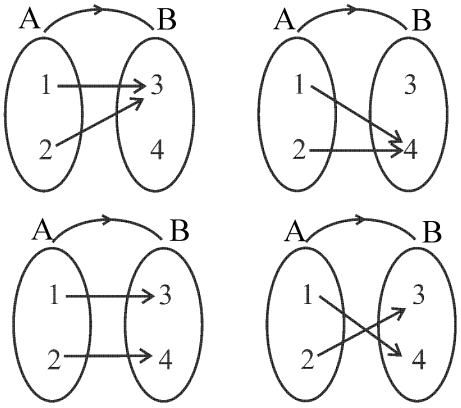
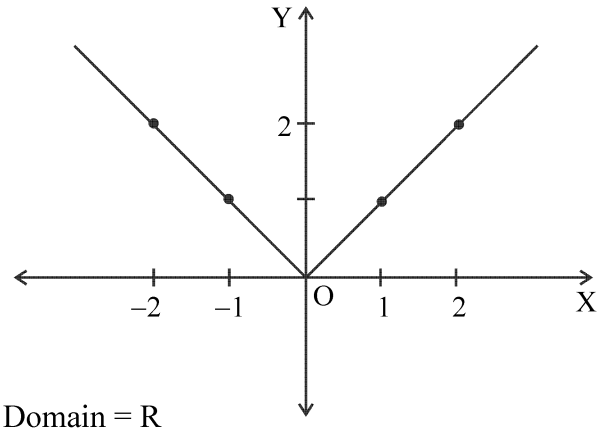
HSE - I

MATHEMATICS (Science)

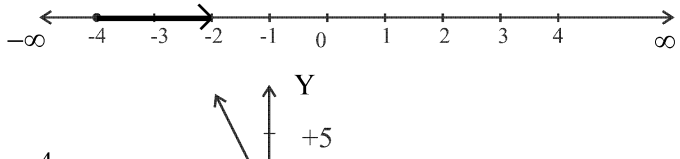
Scoring Indicators

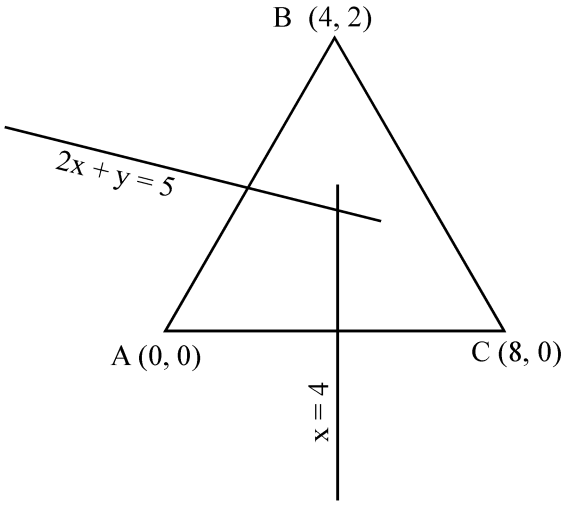
Sl.NO	Answer Key/Value points	Score	Total
1.	a. A = {1, 2, 3, 4, 5, 6, 7} b. {2, 4, 6} or {2, 4, 6, 7} c. 10	1 1 1	3
2.	a. (i) 120° b. $\frac{\sin 5x+\sin 3x}{\cos 5x+\cos 3x}=\frac{2\sin 4x.\cos x}{2\cos 4x.\cos x}$ $=\tan 4x$	1 1 1	3
3.	a. (ii) $N \subset Z \subset R \subset C$ b. $x=\frac{-3 \pm \sqrt{9-20}}{2}$ $=\frac{-3 \pm i\sqrt{11}}{2}$	1 1 1	3
4.	a. iii) $x < 0, y > 0$ b. $-2 \le x \le 2$ $-1 \le y \le 1$	1 2	3
5.	a. $5P_2 = 20$ b. $\frac{1}{6\dot{1}}\left(1+\frac{1}{7}\right)=\frac{x}{61_0 \times 7 \times 8}$ $\frac{8}{7}=\frac{x}{7\times 8}$ $x = 64$	1 1 ½ ½	3
6.	a. $(101)^4 = (100+1)^4$ $= (100)^4 + 4\times(100)^3 + 6\times(100)^2 + 4\times 100 + 1$ $= 104060401$	1 1 1	3
7.	a. Figure II b. $3x + 4y = 12$ $\frac{x}{4}+\frac{y}{3}=1$ x - intercept = 4 y - intercept = 3 OR Remarks by giving $x = 0$ and then $y = 0$	1 1 1	3
8.	a. A = {1, 3, 4, 8} B = {2, 3, 5} b. A - B = {1, 4, 8} $A \cap B = \{3\}$ $(A - B) \cup (A \cap B) = A$ c. $(A \cap B)' = \{1, 2, 4, 5, 6, 7, 8, 9\}$	½ ½ 1 1 1	4

