ANSWER KEY

FIRST YEAR HIGHER SECONDARY EXAMINATION SEPTEMBER 2021

PART-1/2/3

SUBJECT : MATHEMATICS(SCIENCE)

60 SCORES CODE No: FY 227 2 HOURS

Qn No	Sub Qn	Answer Key/Value points	Score	Total score
1	(i)	$A = \{1, 2, 3, 4, 5\}$	1	3
	(ii)	$A \cap B = \{1, 2\}$	1	
	(iii)	$A - B = \{3, 4, 5\}$	1	
		Remark:- If A is wrong and $A \cap B$ and $A - B$ are correct with that A give full score for (ii) and (iii)		
2		$a = 105 \quad a_n = 995$	$\frac{1}{2}$	
		$d = 5$		
		$n = \frac{a_n - a}{d} + 1$	$\frac{1}{2}$	
		$= \frac{995 - 105}{5} + 1 = 179$	$\frac{1}{2}$	
		$S_n = \frac{n}{2}[a + a_n]$	$\frac{1}{2}$	

QN No	Sub Qn	Answer Key/Value points	Score	Total score
		$= \frac{179}{2}[105+995]$	$\frac{1}{2}$	3
		$= 98450$	$\frac{1}{2}$	
		Remark: Any correct formula for S_n give $\frac{1}{2}$ score		
3		$(2x+3)^5 = {}^5C_0(2x)^5 + {}^5C_1(2x)^4 \times 3 + {}^5C_2(2x)^3 \times 3^2 + {}^5C_3(2x)^2 \times 3^3 + {}^5C_4(2x) \times 3^4 + {}^5C_5(3)^5$	$2\frac{1}{2}$	3
		$= 32x^5 + 240x^4 + 720x^3 + 1080x^2 + 810x + 243$	$\frac{1}{2}$	
		Remark:- For Binomial theorem $(a+b)^n = {}^nC_0 a^n + {}^nC_1 a^{n-1}b + \cdots + {}^nC_n b^n$ give 1 score		
4		$\lim_{x \to 0^-} f(x) = \lim_{x \to 0} (2x+3) = 3$	1	3
		$\lim_{x \to 0^+} f(x) = \lim_{x \to 0} 3(x+1) = 3$	1	
		$\therefore \lim_{x \to 0} f(x) = 3$	1	

QN No	Sub Qn	Answer Key/Value points	Score	Total score
		Remark :— For direct answer give full score For concept of left limit, right limit give 1 score each		
5		Let A be the set of students who speak Hindi and B be the set of students who speak English $n(A \cup B) = 400,\ n(A) = 250,\ n(B) = 200$ $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ $n(A \cap B) = 250 + 200 - 400$ $= 50$ Remark :— For direct answer give full score For any alternate method give full score	1 1 1	3
6	(i)	$3y = -2x + 6$ $y = \frac{-2}{3}x + \frac{6}{3}$ $y = -\frac{2}{3}x + 2$	$\frac{1}{2}$ $\frac{1}{2}$	

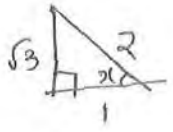
QN No	Sub Qn	Answer Key/Value points	Score	Total score
		slope $= \frac{-2}{3}$	1	3
	(ii)	y intercept $= 2$	1	
		Remark:—		
		(i) $A=2$, $B=3$, $C=-6$ (give $\frac{1}{2}$ score)		
		slope $= -\frac{A}{B} = \frac{-2}{3}$ (give $1\frac{1}{2}$ score)		
		(ii) y intercept $= \frac{-C}{B} = \frac{6}{3} = 2$ (give 1 score)		
		For writing $y = mx + c$ (give 1 score)		
7		$y^2 = 12x$		
		$4a = 12$		
		$a = 3$	$\frac{1}{2}$	
	(i)	Focus $= (a, 0)$	$\frac{1}{2}$	3
		$= (3, 0)$		
	(ii)	Equation of directrix		
		$x = -a$	1	
		$x = -3$		
	(iii)	Length of latus rectum =		
		$4a = 4 \times 3$	1	
		$= 12$		

