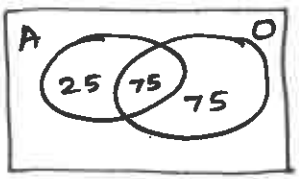
FIRST YEAR HIGHER SECONDARY EXAMINATION MARCH 2019

SUBJECT : MATHEMATICS (SCIENCE) **CODE. NO: FY 27**

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
1	(i)	$A = \{2,3,5,7\}$ $B = \{2,3,4,5,6,7,8\}$	½	1
		$C = \{2,3,5,7\}$	½	
	(ii)	4	1	1
	(iii)	P(getting a subset of 3 elements) = $\frac{\text{no. of favourable cases}}{\text{Total no of cases}}$	½	1
		$= \frac{4}{2^4} = \frac{1}{4}$	½	
		Remark: Q(ii) : For writing the subsets with '3' elements (1) : For writing three subsets with '3' elements (½).		
2.	(i)	$(a+b)^4 - (a-b)^4 = 2\times 4a^3b + 2\times 4ab^3 = 8ab(a^2+b^2)$	2	2
		Remark: Expansion (i) For $(a+b)^n$ give (½) (ii) For $(a+b)^4$ give (½) (iii) For $(a-b)^4$ give (½)		
	(ii)	$(\sqrt{3}+\sqrt{2})^4 - (\sqrt{3}-\sqrt{2})^4 = 8(\sqrt{3})^3(\sqrt{2}) + 8\sqrt{3}(\sqrt{2})^3$	½	1
		$= 40\sqrt{2}\sqrt{3}$	½	
3		$\sqrt{3+4i} = x+iy$	½	3
		$x^2 - y^2 + 2xyi = 3+4i$	½	
		$x^2 - y^2 = 3$ $\quad 2xy = 4$	½	
		$x^2 + y^2 = 5$	½	
		Solving $x = \pm 2$ $\quad y = \pm 1$	½	
		Roots are $2+i$ and $-2-i$	½	
		Remark: For any alternative method and getting correct answer give 3 score.		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
4.		Let $\frac{a}{r}, a, ar$ be the numbers ½	½	
		$\frac{a}{r} \times a \times ar = -1 \Rightarrow a = -1$	½	
		Then $\frac{-1}{r} - 1 - r = \frac{13}{12}$	½	
		$\Rightarrow 12r^2 + 25r + 12 = 0$	½	
		$\Rightarrow r = \frac{-3}{4}$ or $\frac{-4}{3}$	½	
		$\Rightarrow$ The numbers are $\frac{4}{3}, -1, \frac{3}{4}$ or $\frac{3}{4}, -1, \frac{4}{3}$	½	3
5.		$2 \sin 3x \cos 2x + \sin 3x = 0$	½	
		$\sin 3x (2\cos 2x + 1) = 0$	½	
		$\sin 3x = 0$ $\quad 2\cos 2x + 1 = 0$	½+½	
		$3x = n\pi$	½	
		$\cos 2x = -1/2 = \cos \frac{2\pi}{3}$	½	3
		$2x = 2n\pi \pm \frac{2\pi}{3}$		
		Remark. For (i) $\sin C + \sin D = 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$ (½)		
		(ii) When $\sin x = 0 \quad x = n\pi$ (½)		
		(iii) When $\cos x = \cos y \quad x = 2n\pi \pm y$ (½)		
6	(a)	(i) $\sin x$	1	
	(b)	$\lim_{x \to \pi/2} \frac{\sin x - \sin \pi/2}{x - \pi/2}$	1	
		Put $x - \pi/2 = y$; $x \to \pi/2 \Rightarrow y \to 0$	½	
		$= \lim_{y \to 0} \frac{\sin(\pi/2 + y) - 1}{y}$		
		$= \lim_{y \to 0} \frac{\cos y - 1}{y} = \lim_{y \to 0} \frac{-2\sin^2 y/2}{y}$	½	3
		$= 0$		
		Remark. (i) $\lim_{x \to \pi/2} \frac{\sin x - \sin \pi/2}{x - \pi/2} = \cos \pi/2 = 0$ (2)		
		(ii) $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$ (½)		
		(iii) $f'(x) = \cos x$ (1)		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
7.	(d)	General term $t_{r+1} = {}^nC_r\, a^{n-r} b^r$ $= 5C_r (x^2)^{5-r} \left(\frac{1}{x}\right)^r$ $= 5C_r\, x^{10-2r}\, x^{-r}$ $= 5C_r\, x^{10-3r}$	½ ½ ½ ½	
	(b)	(a) 18	1	3
8.		$n(A) = 100 \quad n(O) = 150 \quad n(A \cap O) = 75$	1	
	(a)	For  or $n(A \cup O) = n(A) + n(O) - n(A \cap O)$	½	
		$n(A \cup O) = 175$	½ 1	
	(b)	$n(A \cap O') = 25$	1	
	(c)	$n(A' \cap O') = 400 - 175 = 225$	1	4
9.	(a)	Domain $= \mathbb{R}$ Range $= (-\infty, 0) \cup \{1\}$	1 1	
		Remarks For Range $= (-\infty, 0)$ or $(-\infty, 1)$ or $\{1\}$ (½) for Domain and Range as per figure give (2) score.		
	(b)	$f(0) = 1$; $f(-0.01) = -0.01$	½ + ½	
	(c)	Limit does not exists	1	4
10	(a)	$A \times A = \{(1,-1), (-1,1), (1,-1), (1,1)\}$	1	
	(b)	no of relations $= 2^{[n(A)]^2}$ $= 2^4 = 16$	½ ½	
	(c)	There are two functions $\{(1,-1),(1,1)\}$ and $\{(1,1),(1,-1)\}$	1+1	4

