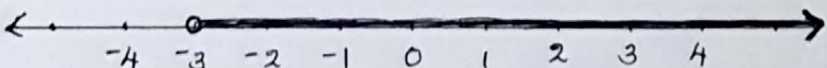


FIRST YEAR HIGHER SECONDARY EXAMINATION SEPT. 2021

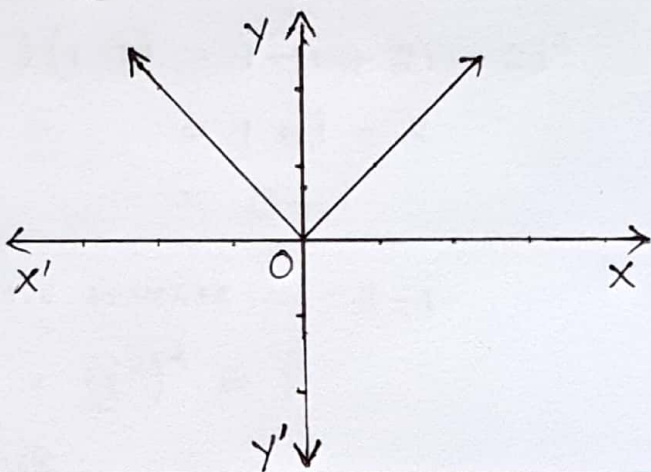
Subject: MATHEMATICS (Commerce)

Code No: FY 251

| Qn. No. | Sub Qns | Answer key / Value Points | Score | Total Score | |
|---------|---------|--|---------------------------------|-------------|---|
| 1. | | $(a+b)^n = {}^n C_0 a^n + {}^n C_1 a^{n-1} b + {}^n C_2 a^{n-2} b^2 + \dots + {}^n C_n b^n$ $(1+x)^4 = {}^4 C_0 + {}^4 C_1 x + {}^4 C_2 x^2 + {}^4 C_3 x^3 + {}^4 C_4 x^4$ $= 1 + 4x + 6x^2 + 4x^3 + x^4$ $(101)^4 = (1+100)^4$ $= 1 + 4 \times 100 + 6 \times (100)^2 + 4 \times (100)^3 + (100)^4$ $= 104060401$ Remark : For direct answer give 1/2 score | 1/2 1/2 1/2 1/2 1/2 | 3 | 3 |
| 2 | (i) | $a r^2 = 4 \rightarrow (1)$ $a r^5 = \frac{1}{2} \rightarrow (2)$ $(2) \div (1) \rightarrow r^3 = \frac{1}{8}$ $\therefore r = \frac{1}{2}$ Remark : For $a_n = a r^{n-1}$ give 1 score. | 1/2 1/2 1/2 1/2 | 2 | 3 |
| | (ii) | $(1) \rightarrow a \left(\frac{1}{2}\right)^2 = 4 \Rightarrow a = 16$ The G.P is a, ar, ar^2, \dots ie $16, 8, 4, \dots$ | 1/2 1/2 | 1 | |
| 3 | (i) | (A) 1 | 1 | 1 | |
| | (ii) | $(\sin x + \cos x)^2 = \sin^2 x + \cos^2 x + 2 \sin x \cos x$ $= 1 + \sin 2x$ | 1 1 | 2 | 3 |
| 4 | (i) | (B) 17 | 1 | 1 | |
| | (ii) | No. of chords = ${}^{12} C_2$ $= 12 C_2 = 66$ Remark : For ${}^{12} P_2$ give 1 score | 1 1 | 2 | 3 |