QN No	Sub Qn	Answer Key/Value points	Score	Total score
		Remark:— For $y^2 = 4ax$ give $\frac{1}{2}$ score		
8	(i)	(b) YZ plane	1	
	(ii)	$PQ = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2}$	1	
		$= \sqrt{(2--3)^2+(4-7)^2+(-1-2)^2}$	$\frac{1}{2}$	3
		$= \sqrt{5^2+(-3)^2+(-3)^2}$		
		$= \sqrt{25+9+9}$	$\frac{1}{2}$	
		$= \sqrt{43}$		
9		$P(n): 7^n-3^n$ is divisible by 4 for all $n \in N$		
		$P(1): 7^1-3^1$ is divisible by 4		
		4 is divisible by 4		
		$\therefore P(1)$ is true	1	
		Assume that $P(k)$ is true		
		$P(k): 7^k-3^k$ is divisible by 4	1	
		$7^k-3^k = 4d$		
		$7^k = 4d+3^k$		

QN No	Sub Qn	Answer Key/Value points	Score	Total score
		We want to prove that $P(k+1)$ is true Consider $7^{k+1} - 3^{k+1} = 7^k \times 7 - 3^k \times 3$ $= (4d + 3^k) \times 7 - 3^k \times 3$ $= 4d \times 7 + 3^k (7-3)$ $= 4 [7d + 3^k]$ is divisible by 4 $\therefore P(k+1)$ is true whenever $P(k)$ is true $\therefore$ By PMI $P(n)$ is true for every positive integer n Remark:- To prove $P(k+1)$ true alternate methods can be used.	1	3
10	(i)	$T_{r+1} = {}^nC_r \, a^{n-r} b^r$ OR $T_{r+1} = (-1)^r \, {}^nC_r \, a^{n-r} b^r$	1	
		$T_{r+1} = {}^{12}C_r \, x^{12-r} (-2y)^r$ OR $T_{r+1} = (-1)^r \, {}^{12}C_r \, x^{12-r} \times 2^r \times y^r$	1	
	(ii)	To find T_4 put $r = 3$	$\frac{1}{2}$	

QN No	Sub Qn	Answer Key/Value points	Score	Total score
.		$T_4 = (-1)^3 \times {}^{12}C_3 \times x^{12-3} \times 2^3 y^3$	$\frac{1}{2}$	3
		$= -{}^{12}C_3 \, x^9 \times 8y^3$		
		$= -1760 \, x^9 y^3$		
11		Let XY plane divide the line segment joining the points (4, 8, 10) and (6, 10, −8) in the ratio $k:1$		
		Its Z-co-ordinate is zero	1	3
		$\frac{-8k+10}{k+1} = 0$	1	
		$-8k+10 = 0$		
		$k = \frac{5}{4}$	1	
		$\therefore$ Required ratio = 5:4		
		Remark:- Alternate method give full score		

QN No	Sub Qn	Answer Key/Value points	Score	Total score
12.	(i)	It is false that every natural number is greater than zero OR There exists a natural number which is not greater than zero OR It is not the case that every natural number is greater than zero	1	3
	(ii)	Converse If a number n is even then n^2 is even	1	
		Contrapositive If a number n is not even then n^2 is not even	1	
13	(i)	(c) 8.	1	4
	(ii)	$\{1,2\}, \{2,3\}, \{1,3\}$	2	
	(iii)	$A' = \{4,5,6\}$	1	
		Remark :- (ii) For writing all subsets of A (give full score) (iii) For $A' = U - A$ (give $\frac{1}{2}$ score)		

QN No	Sub Qn	Answer Key/Value points	Score	Total score
14	(i)	$x+1 = 3$; $y-2 = 1$	1	4
		$x = 2$; $y = 3$	1	
	(ii)	$A \times B = \{(1,3), (1,4), (2,3), (2,4), (3,3), (3,4)\}$	2	
		Remark :- (ii) If any 5 entries are correct give full score. For arrow diagram also give full score		
15	(i)	$\sin x = -\frac{\sqrt{3}}{2}$	1	4
		$\tan x = \sqrt{3}$	1	
				
