FIRST YEAR HIGHER SECONDARY IMPROVEMENT EXAMINATION JULY 2017

SUBJECT : MATHEMATICS (SCIENCE) **CODE. NO: 818**

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
1.	a.	$n(A) = 5$ Remark: $A = \{1,2,3,4,5\}$ give $\frac{1}{2}$ score	1	
	b.	$B \cup C = \{1,2,3,4,5,6,8,9,10\}$	½	
		$A \cap (B \cup C) = \{1,2,3,4,5\}$ → Remark: For any A give 2 score	½	
		$A \cap B = \{2,3\}$	½	
		$A \cap C = \{1,4,5\}$	½	5
		$(A \cap B) \cup (A \cap C) = \{1,2,3,4,5\}$		
	c.	$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$	1	
		$= 17 + 23 - 38$	½	
		$= 2$	½	
2.	a.	$2^{2\times3} = 2^6 = 64$	1	
	b.	$R = \{(1,3),(2,6),(3,9),(4,12)\}$		
		Domain $= \{1,2,3,4\}$	1	
		Range $= \{3,6,9,12\}$	1	6
	c.	Co-domain $= A = \{1,2,3,\ldots,14\}$	1	
		$f \cdot g(x) = x^2(2x+1)$ $f+g(x) = x^2+2x+1$	1+1	
		Remark: b) Roster form only – 1 score c) $f \cdot g(x) = f(x) \cdot g(x)$ $-\frac{1}{2}$ $f+g(x) = f(x)+g(x)$ $-\frac{1}{2}$		
3.	a.	$\frac{1}{\sqrt{2}}$		
		Remark: $\sin(720^\circ+45^\circ) = \sin 45^\circ = \frac{1}{\sqrt{2}}$	$\frac{1}{2}+\frac{1}{2}$	
	b.	$\frac{2\cos 6x \cos x}{2\cos 6x \sin x}$ → 1 score → 1 score	2	
		Remark: formula $\frac{1}{2}$ each.		
	c.	$\cos 4x = \cos 2(2x)$	1	
		$= 1 - 2\sin^2 2x$	1	

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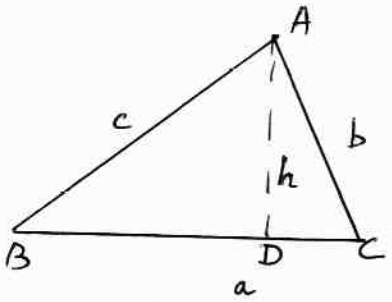
		$= 1 - 2(2\sin x \cos x)^2$	1	6.
		Remark: formula for $\cos 2x$ or $\sin 2x$ give 1 score		
		OR		
3	a.	$\sin x$	1	OR
	b.	$\frac{2\sin 4x \cos x}{2\cos 4x \cos x}$ → 1 score → 1 score	2.	
		Remark: formula $\frac{1}{2}$ each.		
	c.	 $\sin B = \frac{h}{c}$ $\sin C = \frac{h}{b}$ $c\sin B = b\sin C$ $\frac{\sin B}{b} = \frac{\sin C}{c}$ III^{rly} $\frac{\sin A}{a} = \frac{\sin B}{b}$	1 1 $\frac{1}{2}$ $\frac{1}{2}$	6.
		Remark: fig. only give 1 score		
4.	a.	$P(1)$: $7-3=4$, divisible by 4	1	4
	b	$P(k)$: $7^k - 3^k$ is divisible by 4	1	
		$P(k+1)$: $7^{k+1} - 3^{k+1}$ is divisible by 4	1	
		Proving $P(k+1)$ is true give 1 score	1	
5.	a.	$z^{-1} = \frac{1}{z} = \frac{1}{3+4i}$	$\frac{1}{2}$	
		$= \frac{3-4i}{25}$	$\frac{1}{2}$	
		Remark: formula $z^{-1} = \frac{\bar{z}}{\lvert z\rvert^2}$ give $\frac{1}{2}$ score		

