ANSWER KEY

FIRST

~~2022~~ YEAR HIGHER SECONDARY EXAMINATION 2022

PART-I/II/III

SUBJECT: MATHEMATICS SCIENCE

CODE NO: FY 427 VERSION: ____

60 SCORES ____ HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1.	(a)	$A = \{1, 2\}$	1	3
	(b)	$\{1,2\}, \{\}, \{1\}, \{2\}$	2	
2.	(a)	$n(H \cup E) = 400$ $n(H) = 250$ $n(E) = 200$ $n(H \cup E) = n(H) + n(E) - n(H \cap E)$ $400 = 250 + 200 - n(H \cap E)$ $\therefore n(H \cap E) = 50$	1 1 1	3
	(b)	Remark: For alternate method give full score B	1	
3.	(a)	$P(1) = 1$, R.H.S $= \frac{1(1+1)}{2} = \frac{1 \times 2}{2} = 1$ ~~True~~ $\therefore P(1)$ is true	1	
	(b)	Assume that the result is true for $n = k$. $P(k): 1+2+3+\cdots+k = \frac{k(k+1)}{2}$ To prove that the result is true	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$P(k+1) = 1+2+3+\cdots+k+(k+1)$ $= \frac{k(k+1)}{2} + (k+1)$ $= (k+1)\left(\frac{k}{2}+1\right)$ $= \frac{(k+1)(k+2)}{2}$ Result is true for $n = k+1$. Hence by PMI, result is true for all $n \in N$.	½ ½	3
4	(a)	$(a+b)^4 = a^4 + {}^4C_1 a^3b + {}^4C_2 a^2b^2 + {}^4C_3 ab^3 + b^4$ $(a-b)^4 = a^4 - {}^4C_1 a^3b + {}^4C_2 a^2b^2 - {}^4C_3 ab^3 + b^4$ $(a+b)^4 - (a-b)^4 = {}^4C_1 a^3b + {}^4C_1 a^3b + {}^4C_3 ab^3 + {}^4C_3 ab^3$ $= 8a^3b + 8ab^3$ $= 8ab(a^2+b^2)$ Remark. For writing the formula $(a+b)^n$ give 1 score	1 ½ ½	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	(b)	$(\sqrt{3}+\sqrt{2})^4 - (\sqrt{3}-\sqrt{2})^4$		3
		$= 8\sqrt{3}\sqrt{2}\,(\sqrt{3}^2+\sqrt{2}^2)$	1	
		$= \underline{\underline{40\sqrt{6}}}$		
5.		$t_{r+1} = {}^nC_r\, a^{n-r}\, b^r$	1	
		$= {}^{10}C_r\, x^{10-r} \left(\frac{1}{x}\right)^r$		
		$= {}^{10}C_r\, x^{10-r} \times \frac{1}{x^r}$	½	3
		$= {}^{10}C_r\, x^{10-2r}$		
		For term independent of x,		
		$10-2r = 0$		
		$r = \underline{\underline{5}}$	1	
		Term independent of x = 6^{th} term	½	
		$= \underline{\underline{{}^{10}C_5}}$		
6		$a_n = n(n+2)$	½	
		$a_1 = 1(1+2) = 3$	½	
		$a_2 = 2(2+2) = 8$	½	
		$a_3 = 3(3+2) = 15$	½	3
		$a_4 = 4(4+2) = 24$	½	
		$a_5 = 5(5+2) = 35$	½	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
7.	(a)	x intercept $= -\frac{10}{3}$	1	
		y intercept $= \frac{5}{2}$	1	
		Remark: For writing $\frac{x}{a}+\frac{y}{b}=1$ give 1 score.		
	(b)	$3x - 4y = -10$		3
		$\frac{3x}{-10} - \frac{4y}{-10} = 1$	½	
		$\frac{x}{\left(\frac{-10}{3}\right)} + \frac{y}{\left(\frac{5}{2}\right)} = 1$	½	
		Remark: For direct answer give 1 score.		
8.		$y^2 = 8x$		
		$4a = 8$	1	
		$a = 2$		
		focus $= (2, 0)$	1½	3
		Axis is x-axis $(y=0)$	1	
		Length of latusrectum $= 8$	½	
		Remark: For writing formula for focus and length of latus rectum give ½ score each.		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
9.	(a)	$D = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2}$	1	3
		$= \sqrt{3^2+3^2+(-1)^2}$	1	
		$= \underline{\underline{\sqrt{19}}}$		
	(b)	(i) $(1, 2, 0)$	1	
10		Using section formula, pt of division is $\left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}, \frac{mz_2+nz_1}{m+n}\right)$	1	3
		Since point is on XY plane,		
		z coordinate $= 0$	½	
		$\frac{mz_2+nz_1}{m+n} = 0$	½	
		$mz_2+nz_1 = 0$		
		$m \times 8 + n \times 7 = 0$	½	
		$8m + 7n = 0$		
		$8m = -7n$		
		$\frac{m}{n} = \frac{-7}{8}$	½	
		$m : n = -7 : 8$		
		Remark : For alternate method		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
11.	(a)	2	1	
	(b)	$\lim_{x \to 1} \frac{(x^2 - 1^2)}{(x-1)} = \lim_{x \to 1} \frac{(x-1)(x+1)}{(x-1)}$	1	3
		$= \lim_{x \to 1} (x+1)$		
		$= \underline{2}$	1	
		Remark : For alternate method give full score.		
12.	(a)	$\sqrt{5}$ is not an irrational number.	1	
		OR		
		It is false that $\sqrt{5}$ is an irrational number.		
	(b)	Converse :		
		If n^2 is an odd natural number, then n is an odd natural number.	1	3
		Contrapositive		
		If n^2 is not an odd natural number then n is not an odd natural number.	1	
13.	(a)	$A' = \{1, 3, 5, 7\}$	½	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	#	$B' = \{1, 3, 5, 6, 7\}$	½	
	(b)	$A \cup B = \{2, 4, 6, 8\}$	1	
		$(A \cup B)' = \{1, 3, 5, 7\}$	1	4
	(c)	$A' \cap B' = \{1, 3, 5, 7\}$	1	
		$\therefore (A \cup B)' = A' \cap B'$		
14.	(a)	$G \times H = \{(7,5), (7,2), (7,4), (8,5), (8,2), (8,4)\}$	1	
		$H \times G = \{(5,7), (2,7), (4,7), (5,8), (2,8), (4,8)\}$	1	4
	(b)	$x + 1 = 3$		
		$x = 2$	1	
		$y - 2 = 1$		
		$y = 3$	1	
15	(a)	$\frac{2\pi^c}{3} = 120^\circ$	1	
	(b)	$\cos x = -\frac{4}{5}$	1	
		$\sec x = -\frac{5}{4}$	1	4
		$\tan x = \frac{-3}{}$	1	

