ANSWER KEY

FIRST YEAR HIGHER SECONDARY EXAMINATION JUNE 2021

PART-I/II/III

SUBJECT: Mathematics (Science)

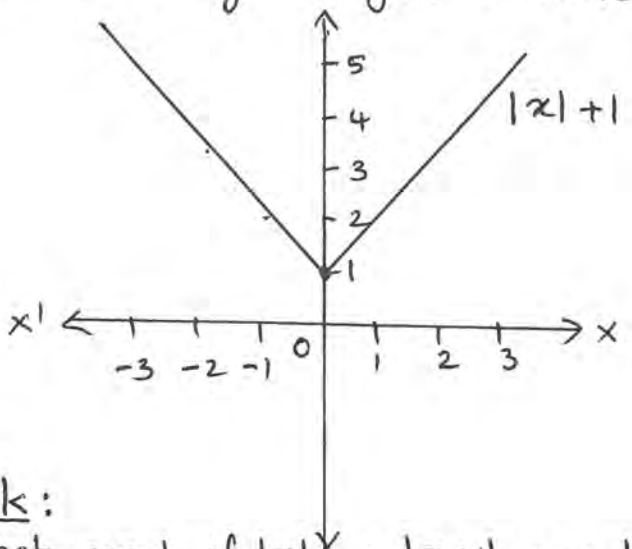
CODE NO: FY27 VERSION: ....

60 SCORES 2 HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1	(i)	(b) ϕ	1	
	(ii)	(a) $A = \{1, 2\}$	1	
		(b) $\{1\}, \{2\}, \{1, 2\}, \phi$	1	3
		Remark (b) For any correct three answer give 1 score.		
2	(i)	$\frac{25\pi}{180}$ or $\frac{5\pi}{36}$	1	
		Remark $1^\circ = \frac{\pi}{180}{}^c$ give ½ score		
	(ii)	$\sin x = \frac{-5}{13}$,	1	
		$\cos x = \frac{-12}{13}$	1	3
		Remark $\sin x = \frac{5}{13}$, and $\cos x = \frac{12}{13}$ give 1½ Score		
3	(i)	$x = \pm 1$	1	
		Remark: 1 for $b^2 = ac$ give ½ score		
		Remark 2 $x = 1$ or $x = -1$ give 1 score		
	(ii)	$a = \sqrt{3}$, $r = \sqrt{3}$	½	
		$a_n = a\, r^{n-1}$	1	
		$= \sqrt{3}\,(\sqrt{3})^{n-1}$	½	3
		$= \sqrt{3}^{\,n}$		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
4		$m_1 = \sqrt{3}$, $m_2 = \frac{1}{\sqrt{3}}$	1	
		$\tan\theta = \left\lvert \frac{m_1 - m_2}{1 + m_1 m_2} \right\rvert$	1	
		$= \left\lvert \frac{\sqrt{3} - \frac{1}{\sqrt{3}}}{1 + 1} \right\rvert$	$\frac{1}{2}$	
		$= \frac{1}{\sqrt{3}}$		
		$\theta = 30^\circ$ or $\frac{\pi}{6}$	$\frac{1}{2}$	3
		Remark: Slope $(m) = \frac{-a}{b}$ give ½ score		
5	(i)	(d) (2, 0)	1	
	(ii)	$x^2 + 6x + 3^2 + y^2 - 4y + 2^2 - 9 - 4 - 3 = 0$	½	
		$(x+3)^2 + (y-2)^2 - 16 = 0$	½	
		$(x+3)^2 + (y-2)^2 = 16$		
		Centre $= (-3, 2)$	½	
		radius $= 4$	½	3
		Remark: Centre $= (-g, -f)$ give ½ score radius $= \sqrt{g^2 + f^2 - c}$ give ½ score		
6		x – coordinate is zero or $x = 0$	1	
		$\frac{mx_2 + nx_1}{m+n} = 0$	½	
		$3m - 2n = 0$	1	
		$3m = 2n$	½	3
		$\frac{m}{n} = \frac{2}{3}$ or $m : n = 2 : 3$		
		Remark: 1 $m : n = k : 1$ and getting correct answer give 3 score.		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		Remark 2 For $\frac{m}{n} = \frac{-x_1}{x_2} = \frac{2}{3}$, $m:n = 2:3$ give 3 score.		
7	(I)	$= 2^2 - 4$	½	
		$= 0$	½	
	(II)	$\lim_{x \to 2} (x+2)$	½	
		$= 4$	½	
		Remark1 $\lim_{x \to a} \frac{x^n - a^n}{x-a} = n a^{n-1}$ give ½ score		
		Remark2 $x^2 - 4 = (x-2)(x+2)$ give ½ score		
	(III)	4	1	3
		Remark $\lim_{x \to 0} \frac{\sin x}{x} = 1$ give ½ score		
8		Assume that $\sqrt{3}$ is rational	1	
		$\sqrt{3} = \frac{a}{b}$, a and b have no common factors	½	
		$3 = \frac{a^2}{b^2}$, $a^2 = 3b^2 \Rightarrow$ 3 divides a	1	
		Let $a = 3c$, $a^2 = 9c^2$,		
		$b^2 = 3c^2 \Rightarrow$ 3 divides b	½	3
		3 is a common factor of both a and b a contradiction, therefore $\sqrt{3}$ is irrational		
9	(I)	(a) $(-4, 5]$	1	
	(II)	$A \cup B = \{2,3,4,5,6\}$	1	
		$(A \cup B)' = \{1,7\}$	½	
		$A' = \{1,5,7\}$	½	
		$B' = \{1,2,6,7\}$	½	
		$A' \cap B' = \{1,7\}$	½	4