| Qn No | Sub Qns | Answer key / Value Points | Score | Total Score |
|-------|---------|--|---------|-------------|
| 5 | (i) | $4a = 16$ $\therefore a = 4$ focus = $(0, a)$ $= (0, 4)$ | 1 1 | 2 3 |
| | (ii) | Length of Latus Rectum = $4a$ $= 16$ | 1 | 1 |
| 6 | (i) | (C) $2n+1$ | 1 | 1 |
| | (ii) | $T_{n+1} = {}^{2n}C_n \left(\frac{x}{9}\right)^{2n-n} (9y)^n$ $= {}^{2n}C_n x^n y^n$ | 1½ ½ | 2 3 |
| | | Remark: For $T_{n+1} = {}^nC_n a^{n-n} b^n$ give 1 score | | |
| 7 | (i) | (D) does not exist | 1 | 1 |
| | (ii) | $\lim_{x \rightarrow 2} \frac{x^3 - 2^3}{x^2 - 2^2}$ $= \frac{3 \times 2^2}{2 \times 2^1}$ $= 3$ | 1 1 | 2 3 |
| | | Remark: For $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$ give 1 score | | |
| 8 | (i) | The sum of 3 and 4 is not 9 OR It is false that the sum of 3 and 4 is 9 | 1 | 1 |
| | (ii) | If n^2 is even, then n is even | 2 | 2 |
| 9 | (i) |  | 1 | 1 |
| | (ii) | $4x + 6 - 10 < 6x - 12$ $-2x < -8$ $x > 4$ | 1 1 | 2 3 |

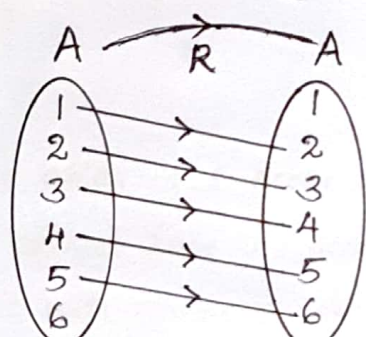
| Qn No | Sub Qns | Answer key / Value Points | | | |
|-------|---------|---|-----------------|---|---|
| 10 | (i) | (C) $(-5, -4, -5)$ | 1 | 1 | |
| | (ii) | Let the point be $(x, 0, 0)$ $\sqrt{(x+2)^2 + 9 + 25} = \sqrt{(x-1)^2 + 4 + 9}$ $x^2 + 4x + 38 = x^2 - 2x + 14$ $6x = -24 \Rightarrow x = -4$ \therefore The point is $(-4, 0, 0)$ | 1 1/2 1/2 | 2 | 3 |
| | | Remark: For distance formula, give 1 score. | | | |
| 11 | (i) | Median = 60 | 1 | 1 | |
| | (ii) | $\sum_{i=1}^5 x_i - M = 20 + 0 + 8 + 18 + 6$ $= 52$ $\therefore \text{M.D.} = \frac{\sum x_i - M }{n}$ $= \frac{52}{5} = 10.4$ | 1 1/2 1/2 | 2 | 3 |
| | | Remark: If M.D. about mean is calculated, give 2 score. | | | |
| 12 | (i) | $P(A \cup B) = P(A) + P(B)$ $= \frac{3}{5} + \frac{1}{5} = \frac{4}{5}$ | 1/2 1/2 | 1 | |
| | (ii) | Event = $\{(2,1), (2,2), (2,3), (2,4), (2,5), (2,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$ | 2 | 2 | 3 |
| | | Remark: For any 6 elements, give 1 score. | | | |
| 13 | (i) | $A = \{1, 2, 3, 4, 5, 6, 7\}$ $B = \{2, 3, 5, 7\}$ | 1 1 | | |
| | (ii) | $C = A \cup B = \{1, 2, 3, 4, 5, 6, 7\}$ | 1 | | |
| | (iii) | For any subset of C give 1 score | 1 | | |