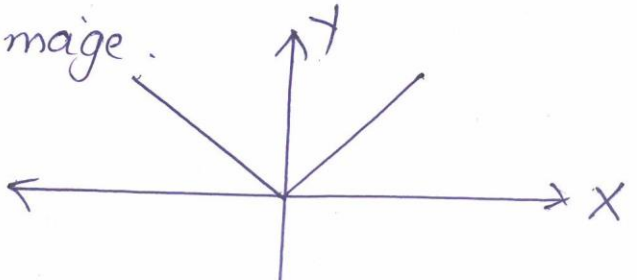
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		Remark : For any method, give full score.		
16.	(a)	L.H.S = 1, $P(1) = \frac{3^1-1}{2} = \frac{2}{2} = 1$ $\therefore P(1)$ is true.	1	
	(b)	Suppose that the result is true for $n = k$. $P(k) : 1+3+3^2+\cdots+3^{k-1} = \frac{3^k-1}{2}$	1	
		To prove the result is true for $n=k+1$ $P(k+1) = 1+3+\cdots+3^{k-1}+3^k$	½	
		$= P(k) + 3^k$		
		$= \frac{3^k-1}{2} + 3^k$	½	
		$= \frac{3^k-1+2\times 3^k}{2}$		4
		$= \frac{3\times 3^k-1}{2}$		
		$= \frac{3^{k+1}-1}{2}$	1	
		Result is true for $n=k+1$ Hence by PMI, result is true for all positive integers.		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
17.	(a)	1	1	
	(b)	$i^{39} = i^{36} \times i^3 = 1 \times -i = -i$	1	4
		$= 0 - i$	1	
	(c)	$(3 - 4i)$	1	
18.	(a)	$\frac{1}{(1+i)} = \frac{1-i}{(1+i)(1-i)} = \frac{1-i}{1+1}$	1	
		$= \frac{1}{2} + \frac{-1}{2}i$	1	
	(b)	$1+i = r(\cos\theta + i\sin\theta)$		
		$r\cos\theta = 1$, $r\sin\theta = 1$	½	
		$r^2 = 1+1 = 2 \therefore r = \sqrt{2}$	½	
		$\tan\theta = 1$, $\theta = \pi/4$	½	4
		$1+i = \sqrt{2}(\cos\pi/4 + i\sin\pi/4)$	½	
		Remark: for writing $1+i = r(\cos\theta + i\sin\theta)$, give 1 score.		
19.	(a)	Number of 3 digit numbers		