9.	a. $A \times B = \{(1, 3) (1, 4) (2, 3) (2, 4)\}$ b. Any subset of $A \times B$ c. 	1 1 2	4
10.	a. $\text{cosec}x = \frac{1}{3}$ b. $\sin 15° = \sin(45° - 30°)$ $= \sin 45°.\cos 30° - \cos 45°.\sin 30°$ $= \frac{1}{\sqrt{2}}.\frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}.\frac{1}{2}$ $= \frac{\sqrt{3}-1}{2\sqrt{2}}$ c. $\sin 15° = \cos 75°$	1 ½ ½ ½ ½ 1	4
11.	a. $n = 10$ b. $n(n - 1)(n - 2)(n - 3)(n - 4) = 42\, n(n - 1)(n - 2)$ $(n - 3)(n - 4) = 42$ $n^2 - 7n - 30 = 0$ $(n - 10)(n + 3) = 0$ $n = 10, n = -3$ As n cannot be negative, so $n = 10$	1 1 1 ½ ½	4
12.	a. $T_{r+1} = {}^nC_r\, a^{n-r}\, b^r$ $= {}^6C_r\, x^{12-3r}.2^r$ $12 - 3r = 0$ $r = 4$ $T_5 = {}^6C_4 \times 2^4$ b. $m = 1$	½ ½ + ½ ½ ½ + ½ 1	4
13.	a. (ii) $a_n = 2 + 5n$ b. $t_{12} + t_{22} = 100$½ $a + 11d + a + 21d = 100$ $2a + 32d = 100$ $S_{33} = \frac{33}{2}(2a + 32d)$ $= \frac{33}{2} \times 100$ $= 1650$	1 1 1 1	4

14.	a. $4x - 3y + k = 0$ Passing through (1, 2) required equation $4x - 3y + 2 = 0$ b. distance = $\left\|\frac{12-2}{\sqrt{25}}\right\| = \frac{10}{5} = 2$ c. $3x + 4y + 9 = 0$	1 1 1 1	 4
15.	a. $15C_2 = \frac{15 \times 14}{1 \times 2}$ $= 105$ b. $5C_2 \times 6C_3$ $= 10 \times 20 = 200$	1 1 1 1	 4
16.	a. k = -4 b. Vertex = (0, 0) Focus = (-1, 0) Length of latus rectum = 4a $= 4 \times 1 = 1$ Axis of parabola is *x* axis	1 ½ 1 1 ½	 4
17.	a. foci = (±3, 0) b. length of SS′= **6** c. Maximum Area = ½ × 6 × 4 = 12	2 1 1	 4
18.	a. <table><tr><td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td></tr><tr><td>y</td><td>2</td><td>1</td><td>0</td><td>1</td><td>2</td></tr></table>  Domain = R Range = [0,∞] b. i. Figure I ii. Figure III iii $\|x\|$	1 1 ½ ½ 1 1 1	 6
19.	a. (ii) $\frac{\pi}{4}$ b. sin 200°, sin 0°, sin 50°, sin 100° c. sin 6*x* + sin 2*x* - sin 4*x* = 0 2 sin 4*x*. cos 2*x* - sin 4*x* = 0 sin 4*x* (2 cos 2*x* - 1) = 0	1 2 ½ ½ ½	

