SECOND Y[redacted]R HIGHER SECONDARY EXAMINATION [redacted]ARCH 2017

SUBJECT : MATHEMATICS (SCIENCE) CODE. NO: 5018

| Qn No | Sub Qns | Answer Key/Value Points | Score | Total |
|---|---|---|---|---|
| 1. | (a) | (b) Symmetric | 1 | 1 |
| | (b) | $fog(x) = f(g(x)) = f(2x-1)$ | ½ | |
| | | $= \lvert 2x-1+1 \rvert$ | ½ | |
| | | $= \lvert 2x \rvert$ | | 2 |
| | | $gof(x) = g(f(x)) = g\lvert x+1 \rvert$ | ½ | |
| | | $= 2\lvert x+1 \rvert - 1$ | ½ | |
| | (c) | If $(c,d)$ is the identity element | | |
| | | $(a,b) * (c,d) = (a,b)$ | ½ | |
| | | $(a,b) * (c,d) = (a+c, b+d)$ | ½ | |
| | | $(a+c, b+d) = (a,b)$ | ½ | 2. |
| | | $(c,d) = (0,0)$ | ½ | |
| | | Not an element of $N \times N$ | | |
| | | ∴ Identity element does not exist | | |
| | | Remark. | | |
| | | (b) For $fog(x) = f(g(x))$ or $gof(x) = g(f(x))$ only (½) | | |
| | | (c) For $a * e = a = e * a$ (½ score) | | |
| | | Give 2 score for identity element does not exist | | |
| 2. | (a) | d. $2\pi/3$ | 1 | 1 |
| | (b) | $\tan^{-1}\left[\dfrac{\frac{x-1}{x-2} + \frac{x+1}{x+2}}{1 - \left(\frac{x-1}{x-2}\right)\left(\frac{x+1}{x+2}\right)}\right] = \pi/4$ | 1 | |
| | | $\tan^{-1}\left[\dfrac{2x^2-4}{-3}\right] = \pi/4$ | 1 | |

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| | | $\dfrac{2x^2-4}{-3} = 1$ | ½ | 3 |
| | | $x = \pm \dfrac{1}{\sqrt{2}}$ | ½ | |
| | | Remark : $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\dfrac{x+y}{1-xy}\right)$ give (1) score | | |
| 3. | (a) | a. $\underline{k=0}$ | 1 | 1 |
| | (b) | $A^2 = A \cdot A$ | ½ | 3 |
| | | $= \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ | ½ | |
| | | $= \begin{bmatrix} \cos^2\theta - \sin^2\theta & \sin\theta\cos\theta + \cos\theta\sin\theta \\ -\sin\theta\cos\theta - \cos\theta\sin\theta & \cos^2\theta - \sin^2\theta \end{bmatrix}$ | 1 | |
| | | $= \begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$ | 1 | |
| | (c) | $A' = \begin{bmatrix} 1 & 4 \\ 3 & 1 \end{bmatrix}$ | ½ | 2 |
| | | $3A' = \begin{bmatrix} 3 & 12 \\ 9 & 3 \end{bmatrix}$ | ½ | |
| | | $\lvert 3A' \rvert = -99$ | 1 | |
| | | Remark: Since $\lvert A' \rvert = \lvert A \rvert$ for the correct $\lvert 3A' \rvert$ give (2) score. For alternate method and correct answer give (2) score. | | |
| 4. | a) | (c) 0 | 1 | 1 |
| | (b) | $AX = B$ form $\begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$ | ½ | |

