Q1(a) $-2.591666 = \underline{-2.592}$

(b) $\underline{(1+2x)(1-2x+4x^2)}$

(c) $2x-1 \le 3$

$x \le 2$

$-(2x-1) \le 3$

$-2x+1 \le 3$

$x \ge -1$

$\underline{-1 \le x \le 2}$

(d) $\underline{4 + 3\sin 3x}$

(e) $2(3x-2) - 3(2-x) = 6$

$6x - 4 - 6 + 3x = 6$

$9x = 16$

$\underline{x = 1\frac{7}{9}}$

(f) G only $= 12-6 = 6$

H only $= 9-6 = 3$

H+G $= 6$

15 H and/or G

$\therefore P(\bar{H}\bar{G}) = \frac{35}{50} = \underline{\frac{7}{10}}$

Q2(a)(i) $\dfrac{(\ln x)\cdot 1 - x\cdot\frac{1}{x}}{(\ln x)^2}$

$= \underline{\dfrac{\ln x - 1}{(\ln x)^2}}$

(ii) $\underline{5(1+\tan x)^4 \cdot \sec^2 x}$

(b) $\angle A$ is largest

$\cos A = \dfrac{3.5^2 + 3^2 - 5^2}{2\times 3 \times 3.5}$

$= -0.1785\ldots$

$\underline{\angle A = 100°17'}$

(c) (i) $2\int_0^2 \dfrac{3x^2}{1+x^3}\,dx$

$= 2\left[\ln(1+x^3)\right]_0^2$

$= 2(\ln 9 - \ln 1)$

$= \underline{2\ln 9}$

(ii) $\underline{x + \frac{1}{3}e^{3x} + c}$

Q3(a)(i) $\underline{\text{Trapezium}}$

(ii) $m = \dfrac{3-0}{0-2} = \underline{\dfrac{-3}{2}}$

(iii) $y - 1 = -\frac{3}{2}(x-4)$

$2y - 2 = -3x + 12$

$\underline{3x + 2y - 14 = 0}$

(iv) at C, $x = 0$

$\therefore 2y - 14 = 0$

$y = 7$

$\underline{C = (0,7)}$

(v) Pythagoras' Th.

$AB^2 = 3^2 + 2^2$

$\underline{AB = \sqrt{13}}$

(vi) $CD = \sqrt{(4-0)^2 + (1-7)^2}$

$= \sqrt{52}$

$= \underline{2\sqrt{13}}$

(vii) $p = \left|\dfrac{3(2) + 2(0) - 14}{\sqrt{3^2+2^2}}\right|$

$= \dfrac{8}{\sqrt{13}} = \underline{\dfrac{8\sqrt{13}}{13}}$

(viii) $A = \frac{1}{2}(\sqrt{13} + 2\sqrt{13})\frac{8}{\sqrt{13}}$

$= \underline{12 \text{ units}^2}$

Q4(a)(i) ΔBCD is equilateral

$\therefore$ All angles $60°$

ie $\angle BCD = 60°$

ΔABC is isosceles

$\therefore \angle ABC = \angle ACB = 45°$

($\angle$ sum ΔABC)