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$(A \cup B)' = A' \cap B'$ Remark $A' = U - A$, give ½ score		
10	(i)	$R = \{(1,2), (2,4), (3,6), (4,8)\}$ Domain $= \{1, 2, 3, 4\}$ Range $= \{2, 4, 6, 8\}$ Remark: For writing $R = \{(1,2),(2,4),(3,6),(4,8)\}$ or arrow diagram give 1 score.	1 1	
	(ii)	 Remark: correct graph of $\|x\|$ or $\|x+1\|$ give 1 score	2	4
11	(i)	$P(1) = \frac{1}{2}$ $P(1)$ is true	1	
	(ii)	Assume that $P(k)$ is true $P(k) = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots + \frac{1}{2^k} = 1 - \frac{1}{2^k}$ $P(k+1) = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots + \frac{1}{2^k} + \frac{1}{2^{k+1}}$ $= 1 - \frac{1}{2^k} + \frac{1}{2^{k+1}}$ $= 1 - \frac{1}{2^k}\left(1 - \frac{1}{2}\right)$ $= 1 - \frac{1}{2^{k+1}}$ $P(k+1)$ is true whenever $P(k)$ is true. $\therefore$ PMI $P(n)$ is true for every n	1 1 ½ ½	4

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
12	(i)	$n = 17$	1	
		Remark $n = a+b$ give ½ Score		
	(ii)	${}^{n}P_{r} = \frac{n!}{(n-r)!}$ or $\frac{17!}{(17-r)!}$	1	
	(iii)	Required permutation $= \frac{11!}{2! \times 2! \times 2!}$	2	4
		Remark 1 $\frac{n!}{P_1! \times P_2! \times \cdots P_k!}$ give ½ Score.		
		Rermark 2 : n=11, M's −2, A−2, T−2 give 1 Score.		
13	(i)	11	1	
	(ii)	$T_{r+1} = {}^{n}C_{r}\, a^{n-r}\, b^{r}$	1½	
		$= {}^{10}C_{r}\, x^{10-r} (9y)^{r}$	½	
	(iii)	$T_5 = {}^{10}C_4\, x^{10-4} (9y)^4$	1	4
		$= {}^{10}C_4\, x^6\, 9^4\, y^4$		
		Remark: r=4, give ½ Score.		
14		$S_n = 8 + 88 + \cdots$ n terms	½	
		$= 8[1 + 11 + \cdots$ n terms$]$	½	
		$= \frac{8}{9}[9 + 99 + \cdots$ n terms$]$	1	
		$= \frac{8}{9}[(10-1) + (100-1) + \cdots +$ n terms$]$	1	
		$= \frac{8}{9}[(10 + 100 + \cdots +$ n terms$) - (1 + 1 + \cdots +$ n terms$)]$		
		$= \frac{8}{9}\left[\frac{10(10^n - 1)}{9} - n\right]$	1	4
		Remark: $S_n = \frac{a(r^n - 1)}{r-1}$ give 1 Score.		
		Remark 2 : For direct answer give 1 Score.		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
15	(i)	Slope $= \frac{1}{7}$	1	
	(ii)	Slope of perpendicular line $= -7$	1	
		$(x_1, y_1) = (3, 0)$	½	