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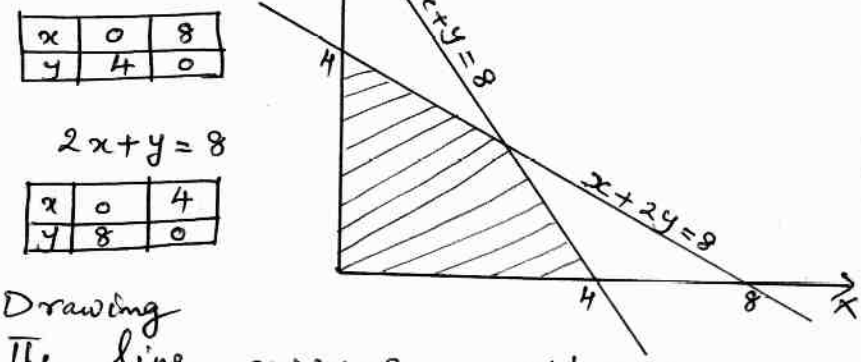
	b.	$z = r(\cos\theta + i\sin\theta)$	$\frac{1}{2}$	
		$r = \lvert z\rvert = 2$, $\theta = \frac{\pi}{3}$ ⟶	$\frac{1}{2} + \frac{1}{2}$	
		$z = 2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$	$\frac{1}{2}$	
	c.	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ ⟶	1	5
		$= \frac{-3 \pm \sqrt{-11}}{2} = \frac{-3 \pm i\sqrt{11}}{2}$	1	
6.	a.	$4x - 5x < 7 - 3$	$\frac{1}{2}$	
		$-x < 4$	$\frac{1}{2}$	
		$x > -4$		
	b.	$x + 2y = 8$		
				
		$2x + y = 8$		
		Drawing	4	5
		The line $x + 2y = 8$ ⟶ $1\frac{1}{2}$ score		
		The line $2x + y = 8$ ⟶ $1\frac{1}{2}$ score		
		x & y axis ⟶ $\frac{1}{2}$ score		
		Shading ⟶ $\frac{1}{2}$ score		
		Remark: For table only $\frac{1}{2}$ score each.		
7.	a.	C^3 or $C P_3$ give 1 score	1	
	b.	$\frac{12!}{3!\,4!\,2!}$ ⟶	2	
		Remark: formula only ⟶ 1 score		
		Total – 12 N ⟶ 3 E ⟶ 4 D ⟶ 2 Give 1 score		

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	c	Total $= \frac{12!}{3!4!2!}$ ⟶	1	
		Vowels come together $= \frac{8!}{3!2!} \times \frac{5!}{4!}$ ⟶	1	6
		∴ No. of words vowels never come together $= \frac{12!}{3!4!2!} - \frac{8!}{3!2!} \times \frac{5!}{4!}$	1	
		$= 16\,46400$		
		Remark: $\frac{8!}{3!2!}$ give 1 score		
		OR.		OR
7	a.	$n = 7$	1	
	b	$21C_2$	2	
		$= 210$		
		Remark: $21P_2$ give 1 score		
	c.	3 boys, 4 girls $= {}^4C_3 \times {}^9C_4$ ⟶	$\frac{1}{2} + \frac{1}{2}$	6
		4 boys, 3 girls $= {}^4C_4 \times {}^9C_3$ ⟶	$\frac{1}{2} + \frac{1}{2}$	
		Total $= {}^4C_3 \times {}^9C_4 + {}^4C_4 \times {}^9C_3$ ⟶	1	
		$= 588$		
		Remark: Direct answer give full score		
8.	a.	10	1	
	b.	$(a+b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$	1	
		$(a-b)^4 = a^4 - 4a^3b + 6a^2b^2 - 4ab^3 + b^4$		
		$(a+b)^4 - (a-b)^4 = 8a^3b + 8ab^3$	1	
		Remark: for any formula $(a+b)^4$ or $(a-b)^4$ give 1 score		
	c.	put $a = \sqrt{3}$ $b = \sqrt{2}$	1	
		$(\sqrt{3}+\sqrt{2})^4 - (\sqrt{3}-\sqrt{2})^4 = 40\sqrt{6}$	1	

