(x) = x^3 + x - 1 = 0$

$f(0.6) = -0.184 < 0$

$f(0.7) = 0.043 > 0$

interval	mid-value	sign of f(x)
$0.6 \le x \le 0.7$	0.65	−
$0.65 \le x \le 0.7$	0.675	−
$0.675 \le x \le 0.7$	0.6875	+
$0.675 \le x \le 0.6875$	0.68125	−
$0.68125 \le x \le 0.6875$	0.684375	+
$0.68125 \le x \le 0.684375$		

By method of bisection, the root of the eqt. is 0.68 (2 dec. pl.)

P5

6(85) cont'd.

b) i) $(x+1)^4-(x-1)^4$

$= [(x+1)^2+(x-1)^2][(x+1)^2-(x-1)^2]$

$= [x^2+\cancel{2x}+1+x^2-\cancel{2x}+1][\cancel{x^2}+2x+\cancel{1}-\cancel{x^2}+2x-\cancel{1}]$

$= 2(x^2+1)(4x)$

$= 8x^3+8x$.

ii) the eqt.

$(x+1)^4-(x-1)^4 = 8$.

$\therefore \quad 8x^3+8x = 8$.

$x^3+x=1$

$x^3+x-1=0$.

$\because$ the eqt. in a ii)

$\therefore$ the root of eqt is also 0.68 (2 dec. pl.)

7(86). a)
$$\begin{cases} y = x^4+x. \\ x^4-x-1=0 \end{cases}$$

$$\begin{cases} y = x^4+x & \text{— ①} \\ 0 = x^4-x-1 & \text{— ②}. \end{cases}$$

① − ②

$y = 2x+1$.

$\therefore$ $2x-y+1=0$ is the line added on the graph.

From the graph, the root of the eqt is 1.2 (1 dec. pl.)

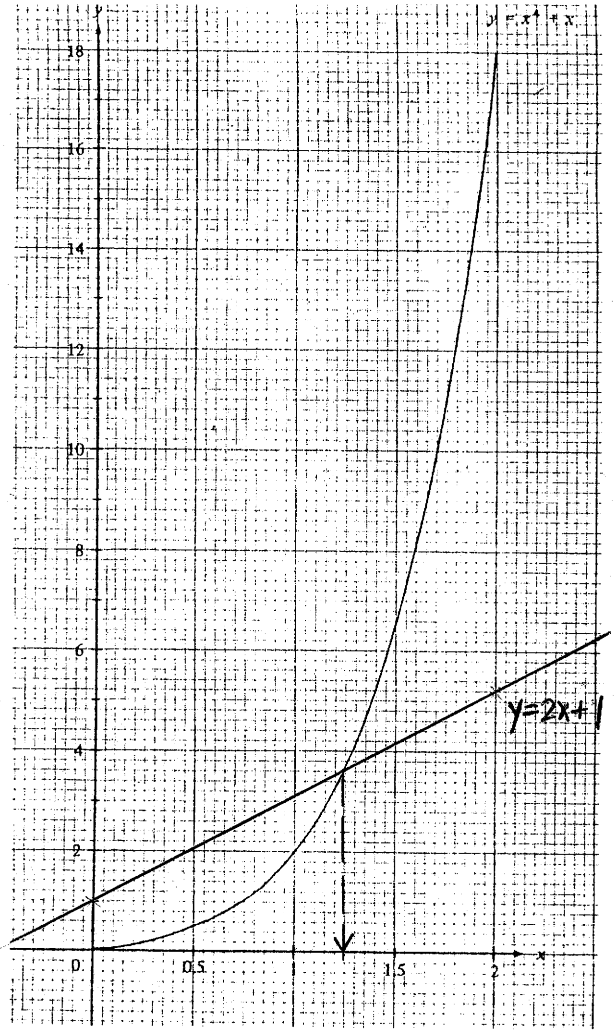
b) Let. $f(x) = x^4-x-1$

$f(1.2) = -0.1264 < 0$

$f(1.3) = 0.5561 > 0$.

interval	mid-value	sign of f(x)
$1.2 \le x \le 1.3$	1.25	+
$1.2 \le x \le 1.25$	1.225	+
$1.2 \le x \le 1.225$	1.2125.	−
$1.2125 \le x \le 1.225$	1.21875	−
$1.21875 \le x \le 1.225$.		