$\therefore A\hat{C}D = 45° + 60°$

$= \underline{105°}$

(ii) ΔBCD equilateral

$\therefore BD = DC = 3\text{cm}$

ΔABC isosceles

Let $AB = AC = x$

By Pythag' Thm

$2x^2 = 3^2$

$x = \dfrac{3\sqrt{2}}{2}$

$\therefore$ Perimeter $=$

$= 2\times 3 + 2\times\dfrac{3\sqrt{2}}{2}$

$= \underline{(6 + 3\sqrt{2})\text{cm}}$

Q3(c) $x = 0 \quad y = e^0 + 0 = 1$

$y' = 2e^{2x} + 1$

$m = 2e^0 + 1 = 3$

Tangent $y - 1 = 3(x-0)$

$\underline{y = 3x + 1}$

Q4(b) $x = e^y$

$V = \pi\int_0^{\log 4} (e^y)^2\,dy$

$= \pi\left[\dfrac{e^{2y}}{2}\right]_0^{\ln 4}$

$= \dfrac{\pi}{2}\left((e^{\ln 4})^2 - e^0\right)$

$= \dfrac{\pi}{2}(16-1)$

$= \underline{\dfrac{15\pi}{2} \text{ units}^3}$

(c) $a = 1 \quad r = -x$

$4 = \dfrac{1}{1-(-x)}$

$4 + 4x = 1$

$\underline{x = -\dfrac{3}{4}}$

(d) $x^2 - 2x + 1 = 6y + 12$

$(x-1)^2 = 4(1\tfrac{1}{2})(y+2)$

$V = (1,-2) \quad a = 3/2$

$\underline{S = (1, -\tfrac{1}{2})}$

Q5(a)(i) In Δ's AED, BEF

BF ∥ DA (opp. sides para)

$\therefore \angle FBE = \angle DAE$

(alt $\angle$'s)

sim $\angle ADE = \angle BFE$

$\angle AED = \angle BEF$ (Vert opp)

$\therefore \Delta AED ||| \Delta BEF$

(equiangular)

(ii) $AD = BC$ (opp. sides of parm)

$\dfrac{AE}{AD} = \dfrac{BE}{BF}$ (corr. sides of sim Δ's)

$\dfrac{AE}{9} = \dfrac{8}{6}$

$\underline{AE = 12\text{cm}}$

$AB = 20$

$\therefore \underline{DC = 20\text{cm}}$ (opp sides of parm)

(b)(i) AP $a = 3 \quad d = 2$

$T_n = a + (n-1)d$

$27 = 3 + (n-1)2$

$n = 13$

cost AP $a = 260 \quad d = 20$

$T_{13} = 260 + (13-1)20$

$= \underline{\$500}$

Q5(b) (ii)

Cost AP

$S_{13} = \frac{13}{2}\left(2(260) + (13-1)20\right)$

$= \$4940$

(iii)

$12\,500 = \frac{n}{2}\left(2(260) + (n-1)20\right)$

$1250 = n^2 + 25n$

$n^2 + 25n - 1250 = 0$

$(n+50)(n-25) = 0$

$n = 25 \quad (n \neq -25)$

Borehole AP

$T_{25} = 3 + (25-1)2$

$= 51$ metres

Q5(c)

0	·25	·5	·75	1
1	1·7783	3.1625	5·6234	10

$\int_0^1 10^x \, dx \approx$

$\frac{0.25}{3}\{(1+10) + 4(1.7783 + 5.6234) + 2(3.1625)$

$= 3.911$

Q6.(a)

(i) $f'(x) = 3x^2 - 6x - 9$

$3(x-3)(x+1) = 0$

$x = 3, -1$

$f''(x) = 6x - 6 = 0$

$x = 1$

At $x = 3$, $y = -27$

$f''(x) > 0$ Conc up.

$\therefore (3, -27)$ Min TP

Simi $(-1, 5)$ Max T.P.

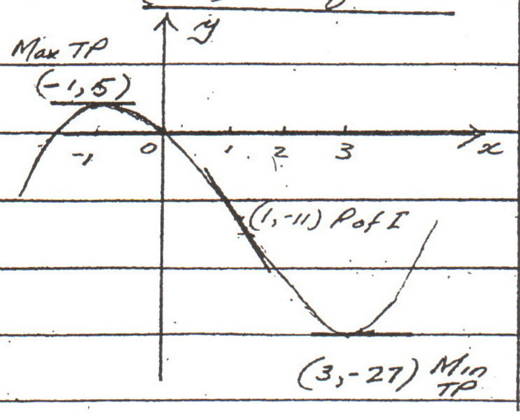
(ii) at $x = 1$ $y = -11$

$x > 1$ $f''(x) > 0$

$x < 1$ $f''(x) < 0$

$\therefore$ Conc changes

$(1, -11)$ Pt of infl.