	(ii)	$\sin^2 \frac{\pi}{6} + \cos^2 \frac{\pi}{3} = \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2$	1	
		$= \frac{1}{4} + \frac{1}{4}$	1	
		$= \frac{1}{2}$		
		Remark :- For $\sin x = \frac{\sqrt{3}}{2}$ give $\frac{1}{2}$ score		
		$\sin \frac{\pi}{6} = \frac{1}{2}$; $\cos \frac{\pi}{3} = \frac{1}{2}$ give $\frac{1}{2}$ score each		

QN No	Sub Qn	Answer Key/Value points	Score	Total score
16	(i)	$P(n): 1+3+3^2+\cdots+3^{n-1} = \frac{3^n-1}{2}$		
		$P(1): \quad 1 = \frac{3^1-1}{2}$		
		$1 = 1$		
		$\therefore P(1)$ is true	1	
	(ii)	Assume that $P(k)$ is true		
		$P(k): 1+3+3^2+\cdots+3^{k-1} = \frac{3^k-1}{2}$	1	
		LHS of $P(k+1): 1+3+3^2+\cdots+3^{k-1}+3^k$	1	4
		$= \frac{3^k-1}{2} + 3^k$	$\frac{1}{2}$	
		$= \frac{3^k-1+2\times3^k}{2}$		
		$= \frac{3\times3^k-1}{2}$		
		$= \frac{3^{k+1}-1}{2}$	$\frac{1}{2}$	
		$\therefore P(k+1)$ is true		
		$\therefore$ By PMI $P(n)$ is true for all $n \in N$		
17	(i)	b) i	1	
	(ii)	$Z = 21 + 21i + 7i - 7$	2	4
		$= 14 + 28i$	1	
		Remark:-		
		Alternate method give full score		

QN No	Sub Qn	Answer Key/Value points	Score	Total score
18		$Z = 1 + i\sqrt{3}$		
		Polar form is, $Z = r(\cos\theta + i\sin\theta)$	1	
		$r\cos\theta = 1$; $r\sin\theta = \sqrt{3}$		
		By squaring and adding,		4
		$r^2(\cos^2\theta + \sin^2\theta) = 4$		
		$r = 2$	$1\frac{1}{2}$	
		$\therefore \cos\theta = \frac{1}{2}$; $\sin\theta = \frac{\sqrt{3}}{2}$		
		$\therefore \theta = \frac{\pi}{3}$	$1\frac{1}{2}$	
		$\therefore$ Polar form is,		
		$Z = 2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$		
		Remark :-		
		$r = \sqrt{x^2+y^2}$ give 1 score		
		For alternate method give full score		
19	(i)	d) 10	1	
	(ii)	No: of chords $= {}^{21}C_2$	3	4
		$= 210$		
		Remark :-		
		For idea of combination give 1 score		
20	(i)	No: of 3 digit numbers $= 5 \times 4 \times 3$		
		$= 60$	2	

QN No	Sub Qn	Answer Key/Value points	Score	Total score
	(ii)	There are 4 A's 2 L's 1 H 1 B 1 D	$\frac{1}{2}$	4
		Required permutation $= \frac{9!}{4! \wedge 2!}$	$1\frac{1}{2}$	
		$= 7560$		
		Remark: (i) For $5P_3$ give full score		
21		$m_1 = \frac{1}{7}$	1	4
		$m_2 = -7$	1	
		$y - y_1 = m(x - x_1)$	1	
		$y + 3 = -7(x - 2)$	1	
		$y + 7x - 11 = 0$		
		$7x + y - 11 = 0$		
		Remark:- $m_1 \times m_2 = -1$ give 1 score		
22	(i)	Equation of the ellipse is, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	1	
		$a = 5, \quad c = 4$	$\frac{1}{2}$	
		$c^2 = a^2 - b^2$	1	
		$b^2 = a^2 - c^2 = 25 - 16 = 9$		
		Ellipse is, $\frac{x^2}{25} + \frac{y^2}{9} = 1$	$\frac{1}{2}$	