		$y - y_1 = m(x - x_1)$ or $y = m(x - d)$	1	
		$y - 0 = -7(x - 3)$	½	4
		$7x + y - 21 = 0$		
		Remark $m_1 \times m_2 = -1$ give ½ score		
		Remark 2 Alternate method with correct answer give 3 score.		
16		$a^2 = 36$, $b^2 = 16$, $c^2 = a^2 - b^2 = 20$		
		$c = \sqrt{20}$		
		foci $= (\pm\sqrt{20}, 0)$	1	
		Vertices $= (\pm 6, 0)$	1	
		Length of major axis $= 12$	1	
		Length of latus rectum $= \frac{32}{6}$ or $\frac{16}{3}$	1	4
		Remark $a^2 = 36$, $b^2 = 16$, $c^2 = 20$ give ½ score each		
		Remark For each formula give ½ score		
17	(i)	$P(A \text{ or } B) = P(A \cup B) = P(A) + P(B) - P(A \cap B)$	1	
		$= 0.54 + 0.69 - 0.35$	½	
		$= 0.88$	½	
	(ii)	$P(A' \cap B') = P(A \cup B)'$	½	
		$= 1 - P(A \cup B)$	½	
		$= 0.12$	1	4
		Remark For $P(A' \cap B') = 1 - 0.88 = 0.12$ give 2 score		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
18	(i)	$\cos x - \cos y = -2\sin\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)$	½	
		$\sin x - \sin y = 2\cos\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)$	½	
		$\frac{\cos 9x - \cos 5x}{\sin 17x - \sin 3x} = \frac{-2\sin 7x \sin 2x}{2\cos 10x \sin 7x}$	1	
		$= -\frac{\sin 2x}{\cos 10x}$	1	3
	(ii)	$\sin x = \frac{-\sqrt{3}}{2}$		
		Principal solution $= 4\frac{\pi}{3}$ or $5\frac{\pi}{3}$	1	
		general solution, $x = n\pi + (-1)^n \frac{4\pi}{3}$, $n \in Z$	2	3
		Remark: $x = n\pi + (-1)^n y$, $n \in Z$ give 1 score		
		Remark 2 $\sin x = \sin\left(-\frac{\pi}{3}\right)$ give ½ Score		
19	(i)	$r = \sqrt{4} = 2$	1	
		$\cos\theta = -\frac{1}{2}$, $\sin\theta = \frac{\sqrt{3}}{2}$	½	
		$\theta = \frac{2\pi}{3}$	½	
		$z = r[\cos\theta + i\sin\theta]$		
		$= 2\left[\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right]$	1	3
		Remark		
		$z = r(\cos\theta + i\sin\theta)$ give 1 score		
		Remark 2 $\tan\theta = \left\lvert\frac{b}{a}\right\rvert$ give ½ Score		
		$r = \sqrt{a^2+b^2}$ give ½ Score.		
	(ii)	$x = \frac{-1 \pm \sqrt{1-20}}{2\sqrt{5}}$	2	
		$= \frac{-1 \pm \sqrt{19}\, i}{2\sqrt{5}}$	1	3
		Remark $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ give 1 score		

