

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) $A = \{1, 2, 3, 4, 5\}$ ii) $A \cap B = \{1, 2\}$ iii) $A - B = \{3, 4, 5\}$	Remark:- If A is wrong and $A \cap B$ and $A - B$ are correct with that A give full score for ii) and iii)	1 1 1	3
2	$a = 105$ $a_n = 995$ $d = 5$ $n = \frac{a_n - a}{d} + 1$ $= \frac{995 - 105}{5} + 1 = 179$ $S_n = \frac{n}{2} [a + a_n]$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$		

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

QN No	Sub Qn	Answer Key/Value points	Score	Total score
		<u>Remark:-</u> 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 $n(A \cup B) = 400, n(A) = 250, n(B) = 200$ $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ $n(A \cap B) = 250 + 200 - 400$ $= 50$	1 1 1	3
		<u>Remark:-</u> For direct answer give full score For any alternate method give full score		
6	①	$3y = -2x + 6$ $y = -\frac{2}{3}x + \frac{6}{3}$ $y = -\frac{2}{3}x + 2$	$\frac{1}{2}$ $\frac{1}{2}$	

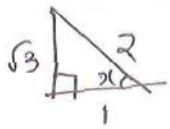
QN No	Sub Qn	Answer Key/Value points	Score	Total score
		$\text{slope} = -\frac{2}{3}$	1	3
	ii	$y \text{ intercept} = 2$ <u>Remark:—</u> ① $A=2, B=3, C=-6$ (give $\frac{1}{2}$ score) $\text{slope} = -\frac{A}{B} = -\frac{2}{3}$ (give $\frac{1}{2}$ score) ② $y \text{ intercept} = -\frac{C}{B} = \frac{6}{3}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

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	3
	(ii)	$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$ $= \sqrt{(2 - -3)^2 + (4 - 7)^2 + (-1 - 2)^2}$ $= \sqrt{5^2 + (-3)^2 + (-3)^2}$ $= \sqrt{25 + 9 + 9}$ $= \sqrt{43}$	1	
			$\frac{1}{2}$	
			$\frac{1}{2}$	
9		$P(n): 7^n - 3^n$ is divisible by 4 for all $n \in \mathbb{N}$ $P(1): 7^1 - 3^1$ is divisible by 4 4 is divisible by 4 $\therefore P(1)$ is true Assume that $P(k)$ is true $P(k): 7^k - 3^k$ is divisible by 4 $7^k - 3^k = 4d$ $7^k = 4d + 3^k$	1	

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 <u>Remark:-</u> To prove $P(k+1)$ true alternate methods can be used.	1	3
10	(i) $T_{x+1} = nC_x a^{n-x} b^x$ OR $T_{x+1} = (-1)^x nC_x a^{n-x} b^x$ $T_{x+1} = 12C_x x^{12-x} (-2y)^x$ OR $T_{x+1} = (-1)^x 12C_x x^{12-x} \times 2^x y^x$ (ii) To find T_4 put $x=3$	1 1 $\frac{1}{2}$		

QN No	Sub Qn	Answer Key/Value points	Score	Total score
		$T_4 = (-1)^3 \times 12 C_3 \times x^{12-3} \times 2^3 y^3$ $= -12 C_3 \times x^9 \times 8 y^3$ $= -1760 x^9 y^3$	$\frac{1}{2}$	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 $\frac{-8k + 10}{k + 1} = 0$ $-8k + 10 = 0$ $k = \frac{5}{4}$ $\therefore$ Required ratio = 5:4 <u>Remark:-</u> Alternate method give full score	1 1 1	3

Qn No	Sub Qn	Answer Key/Value points	Score	Total score
12	① 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 ② <u>Converse</u> If a number n is even then n^2 is even <u>Contrapositive</u> If a number n is not even then n^2 is not even	1 1 1	3	
13	① (c) 8 ② $\{1, 2\}, \{2, 3\}, \{1, 3\}$ ③ $A' = \{4, 5, 6\}$ <u>Remark:-</u> (ii) For writing all subsets of A (give full score) (iii) For $A' = U - A$ (give $\frac{1}{2}$ score)	1 2 1	4	

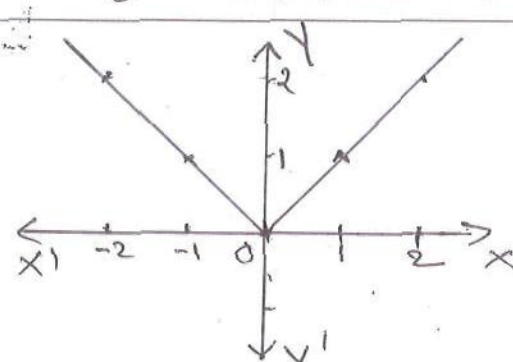
QN No	Sub Qn	Answer Key/Value points	Score	Total score
14	(i)	$x+1 = 3$; $y-2 = 1$ $x = 2$; $y = 3$	1 1	4
	(ii)	$A \times B = \{(1,3), (1,4), (2,3), (2,4), (3,3), (3,4)\}$ Remark:- If any 5 entries are correct give full score. For arrow diagram also give full score	2	
15	(i)	$\sin \alpha = -\frac{\sqrt{3}}{2}$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

