

6

$$a) \quad a = -1$$

$$d = 5$$

$$\begin{aligned} T_{60} &= a + 59d \\ &= -1 + 59(5) \\ &= 294 \end{aligned}$$

$$\begin{aligned} ii) \quad S_{60} &= \frac{60}{2} [-1 + 294] \\ &= 30(293) \\ &= 8790 \end{aligned}$$

$$b) \quad 100(1.23)^t = 100e^{\alpha t}$$

$$(1.23)^t = e^{\alpha t}$$

$$t \ln 1.23 = \alpha t$$

$$\ln 1.23 = \alpha$$

$$\alpha = 0.207\dots$$

$$= 0.207 \text{ (3 decpl)}$$



$$c) i. y = x^3 + x^2 - x + 2$$

$$y' = 3x^2 + 2x - 1$$

when  $y' = 0$  (stat pt)

$$0 = 3x^2 + 2x - 1$$

$$= 3x^2 + 3x - x - 1$$

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

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

$$x = -1, \frac{1}{3}$$

when  $x = -1$

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

$$\therefore A = (-1, 1)$$

when  $x = \frac{1}{3}$

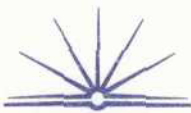
$$y = \left(\frac{1}{3}\right)^3 + \left(\frac{1}{3}\right)^2 - \frac{1}{3} + 2$$

$$= \frac{1}{27} + \frac{1}{9} - \frac{1}{3} + 2$$

$$= \frac{1+3-9+54}{27} = \frac{49}{27}$$

$$= \frac{35}{18}$$

$$\therefore B = \left(\frac{1}{3}, \frac{49}{27}\right)$$



ii) concave up = minimum.

$$\therefore y'' > 0 \text{ (positive)}$$

$$y'' = 6x + 2$$

$$6x + 2 > 0$$

$$6x > -2$$

$$x > \frac{-2}{6}$$

$$x > -\frac{1}{3}$$

$\therefore$  concave up when  $x > -\frac{1}{3}$

because it forms a minimum

iii)  $x^3 + x^2 - x + 2 = k$

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

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

$$x^2(x + 1) - x$$