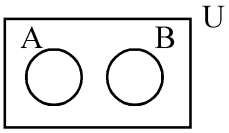
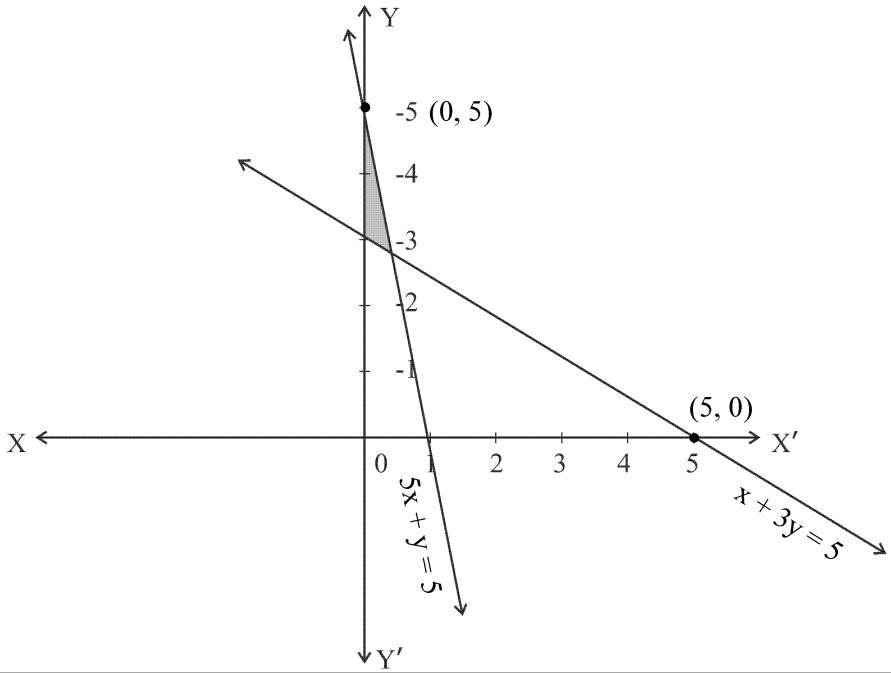
HSE - I

MATHEMATICS (Commerce)

Scoring Indicators

Sl.NO	Answer Key/Value points	Score	Total
1.	i. b) 	1	
	ii. $A \cap B = \{1, 3, 5\}$	1	
	$n(A \cap B) = 3$	1	3
2.	i. a) $R = \{(2, 1), (3, 3), (4, 5), (5, 7), (6, 9)\}$	1	
	b) Domain = {2, 3, 4, 5, 6}		
	Range = {1, 3, 5, 7, 9}	1	
	ii. 2^{100}	1	3
3.	i. $15 \times \frac{\pi}{180} = \frac{\pi}{12}$	1	
	ii. $l = r\theta$		
	$= \frac{55}{42}$	1	
	= 1.3 cm	1	3
4	i. $z = \frac{1}{1+i} = \frac{1-i}{2}$		
	Real part = $\frac{1}{2}$	1	
	ii. $x = \frac{5}{2} \pm \frac{\sqrt{3}\,i}{2}$	2	3
5.	P(1) : $1 = 1^2$ is true	1	
	Assurme that p(k) is true		
	ie. $1 + 3 + \ldots\ldots + (2k - 1) = k^2$	1	
	p (k + 1) :		
	$1 + 3 + \ldots\ldots(2k - 1) + (2k + 1) = k^2 + 2k + 1 = (k + 1)^2$	1	3
6.	n = 9 + 11 = 20	1	
	$20C_2 = 190$	1	

	$^{20}C_{20} = 1$	1	3
7.	i. a = 10 d = 3	1	
	ii. $S_n = \frac{n}{2}(17 + 3n)$	2	3
8.	i. $A \cup B = \{1, 2, 3, 4, 5, 7, 9\}$	1	
	ii. $A' = \{5, 6, 7, 8, 9\}$	1	
	iii. $(A \cup B)' = \{6, 8\}$ $B' = \{2, 4, 6, 8\}$		
	$A' \cap B' = \{6, 8\}$	1	
	$(A \cup B)' = A' \cap B'$	1	4
9.	i. Domain = R -{2}	1	
	ii. a. $(g + h)(x) = 2x$	1	
	b. $gh = x^2 - 1$	1	
	Range = [-1 α)	1	4
10.	i. $\cos x = -\frac{4}{5}$	1	
	ii. $\cos x = 4\cos^3 x - 3\cos x$	1	
	$= \frac{44}{125}$	2	4
11.	p(1) is true	1	
	Assuming p(k) is true	1	
	For proving p(k + 1) time	2	4
12.	i. $\frac{2 - i}{(1 - i)(1 + 2i)} = \frac{1}{2} - \frac{1}{2}i$	2	
	ii. $r = \sqrt{\left(\frac{1}{2}\right)^2 + \left(\frac{-1}{2}\right)^2} = \frac{1}{\sqrt{2}}$	1	
	$\theta = -\frac{\pi}{4}$		
	Polar form is $\frac{1}{\sqrt{2}}\left(\cos\left(-\frac{\pi}{4}\right) + i\sin\left(-\frac{\pi}{4}\right)\right)$	1	4