QN No	Sub Qn	Answer Key/Value points	Score	Total score
	(ii)	$e = \frac{c}{a} = \frac{4}{5}$	$\frac{1}{2}+\frac{1}{2}$	4
Q3	(i)	$f(x) = x(x^2+2x+1)$		
		$= x^3 + 2x^2 + x$	1	
		$f'(x) = 3x^2 + 4x + 1$	1	4
	(ii)	$f(x) = \frac{x+1}{x} = 1 + \frac{1}{x}$	1	
		$f'(x) = \frac{-1}{x^2}$	1	

Remark :-

(i) For product rule give 1 score

$f'(x) = x(2x+2) + (x^2+2x+1)\times 1$ give $\frac{1}{2}$ score

$= 2x^2+2x+x^2+2x+1$

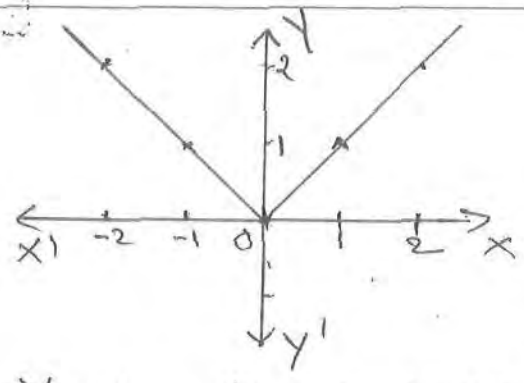
$= 3x^2+4x+1$ (give $\frac{1}{2}$ score)

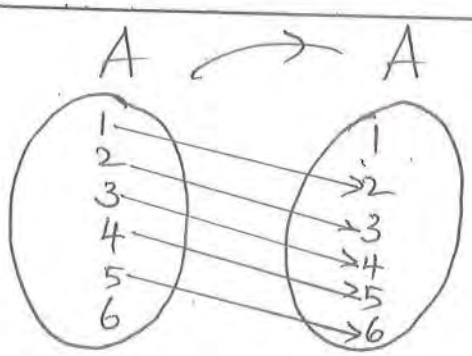
(ii) For quotient rule give 1 score

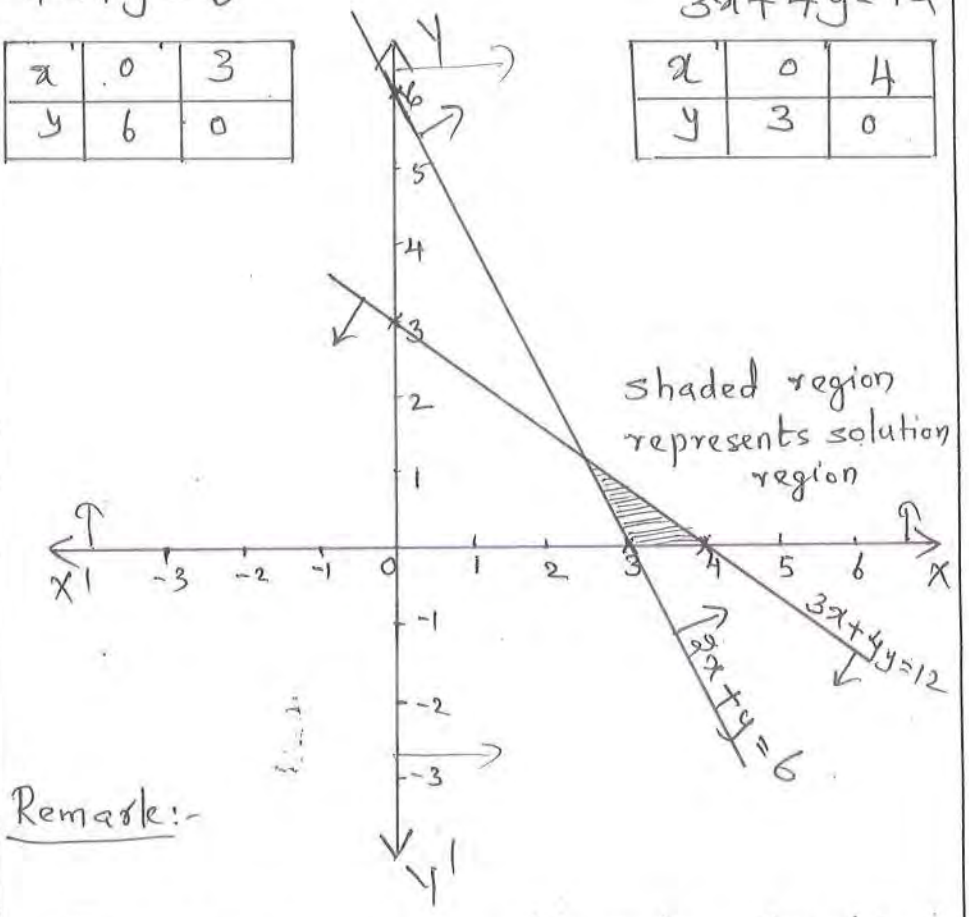
$f'(x) = \frac{x \times \frac{d}{dx}(x+1) - (x+1)\times \frac{d}{dx}x}{x^2}$ (give $\frac{1}{2}$ score)

