# ANSWER KEY

_____YEAR HIGHER SECONDARY EXAMINATION _____20_____

PART-I/II/III

SUBJECT: MATHEMATICS (Com 60)

CODE NO: SY.51 VERSION:____

60 SCORES 2 HOURS

| Qn. No | Sub Qns | Answer Key/Value Points | Score | Total Score |
|---|---|---|---|---|
| 1 | | (b) $y$ | 1 | 1 |
| 2. | | (a) $\pi/2$ | 1 | 1 |
| 3. | | (a) 5 | 1 | 1 |
| 4. | | (b) $(0, \pi/2)$ | 1 | 1 |
| 5. | | (c) 1 | 1 | 1 |
| 6. | | (a) 1 | 1 | 1 |
| 7. | | 0 | 1 | 1 |
| 8. | | $5\hat{i}-4\hat{j}+6\hat{k}+\lambda(3\hat{i}+7\hat{j}+2\hat{k})$ | 1 | 1 |
| 9. | | (a) $3/25$ | 1 | 1 |
| 10. | | (b) $\pi/3$ | 1 | 1 |
| 11. | | (d) $9\|A\|$ | 1 | 1 |
| 12. | | (c) $1/x$ | 1 | 1 |

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|---|---|---|---|---|
| 13. | | (d) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ | 1 | 1. |
| 14. | | $x = 1, y = 4, z = 3$<br>Remark: For any two Correct answer give 1½ score. | 2 | 2 |
| 15. | | $y = x^2$<br>$\frac{dy}{dx} = 2x$<br>$\frac{dy}{dx}(1,2) = 2 \times 1 = 2$<br>$y - y_1 = \frac{dy}{dx}(x - x_1)$<br>$y - 2 = 2(x - 1)$<br>$2x - y = 0$.<br>Remark: For writing $y - y_1 = \frac{dy}{dx}(x - x_1)$ give ½ score. | ½<br>½<br>1 | 2 |
| 16. | i) | $f'(x) = 2e^{2x}$. | 1 | |
| | ii) | Since $f'(x) = 2e^{2x} > 0$<br>$f$ is increasing on $R$. | 1 | 2. |
| 17 | | $\frac{dy}{1+y^2} = \frac{dx}{1+x^2}$ | 1 | |

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|---|---|---|---|---|
| | | $\int \frac{dy}{1+y^2} = \int \frac{dx}{1+x^2}$ | ½ | 2. |
| | | $\tan^{-1}y = \tan^{-1}x + c.$ | ½ | |
| 18. | | $\frac{dy}{dx} = 2x+3$ | 1 | 2. |
| | | $\frac{d^2y}{dx^2} = 2$ | 1 | |
| 19. | | $P = 2/x \quad Q = x$ | ½ | 2. |
| | | $I.F = e^{\int P dx} = e^{\int 2/x\, dx}$ | | |
| | | $= e^{2\log x}$ | ½ | |
| | | $= x^2$ | | |
| | | $\therefore y.\ I.F = \int Q.\ I.F\, dx + C$ | | |
| | | $y.x^2 = \int x.x^2\, dx$ | ½ | |
| | | $= \int x^3\, dx$ | ½. | |
| | | $= x^4/4 + C.$ | | |
| 20 | | $d = \left\lvert \frac{6\times2 - 3\times5 + 2\times-3 - 4}{\sqrt{6^2+(-3)^2+2^2}} \right\rvert$ | 1 | 2. |
| | | $= \left\lvert \frac{12-15-6-4}{\sqrt{36+9+4}} \right\rvert$ | ½ | |
| | | $= \frac{13}{\sqrt{49}} = 13/7$ | ½ | |

NB: For writing for finding the distance give ½ score.