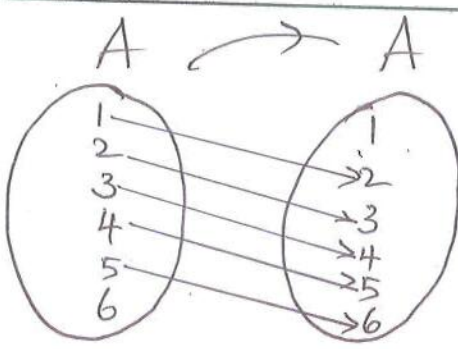
QN No	Sub Qn	Answer Key/Value points	Score	Total score
16	(i)	$P(n): 1+3+3^2+\dots+3^{n-1} = \frac{3^n-1}{2}$ $P(1): 1 = \frac{3^1-1}{2}$ $1 = 1$ $\therefore P(1) \text{ is true}$	1	
	(ii)	Assume that $P(k)$ is true $P(k): 1+3+3^2+\dots+3^{k-1} = \frac{3^k-1}{2}$ LHS of $P(k+1): 1+3+3^2+\dots+3^{k-1}+3^k$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

Qn No	Sub Qn	Answer Key/Value points	Score	Total score
18		$Z = 1 + i\sqrt{3}$ Polar form is, $Z = r(\cos \theta + i \sin \theta)$ $r \cos \theta = 1 ; r \sin \theta = \sqrt{3}$ By squaring and adding, $r^2 (\cos^2 \theta + \sin^2 \theta) = 4$ $r = 2$ $\therefore \cos \theta = \frac{1}{2} ; \sin \theta = \frac{\sqrt{3}}{2}$ $\therefore \theta = \frac{\pi}{3}$ $\therefore$ Polar form is, $Z = 2 \left(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3} \right)$ <u>Remark:-</u> $r = \sqrt{x^2 + y^2}$ give 1 score for alternate method give full score	1 $1\frac{1}{2}$ $1\frac{1}{2}$	4
19	(i) d) 10 (ii) No. of chords = 2P_2 $= 2 \times 1 = 2$	<u>Remark:-</u> For idea of combination give 1 score	1 3	4
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 Required permutation = $\frac{9!}{4!1!2!}$ = 7560 Remark: ① For $5P_3$ give full score	$\frac{1}{2}$ $1\frac{1}{2}$	4
21		$m_1 = \frac{1}{7}$ $m_2 = -7$ $y - y_1 = m(x - x_1)$ $y + 3 = -7(x - 2)$ $y + 7x - 11 = 0$ $7x + y - 11 = 0$ Remark:- $m_1 \times m_2 = -1$ give 1 score	1 1 1 1	4
22	①	Equation of the ellipse is, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ $a = 5, c = 4$ $c^2 = a^2 - b^2$ $b^2 = a^2 - c^2 = 25 - 16 = 9$ Ellipse is, $\frac{x^2}{25} + \frac{y^2}{9} = 1$	1 $\frac{1}{2}$ 1 $\frac{1}{2}$	

QN No	Sub Qn	Answer Key/Value points	Score	Total score
	(i)	$e = \frac{c}{a} = \frac{4}{5}$	$\frac{1}{2} + \frac{1}{2}$	4
23	(i)	$f(x) = x(x^2 + 2x + 1)$ $= x^3 + 2x^2 + x$ $f'(x) = 3x^2 + 4x + 1$	1 1	4
	(ii)	$f(x) = \frac{x+1}{x} = 1 + \frac{1}{x}$ $f'(x) = -\frac{1}{x^2}$	1 1	
		<u>Remark :-</u>		
		(i) For product rule give 1 score $f'(x) = x(2x+2) + (x^2+2x+1)x$ give $\frac{1}{2}$ score $= 2x^2 + 2x + x^2 + 2x + 1$ $= 3x^2 + 4x + 1 \quad (\text{give } \frac{1}{2} \text{ score})$		
		(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) $= \frac{x \times 1 - (x+1) \times 1}{x^2}$ $= -\frac{1}{x^2} \quad (\text{give } \frac{1}{2} \text{ score})$		