$= \frac{x\times 1 - (x+1)\times 1}{x^2}$

$= \frac{-1}{x^2}$ (give $\frac{1}{2}$ score)

QN No	Sub Qn	Answer Key/Value points	Score	Total score
24		Assume that $\sqrt{5}$ is rational $\sqrt{5} = \frac{a}{b}$, where a and b are real numbers, $b \neq 0$, a and b have no common factor	1	
		Squaring, $5 = \frac{a^2}{b^2}$ $a^2 = 5b^2 \Rightarrow$ 5 divides a	1	4
		$\therefore$ There exists an integer c such that $a = 5c$ squaring $a^2 = 25c^2$ Also $a^2 = 5b^2$ $\therefore 5b^2 = 25c^2$ $b^2 = 5c^2 \Rightarrow$ 5 divides b	1	
		$\therefore$ 5 is a common factor of a and b This contradicts our assumption $\therefore \sqrt{5}$ is irrational	1	
25	(i)	 Remark :- For X-axis and Y-axis give 1 score	3	

QN No	Sub Qn	Answer Key/Value points	Score	Total score
	(ii) (a)		2	6
	(b)	Domain = $\{1, 2, 3, 4, 5\}$	1	
		Remark: (ii)(a) For roster form give 1 score $\{(1,2), (2,3), (3,4), (4,5), (5,6)\}$		
26	(i)	$\sin 75^0 = \sin(45^0 + 30^0)$	$\frac{1}{2}$	6
		$= \sin 45 \cos 30 + \cos 45 \sin 30$	$1\frac{1}{2}$	
		$= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \times \frac{1}{2}$	1	
		$= \frac{\sqrt{3}+1}{2\sqrt{2}}$		
	(ii)	$\frac{\sin 5x + \sin 3x}{\cos 5x + \cos 3x}$		
		$= \frac{2\sin\left(\frac{5x+3x}{2}\right)\cos\left(\frac{5x-3x}{2}\right)}{2\cos\left(\frac{5x+3x}{2}\right) \times \cos\left(\frac{5x-3x}{2}\right)}$	2	
		$= \frac{2\sin 4x \cos x}{2\cos 4x \cdot \cos x}$		
		$= \frac{\sin 4x}{\cos 4x}$		
		$= \tan 4x$	1	