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|---|---|---|---|---|
| 21. | | $f(x_1) = f(x_2)$ | | |
| | | $\Rightarrow 4x_1 + 3 = 4x_2 + 3$ | ½ | |
| | | $\Rightarrow 4x_1 = 4x_2$ | ½ | |
| | | $\Rightarrow x_1 = x_2 \therefore f$ is one-one | ½ | |
| | | Let $y \in R$ then $y = 4x + 3$ | ½ | 3. |
| | | $x = \frac{y-3}{4} \in R$ | ½ | |
| | | $\therefore f$ is onto | ½ | |
| 22. | (i) | $A + B = \begin{bmatrix} 10 & 1 \\ 6 & 3 \end{bmatrix}$ | 1 | |
| | ii) | $2A = 2\begin{bmatrix} 8 & 0 \\ 3 & 1 \end{bmatrix} = \begin{bmatrix} 16 & 0 \\ 6 & 2 \end{bmatrix}$ | 1 | 3. |
| | iii | $A' = \begin{bmatrix} 8 & 3 \\ 0 & 1 \end{bmatrix}$ | 1 | |
| 23. | i) | $\vec{a} \cdot \vec{b} = 1\times1 + -1\times1 = 0$ | 1 | |
| | | For writing $\vec{a} \cdot \vec{b} = a_1a_2 + b_1b_2 + c_1c_2$ give (½) score | | |
| | ii) | projection of $\vec{a}$ on $\vec{b} = \frac{\vec{a} \cdot \vec{b}}{\lvert\vec{b}\rvert}$ | 1 | 3 |
| | | $= 0/\sqrt{2}$ | 1 | |
| | | $= 0$ | | |
| | | Remark Finding $\lvert\vec{b}\rvert = \sqrt{2}$ give 1 score. | | |
| 24. | 1) | $K + 2K + 3K = 1$ | 1 | |
| | | $6K = 1$ | ½ | |
| | | $K = 1/6$ | ½. | |
| | | Remark: For writing $\Sigma P_i = 1$ give 1 score | | |

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|---|---|---|---|---|
| | ii) | $P(X<2) = P(X=0) + P(X=1)$ | | |
| | | $= K + 2K$ | ½ | 3. |
| | | $= 3K$ | | |
| | | $= 3 \times \frac{1}{6} = \frac{1}{2}$ | ½ | |
| 25. | i) | $5 * 7 = 35$ | 1 | |
| | ii) | $a * b = ab$ | ½ | |
| | | $b * a = ba = ab$ | ½ | |
| | | $\therefore a * b = b * a$ | | 3. |
| | | $\therefore *$ is Commutative | | |
| | iii) | Identity element of $*$ in $N$ is 1 | 1 | |
| | | Remark: For writing $a*e = e*a = a$ give ½ Score. | | |
| 26. | | $A = IA$. | ½ | |
| | | $\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A$ | ½ | |
| | | $\begin{bmatrix} 1 & -1 \\ 0 & 5 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -2 & 1 \end{bmatrix} A$ : $R_2 \to R_2 - 2R_1$ | ½ | |
| | | $\begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -2/5 & 1/5 \end{bmatrix} A$ ; $R_2 \to \frac{1}{5} R_2$ | ½ | 3 |
| | | $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 3/5 & 1/5 \\ -2/5 & 1/5 \end{bmatrix} A$ $R_1 \to R_1 + R_2$ | 1 | |

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|---|---|---|---|---|
| | | $A^{-1} = \begin{bmatrix} 3/5 & 1/5 \\ -2/5 & 1/5 \end{bmatrix}$ | | |
| | | Remark: For finding $A^{-1}$ directly give 1 score. | | |
| 27. | | A: First ball drawn is black | ½ | |
| | | B: Second ball is red | ½ | |
| | | $P(A) = 10/18$ | ½ | |
| | | $P(B/A) = 8/17$. | ½ | 3 |
| | | $P(A \cap B) = P(A) \times P(B/A)$ | ½ | |
| | | $= 10/18 \times 8/17$ | ½ | |
| | | $= \frac{40}{153}$. | | |
| 28. | i) | $\tan^{-1}\left(\frac{x+y}{1-xy}\right)$ | 1 | |
| | ii) | $\tan^{-1} 1/2 + \tan^{-1} 2/11 = \tan^{-1}\left(\frac{1/2 + 2/11}{1 - 1/2 \cdot 2/11}\right)$ | 1 | |
| | | $= \tan^{-1}\left(\frac{\frac{11+4}{22}}{\frac{22-2}{22}}\right)$ | 1 | 4. |
| | | $= \tan^{-1}(15/20)$ | 1 | |
| | | $= \tan^{-1}(3/4)$ | | |