13.	i. $x \leq -1$ ii. $5x + y = 5$ $\qquad$ $x + 3y = 5$ x | 0 | 1 y | 5 | 0 x | 5 | 2 y | 0 | 1  	1 3	 4
14.	i. 6! ii. B and T when considered as one letter No. of arrangements = 5! = 20 B & T can be arranged in 2! ways. No. of words in which B & T are always together = 5! x 2! = 240	1 1 1 1	 4
15.	i. 6 terms ii. $(a + b)^5 - (a - b)^5 = 10a^4b + 20a^2b^3 + 2b^5$ iii. $\left(\sqrt{5} + 1\right)^5 - \left(\sqrt{5} - 1\right)^5 = 352$	1 2 1	 4
16.	$ar^3 = 27$, $ar^6 = 729$ $r^3 = 27 \Rightarrow r = 3$ $a = 1$ GP is 1, 3, 9, ...	1 1 1 1	 4

17.	i. Slope = $\frac{-4}{3}$	1	
	ii. x - intercept = $\frac{9}{4}$, y-intercept = 3	1	
	iii. Perpendicular distance from origin = p = $\frac{9}{5}$	2	4
18.	i. $\cos x = -\frac{\sqrt{3}}{2} = -\cos\frac{\pi}{6}$	1	
	$\Rightarrow x = \pi - \frac{\pi}{6}, \pi + \frac{\pi}{6} = \frac{5\pi}{6}, \frac{7\pi}{6}$ is the principle solution	1	
	General solution is $x = 2n\pi \pm \frac{5\pi}{6}$, $n \in z$	1	
	ii. $\frac{b^2 + c^2 - a^2}{2abc} + \frac{c^2 + a^2 - b^2}{2abc} + \frac{a^2 + b^2 - c^2}{2abc}$	1	
	$= \frac{b^2 + c^2 - a^2 + c^2 + a^2 - b^2 + a^2 + b^2 - c^2}{2abc}$	1	
	$= \frac{a^2 + b^2 + c^2}{2abc}$	1	6
19.	i. Slope of given line = $-\frac{3}{4}$		
	Slope of perpendicular line = $\frac{4}{3}$		
	Equation of perpendicular line is $4x - 3y + 1 = 0$	2	
	ii. Equation of family of lines through the intersection of	1	
	above lines is		
	$(3x + 4y + 8) + k(4x - 3y + 1) = 0$	1	
	Slope = 0		
	k = $-\frac{3}{4}$	1	
	Equation of line is $y = -\frac{29}{25}$	1	6
20.	$\frac{x^2}{4} + \frac{y^2}{9} = 1$	1	
	a = 3, b = 2		
	c = $\sqrt{a - 4} = \sqrt{5}$	1	
	e = $\frac{c}{a} = \frac{\sqrt{5}}{3}$	1	
	foci are $\left(0, \pm\sqrt{5}\right)$	1	

	Vertices are $(0, \pm 3)$		
	Length of major axis = 6 units	1	
	Length of minor axis = 4 units	1	6
21.	i. $Z_1 + Z_2 = -3 + 4i$	1	
	ii. $x + iy = \sqrt{-3 + 4i}$		
	$x^2 - y^2 = -3$ ----------(1)	1	
	$2xy = 4$	1	
	$(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2x\,y)^2$		
	$x^2 + y^2 = 5$ ----------(2)	1	
	(1) + (2) $\Rightarrow x^2 = 1$		
	$\Rightarrow x = \pm 1$	1	
	(2) $\Rightarrow y^2 = 4$		
	$\Rightarrow y = 2$		
	$2xy$ is +ve x & y of same sign		
	Square roots are $1 + 2i$ and $-1 - 2i$	1	6
22.	$n(A \cup B) = 20$	1	
	$n(A) = 12$		
	$n(B) = 12$		
	i. $n(A \cap B) = n(A) + n(B) - n(A \cup B)$	1	
	$= 4$	1	
	ii. $n(A - B) = n(A) - n(A \cap B)$		
	$= 12 - 4$		
	$= 8$	1	
	iii. Number of teachers teaching only one subject = $n(A - B) + n(B - A)$	1	
	$= 8 + 8$		
	$= 16$	1	6

23.	i. $S_n = \sum_{k=1}^{n} ak = \sum_{k=1}^{n} k^2 + 3\sum_{k=1}^{n} k$	1	
	$= \frac{n(n+1)(2n+1)}{6} + \frac{3n(n+1)}{2}$	1	
	$= \frac{n(n+1)(n+5)}{3}$	1	
	ii. $= 8[1 + 11 + 111 + \ldots\ldots\ldots$ to n terms]		
	$= \frac{8}{9}[(10 - 1) + (10^2 - 1) + (10^3 - 1) + \ldots\ldots\ldots$ to n terms]	1	
	$= \frac{8}{9}\left[\frac{10(10^n - 1)}{10 - 1} - n\right]$	1	
	$= \frac{8}{9}\left[\frac{10}{9}(10^n - 1) - n\right]$	1	6
24.	i. $a + 3 = 4$ $a = 1$	½	
	$b + 4 = 3$ $b = -1$	½	
	ii. $A \times B = \{(1, 4)(1, 5), (2, 4), (2, 5), (3, 4), (3, 5)\}$	1	
	$B \times A = \{(4, 1), (4, 2), (4, 3), (5, 1), (5, 2), (5, 3)\}$	1	
	$A \times B \neq B \times A$	1	
	$P \times P = \{(a, a), (a, b), (b, a), (b, b)\}$	1	
	$P \times P \times P = \{(a, a, a), (a, a, b), (a, b, b), (b, a, a), (b, a, b),$ (b, b, a), (b, b, b)$\}$	1	6