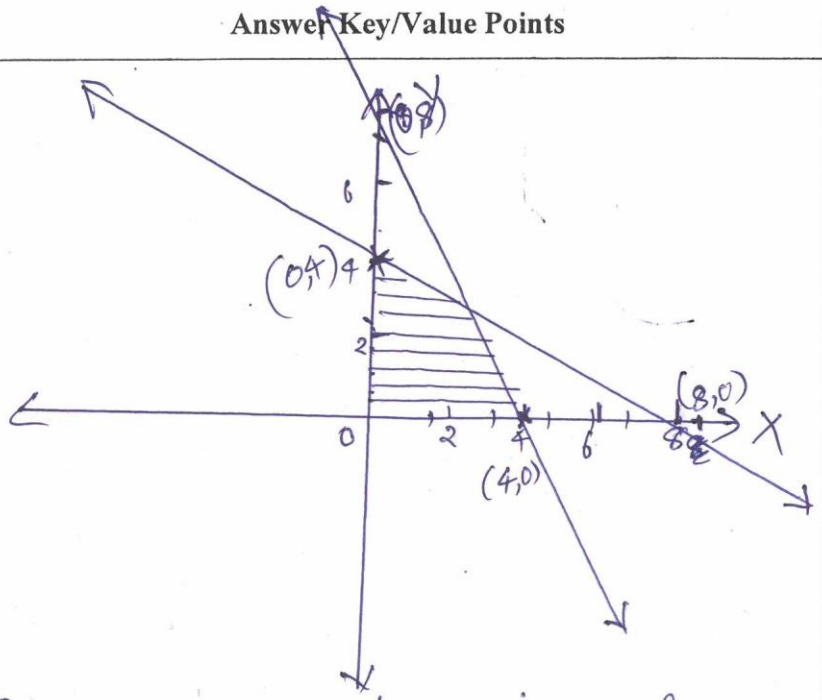
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		with repetition $= 5 \times 5 \times 5$	2	
		$= \underline{125}$		
	(b)	Number of selections $= {}^5C_2 \times {}^6C_3$	2	4
		$= 200$		
20	(a)	$A(x, -1)$, $B(2, 1)$, $C(4, 5)$		
		Slope of $AB = \frac{1-(-1)}{2-x} = \frac{2}{2-x}$	½	
		Slope of $BC = \frac{5-1}{4-2} = \frac{4}{2} = 2$	½	
		$\frac{2}{2-x} = 2$	½	
		$2 = 4 - 2x$		
		$2x = 2$		
		$\therefore x = 1$	½	
	(b)	Remark: For alternative method, give full score.		4
	(b)	$m = -4$		
		$(x_1, y_1) = (-2, 3)$		
		Point slope form		
		$y - y_1 = m(x - x_1)$	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$y-3 = -4(x-^{-}2)$ $= -4(x+2)$	½	
		$y-3 = -4x+^{-}8$ $4x+y = -5$ $4x+y+5=0$	½	
21.		focus $= (\pm c, 0) = (\pm 4, 0)$	1	
		vertex $= (\pm a, 0) = (\pm 5, 0)$	1	
		Length of major axis $= 2a = 10$	1	
		Length of latus rectum $= \frac{2b^2}{a} = \frac{18}{5}$	1	4
		Remark : For finding correct values of a, b and c, only give ½ score each.		
22	(a)	$y = \frac{x^2}{x+1}$		
		$\frac{dy}{dx} = \frac{(x+1)\cdot 2x - x^2 \cdot x\,1}{(x+1)^2}$	1	
		$= \frac{2x^2+2x-x^2}{(x+1)^2}$	1	
		$= \frac{x^2+2x}{(x+1)^2}$	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		Remark: For writing quotient rule give 1 score.		4
	(b).	$\frac{d}{dx}(x^2+2) = \frac{d}{dx}(x^2) + \frac{d}{dx}(2)$ $= 2x + 0 = \underline{\underline{2x}}$	1	
23.		Suppose $\sqrt{7}$ is not irrational ~~(or rational)~~.	1	
		$\sqrt{7} = \frac{a}{b}$, $a, b \in Z$, $b \neq 0$ its simplest form	½	
		Squaring $7 = \frac{a^2}{b^2}$ $a^2 = 7b^2$	½	
		$\therefore a$ is multiple of 7. $\therefore a = 7k$		
		ie $(7k)^2 = 7b^2$ $49k^2 = 7b^2$ $b^2 = 7k^2$	1	4
		b is multiple of 7	½	
		a and b have common multiple which is a contradiction	½	
		$\therefore \sqrt{7}$ is irrational		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
24.	(a)	$^{n-1}P_3 : {}^{n}P_4 = 1 : 9$		
		$\frac{(n-1)(n-2)(n-3)}{n(n-1)(n-2)(n-3)} = \frac{1}{9}$	1	
		$\frac{1}{n} = \frac{1}{9}$	1	
		$\therefore n = 9$		
	(b)	$\frac{1}{8!} + \frac{1}{9!} = \frac{x}{10!}$		
		$\frac{10!}{8!} + \frac{10!}{9!} = x$	1	4
		$10 \times 9 + 10 = x$	½	
		$90 + 10 = x$		
		$\therefore x = 100$	½	
		Remark: For alternate method give full score.		
25.	(a)	R is not a function	1	
		The element 1 have more than one image.	1	
	(b)		2	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	(c)	$y = x+1$	1	
		$R = \{(1,2),(2,3),(3,4),$ $(4,5),(5,6)\}$	1	6
26.	(a)	$\cos(x+y) = \cos x \cos y - \sin x \sin y$	1	
		$\cos(x-y) = \cos x \cos y + \sin x \sin y$	½	
		$\cos(x+y) + \cos(x-y) = 2\cos x \cos y$	½	
	(b)	$\cos\left(\frac{\pi}{4}+x\right) + \cos\left(\frac{\pi}{4}-x\right) = 2\cos\frac{\pi}{4}\cdot\cos x$		
		$= 2\times\frac{1}{\sqrt{2}}\times\cos x$	1	
		$= \sqrt{2}\cos x.$		
	(c)	$\sin^2\left(\frac{\pi}{6}\right) + \cos^2\left(\frac{\pi}{3}\right) - \tan^2\frac{\pi}{4}$	1	6
		$= \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2 - (1)^2$	1	
		$= \frac{1}{4} + \frac{1}{4} - 1 = \frac{1}{2} - 1$		
		$= \frac{-1}{2}$	1	
27.		$x + 2y = 8$ $\quad$ $2x + y = 8$		
		$x \mid 0 \mid 8$ $\quad$ $y \mid 4 \mid 0$ $\quad$ $x \mid 0 \mid 4$ $\quad$ $y \mid 8 \mid 0$	1+1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		 Common shaded region shows the solution. Remark: For drawing correct lines give 2 score each. For axes give 1 score.	4	6
28.	(a)	$t_{10} = a \cdot r^9$ $= 5 \times 5^9 = \underline{5^{10}}$ $t_n = a \cdot r^{n-1}$ $= 5 \times 5^{n-1} = 5^n$ Remark: For finding the value of $r = 5$, give ½ score.	½ ½ ½ ½	
	(b)	$S = 7 + 77 + 777 + \cdots$ $= 7(1 + 11 + 111 + \cdots)$	1	