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|---|---|---|---|---|
| 29. | | Since $f$ is Continuous at $x=2$ | | |
| | | $\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} f(x)$ | 1 | |
| | | $\lim_{x\to 2^-} kx^2 = \lim_{x\to 2^+} 3.$ | 1 | 4. |
| | | $4k = 3$ | 1 | |
| | | $k = 3/4.$ | 1 | |
| 30 | 1) | $f(x) = 2x^2 - 3x$ | | |
| | | $f'(x) = 4x - 3$ | 1 | |
| | | $f'(x) = 0 \Rightarrow 4x - 3 = 0$ | | |
| | | $x = 3/4$ | 1/2 | |
| | | $f$ is increasing in $(3/4, \infty)$ | 1/2 | |
| | ii | $f$ is decreasing in $(-\infty, 3/4)$ | 2 | 4. |
| | | Remark: i) For writing $f'(x) > 0$, the function is increasing give 1 score | | |
| | | ii) For writing $f'(x) < 0$, the function is decreasing give 1 score. | | |

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|---|---|---|---|---|
| 31. | | $\vec{a_1} = \hat{i}+\hat{j}+0\hat{k}$ $\quad \vec{b_1} = 2\hat{i}-\hat{j}+1\hat{k}$<br>$\vec{a_2} = 2\hat{i}+\hat{j}-1\hat{k}$ $\quad \vec{b_2} = 3\hat{i}-5\hat{j}+2\hat{k}$ | 1 | |
| | | $\vec{a_2}-\vec{a_1} = \hat{i}+0\hat{j}-1\hat{k}$ | ½ | |
| | | $\vec{b_1}\times\vec{b_2} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -1 & 1 \\ 3 & -5 & 2 \end{vmatrix}$ | ½ | |
| | | $= \hat{i}(-2+5) - \hat{j}(4-3) + \hat{k}(-10+3)$<br>$= 3\hat{i} - \hat{j} - 7\hat{k}$ | ½ | |
| | | $\lvert\vec{b_1}\times\vec{b_2}\rvert = \sqrt{9+1+49} = \sqrt{59}$. | ½ | 4. |
| | | $(\vec{a_2}-\vec{a_1})\cdot(\vec{b_1}\times\vec{b_2}) = 3+0+7$<br>$= 10$ | ½ | |
| | | $S.D = \left\lvert \dfrac{(\vec{a_2}-\vec{a_1})\cdot(\vec{b_1}\times\vec{b_2})}{\lvert\vec{b_1}\times\vec{b_2}\rvert} \right\rvert$ | | |
| | | $= 10/\sqrt{59}$. | ½ | |
| | | Remark: For writing the formula give 1 score | | |

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| Qn. No | Sub Qns | Answer Key/Value Points | Score | Total Score |
|---|---|---|---|---|
| 32. | | $\begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$ | | |
| | | $= \begin{vmatrix} x+y+z & x+y+z & x+y+z \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$ $R_1 \to R_1 + R_2$ | 2 | |
| | | $= (x+y+z)\begin{vmatrix} 1 & 1 & 1 \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$ | 1 | 4 |
| | | $= (x+y+z) \times 0 = 0$ | 1 | |
| | | Remark: The Given Qn. is wrong. So for attempting give full Score. | | |
| 33 | i) | $p = 1/2$ | 1/2 | |
| | | $q = 1-p = 1-1/2$ | 1/2 | |
| | | $= 1/2$ | | |
| | | $n = 5$ | 1/2 | |
| | | $P(x=4) = 5C_4 (1/2)^4 (1/2)^{5-4}$ | 1/2 | |
| | | $= 5 \times (1/2)^5 = 5/32$ | | |
| | ii) | $P(x=5) = 5C_5 (1/2)^5 (1/2)^{5-5}$ | 1/2 | 4 |
| | | $= (1/2)^5 = 1/32$ | 1/2 | |
| | | $\therefore P(x \geq 4) = P(x=4) + P(x=5)$ | 1/2 | |
| | | $= 5/32 + 1/32$ | 1/2 | |

| Qn. No | Sub Qns | Answer Key/Value Points | Score | Total Score |
|---|---|---|---|---|
| | | $= 6/32$ <br> $= 3/16$ <br> Remark: For part i & ii any other method give full score. | | |
| 34. | i) | $AX = B$ <br> $\begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$ | 1 | |
| | ii) | $\lvert A \rvert = \begin{vmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{vmatrix}$ | ½ | |
| | | $= 1(1+3) - {}^{-}1(2+3) + 1(2-1)$ <br> $= 4 + 5 + 1 = 10$ | ½ | |
| | | $\text{adj}(A) = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix}$ | 1 | |
| | | $A^{-1} = \frac{1}{\lvert A \rvert} \text{adj}(A)$ | ½ | |
| | | $= \frac{1}{10} \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix}$ | ½ | |
| | iii | $X = A^{-1} \cdot B$ | ½ | |