By method of bisection,
the approximate root is 1.22 (2 dec. pl.)



c) the eqt.

$(x-1)^4 = x$.

put. $x = y+1$

$\therefore \quad (y+1-1)^4 = y+1$.

$\therefore \quad y^4 = y+1$

$y^4-y-1=0$.

is the same eqt in (a);

By using part b)

the approximate value is 1.22 (2 dec. pl.)

3(87) a) $y = x^3 - 6x^2 + 9x$.

i) $x^3 - 6x^2 + 9x - 1 = 0$.

$\therefore \begin{cases} y = x^3 - 6x^2 + 9x & \text{— ①} \\ 0 = x^3 - 6x^2 + 9x - 1 & \text{— ②} \end{cases}$

① − ② $y = 1$. is the line added on the graph.

From the graph, the real roots are

0.1, 2.3 or 3.5. (1 dec. pl.)

ii) $x^3 - 6x^2 + 10x - 6 = 0$.

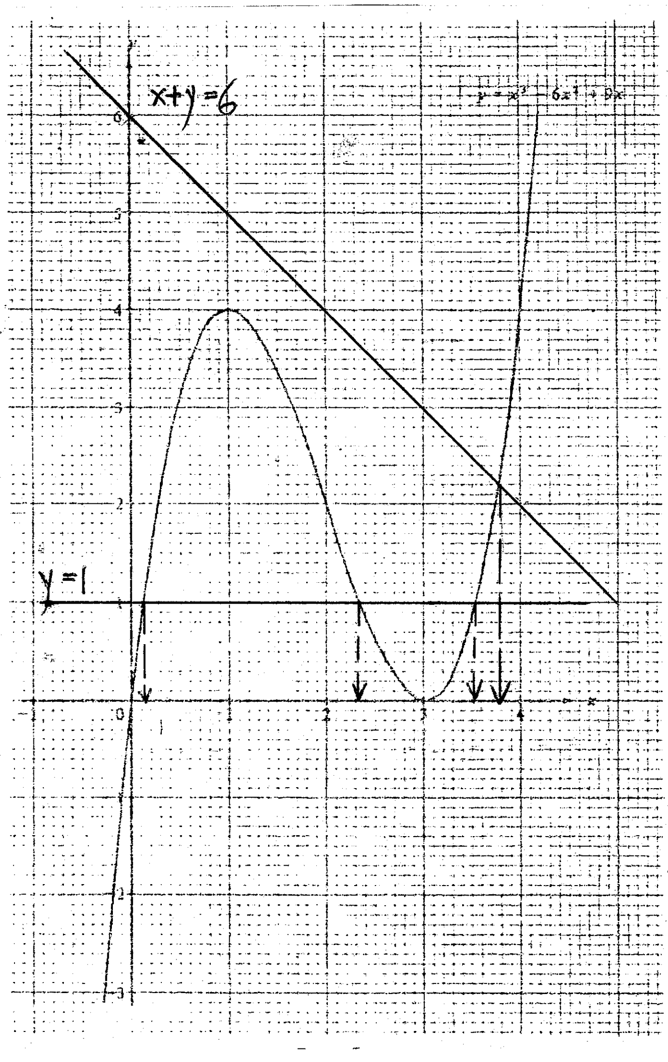
$\begin{cases} y = x^3 - 6x^2 + 9x. & \text{— ①} \\ 0 = x^3 - 6x^2 + 10x - 6 & \text{— ③} \end{cases}$

① − ③

$y = -x + 6$.

$\therefore$ $x + y = 6$ is the line added on the graph.

