ANSWERS TO 1999 HIGHER

PAPER I

1. (a) Verify that $x = 2$ "works" in the equation
   (b) OTHER roots are -3, $\frac{1}{2}$

2. (a) $3x - 4y = -5$ (b) $4x + 3y = 10$

3. (a) $[24 + 9] = 33$ units^2 (b) $\int_2^5 (2x+4)\,dx$ (c) 33 units^2

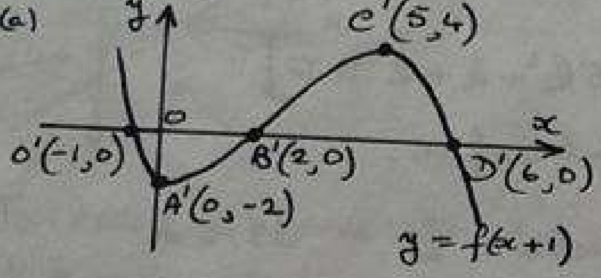
4. $(x+3)^2 + (y-4)^2 = 25$

5. $f'(-1) = 24.$ 6. $\vec{CV} = \begin{pmatrix}-5\\-5\\7\end{pmatrix}\begin{pmatrix}-5\\-5\\7\end{pmatrix}$ 7. $\frac{1}{\sqrt{3}}$

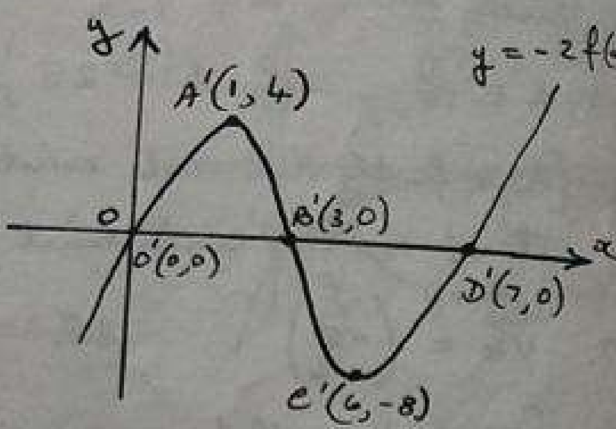
8. (a) $b^2 - 4ac = 0$ (b) Rearrange into $x^2 + 6x + 9 = 0$ and then verify that "Δ" $= 0$.

9. $10x + y = -3$

10. (a)



(b)



11. $y = \frac{1}{4}x^4 - \frac{1}{x} - \frac{1}{4}x + 3$

12. $\left[\cos x = \frac{2}{\sqrt{11}}\right]$ $\therefore \cos 2x = -\frac{3}{11}$

13. (a) $f(x) = 2(x-1)^2 + 3$ (b) S.P. at $(1, 3)$ and it is a MINIMUM

14. $A\left(13 \cdot 93°, \frac{2}{3}a\right)$ $B\left(46 \cdot 07°, \frac{2}{3}a\right)$

15. $a = -2$ $b = 5$

16. $\left[\frac{dy}{dx} = 6x^2 + 6x + 4\right]$ and then verify that $\Delta = -60$ ie $\Delta < 0$ and GIVE A CLEAR CONCLUSION.

17. (a) (i) 9 (ii) 8 (iii) 6 (b) $\underset{\sim}{p} \cdot \underset{\sim}{p} = 68$; $|\underset{\sim}{p}| = 2\sqrt{17}$.

18. $p = 2q$

19. $f'(x) = -2 \sin 2x$ 20. $\frac{2}{3}x^{3/2} + \frac{10}{x^{1/2}} + C$

21. (a) $f(2x) = 1 + 2x + 2x^2 + \frac{4}{3}x^3 + \frac{2}{3}x^4 + \frac{4}{15}x^5 + \ldots$
   (b) $\left[f'(2x) = 2 + 4x + 4x^2 + \frac{8}{3}x^3 + \frac{4}{3}x^4 + \ldots\right]$
   $\therefore f'(2x) = 2f(2x)$

PER II

(a) $3x + y = 14$ (b) $x + 2y = -2$ (c) $(6, -4)$

2. (a) $2x + y = -3$ (b) $B(0, -3)$ (c) $C(-2, 1)$ (d) $(x+1)^2 + (y+1)^2 = 5$

3. (a) $\vec{AK} = \begin{pmatrix} -5 \\ 5 \\ 11 \end{pmatrix}$ (b) $\vec{AL} = \begin{pmatrix} 2 \\ 4 \\ 9 \end{pmatrix}$ (c) $K\hat{A}L = 33{\cdot}96^\circ \; (34^\circ)$

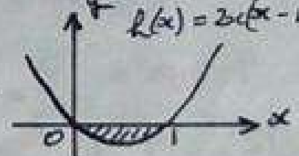
4. (a) $P(4, 0)$ (b) $x + 2y = 4$ (c) $Q\left(\frac{1}{2}, \frac{7}{4}\right)$

5. (a) (i) $8x + 9y$ (ii) [$A = 6xy$ and $y = \frac{360 - 8x}{9}$] Hence required result.

(b) [Verify firstly that $x = 22\frac{1}{2}$ gives a MAX. S.P. Table of values required]

$x = 22\frac{1}{2}$ m $y = 20$ m   MAX. AREA $= 2700 \text{ m}^2$

6. (a) (i) $x^2 - 1$ (ii) $x^2 - 2x + 1$ (b) "PROOF" : GRAPH →



(c) [INTEGRAL $= -\frac{1}{3}$] $\therefore$ Area $= \frac{1}{3}$ unit^2.

7. (a) $k = 0{\cdot}07192$ (b) $51{\cdot}3\%$

8. (a) [DRAW A PERPENDICULAR FROM P TO x-axis AND USE THAT RIGHT-ANGLED TRIANGLE]

(b) $Q(\cos(a - 45^\circ), \sin(a - 45^\circ))$ (c) $R(\cos(a + 45^\circ), \sin(a + 45^\circ))$

(d) $m_{QR} = -\frac{\cos a}{\sin a}$ (e) Prove also that $m_{\text{TGT AT } P} = -\frac{\cos a}{\sin a}$ and then give a clear conclusion.

9. [FIRST VERIFY THAT $2\sin x - 3\cos x = \sqrt{13}\cos(x - 146{\cdot}3^\circ)$]

$x = 100{\cdot}2^\circ, \; 192{\cdot}4^\circ$

10. (a) $p = 1 \quad q = 2$

(b) $\left[1\frac{5}{12} + 1\frac{1}{12}\right] = 2\frac{1}{2}$ units^2.

11. (a) AT P : $y = 3x + 20$ AT Q : $y = 3x - 12$

(b) [DRAW PERP. FROM Q TO OTHER TGT. CALL THIS, SAY QR

OBTAIN : QR : $x + 3y = -16$

$R\left(-7\frac{3}{5}, -2\frac{4}{5}\right)$

$QR^2 = \frac{2560}{25}$]

Required result then follows.