| Qn. No | Sub Qns | Answer Key/Value Points | Score | Total Score |
|---|---|---|---|---|
| | | $X = \frac{1}{10}\begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix}\begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$ | ½ | |
| | | $= \frac{1}{10}\begin{bmatrix} 16+0+4 \\ -20+0+10 \\ 4+0+6 \end{bmatrix}$ | ½ | 6 |
| | | $= 10\begin{bmatrix} 20 \\ -10 \\ 10 \end{bmatrix} = \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$ | ½ | |
| | | $x = 2,\quad y = -1,\quad z = 1$ | | |
| 35 | i) | $\int \frac{e^{\tan^{-1}x}}{1+x^2}\,dx$ | | |
| | | put $\tan^{-1}x = u$ | | |
| | | $\frac{1}{1+x^2}dx = du$ | ½ | |
| | | $= \int e^u\,du$ | ½ | |
| | | $= e^u + C$ | ½ | |
| | | $= e^{\tan^{-1}x} + C$ | ½ | |
| | ii) | $\int x \cdot \sin x\,dx$ | | |
| | | $= x\int \sin x\,dx - \int 1 \cdot \cos x\,dx$ | 1 | |
| | | $= -x\cos x + \int \cos x\,dx$ | ½ | |
| | | $= -x\cos x + \sin x + C$ | ½ | |
| | | Remark · Formula for integration by parts give | 1 score | |

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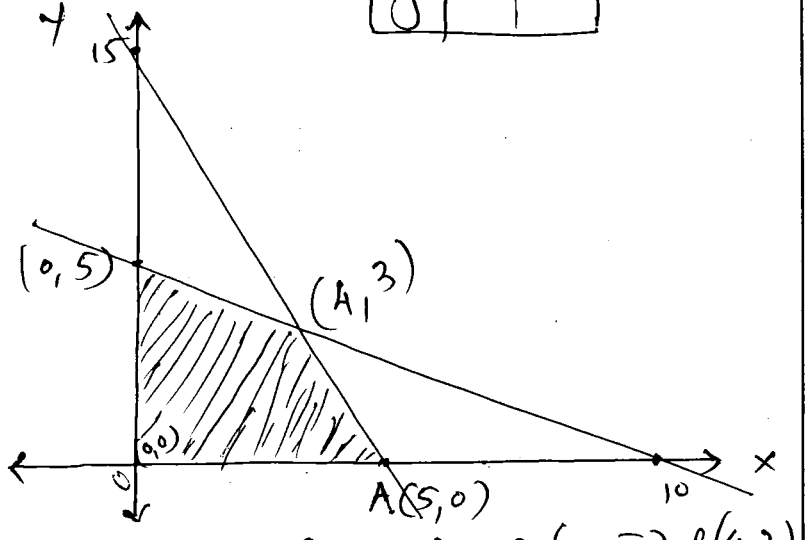
|---|---|---|---|---|
| | iii) | $\int_0^1 \frac{2x}{x^2+1}\,dx$ | | |
| | | $x^2+1 = t$ | ½ | |
| | | $2x\,dx = dt$. | | |
| | | $x=0,\ t=1$ | ½ | 6 |
| | | $x=1,\ t=2$ | | |
| | | $= \int_1^2 \frac{1}{t}\,dt$ | ½ | |
| | | $= [\log\lvert t\rvert]_1^2 = \log 2 - \log 1$ | ½ | |
| | | $= \log 2$. | | |
| 36. | | $x+2y=0$ | | |
| | | $3x+y=15$ | 1 | |
| | |   | 3 | 6 |
| | | Corner p.ts are (0,0), (5,0), (0,5) & (4,3) | 1 | |
| | | Corner p.ts \| $Z = 3x+2y$: (0,0) → 0; (5,0) → 15; (0,5) → 10; (4,3) → 18 ⇒ Maximum | 1 | |

Remark: If the graph of one line is correct give 2 score

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