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| | | $\lvert A\rvert = 10$ | 1 | |
| | | $A^{-1} = \frac{Adj\ A}{\lvert A\rvert} = \frac{1}{10}\begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix}$ | 2 | |
| | | $X = A^{-1}B$ | | |
| | | $= \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$ | ½ | 4 |
| | | Remark: For only $AX = B$ form give (1) score | | |
| | | For $A^{-1} = \frac{Adj\ A}{\lvert A\rvert}$ (½ score) | | |
| | | $X = A^{-1}B$ (½ Score) | | |
| 5 | (a) | $5a = 1$ | 1 | |
| | | $a = 1/5$ | ½ | 3 |
| | | $a = b - \pi/2$ | 1 | |
| | | $b = \frac{1}{5} + \pi/2$ | ½ | |
| | | Remark: For the idea of continuity give (1) score | | |
| | | $\lim_{x \to a^+} f(x) = \lim_{x \to a^-} f(x) = f(a)$ | | |
| | (b) | $\log\left[(\sin x)^{\cos y}\right] = \log\left[(\cos y)^{\sin x}\right]$ | 1 | |
| | | $\cos y \log \sin x = \sin x \log \cos y$ | ½ | |
| | | $\cos y \times \frac{1}{\sin x}\cos x + \log \sin x \cdot -\sin y \frac{dy}{dx}$ | 1 | 3 |
| | | $= \sin x \frac{1}{\cos y} - \sin y \frac{dy}{dx} + \log \cos y \cdot \cos x$ | | |
| | | $\frac{dy}{dx} = \frac{\cos x \cdot \log \cos y - \cos y \cot x}{\sin x \tan y - \sin y \cdot \log \sin x}$ | ½ | |

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|---|---|---|---|---|
| 6 | (a) | (d) $-1$ | 1 | 1 |
| | (b) | $f'(x) = 6x^2+18x+12$ | 1 | |
| | | $f'(x) = 0$ | 1 | |
| | | $x = -1$ or $-2$ | ½ | |
| | | The intervals may be $(-\infty,-2)(-2,-1)$ and $(-1,\infty)$ | ½ | |
| | | $f'(x) > 0$ in $(-\infty,-2)$ and $(-1,\infty)$ | 1 | 4. |
| | | $\therefore f(x)$ is increasing in $(-\infty,-2)$ and $(-1,\infty)$. | | |
| | | Remark: $f(x)$ is increasing when $f'(x) > 0$ give (1) score. | | |
| | | OR. | | |
| | (a) | (a) $4\pi$ | 1 | 1 |
| | (b) | Numbers $x$ and $(16-x)$ | 1 | |
| | | $S = x^3+(16-x)^3$ | ½ | |
| | | $\frac{ds}{dx} = 3x^2+3(16-x)^2 \times -1$ | 1 | |
| | | $\frac{ds}{dx} = 0 \Rightarrow x = 8$ | ½ | 4 |
| | | $\frac{d^2s}{dx^2} = 6x + 6(16-x)$ | ½ | |
| | | $\frac{d^2s}{dx^2}$ at $x=8$ $>0$ | ½ | |
| | | Numbers are 8 and 8 | | |
| 7 | (a) | $\int \frac{x^6}{x^7(x^7+1)}dx = \frac{1}{7}\int \frac{dt}{t(t+1)}$   $t=x^7$, $dt=7x^6dx$ | 1½ | |
| | | $= \frac{1}{7}\left[\int\left(\frac{1}{t}+\frac{-1}{t+1}\right)dt\right.$ | 1 | |

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| | | $= \frac{1}{7}\left[\log x^7 - \log(1+x^7)\right] + c$ | ½ | 3 |
| | | Remark: Put $u = x^7+1$ or $u = x^7$ give (1) score. | | |
| | (b) | $\int_1^4 \lvert x-2\rvert dx = \int_1^2 (2-x)dx + \int_2^4 (x-2)dx$ | 1 | |
| | | $= \left[\frac{(2-x)^2}{-2}\right]_1^2 + \left[\frac{(x-2)^2}{2}\right]_2^4$ | 1 | 3 |
| | | $= \left(0 - \frac{-1}{2}\right) + \left(\frac{4}{2} + 0\right)$ | ½ | |
| | | $= \frac{5}{2}$ | ½ | |
| | | Remark: $\int_1^4 (x-2)dx = \left[\frac{(x-2)^2}{2}\right]_1^4$ give (1) score. For concept of $\lvert x\rvert$ (½) property (½) score. | | |
| | | Alternative method: | | |
| | | $\int_1^2 (2-x)dx + \int_2^4 (x-2)dx$ | | |
| | | $= \left(2x - \frac{x^2}{2}\right)_1^2 + \left(\frac{x^2}{2} - 2x\right)_2^4$ | | |
| | | $= 5/2$. | | |
| 8 | | $I = \int_0^{\pi/2} \log \sin x \, dx$ | | |
| | | $= \int_0^{\pi/2} \log \sin(\pi/2 - x) dx$ | ½ | |
| | | $I = \int_0^{\pi/2} \log \cos x \, dx$ | ½ | |
| | | $2I = \int_0^{\pi/2} (\log \sin x + \log \cos x)\, dx$ | 1 | 4 |
| | | $= \int_0^{\pi/2} \log \sin 2x - \int_0^{\pi/2} \log 2 \, dx$ | 1 | |
| | | $= I - \pi/2 \log 2$ | ½ | |
| | | $I = -\pi/2 \log 2$ | ½ | |