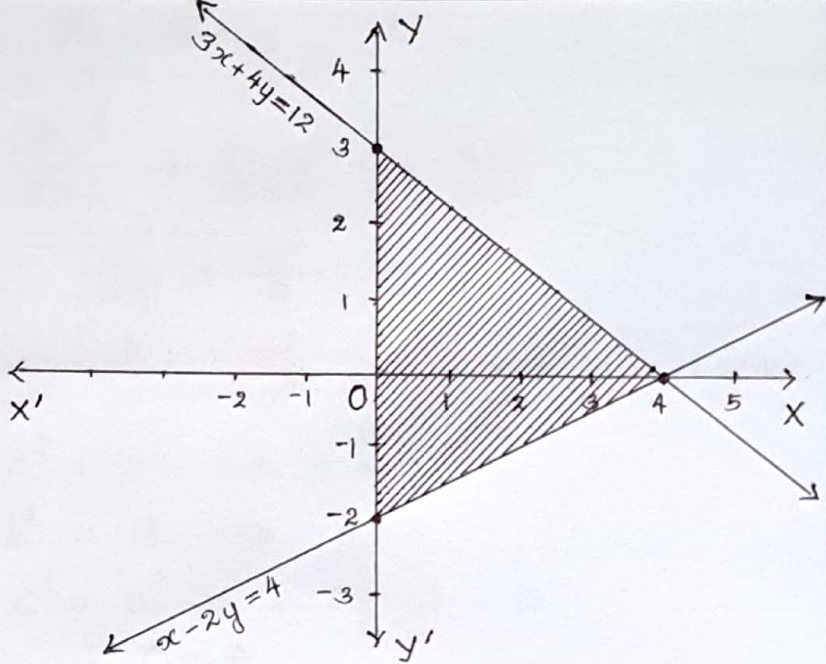
| Qn No | Sub Qn | Answer key / Value Points | Score | Total Score |
|-------|--------|---|--------------------------------|-------------|
| 14 | (i) | No, f is not a function because the element 2 has two images i.e. $(2, 9)$ and $(2, 11)$ are elements of f | 1 1 | 2 |
| | (ii) |  | 2 | 2 |
| 15 | (i) | $\sin(40+x) \cos(10+x) - \cos(40+x) \sin(10+x)$ $= \sin[(40+x) - (10+x)]$ $= \sin 30 = \frac{1}{2}$ <p>Remark: For writing formula for $\sin(A-B)$, give $\frac{1}{2}$ score</p> | $\frac{1}{2}$ $\frac{1}{2}$ | 1 |
| | (ii) | $\frac{\sin 5x + \sin 3x}{\cos 5x + \cos 3x} = \frac{2 \sin\left(\frac{5x+3x}{2}\right) \cos\left(\frac{5x-3x}{2}\right)}{2 \cos\left(\frac{5x+3x}{2}\right) \cos\left(\frac{5x-3x}{2}\right)}$ $= \frac{\sin 4x \cos x}{\cos 4x \cos x}$ $= \tan 4x$ <p>Remark: For the formula for $\sin C + \sin D$ and $\cos C + \cos D$, give $\frac{1}{2}$ score each.</p> | 1 1 1 | 3 |
| 16 | | $P(1) : 2 = 2(2^1 - 1)$ $\Rightarrow P(1) \text{ is true.}$ <p>Assume that $P(k)$ is true</p> $i.e. 2 + 2^2 + 2^3 + \dots + 2^k = 2(2^k - 1)$ | 1 1 | |