	$\sin 4x = 0 \Rightarrow x = n\frac{\pi}{4},\ n \in Z$	½	
	$2\cos 2x - 1 = 0$ $\cos 2x = ½$		
	$\cos 2x = \cos\ \frac{\pi}{3}$	½	
	$x = n\pi \pm \frac{\pi}{6},\ n \in Z$	½	6
20.	a. $z = \frac{1 + i}{1 - i}$		
	$= \frac{(1+i)}{1-i} \times \frac{(1+i)}{1+i}$	1	
	$= \frac{1 + 2i^\circ - 1}{2} = i$	1	
	b. $P \Rightarrow 1\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)$	1	
	$Q \Rightarrow 1\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$	1	
	c. $i = 0 + i$ $\sqrt{i} = x + iy$ $i = x^2 - y^2 + i2xy$	½	
	$x^2 - y^2 = 0$ $2xy = 1$	½	
	$(x^2 + y^2)^2 = 1$ $x^2 + y^2 = 1$ $x^2 - y^2 = 0$ $2x^2 = 1$		
	$x = \mp\frac{1}{\sqrt{2}}$		
	$y = \mp\frac{1}{\sqrt{2}}$	½	
	Roots are $\frac{1}{\sqrt{2}} + i\frac{1}{\sqrt{2}}$ or $\frac{-1}{\sqrt{2}} - i\frac{1}{\sqrt{2}}$	½	6
21.	a. $4x + 3 \le 5x + 7$ $4x - 5x \le 7 - 3$	½	
	$-x \le 4$ $x \ge -4$	½	
		1	

	b.  $2x + y = 4$ x | 0 | 2 y | 4 | 0 $x + y = 3$ x | 0 | 3 y | 3 | 0 $2x - 3y = 6$ x | 0 | 3 y | –2 | 0 	4	6
22.	a) i. $\frac{a}{r} \times a \times ar = 1000$ a = 10 ii. $\frac{a}{r}$, a + 6, ar + 7 form AP. $(a + 6) - \frac{a}{r} = (ar + 7) - (a + 6)$ $16 - \frac{10}{r} = 10r + 7 - 16$ $16r - 10 = 10r^2 - 9r$ $10r^2 - 25r + 10 = 0$ $r = 2$, or ½ terms of GP 5, 10, 20 OR 20, 10, 5 b) $s_n = 7 + 77 + 777 + ...$ $= \frac{7}{9}(10 - 1 + 10^2 - 1 + 10^3 - 1 + ...)$ $= \frac{7}{9}\left[\frac{10(10^n - 1)}{9} - n\right]$	1 ½ ½ ½ 1 1	6

23	a. $p(3) : 1 \times 2 + 2 \times 3 + 3 \times 4 = \frac{3 \times 4 \times 5}{3}$	1	
	ie, $p(3) : 20 = 20$	1	
	$\therefore$ $p(3)$ is true		
	b. Proving $p(1)$ is true	1	
	Assuming $p(k)$ is true	½	
	$p(k) : 1 \times 2 + 2 \times 3 + \ldots\ldots + k(k+1) = \frac{k(k+1)(k+2)}{3}$	1	
	Proving for $k + 1$	1½	6
24.	a. (2, 1)	1	
	b. Equation of $\perp r$ bisetor is $y - 1 = -2(x - 2)$		
	$2x + y = 5$	2	
	c. 		
	Solving $2x + y = 5$ and $x = 4$	1 + 1	
	$y = 5 - 8 = -3$		
	center is (4, -3) radius = 5	½	
	Equation of circle is $(x - 4)^2 + (y + 3)^2 = 5^2$	½`	6