Remarks : For any other representation of functions give 2 score.

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
11		$P(1)$: $(1)(2)(6) = 12$ true for $n=1$	1	
		Assume $P(k)$ is true	1	
		$\Rightarrow$ $P(k)$: $k(k+1)(k+5) = 3M$		
		Then $P(k+1)$: $(k+1)(k+2)(k+6)$	½	
		$=$ [illegible]		
		$= (k+1)[k^2+8k+12)$	½	
		$= k(k+1)(k+5) + 3(k+1)(k+4)$		
		$= 3M + 3(k+1)(k+4)$		
		$= 3[M + (k+1)(k+4)]$	1	
		$\therefore$ $P(k+1)$ is true		4
		$\Rightarrow$ $P(n)$ is true for all $n \in N$ by PMI.		
12.	(a)	$z = r(\cos\theta + i\sin\theta)$	½	
		$= 2\left(\cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3}\right)$	½	
		$= 2\left(-\frac{1}{2} - i\frac{\sqrt{3}}{2}\right)$	½	
		$= -1 - i\sqrt{3}$	½	
	(b)	$\bar{z} = -1 + i\sqrt{3}$	1	
		Remark: For any z corresponding $\bar{z}$ and $(\bar{z})^2$ give 1 marks each.		
	(c)	$(\bar{z})^2 = (-1+i\sqrt{3})^2$		
		$= 1 - 3 - 2i\sqrt{3}$	½	
		$= -2 - 2i\sqrt{3} = 2(-1 - i\sqrt{3})$	½	4
		$= 2z$		
13.	(a)	Total no of ways $= {}^{52}C_7$	1	
	(b)	No of all kings $= {}^{4}C_4 \times {}^{48}C_3$	1	
		Probability of all kings $= \frac{{}^{4}C_4 \times {}^{48}C_3}{{}^{52}C_7}$	1	

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
	(c)	No of ways no king $= {}^{48}C_7$.	½	
		$P(\text{No kings}) = \frac{{}^{48}C_7}{{}^{52}C_7}$	½	4
		Remark: $P(A) = \frac{n(A)}{n(S)}$ give ½ score.		
14	(a)	If a number is not divisible by 3, it is not divisible by 9	1	
	(b)	Assume $\sqrt{7}$ is rational	1	
		$\Rightarrow \sqrt{7} = \frac{a}{b}$		
		$a^2 = 7b^2$		
		$\therefore$ 7 divides a	½	
		let $a = 7c$		
		$(7c)^2 = 7b^2 \Rightarrow 7c^2 = b^2$	½	
		$\Rightarrow$ 7 divides b		
		$\Rightarrow$ a and b have common factor which is a contradiction to our assumption. Hence $\sqrt{7}$ is irrational	1	4
15.				