| Qn No | Sub Qn | Answer key | Value Points | Score | Total Score |
|-------|--------|---|--------------|------------------|-------------|
| | | $P(k+1) : 2 + 2^2 + 2^3 + \dots + 2^k + 2^{k+1}$ $= 2(2^k - 1) + 2^{k+1}$ $= 2(2^{k+1} - 1)$ | | 1 1 | 4 |
| 17 | (i) | $(1 + 2i)(1 - i) = 1 - i + 2i - 2i^2$ $= 1 + i + 2$ $= 3 + i$ | | 1/2 1 1/2 | 2 |
| | (ii) | Additive inverse = $-3 - i$ | | 1 | 1 |
| | (iii) | $i^4 = (i^2)^2 = 1$ | | 1 | 1 |
| | | <p>Remark :</p> <p>(i) Direct answer \rightarrow give 2 score Real part or imaginary part only is correct, give 1 score</p> <p>(ii) $i^2 = -1$ in part(i) or part(iii), give 1/2 score</p> | | | 4 |
| 18 | (i) | (A) $\frac{3}{2}$ | | 1 | 1 |
| | (ii) | $S_n = \sum_{k=1}^n (2k+1)k^2$ $= 2 \sum_{k=1}^n k^3 + \sum_{k=1}^n k^2$ $= 2 \left(\frac{n(n+1)}{2} \right)^2 + \frac{n(n+1)(2n+1)}{6}$ $= \frac{n(n+1)}{2} \left[n(n+1) + \frac{2n+1}{3} \right]$ $= \frac{n(n+1)(3n^2 + 5n + 1)}{6}$ | | 1 1 1 1 | 4 |

| Qn. No. | Sub Ans | Answer key / Value Points | Score | | Total Score |
|---------|---------|--|---------------|---|-------------|
| 19. | (i) | -1 | 1 | 1 | 4 |
| | (ii) | slope of the perpendicular line = 1 Equation of the line is $y - y_1 = m(x - x_1)$ $y - 4 = 1(x - 2)$ ∴ $x - y + 2 = 0$ | 1 | 3 | |
| | | | 1 | | |
| | | | 1 | | |
| 20 | (i) | Let the ratio be $k:1$ The point of division is $\left(\frac{k+2}{k+1}, \frac{2k+1}{k+1}, \frac{3+k}{k+1}\right)$ On the yz plane, x co-ordinate = 0 ∴ $\frac{k+2}{k+1} = 0$ ∴ $k = -2$ ∴ The ratio is $2:-1$ or $-2:1$ | 1 | 1 | 4 |
| | (ii) | <i>Remark: For section formula, give 1 score.</i> The point of division is $(0, 3, -1)$ | $\frac{1}{2}$ | 3 | |
| | | | $\frac{1}{2}$ | | |
| 21 | (i) | $\frac{dy}{dx} = 2(3x^2) - 4(2x)$ $= 6x^2 - 8x$ | 2 | 2 | 4 |
| | (ii) | $\frac{d}{dx} [(x+1)(x+2)] = uv' + vu'$ $= (x+1)1 + (x+2)1$ $= 2x + 3$ | 1 | 2 | |
| | | | 1 | | |

| Qn. No. | Sub Qns | Answer key / Value points | Score | Total Score |
|---------|---------|--|--|-------------|
| 22 | (i) | $6x + 3y = 5$ $\frac{6x}{5} + \frac{3y}{5} = 1$ $\frac{x}{5/6} + \frac{y}{5/3} = 1$ $\therefore x \text{ intercept} = \frac{5}{6}, y \text{ intercept} = \frac{5}{3}$ <p><u>Remark</u>: $\frac{x}{a} + \frac{y}{b} = 1$: 1 score</p> | 1 1 1 | 3 4 |
| | (ii) | The points of intersection with the axes are $(\frac{5}{6}, 0)$ and $(0, \frac{5}{3})$ | 1 | 1 |
| 23 | | <p>Assume that $\sqrt{2}$ is rational</p> $\therefore \sqrt{2} = \frac{p}{q}, p \text{ and } q \text{ have no common factor}$ $\therefore p^2 = 2q^2$ $\therefore 2 \text{ divides } p$ $\therefore p = 2c \Rightarrow p^2 = 4c^2$ $\Rightarrow 2q^2 = 4c^2 \Rightarrow q^2 = 2c^2$ $\therefore 2 \text{ divides } q$ <p>This is a contradiction to our assumption.</p> $\therefore \sqrt{2} \text{ is irrational}$ | 1 1 1 | 4 |
| 24 | (i) | <p>Let A: the ball drawn is RED B: the ball drawn is BLUE C: the ball drawn is YELLOW</p> <p>Then $P(A) = \frac{4}{9}$</p> | $\frac{1}{2}$ $\frac{1}{2}$ | 1 |
| | (ii) | $P(\text{not Yellow}) = P(\text{not } C) = 1 - P(C)$ $= 1 - \frac{2}{9} = \frac{7}{9}$ <p><u>Remark</u>: For direct answer give 1 score</p> | $\frac{1}{2}$ $\frac{1}{2}$ | 1 |
| | (iii) | $P(\text{Either Red or Blue}) = P(A \cup B)$ $= P(A) + P(B)$ $= \frac{4}{9} + \frac{3}{9}$ $= \frac{7}{9}$ <p><u>Remark</u>: For direct answer give 2 score.</p> | $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ | 2 4 |