$f'(x) < 0 \quad -1 < x < 3$

$f'(x) > 0 \quad x > 1$

$\therefore$ Both T $\quad 1 < x < 3$

(b) (i) $\alpha + \beta = -b/a = 3/2$

(ii) $\alpha\beta = c/a = 6/2 = 3$

(iii) $\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta$

$= (3/2) - 2(3)$

$= -15/4$

Q7 (a)

$A = \left|\int_0^1 (x-1)^3 \, dx\right| + \int_1^4 (x-1)^3 \, dx$

$= \left|\left[\frac{(x-1)^4}{4}\right]_0^1\right| + \left[\frac{(x-1)^4}{4}\right]_1^4$

$= \left|\frac{0^4}{4} - \frac{(-1)^4}{4}\right| + \left(\frac{3^4}{4} - \frac{0^4}{4}\right)$

$= \frac{41}{2}$ units^2

(b)(i) Arc $AB = r\theta = 2\theta$

Arc $CD = 5\theta$

$\therefore AB : CD = 2\theta : 5\theta$

$= 2 : 5$

(ii) Area $OAB = \frac{1}{2} r^2 \theta$

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

$= 2\theta$

Area $OACD = \frac{1}{2} \cdot 5^2 \theta$

$= \frac{25\theta}{2}$

Area $ABDC =$

$\frac{25\theta}{2} - 2\theta = \frac{21\theta}{2}$

$\therefore OAB : ABDC$

$= 2 : \frac{21}{2}$

$= 4 : 21$

(c) $P(L) = \frac{1}{8}$

$P(\tilde{L}) = \frac{7}{8}$

(i) $P(LLL) = \left(\frac{1}{8}\right)^3$

$= \frac{1}{512}$

(ii) $P(2L) = P(\tilde{L}LL) + P(L\tilde{L}L) + P(LL\tilde{L})$

$= \left(\frac{7}{8} \cdot \frac{1}{8} \cdot \frac{1}{8}\right)3$

$= \frac{21}{512}$

(iii) $P(\text{at least } 2L)$

$= P(2L) + P(3L)$

$= \frac{21}{512} + \frac{1}{512}$

$= \frac{22}{512} = \frac{11}{256}$

(iv) $P(3T) = \left(\frac{7}{8}\right)^3$

$= \frac{343}{512}$

Q8(a)

(i) $x = \int v \, dt$

$= \int (1 - 2\sin 2t) \, dt$

$= t + \frac{\cancel{2}\cos 2t}{\cancel{2}} + c$

$t = 0, x = 0$

$0 = 0 + \overset{=1}{\cos 0} + c$

$c = -1$

$x = t + \cos 2t - 1$

(ii) $t = \pi/6$

$x = \pi/6 + \cos\frac{\pi}{3} - 1$

$= \pi/6 - 1/2$

(iii) $a = \frac{dv}{dt}$

$= 0 - (2\cos 2t)2$

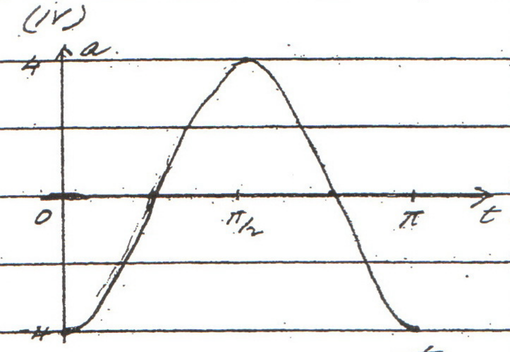
$a = -4\cos 2t$

(v) $-1 \le \cos 2t \le 1$

$\therefore$ Max $a = -4(-1)$

$= 4 \, m/s^2$

(IV)



$a = -4\cos 2t$

Q8(b)