Class	f_i	cf	x_i	$\lvert x_i - M \rvert$	$f_i \lvert x_i - M \rvert$
0–10	6	6	5	23	138
10–20	7	13	15	13	91
20–30	15	28	25	3	45
30–40	16	44	35	7	112
40–50	4	48	45	17	68
50–60	2	50	55	27	54
	50				508

2

$\frac{N}{2} = 25^{th}$ item is (20–30) median class.

Median $= l + \left(\frac{\frac{N}{2} - c}{f}\right) h$ ½

$= 20 + \left(\frac{25 - 13}{15}\right) \times 10 = 28$ ½

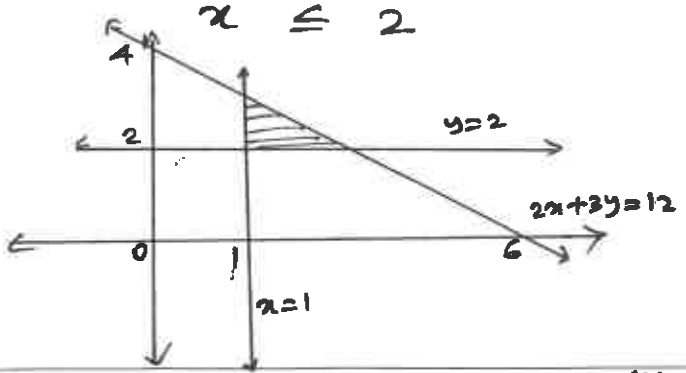
M.D(M) $= \frac{1}{N} \sum f_i \lvert x_i - M \rvert =$ ½

$= \frac{1}{50} \times 508 = 10.16$ ½ 4

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
16.	(a)	A-3, S-4, I-2, N-2, T-1, O-1	1.	
		Total words - $\frac{13!_0}{3!_0\,4!_0\,2!_0\,2!_0}$	1.	
	(b)	Vowels are A, I, O		
		Vowels together = $\frac{8!_0}{4!_0 \times 2!_0} \times \frac{6!_0}{3!_0 \times 2!_0}$	2	
		Remark. (i) For $\frac{8!_0}{4!_0 \times 2!_0}$ give (1 score)		
		(ii) for formula $\frac{n!_0}{p!_0 q!_0 r!_0 \ldots}$ (½)		4.
17.	(a)	$D = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2}$	½	
		$AB^2 = 18 \quad BC^2 = 18 \quad AC^2 = 36$	½+½+½	
		$\Rightarrow AB^2 + BC^2 = AC^2$	1	
		$\therefore \Delta ABC$ is a right Triangle		
	(b)	Centre of the circle is $\left(\frac{0-4}{2}, \frac{7+9}{2}, \frac{10+6}{2}\right)$	½	
		$\Rightarrow (-2, 8, 8)$	½	
		Remark formula of mid point $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}, \frac{z_1+z_2}{2}\right)$ give ½ score.		4.
18.	a.	$y = mx$.	½	
		$m = \tan\theta = \tan 30 = 1/\sqrt{3}$	½+½	2
		$y = \frac{1}{\sqrt{3}} x$	½.	
	(b)	Point A $\Rightarrow (r\cos\theta, r\sin\theta)$	½	
		$\Rightarrow (\cos 30, \sin 30) = \left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$	1	2
		$B\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$	½	
	(c)	Tangent $y - y_1 = m(x - x_1)$	½	