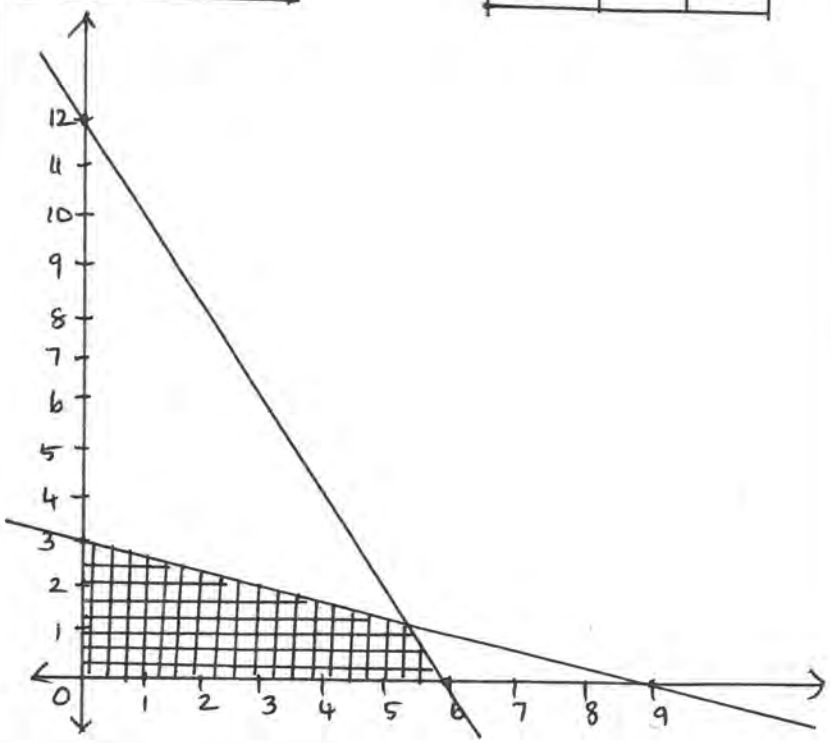
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
20	(i)	$9(x-2) \leq 25(2-x)$	½	
		$9x - 18 \leq 50 - 25x$	½	
		$9x + 25x \leq 50 + 18$		
		$34x \leq 68$	½	
		$x \leq 2$	½	2
	(ii)	$x + 3y = 9$		

x	0	9
y	3	0

$2x + y = 12$

x	0	6
y	12	0

1 | 4



3

Remark : 1 correct lines and incorrect feasible region give $3\frac{1}{2}$ score

Remark 2 Draw seperate graphs for each inequality give 4 score
(Reason : 'System' of inequalities is not mentioned in the question)

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
21	(I)	$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$	1	
		$= \lim_{h\to 0} \frac{\cos(x+h) - \cos x}{h}$	1	
		$= \lim_{h\to 0} \frac{-2\sin x \sin\left(\frac{h}{2}\right)}{h}$	$\frac{1}{2}$	
		$= -\sin x$	$\frac{1}{2}$	3
		Remark: For direct answer give 1 score		
	(II)	$f'(x) = \frac{(3x-1)(2x) - x^2 \cdot 3}{(3x-1)^2}$	3	3
		$= \frac{6x^2 - 2x - 3x^2}{(3x-1)^2} = \frac{3x^2 - 2x}{(3x-1)^2}$		
		Remark Give 1 score for Quotient rule.		
22				

Class	f_i	x_i	$f_i x_i$	$f_i x_i^2$
0 – 10	6	5	30	150
10 – 20	8	15	120	1800
20 – 30	14	25	350	8750
30 – 40	16	35	560	19600
40 – 50	4	45	180	8100
50 – 60	2	55	110	6050
	50		1350	44450

	(I)	Mean $= \bar{x} = \frac{\sum f_i x_i}{N} = \frac{1350}{50} = 27$	2	
	(II)	Variance $(\sigma^2) = \frac{\sum f_i x_i^2}{N} - (\bar{x})^2 = 160$	3	
	(III)	Standard deviation $(\sigma) = \sqrt{160}$	1	6
		Remark 1 for correct table give 3 Score		
		Remark 2 Give $\frac{1}{2}$ Score for each formula		
		Remark 3 Give 6 Score for alternate method		

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