| Qn. No. | Sub Qns. | Answer key / Value Points | Score | Total Score | | | | | | | | | | | |
|---------|---------------------------|--|-------|-------------|---|---|----|---|---|---|---|---|---|---|---|
| 25 | (i) | (D) $\{4\}$ | 1 | 1 | | | | | | | | | | | |
| | (ii) | $A - B = \{1, 2, 3\}$ | 1 | 2 | | | | | | | | | | | |
| | | $A' = U - A = \{5, 6, 7, 8, 9\}$ | 1 | | | | | | | | | | | | |
| (iii) | $B' = \{1, 2, 3, 8, 9\}$ | 1 | 3 | | | | | | | | | | | | |
| | $A \cap B' = \{1, 2, 3\}$ | 1 | | | | | | | | | | | | | |
| | $= A - B$ | 1 | | | | | | | | | | | | | |
| 26 | (i) | $R = \{(1, 2), (2, 3), (3, 4), (4, 5), (5, 6)\}$ | 2 | 2 | | | | | | | | | | | |
| | (ii) |  | 2 | 2 | | | | | | | | | | | |
| | (iii) | Domain = $\{1, 2, 3, 4, 5\}$ Range = $\{2, 3, 4, 5, 6\}$ | 1 | 2 | | | | | | | | | | | |
| 27 | (i) | (C) $x < 0, y > 0$ | 1 | 1 | | | | | | | | | | | |
| | (ii) | $x - 2y = 4$ <table border="1" data-bbox="494 1612 877 1769"> <tr> <td>x</td> <td>0</td> <td>4</td> </tr> <tr> <td>y</td> <td>-2</td> <td>0</td> </tr> </table> $3x + 4y = 12$ <table border="1" data-bbox="494 1881 877 2027"> <tr> <td>x</td> <td>0</td> <td>4</td> </tr> <tr> <td>y</td> <td>3</td> <td>0</td> </tr> </table> | x | 0 | 4 | y | -2 | 0 | x | 0 | 4 | y | 3 | 0 | 1 |
| x | 0 | 4 | | | | | | | | | | | | | |
| y | -2 | 0 | | | | | | | | | | | | | |
| x | 0 | 4 | | | | | | | | | | | | | |
| y | 3 | 0 | | | | | | | | | | | | | |

| Qn. No. | Sub Qns | Answer key | Value Points | Score | Total Score |
|---------|---------|--|--|--------|-------------|
| | | |  | 5 3 | 6 |
| | | <p>Remarks :</p> <p>(i) Drawing the axes : 1 score</p> <p>(ii) For each correct line : 1 score</p> <p>(iii) Correct lines with incorrect shading : 4 1/2 score</p> | | | |
| 28 | (i) | $\frac{5!}{(5-r)!} = \frac{6!}{[6-(r-1)]!}$ $\frac{5!}{(5-r)!} = \frac{6!}{(7-r)!} \Rightarrow 1 = \frac{6}{(7-r)(6-r)}$ $r^2 - 13r + 42 = 6$ $r^2 - 13r + 36 = 0$ $(r-9)(r-4) = 0 \Rightarrow r = 9 \text{ or } r = 4$ <p>But $r < 5 \Rightarrow r = 4$</p> <p>Remark : $nP_r = \frac{n!}{(n-r)!}$: 1 score</p> | 1 1 1/2 1/2 | 3 | 6 |
| | (ii) | <p>Total \rightarrow 9 letters, M \rightarrow 2, A \rightarrow 4, L \rightarrow 2</p> $\frac{9!}{2! 4! 2!}$ | 1 1 | 2 | |
| | (iii) | $\frac{8!}{2! 4! 2!}$ | 1 1 | 1 | |