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| 8 | | OR. $\int_0^4 x^2\,dx = \lim_{h\to 0} h\left[h^2+(2h)^2+\dots+((n-1)h)^2\right]$ | 1 | |
| | | $= \lim_{h\to 0} h^3\left[1^2+2^2+\dots+(n-1)^2\right]$ | 1 | |
| | | $= \lim_{h\to 0} h^3 \frac{n(n-1)(2n-1)}{6}$ | 1 | 4 |
| | | $= \lim_{h\to 0} \frac{h^3 n^3\cdot(1-1/n)(2-1/n)}{6}$ | ½ | |
| | | $= \frac{4\times 4\times 8}{6} = \frac{64}{3}$ | ½ | |
| | | Remark: $\int_a^b f(x)\,dx = \lim_{h\to 0} h\left[f(a)+f(a+h)+\dots+f(a+(n-1)h)\right]$ (1) score.<br>For $(b-a)$, $h$, $f(a)$, $f(a+h)$ give ½ score each.<br>For direct integration and correct answer (1) score. | | |
| 9. | (a) | (c) 1 | 1 | 1 |
| | (b) |  | ½ | |
| | | Point of intersection $(4a, 4a)$ | 1 | |
| | | Area $= \int_0^{4a}\sqrt{4ax}\,dx - \int_0^{4a}\frac{x^2}{4a}\,dx$ | 2 | 5 |
| | | $= \cancel{16}\, 2\sqrt{a}\left(\frac{x^{3/2}}{3/2}\right)_0^{4a} - \frac{1}{4a}\left(\frac{x^3}{3}\right)_0^{4a}$ | 1 | |
| | | $= \frac{16}{3}a^2$ | ½ | |

Remark: $A = \int_a^b y\,dx$ (½) score.
Figure only (1) score. Figure is not necessary

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|---|---|---|---|---|
| 10 | (a) | (d) 2 | 1 | 1 |
| | (b) | Solving second order differential equation is out of syllabus. <br> Remark: Attempting question 10 give 5 score. | | 5 |
| 11. | (a) | b $7/\sqrt{3}$ | 1 | 1 |
| | (b) | $A = \lvert\bar{a}\times\bar{b}\rvert$ | ½ | 2 |
| | | $\bar{a}\times b = \begin{vmatrix} i & j & k \\ 2 & 1 & 1 \\ 1 & -1 & 0 \end{vmatrix}$ | ½ | |
| | | $= \hat{i}+\hat{j}-3k$ | ½ | |
| | | $\lvert\bar{a}\times\bar{b}\rvert = \sqrt{11}$ | ½ | |
| 12 | (a) | a $60^\circ$ $(\pi/3)$ | 1 | 1 |
| | (b) | $\lvert\bar{a}+\bar{b}+\bar{c}\rvert = 0$ | 1 | 4 |
| | | $(\bar{a}+\bar{b}+\bar{c})^2 = 0$ | 1 | |
| | | $\lvert\bar{a}\rvert^2+\lvert\bar{b}\rvert^2+\lvert\bar{c}\rvert^2+2\bar{a}\cdot\bar{b}+2\bar{a}\cdot\bar{c}+2\bar{b}\cdot\bar{c} = 0$ | 1 | |
| | | $3+2(\bar{a}\cdot\bar{b}+\bar{a}\cdot\bar{c}+\bar{b}\cdot\bar{c}) = 0$ | 1 | |
| | | $\bar{a}\cdot\bar{b}+\bar{a}\cdot\bar{c}+\bar{b}\cdot\bar{c} = -3/2$ | 1 | |
| | | Remark: For alternate method and correct answer (4) <br> $\lvert\bar{a}\rvert = \lvert\bar{b}\rvert = \lvert\bar{c}\rvert = 1$ (1 score) | | |
| 13. | (a) | (a) $\frac{x-2}{1} = \frac{y-1}{2} = \frac{z}{-3}$ | 1 | 1 |
| | (b) | $\bar{a}_1 = \hat{i}+2\hat{j}+3\bar{k}$ $\quad \bar{a}_2 = \hat{i}+\hat{j}+\bar{k}$ | 1 | |
| | | $\bar{b}_1 = \bar{i}+\bar{j}+\bar{k}$ $\quad \bar{b}_2 = \hat{i}+\hat{j}+\bar{k}$. | | |
| | | $\bar{a}_2-\bar{a}_1 = -\bar{j}-2\bar{k}$ | ½ | |