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
		$y - \frac{1}{2} = -\sqrt{3}\left(x - \frac{\sqrt{3}}{2}\right)$	½	
		$2y - 1 = -2\sqrt{3}x + 3$	½	2
		$\Rightarrow \sqrt{3}x + y = 2$	½	
		Remarks: (i) $y = mx + c$ (½)		
		(ii) For $r = 1$ $\theta = 30$ (½)		
		(iii) For normal form $x\cos\omega + y\sin\omega = p$ and using this $x\cos 30 + y\sin 30 = 1$ (2)		
19.	(a)	L_1 : $y = -2x + 4$ Slope $= -2$	½	
		L_2 : $y = 2x - 2$ Slope $= 2$	½	
		$\tan\theta = \left\lvert\frac{m_2 - m_1}{1 + m_1 m_2}\right\rvert$	½	
		$= \left\lvert\frac{2 - -2}{1 + 2\times -2}\right\rvert = \frac{4}{3}$	½	
	(b)	Family of lines $L_1 + \lambda L_2 = 0$	½	
		$(2x + y - 4) + \lambda(2x - y - 2) = 0$	½	
		$(2 + 2\lambda)x + (1 - \lambda)y - 4 - 2\lambda = 0$		
		Slope $= -\frac{(2+2\lambda)}{1-\lambda} = \tan 45 = 1$	1	
		$\lambda = -3$	½	
		$\Rightarrow 2x - 2y = 1$	½	
		Remark: Alternate method : By solving for correct answer give full score		
	(c)	$2x - 2y = 1$		
		$\Rightarrow \frac{x}{1/2} + \frac{y}{-1/2} = 1$		
		x intercept $= \frac{1}{2}$ y intercept $= -\frac{1}{2}$	1	6

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
20.		$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	1	
		$\frac{9}{a^2} + \frac{1}{b^2} = 1$	1	
		$c = ae = 4$	½	
		$c^2 = a^2 - b^2 \Rightarrow a^2 = 16 + b^2$	½	
		$\frac{9}{16+b^2} + \frac{1}{b^2} = 1$	½	
		$9b^2 + 16 + b^2 = 16b^2 + b^4$		
		$b^4 + 6b^2 - 16 = 0$ $\quad b^2 = 2$	½	
		$a^2 = 16 + 2 = 18$	½	
		eqn $\frac{x^2}{18} + \frac{b^2}{2} = 1$		
	(a)	length of major axis $= 2a = 6\sqrt{2}$	½	
	(b)	Standard eqn $\frac{x^2}{18} + \frac{b^2}{2} = 1$	½	
	(c)	$e = \frac{c}{a} = \frac{4}{\sqrt{18}} = \frac{4}{3\sqrt{2}}$	½	
		length of latus rectum $= \frac{2b^2}{a} = \frac{4}{3\sqrt{2}}$	½	6.
		Remark: (i) For any alternate method and correct answer give full score.		
		(ii) $FC = \pm c, 0)$ (½)		
		(iii) length of latus rectum $= \frac{2b^2}{a}$ (½)		
		(iv) $e = \frac{c}{a}$ (½)		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
21.	(a)	$\sin 75 = \sin(45+30)$ $= \sin 45 \cos 30 + \cos 45 \sin 30$ $= \frac{1}{\sqrt{2}} \times \frac{1}{2} + \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2}$ $= \frac{\sqrt{3}+1}{2\sqrt{2}}$	½ ½ ½ ½	
	(b)(i)	$l = r\theta$ $10\pi/3 = 4\theta \Rightarrow \theta = \frac{5\pi}{6}$ $\angle A = \frac{5\pi}{12} = \frac{5\pi \times 180}{12 \times \pi} = 75^0$	½ 1 ½.	
	(ii)	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\frac{a}{\sin 75} = \frac{4\sqrt{2}}{\sin 45} = \frac{c}{\sin 60}$ $\frac{a}{\frac{1+\sqrt{3}}{2\sqrt{2}}} = \frac{4\sqrt{2}}{\frac{1}{\sqrt{2}}} = \frac{c}{\frac{\sqrt{3}}{2}}$ $a = 8\left(\frac{1+\sqrt{3}}{2\sqrt{2}}\right)$ $c = 8 \times \frac{\sqrt{3}}{2}$	1 ½ ½	
		Remark: For $\sin(A+B) = \sin A \cos B + \cos A \sin B$. give (½) score.		6
22.	a.	$9(x-2) \leq 25(2-x)$ $x \leq 2$	1 1	
	(b)		4	6