| Qn No. | Sub Qns | Answer key / Value Points | Score | Total Score |
|--------|---------|--|-----------------|-------------|
| 29 | (i) | $\frac{9x^2}{225} + \frac{25y^2}{225} = \frac{225}{225}$ $\frac{x^2}{25} + \frac{y^2}{9} = 1$ <p>Remark: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ give 1 score</p> | 1 | 1 |
| | (ii) | $a^2 = 25 \Rightarrow a = 5$ $b^2 = 9 \Rightarrow b = 3$ $c^2 = a^2 - b^2 = 25 - 9 = 16$ $\therefore c = 4$ foci = $(\pm c, 0)$ $= (\pm 4, 0)$ vertices = $(\pm a, 0)$ $= (\pm 5, 0)$ | 1/2 1/2 1 | 3 |
| | (iii) | eccentricity, $e = \frac{c}{a}$ $= \frac{4}{5}$ length of L.R. = $\frac{2b^2}{a}$ $= \frac{2 \times 9}{5} = \frac{18}{5}$ | 1 | 2 |

| Qn. No. | Sub Qn. | Answer key / Value Points | Score | Total Score | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|---------|---|-------|-------------|-----|------|--------|------|---|---|----|-----|-------|----|---|-----|------|-------|----|----|-----|------|-------|----|----|-----|-------|-------|----|---|-----|-------|--|--|----|------|-------|---|---|
| 30 | | <table border="1"> <thead> <tr> <th>class</th> <th>x</th> <th>f</th> <th>fx</th> <th>fx^2</th> </tr> </thead> <tbody> <tr> <td>0-10</td> <td>5</td> <td>5</td> <td>25</td> <td>125</td> </tr> <tr> <td>10-20</td> <td>15</td> <td>8</td> <td>120</td> <td>1800</td> </tr> <tr> <td>20-30</td> <td>25</td> <td>15</td> <td>375</td> <td>9375</td> </tr> <tr> <td>30-40</td> <td>35</td> <td>16</td> <td>560</td> <td>19600</td> </tr> <tr> <td>40-50</td> <td>45</td> <td>6</td> <td>270</td> <td>12150</td> </tr> <tr> <td></td> <td></td> <td>50</td> <td>1350</td> <td>43050</td> </tr> </tbody> </table> | class | x | f | fx | fx^2 | 0-10 | 5 | 5 | 25 | 125 | 10-20 | 15 | 8 | 120 | 1800 | 20-30 | 25 | 15 | 375 | 9375 | 30-40 | 35 | 16 | 560 | 19600 | 40-50 | 45 | 6 | 270 | 12150 | | | 50 | 1350 | 43050 | 2 | 2 |
| class | x | f | fx | fx^2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0-10 | 5 | 5 | 25 | 125 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10-20 | 15 | 8 | 120 | 1800 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20-30 | 25 | 15 | 375 | 9375 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30-40 | 35 | 16 | 560 | 19600 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40-50 | 45 | 6 | 270 | 12150 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50 | 1350 | 43050 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | (i) | Mean, $\bar{x} = \frac{\sum fx}{\sum f}$ $= \frac{1350}{50}$ $= 27$ | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | (ii) | Variance, $\sigma^2 = \frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2$ $= \frac{43050}{50} - (27)^2$ $= 132$ | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Remark : Give full score for alternate methods. | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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