From the graph, the real root is 3.8 (1 dec. pl.)



b) Let $f(x) = x^3 - 6x^2 + 10x - 6$

$f(3.7) = -0.487 < 0$

$f(3.8) = 0.232 > 0$.

interval	mide-value	sign of f(x)
$3.7 \le x \le 3.8$	3.75	−
$3.75 \le x \le 3.8$	3.775	+
$3.75 \le x \le 3.775$	3.7625	−
$3.7625 \le x \le 3.775$	3.76875	−
$3.76875 \le x \le 3.775$	3.771875	+
$3.76875 \le x \le 3.771875$		

By method of bisection,
the real root is 3.77 (2 dec. pl.)

c) From the graph,
the range of values of k
is $0 < k < 4$.

9(88) a) $\begin{cases} y = x^3 \\ x^3 - \frac{4}{3}x - 6 = 0 \end{cases}$

i)

$\begin{cases} y = x^3 & \text{— ①} \\ 0 = x^3 - \frac{4}{3}x - 6. & \text{— ②} \end{cases}$

① − ②. $y = \frac{4}{3}x + 6$

$3y = 4x + 18$.

$4x - 3y + 18 = 0$. is the line added on the graph.

$\therefore$ The interval of r. is.

$2 \le r \le 2.1$

Let. $f(x) = x^3 - \frac{4}{3}x - 6$.

$f(2) = -0.67 < 0$

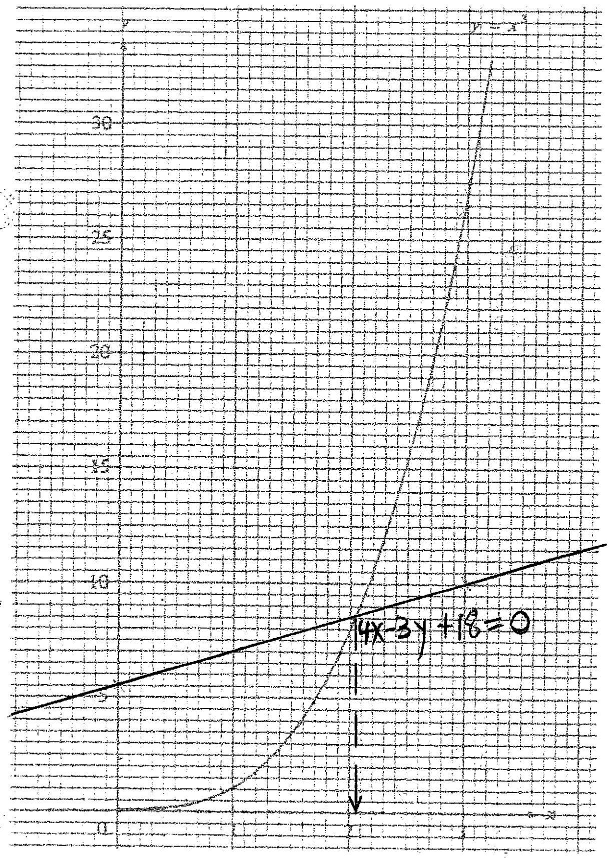
$f(2.1) = 0.461 > 0$.

9(88) cont.

aii) By method of bisection.

interval	mid-value	sign of f(x)
$2 \le x \le 2.1$	2.05	−
$2.05 \le x \le 2.1$	2.075	+
$2.05 \le x \le 2.075$	2.0625	+
$2.05 \le x \le 2.0625$	2.05625	−
$2.05625 \le x \le 2.0625$		

∴ the value of r is 2.06 (2 dec. pl.)



The eqt.

$3(t+1)^3 - 4(t+1) - 18 = 0$

Let $x = t+1$.

∴ $3x^3 - 4x - 18 = 0$

$x^3 - \frac{4}{3}x - 6 = 0$ is the eqt same as (a).