Remark: For x and y axis (½)
For each line (1) score each
For fesible region (½) score

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
23	(a)	$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$	1	
		$= \lim_{h\to 0} \frac{(x+h)^2 - x^2}{h}$	½	
		$= \lim_{h\to 0} \frac{x^2+h^2+2xh - x^2}{h}$	½	
		$= \lim_{h\to 0} \frac{h^2+2xh}{h} = \lim_{h\to 0}(h+2x)$	½	
		$= 2x$	½	
		Remark: For direct $f'(x) = 2x$ give (1)		
	(b)	$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$	1	
		$= \frac{(1+\tan x)\cdot 1 - x\sec^2 x}{(1+\tan x)^2}$	2	6.
		Remark: (i) $\frac{d}{dx}x = 1$ (½) Score.		
		(ii) $\frac{d}{dx}\tan x = \sec^2 x$ (½) Score.		
24	(a)	$99 = 3 + (n-1)3$	½	
		$\therefore n = 33$	½	
	(b)	$S_{33} = 3+6+9+\cdots+99$		
		$= \frac{33}{2}[6+32\times 3] = 51\times 33$	1	
		Mean $= \frac{51\times 33}{33} = 51$	1	
	(c)	$\Sigma t_n = 3^2+6^2+\cdots+99^2$	½	
		$= \Sigma(3n)^2$	½	
		$= 9\,\frac{n(n+1)(2n+1)}{6}$	½	
		$= \frac{9\times 33\times 34\times 67}{6} = 112761$	½	

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
	d.	Variance $= \frac{\Sigma x_i^2}{n} - (\bar{x})^2$	½	
		$= \frac{11276}{33} - (51)^2$	½	
		$= 816$		
		Remark : For any alternate equation give full score for correct answer.		6.

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
	1.	Joseph. T. S Leo XIII. H.S.S. Alappuzha		
	2	Firos. N.S GVHSS, Ambakkayal, Wayanad		
	3.	Ramesh. K.V, GVHSS Karikkakpuram, Kannur		
	4.	Thomas Thomas Nirmala HSS Chengoli Kannur		
	5	SMAJI. A.K. Nanminda H.S.S. 9446645117		
	6.	Gopalal. G, GVHSS Mavelikara Alappuzha		
	7.	Anandakumar MK SHM Govt VHSS, Edavanna, Malappuram		
	8.	Usha. B, BHSS, Karunagappally, Kollam		
	9.	Baby Sreeja. V, T. K. D. M. G. V. HSS. Kollam		
	10	Shini. P. Francis, GVHSS Thrikkakara Ernakulam		
	11	Binesh. K, GVHS (THS) Vadakara		
	12	Ramakrishnanan S. Durga HS Kanhangad Kasaragod		
	13.	Mini James, SMHSS, Kaliyar, Idukki		
	14)	REJU THOMAS St Johns HSS Kuthuparamba PTA (Dist)		
	15	Mary. P. Jose MARM GVHSS Southpuram Thrissur		
	16	PRIYA. K, AR HSS For Girls, Pavithrapuram, Malappuram		
	17	SHAMSUDEEN K Govt HSS KOPPAM PALAKKAD		
	18	Mini Das CMS HSS Melukavu, Kottayam		
	19	Nisha. K.U GHSS, Narakal Ernakulam		
	20	Francis P.S. ST. Mary's HS Muhuzham Trvm 9447586911		