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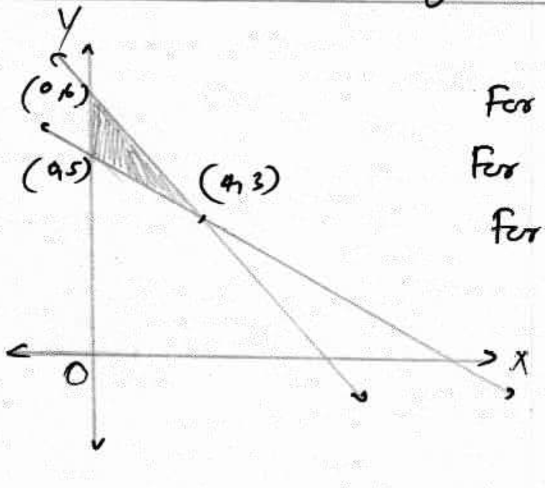
|---|---|---|---|---|
| | | $S.D = \left\| \dfrac{\bar{b} \times (\bar{a}_2 - \bar{a}_1)}{\|b\|} \right\|$ | $\frac{1}{2}$ | 3 |
| | | $= \sqrt{2}$ | 1 | |
| | | Remark: $SD = \left\| \dfrac{(\bar{a}_2 - \bar{a}_1) \cdot (\bar{b}_1 \times \bar{b}_2)}{\|b_1 \times b_2\|} \right\|$ give ($\frac{1}{2}$ score) | | |
| | | For $SD = 0$ give ( 3 score) | | |
| | | For $\|b\| = \sqrt{3}$ give ($\frac{1}{2}$ score) | | |
| 14. | (a) | b $2/\sqrt{3}$ | 1 | 1 |
| | (b) | $(x+y+z-1) + \lambda(2x+3y+4z-5) = 0$ | 1 | |
| | | $(2\lambda+1)x + (3\lambda+1)y + (4\lambda+1)z - 5\lambda - 1 = 0$ | $\frac{1}{2}$ | |
| | | $(2\lambda+1) \cdot 1 + (3\lambda+1) \times {}^{-}1 + (4\lambda+1) \times 1 = 0$ | $\frac{1}{2}$ | |
| | | $\lambda = -\frac{1}{3}$ | $\frac{1}{2}$ | 3 |
| | | $(x+y+z-1) - \frac{1}{3}(2x+3y+4z-5) = 0$ | $\frac{1}{2}$ | |
| | | $x - z + 2 = 0$ | | |
| | | Remark: Concept of $\perp^r$ planes give (1) score. | | |
| 15. | (a) |  | | |
| | | For I Quadrant | $\frac{1}{2}$ | |
| | | For two lines | 2 | 3 |
| | | For fessible region | $\frac{1}{2}$ | |