16/18

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$= \frac{7}{9}(9+99+999+\text{----})$		
		$= \frac{7}{9}((10-1)+(10^2-1)+\text{----})$	1	
		$= \frac{7}{9}[10+10^2+\text{---}+10^n-(1+1+\cdots n \text{ ter}$	1	6
		$= \frac{7}{9}\left[\frac{10(10^n-1)}{10-1} - n\right]$	1	
		$= \frac{7}{9}\left[\frac{10(10^n-1)}{9} - n\right]$		
29.			3	

Mid x	f_i	$u_i = \frac{x-a}{c}$	$f_i u_i$	$f_i u_i^2$
5	10	-1	-10	10
15	17	0	0	0
25	13	1	13	13
35	10	2	20	40
	50		23	63

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$V(X) = \left[\frac{\Sigma f_i u_i^2}{N} - \left(\frac{\Sigma f_i u_i}{N}\right)^2\right] \times c^2$	1	
		$= \left[\frac{63}{50} - \left(\frac{23}{50}\right)^2\right] \times 10^2$	1	
		$= \underline{104.84}$		6
		$S.D = \sqrt{Var.}$	½	
		$= \sqrt{104.84}$	½	
		$= \underline{10.239}$		
30.		$A = NCC$		
		$B = NSS$		
		$P(A) = \frac{30}{60}$		
		$P(B) = \frac{32}{60}$		
		$P(A \cap B) = \frac{24}{60}$		
	(i)	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	1	
		$= \frac{30}{60} + \frac{32}{60} - \frac{24}{60}$	1	
		$= \frac{38}{60} = \underline{\frac{19}{30}}$		
	(ii)	$P(A' \cap B') = P(A \cup B)'$	½	

18/18

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$= 1 - \frac{19}{30}$	1	
		$= \frac{11}{30}$		6
	(iii)	$P(B - A) = P(B) - P(B \cap A)$	1½	
		$= \frac{32}{60} - \frac{24}{60}$	½	
		$= \frac{8}{60} = \frac{2}{15}$		
		Remark : For finding $P(A) = \frac{30}{60}$, $P(B) = \frac{32}{60}$ $P(A \cap B) = \frac{24}{60}$ give ½ score each		