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
		Remark: Alternate method give full score		5
9.	a.	$d = 3$	1	
		Remark: for any two consecutive terms give $\frac{1}{2}$ score		
	b.	$a + a+d + a+2d + a+3d + a+4d$	1	
		$= \frac{1}{4}(a+5d + a+6d + a+7d + a+8d + a+9d)$	1	
		$5a + 10d = \frac{1}{4}(5a + 35d)$		5
		$20a + 40d = 5a + 35d$	1	
		$d = -6$	$\frac{1}{2}$	
		$t_{20} = a + 19d = -112$	$\frac{1}{2}$	
		Remark: formula for S_n in A.P. give 1 score		
		" a_n in A.P give 1 score		
		OR		OR
	a.	$r = \frac{1}{2}$	1	
	b.	$S_n = 8(1 + 11 + 111 + \ldots$ to n terms)	1	
		$= \frac{8}{9}(9 + 99 + 999 + \ldots n$ terms)	1	5
		$= \frac{8}{9}[(10-1) + (100-1) + \ldots n$ terms$]$	1	
		$= \frac{8}{9}\left[\frac{10(10^n - 1)}{9} - n\right]$	1	
		Remark: formula for S_n in G.P give 1 score		
10.	a.	$\frac{-2}{3}$	1	
	b.	slope of perpendicular $= \frac{3}{2}$	1	
		$y - y_1 = m(x - x_1)$	1	
		$y - 1 = \frac{3}{2}(x - -1)$	1	
		Remark: Alternate method give full score		
		$m_1 m_2 = -1$ give $\frac{1}{2}$ score		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
	c.	Solving $2x+3y-6=0$ & $3x-2y+5=0$	1	6.
		$x=\frac{-3}{13}$ $\quad y=\frac{28}{13}$	1	
		foot $=\left(\frac{-3}{13}, \frac{28}{13}\right)$		
		Remark: Alternate method give full score		
		OR		OR
10	a.	$-\sqrt{3}$	1	
	b.	$3x-4y=-10$ $\longrightarrow$	1	
		$\frac{x}{(-10/3)}+\frac{y}{(5/2)}=1$ $\longrightarrow$	1/2	
		x-intercept $=-10/3$; y-intercept $=5/2$	1/2	
		Remark: Intercept form $\frac{x}{a}+\frac{y}{b}=1$ give $\frac{1}{2}$ score		
		x-intercept $=-c/a$ } - give 1 score y-intercept $=-c/b$ }		
	c.	$m_1=\sqrt{3}$ $\quad m_2=\frac{-1}{\sqrt{3}}$	$\frac{1}{2}+\frac{1}{2}$	
		$\tan\theta=\frac{m_1-m_2}{1+m_1m_2}$	1	6
		$=\frac{\sqrt{3}+\frac{1}{\sqrt{3}}}{1+\sqrt{3}\times\frac{-1}{\sqrt{3}}}$ $=\frac{\sqrt{3}+\frac{1}{\sqrt{3}}}{0}$	$\frac{1}{2}$	
		$\theta=90^\circ$	$\frac{1}{2}$	
		Remark: $m_1m_2=-1$ give $\frac{1}{2}$ score		
		$\theta=90^\circ$ give full score		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
11	a.	8	1	
	b.	$a = 5 \quad b = 3 \quad c = 4$	½	
		Length of major axis $= 10$	½	
		" minor axis $= 6$	½	4
		foci $= (\pm 4, 0)$ vertices $= (\pm 5, 0)$	½	
		$e = c/a = 4/5$	½	
		$l.R. = \frac{2b^2}{a} = \frac{18}{5}$	½	
		Remark: for any two correct formula give 1 score		
12.	a.	$(1, 2, 0)$	1	
	b.	$z = 0$	½	
		$0 = \frac{8m + 7n}{m+n}$	1	3.
		$m:n = 8:-7$ or $8:7$ externally	½	
		Remark: Section formula give 1 score		
		$z = 0$ give ½ score		