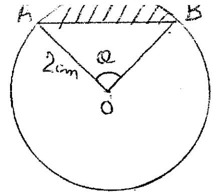
∴ the soln. of eqt.

$x = 2.06$.

∴ $t+1 = 2.06$

$\Rightarrow t = 1.06$ (2 dec. pl.)

10(84).



a)(i) area of $\triangle OAB$

$= \frac{1}{2}(OA)(OB)\sin\angle AOB$

$= \frac{1}{2}(2)(2)\sin\theta$

$= 2\sin\theta$

ii) the area of $\triangle OAB$ is greatest, when $\theta = \pi/2$, since $\sin\theta$ is max. when $\theta = \pi/2$.

b) area of sector OAB

$= \frac{1}{2}r^2\theta$

$= \frac{1}{2}(2)^2\theta$

$= 2\theta$

area of shaded segment

= area of sector OAB − area of $\triangle OAB$

∴ $2 = 2\theta - 2\sin\theta$

∴ $\theta - \sin\theta - 1 = 0$

c) Let $f(\theta) = \theta - \sin\theta - 1$.

$f(0) = 0 - \sin 0 - 1$

$= -1 < 0$

$f(3) = 3 - \sin 3 - 1$

$= 1.859 > 0$

∴ α lies between 0 and 3.

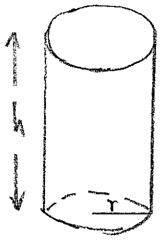
d)

interval	mid-value	sign of f(x)
$0 \le \theta \le 3$	1.5	−
$1.5 \le \theta \le 3$	2.25	+
$1.5 \le \theta \le 2.25$	1.875	−
$1.875 \le \theta \le 2.25$	2.0625	+
$1.875 \le \theta \le 2.0625$	1.96875	+
$1.875 \le \theta \le 1.96875$	1.921875	−
$1.921875 \le \theta \le 1.96875$	1.9453125	+
$1.921875 \le \theta \le 1.9453125$		

∴ the value of $\alpha = 1.9$ (1 dec. pl.)

11.(90) a)

$\begin{cases} V - \text{volume.} \\ S - \text{total surface area.} \end{cases}$



$S =$ curve surface area + base area.

$S = 2\pi r h + 2\pi r^2$

$V = \pi r^2 h. \Rightarrow h = \dfrac{V}{\pi r^2}$

$\therefore S = 2\pi r\left(\dfrac{V}{\pi r^2}\right) + 2\pi r^2.$

$S = 2\pi r^2 + \dfrac{2V}{r}.$

b) Given that. $V = 2\pi.$
$S = 6\pi.$

$\therefore 6\pi = 2\pi r^2 + \dfrac{2(2\pi)}{r}$

$3 = r^2 + \dfrac{2}{r}.$

$\therefore 3r = r^3 + 2$

$r^3 - 3r + 2 = 0.$

$$\begin{array}{c|cccc} r=1 & 1 & 0 & -3 & 2 \\ & \downarrow & 1 & 1 & -2 \\ \hline & 1 & 1 & -2 & 0 \end{array}$$

$(r-1)(r^2 + r - 2) = 0.$

$(r-1)^2(r+2) = 0.$

c) $V = 3\pi,\ S = 10\pi.$

$10\pi = 2\pi r^2 + \dfrac{2(3\pi)}{r}$

$5 = r^2 + \dfrac{3}{r}.$

$\therefore r^3 - 5r + 3 = 0.$

Let. $f(r) = r^3 - 5r + 3.$

$f(1) = -1 < 0$

$f(2) = 1 > 0$

interval	mid-value	sig of $f(x)$
$1 \le r \le 2$	1.5	−
$1.5 \le r \le 2$	1.75	−
$1.75 \le r \le 2$	1.875	+
$1.75 \le r \le 1.875$	1.8125	−
$1.8125 \le r \le 1.875$	1.84375	+
$1.8125 \le r \le 1.84375$		

By method of bisection, $r = 1.8$. (1 dec. pl.)