Qn No	Sub Qn	Answer Key/Value points	Score	Total score
24		Assume that $\sqrt{5}$ is rational $\sqrt{5} = \frac{a}{b}, \text{ where } a \text{ and } b \text{ are real numbers, } b \neq 0, a \text{ and } b \text{ have no common factor}$ Squaring, $5 = \frac{a^2}{b^2}$ $a^2 = 5b^2 \Rightarrow 5 \text{ divides } a$ $\therefore$ There exists an integer c such that $a = 5c$ Squaring $a^2 = 25c^2 \quad \text{Also } a^2 = 5b^2$ $\therefore 5b^2 = 25c^2$ $b^2 = 5c^2 \Rightarrow 5 \text{ divides } b$ $\therefore 5$ is a common factor of a and b This contradicts our assumption $\therefore \sqrt{5}$ is irrational	1 1 1 1 1 1	4
25	①	 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 = $\{1, 2, 3, 4, 5\}$ Remark: (ii)(a) For roster form give 1 score $\{(1,2), (2,3), (3,4), (4,5), (5,6)\}$	1	
26	(i)	$\sin 75^\circ = \sin (45^\circ + 30^\circ)$ $= \sin 45^\circ \cos 30^\circ + \cos 45^\circ \sin 30^\circ$ $= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \times \frac{1}{2}$ $= \frac{\sqrt{3} + 1}{2\sqrt{2}}$	$\frac{1}{2}$ $1\frac{1}{2}$ 1	6
	(ii)	$\frac{\sin 5x + \sin 3x}{\cos 5x + \cos 3x}$ $= \frac{2 \sin \left(\frac{5x+3x}{2} \right) \cos \left(\frac{5x-3x}{2} \right)}{2 \cos \left(\frac{5x+3x}{2} \right) \cos \left(\frac{5x-3x}{2} \right)}$ $= \frac{2 \sin 4x \cos x}{2 \cos 4x \cos x}$ $= \frac{\sin 4x}{\cos 4x}$ $= \tan 4x$	2 1	

Qn No	Sub Qn	Answer Key/Value points	Score	Total score												
		<u>Remark:-</u> (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														
7		$2x+y=6$ <table border="1"><tr><td>x</td><td>0</td><td>3</td></tr><tr><td>y</td><td>6</td><td>0</td></tr></table> $3x+4y=12$ <table border="1"><tr><td>x</td><td>0</td><td>4</td></tr><tr><td>y</td><td>3</td><td>0</td></tr></table> shaded region represents solution region <u>Remark:-</u> 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	x	0	3	y	6	0	x	0	4	y	3	0	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)	$a = 5 \quad r = 5$ $a_n = ar^{n-1}$ $a_{12} = ar^{11} = 5 \times 5^{11} = 5^{12}$	$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	6
	(ii)	$S_n = 8 + 88 + 888 + \dots n \text{ terms}$ $= 8 [1 + 11 + 111 + \dots n \text{ terms}]$ $= \frac{8}{9} [9 + 99 + 999 + \dots n \text{ terms}]$ $= \frac{8}{9} [(10-1) + (100-1) + (1000-1) + \dots n \text{ terms}]$ $= \frac{8}{9} [(10 + 100 + 1000 + \dots n \text{ terms}) - (1 + 1 + \dots n \text{ terms})]$ $= \frac{8}{9} \left[\frac{10(10^n - 1)}{10 - 1} - n \right]$ $= \frac{8}{9} \left[\frac{10(10^n - 1)}{9} - n \right]$	$\frac{1}{2}$ $\frac{1}{2}$ 1 1 1	
		<u>Remark :</u>		
		(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) Mean = $\frac{\sum f_i x_i}{N}$ $= \frac{3100}{50} = 62$						1	
		(ii) Variance = $\sigma^2 = \frac{1}{N} \sum f_i (x_i - \bar{x})^2$ $= \frac{1}{50} \times 10050$ $= 201$						1	
		(iii) S.D = $\sqrt{\text{Variance}}$ $= \sqrt{201} = 14.18$						$\frac{1}{2}$	
		<u>Remark:-</u> 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)						$\frac{1}{2}$	

6

Q.N No	Sub Qn	Answer Key/Value points	Score	Total score
30	(i)	$S = \{HH, HT, TH, TT\}$ 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	$P(E \cap F) = P(E \cup F)$ $= P(E) + P(F) - P(E \cap F)$ $= \frac{1}{4} + \frac{1}{2} - \frac{1}{8}$ $= \frac{5}{8}$	$\frac{1}{2}$ 1 $\frac{1}{2}$	6
	(b)	$P(\text{not } E \text{ and not } F) = P(E' \cap F')$ $= P(E \cup F)'$ $= 1 - P(E \cup F)$ $= 1 - \frac{5}{8}$ $= \frac{3}{8}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	
		<u>Remark:-</u> (i) For formula give 1 score For direct answer give full score		

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