(i) $x = -3$

$(-3)^2 - (k+3)(-3) + 4k = 0$

$9 + 3k + 9 + 4k = 0$

$k = -18/7$

(ii) $\Delta < 0 \rightarrow$ No Real Roots

$\{-(k+3)\}^2 - 4 \cdot 1 \cdot 4k < 0$

$k^2 + 6k + 9 - 16k < 0$

$k^2 - 10k + 9 < 0$

$(k-9)(k-1) < 0$

$1 < k < 9$

(c) $\cos A = -\frac{\sqrt{3}}{2}$

Acute $\angle = \pi/6$ Q. 2,3

$\therefore A = \pi \pm \pi/6$

$= 5\pi/6, 7\pi/6$

Q9(b)

$P = 2400$

(i) $A_1 = P + 9\%$ of P

$= (1.09)P$

$A_2 = 1.09P + 9\% A_1$

$= (1.09)^2 P$

$A_{30} = (1.09)^{30} P$

$= 2400(1.09)^{30}$

(ii) For 2nd \$2400 invested 29 years

$A_{29} = (1.09)^{29} \times 2400$

$A_{28} = (1.09)^{28} \times 2400$

(iii) Value

$= (1.09)^{30} \times 2400 +$

$(1.09)^{29} \times 2400 +$

$(1.09)^{28} \times 2400 + \ldots$

$(1.09) \times 2400$

$= 2400(1.09 + 1.09^2 + \ldots$

$\ldots + 1.09^{30})$

$= \frac{2400\,(1.09)(1.09^{30} - 1)}{(1.09 - 1)}$

$= \$356580.52$

(c)(i) $t = 0$ $P = 2500$

$P_0 = 2500$

$t = 5$ $P = 4000$

$4000 = 2500\,e^{5k}$

$1.6 = e^{5k}$

$k = \frac{\ln 1.6}{5}$

$= 0.094$

(ii) $t = 10$ $P = e^{0.094 \times 10}$

$= 6399.95$

$= 6400$ pa

(iii) $P = 5000$

$5000 = 2500\,e^{kt}$

$0.094t = \ln 2$

$t = 7.4$ yrs.

(iv) $\frac{dP}{dt} = kP_0e^{kt}$

$= kP$

$= .094 \times 4000$

$= 376$

Q9

(a) $3^{-2} + 3^{-3} + 3^{-4}$

$= \frac{1}{9} + \frac{1}{27} + \frac{1}{81}$

$= \frac{13}{81}$

Q10(a) $\frac{1}{\sin A} \cdot \frac{1}{\cos A} \cdot \frac{\cos A}{\sin A}$

$= \frac{1}{\sin^2 A} = \operatorname{cosec}^2 A$

Q10(b) $\frac{dD}{dt} = -\frac{16}{t^3}$

(i) $D = \frac{-16t^{-2}}{-2} + c$

$= 8/t^2 + c$

$t = 1$ $D = 24$

$24 = \frac{8}{1^2} + c$

$c = 16$

$\therefore D = 8/t^2 + 16$

(ii) when $t = 2$

$D = 8/2^2 + 16$

$= \$18$

(iii) $\frac{dD}{dt} = -\frac{16}{3^3}$

$= -\frac{16}{27}$

$= -0.59$

ie 59 cents/mth

(iv) as $t \rightarrow \infty$

$8/t^2 \rightarrow 0$

$\therefore D \rightarrow 16$

(c)(i) $0 < x < 4$

$PQ = PR + RQ$

$= x(6-x) - x(x-4)$

$= 10x - 2x^2$

$4 < x < 5$

$PQ = PR - RQ$

$= 10x - 2x^2$

$\therefore PQ = 10x - 2x^2$

(ii) $OR = x$

$\therefore$ Area $PQST$

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

$A = 10x^2 - 2x^3$

(iii) $A' = 20x - 6x^2 = 0$

$= 2x(10 - 3x)$

$x = 0, 10/3$

$A'' = 20 - 12x$

$< 0, x = 10/3$

$\therefore$ Max.

Max A when $x = 10/3$.