| Qn No | Sub Qns | Answer Key/Value Points | Score | Total |
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| | (b) | Corner points (0,5) (0,6) (4,3) | 2 | 2 |
| | (c) | at (0,5) $z = 200$<br>at (0,6) $z = 240$<br>at (4,3) $z = 320$ ←<br>$z$ is max$^m$ at (4,3) and it is $\underline{\underline{320}}$<br>Remarks : For any two correct corner points (2) score<br>: max$^m$ according to the obtained corner points give (1) score | 1 | 1 |
| 16. | (a) | (a) $\frac{P(A)}{P(B)}$ | 1 | 1 |
| | (b)(i) | $P(E_1) = P(E_2) = \frac{1}{2}$ | ½ | 2 |
| | | $P(A/E_1) = 5/9$ $P(A/E_2) = 3/7$ | ½ | |
| | | P (the ball drawn is red)<br>$= \frac{1}{2} \times \frac{5}{9} + \frac{1}{2} \times \frac{3}{7}$ | ½ | |
| | | $= \frac{62}{126} = \frac{31}{63}$ | ½ | |
| | (ii) | P (the ball was drawn from bag I)<br>$= \frac{\frac{1}{2} \times \frac{3}{7}}{\frac{1}{2} \times \frac{5}{9} + \frac{1}{2} \times \frac{3}{7}}$ | 1 | 2 |
| | | $= \frac{27}{62}$ | 1 | |
| | | Remark : $P(A) = P(E_1) \times P(A/E_1) + P(E_2) \times P(A/E_2)$ (½) score. | | |

$P(E_1/A) = \frac{P(E_1) \times P(A/E_1)}{P(E_1) \times P(A/E_1) + P(E_2) \times P(A/E_2)}$ (½) score.

(10/10)

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| | | OR. | | |
| 16. | (i) | $\sum P(x) = 1$ | ½. | 1 |
| | | $k = \frac{7}{16}$ | ½. | |
| | (ii) | $E(x) = \sum x \cdot P(x)$ | 1 | |
| | | $= 0 + \frac{2}{16} + \frac{14}{16} + \frac{15}{16} + \frac{4}{16}$ | ½ | |
| | | $= \frac{35}{16}$ | ½ | |
| | | $E(x^2) = \sum x^2 \; P(x)$ | ½ | |
| | | $= 0 + \frac{2}{16} + \frac{28}{16} + \frac{45}{16} + \frac{16}{16}$ | | |
| | | $= \frac{91}{16}$ | ½ | |
| | | Variance $= \sum x^2 P(x) - \left(\sum x P(x)\right)^2$ | ½ | |
| | | $= \frac{91}{16} - \left(\frac{35}{16}\right)^2$ | | 4. |
| | | $= \frac{231}{256}$ | ½ | |
| | | $= 0.902$ | | |

10/10

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|---|---|---|---|---|
| | 1 | Valsa. P.P AKMHSS Poochatty TCR | | |
| | 2. | Geetha M RMVHSS Perinjanam TCR | | |
| | 3. | Bindu. D, St: Ignatius VHSS, Kanjiramattam, EKM | | |
| | 4 | Beena. O.P SKVHSS Kurichithanam; kottayam | | |
| | 5. | Manju P. Viswambharan, SNVHSS Nankiruthy Idukki | | |
| | 6. | Abhilash KA, GVHSS Vellarmala, Wayanad | | |
| | 7. | Lali John, AMMHSS, Edayaranmula | Raly George | |
| | 8 | Shaji. A.K. Naduvannur HSS CLT | | |
| | 9. | Rajan. K.V SSVHS Chirayinkeezh | | |
| | 10 | Ambika S. Menon GMVHS Thiruvaloor | | |
| | 11. | Mini Das CMSHSS Melukavu | | |
| | 12. | Biji B. KPM HSS, Poothotta, Ernakulam | | |
| | 13 | S. Suja Devi, S.S.H.SS, cheerathalam | | |
| | 14. | Manju. V.P. CHSS, Poothakulam, Kollam | | |
| | 15 | Mini. K.L Elamannoor VHSS | Mini | |
| | 16 | Shaji mathew M.S.M.H.S.S | | |
| | 17. | SHAFEEQ RAHMAN. M Kalladi HSS Kumaramputhur | | |
| | 18. | Raghunathan. K.V. Chattanchal HSS Kasargod | | |
| | 19 | Abdul Gafoor. K JDT Islam VHSS, Calicut-K | | |
| | 20 | Gracy P V St. Mary's HSS Mullankolly | | |
| | 21. | Daphy K Mani St. Mary's HSS Edoor | | |

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