		Alternate method give full score		
13.	a.	2	1	
	b.	$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$	1	
		$= \lim_{h \to 0} \frac{\frac{1}{x+h} - \frac{1}{x}}{h}$	1	
		$= \lim_{h \to 0} \frac{-h}{h(x+h)x}$	½	
		$= \frac{-1}{x^2}$	½	
		Remark: direct $\frac{d}{dx}\left(\frac{1}{x}\right) = \frac{-1}{x^2}$ give 1 score		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
	c.	$\frac{d}{dx}(x\sin x) = x\frac{d}{dx}(\sin x) + \sin x \frac{d}{dx}(x)$	1	
		$= x\cos x + \sin x$	1	6
		Remark: formula for product rule give 1 score		
		$\frac{d}{dx}(\sin x) = \cos x$ give $\frac{1}{2}$ score		
		OR		OR
13	a.	$\lim_{x\to 0} \frac{(x+1)^5 - 1}{x} = \lim_{x+1\to 1} \frac{(x+1)^5 - 1^5}{(x+1)-1}$	1	
		$= 5 \times 1^4$	1	
		Remark: formula $\lim_{x\to a} \frac{x^n - a^n}{x-a} = na^{n-1}$ give 1 score		
		Alternate method give full score		
	b	$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$	1	
		$= \lim_{h\to 0} \frac{\cos(x+h) - \cos x}{h}$	1	6.
		$= \lim_{h\to 0} \frac{-2\sin\left(\frac{2x+h}{2}\right)\sin\left(\frac{h}{2}\right)}{h}$	$\frac{1}{2}$	
		$= -\sin x$	$\frac{1}{2}$	
		Remark: $\frac{d}{dx}(\cos x) = -\sin x$ give 1 score		
	c.	$n \cdot x^{n-1}$	1	
14.	a.	It is false that $\sqrt{2}$ is irrational	1	
	b.	Assume that $\sqrt{2}$ is rational	1	
		$\sqrt{2} = \frac{a}{b}$, a & b have no common factor	1	4
		$a^2 = 2b^2 \Longrightarrow 2$ divides a	½	
		$a = 2c$ $\quad 4c^2 = 2b^2 \Rightarrow 2$ divides b.	½	
		Contradiction		

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15.				

class	f	x	fx	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
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
	50		3100		10050

a. Mean $\bar{x} = \frac{1}{N} \Sigma fx = \frac{3100}{50} = 62$ — 2

b. SD $\sigma = \sqrt{\frac{1}{N} \Sigma f(x-\bar{x})^2}$

$= \sqrt{\frac{1}{50} \times 10050} = 14.18$ — 3

Remark: Alternate method give full score
Table give 2 score
formula for mean → 1 score
formula for SD or Variance → 1 score

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16.	a.	$P(A') = 1 - P(A)$	$\frac{1}{2}$	
		$= 1 - \frac{2}{11} = \frac{9}{11}$	$\frac{1}{2}$	
	b.	$n(S) = 52C_4$ ⟶	1	5
		3 diamonds $= 13C_3$ ⟶	1	
		1 spade $= 13C_1$ ⟶	1	
		$\frac{13C_3 \times 13C_1}{52C_4}$ ⟶	1	
		Remark:		
		$P(A) = \frac{n(A)}{n(S)}$ give 1 score		
		$n(S) = 52C_4$ give 1 score		
		$\frac{13C_3 + 13C_1}{52C_4}$ give $\frac{1}{2}$ score		

(10/10)

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