QN No	Sub Qn	Answer Key/Value points	Score	Total score
		Remark:- (i) $\sin(x+y) = \sin x \cos y + \cos x \sin y$ give 1 score (ii) $\sin x + \sin y = 2\sin\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$ give 1 score $\cos x + \cos y = 2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$ give 1 score		
27		$2x+y=6$ $3x+4y=12$  **Remark:-** For X-axis and Y-axis give 1 score For each correct line give 1 score If the shaded region is incorrect reduce only $\frac{1}{2}$ score	1+1 4	6

x	0	3
y	6	0

x	0	4
y	3	0

QN No	Sub Qn	Answer Key/Value points	Score	Total score
28.	(i)	$a = 5 \qquad r = 5$	$\frac{1}{2}+\frac{1}{2}$	
		$a_n = ar^{n-1}$	$\frac{1}{2}$	
		$a_{12} = ar^{11} = 5 \times 5^{11} = 5^{12}$	$\frac{1}{2}$	
	(ii)	$S_n = 8 + 88 + 888 + \cdots$ n terms		
		$= 8\,[1 + 11 + 111 + \cdots$ n terms$]$	$\frac{1}{2}$	
		$= \frac{8}{9}\,[9 + 99 + 999 + \cdots$ n terms$]$	$\frac{1}{2}$	6
		$= \frac{8}{9}\,[(10-1) + (100-1) + (1000-1) + \cdots$ n terms$]$	1	
		$= \frac{8}{9}\,[(10 + 100 + 1000 + \cdots$ n terms$) - (1 + 1 + \cdots$ n terms$)]$	1	
		$= \frac{8}{9}\left[\frac{10(10^n - 1)}{10 - 1} - n\right]$	1	
		$= \frac{8}{9}\left[\frac{10(10^n - 1)}{9} - n\right]$		

Remark :

(i) For direct answer give full score

(ii) For the formula for S_n of G.P give 1 score

QN No	Sub Qn	Answer Key/Value points	Score	Total score

29.

class	f_i	x_i	$f_i x_i$	$(x_i-\bar{x})^2$	$f_i(x_i-\bar{x})^2$
30-40	3	35	105	729	2187
40-50	7	45	315	289	2023
50-60	12	55	660	49	588
60-70	15	65	975	9	135
70-80	8	75	600	169	1352
80-90	3	85	255	529	1587
90-100	2	95	190	1089	2178
	N=50		3100		10050

(i) $\text{Mean} = \frac{\sum f_i x_i}{N}$ — 1

$= \frac{3100}{50} = 62$ — 1

(ii) $\text{Variance} = \sigma^2 = \frac{1}{N}\sum f_i(x_i-\bar{x})^2$ — 1

$= \frac{1}{50} \times 10050$ — 1

$= 201$ — 1

(iii) $S.D = \sqrt{\text{variance}}$ — $\frac{1}{2}$

$= \sqrt{201} = 14.18$ — $\frac{1}{2}$

Remark:-
Alternate method give full score
For any correct table give 3 scores
Formula for mean (give 1 score)
Variance (give 1 score)
S.D (give $\frac{1}{2}$ score)

Total score: 6

QN No	Sub Qn	Answer Key/Value points	Score	Total score
30	(i)	$S = \{HH, HT, TH, TT\}$	1	
		Event of atleast 1 tail = E		
		$E = \{HT, TH, TT\}$		
		$P(\text{atleast 1 tail}) = \frac{n(E)}{n(S)} = \frac{3}{4}$	1	
	(ii) a	$P(E \text{ or } F) = P(E \cup F)$	$\frac{1}{2}$	6
		$= P(E) + P(F) - P(E \cap F)$	1	
		$= \frac{1}{4} + \frac{1}{2} - \frac{1}{8}$	$\frac{1}{2}$	
		$= \frac{5}{8}$		
	(b)	$P(\text{not E and not F}) = P(E' \cap F')$	$\frac{1}{2}$	
		$= P(E \cup F)'$	$\frac{1}{2}$	
		$= 1 - P(E \cup F)$	$\frac{1}{2}$	
		$= 1 - \frac{5}{8}$		
		$= \frac{3}{8}$	$\frac{1}{2}$	
		Remark :-		
		(i) For formula give 1 score		
		For direct answer give full score		

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