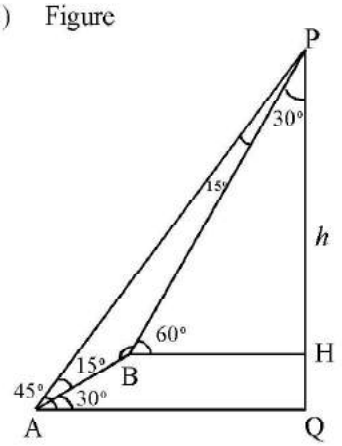
Answer Key: Sample Question Paper - 1
MATHEMATICS (Science)

Qn. No.	Scoring indicators	Split up score	Sub total	Total
1.	a) i) $A = \{-2, -1, 0, 1, 2\}$	½		
	$B = \{1, 2, 3, 6\}$	½	1	
	ii) $A - B = \{-2, -1, 0\}$	1		
	$A \cap B = \{1, 2\}$	1	2	
	b) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$	1		
	$= 140$			
	$n(A' \cap B') = n(U) - n(A \cup B)$	1		
	$= 60$		2	5
2.	a) $A \times B$		1	
	b) $R = \{(7, 6), (8, 7)\}$	2	2	
	c) (i) R	1		
	(ii) $[1, \infty)$	1		
	(iii) $[-3, 3]$	1	3	6
3.	a) $\sin\theta = \frac{3}{2}$	1	1	
	b) $\frac{2\cos\left(\frac{7x+5x}{2}\right)\cos\left(\frac{7x-5x}{2}\right)}{2\cos\left(\frac{7x+5x}{2}\right)\sin\left(\frac{7x-5x}{2}\right)}$	1		3
	$= \frac{\cos x}{\sin x} = \cot x$	1	2	
	c) Figure	½		



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	$\angle APQ = 45^\circ$, $\angle BPH = 30^\circ$,			
	$\angle APB = 15^\circ$, $\angle ABP = 150^\circ$	½		
	From Δ APQ $AP^2 = h^2 + h^2 = 2h^2$			
	$AP = \sqrt{2}\ h$	½		
	For formula			
	$\frac{AB}{\sin 15^\circ} = \frac{AP}{\sin 150^\circ} \Rightarrow \frac{d}{\sin 15^\circ} = \frac{\sqrt{2}\ h}{\sin 150^\circ}$	1		
	$d = \frac{\sqrt{2}\ h \sin 15^\circ}{\sin 30^\circ}$	½		
	$= h\left(\sqrt{3}-1\right)$	½	3	6
4.	P (n): $x^n - y^n$ is divisible by $x - y$			
a)	P (1) = $x - y$ is divisible by $x - y$	1	1	
b)	Assume P (k) is true			
	P (k): $x^k - y^k$ is divisible by $x - y$	½		
	Consider $x^{k+1} - y^{k+1} = x^k . x - x^k y + x^k y - y^k y$	1		
	$= x^k (x - y) + y (x^k - y^k)$	½		
	= which is divisible by $x^k - y^k$	½		
	$\therefore$ P$(k + 1)$ is true for all $n \in N$	½	3	4
5.	a) 1-i	1	1	
	b) $1 - i = r(\cos\theta + i \sin\theta)$	½		
	$r = \sqrt{1+1} = \sqrt{2}$	½	2	
	$\sqrt{2}\cos\theta = 1$ $\quad \sqrt{2}\sin\theta = -1$			
	$\cos\theta = \frac{1}{\sqrt{2}}$ $\quad \sin\theta = \frac{-1}{\sqrt{2}}$			
	$\theta = \frac{7\pi}{4}$	½		
	$1 - i = \sqrt{2}\left(\cos\frac{7\pi}{4} + i \sin\frac{7\pi}{4}\right)$	½		
	c) $x^2 - x + 2 = 0$ ½			
	$a = 1$, $b = -1$, $c = 2$ ½			
	$x = \frac{1 \pm \sqrt{1 - 4 \times 1 \times 2}}{2}$	½		
	$= \frac{1 \pm \sqrt{-7}}{2} = \frac{1 \pm \sqrt{-7}\,i}{2}$	½	2	5

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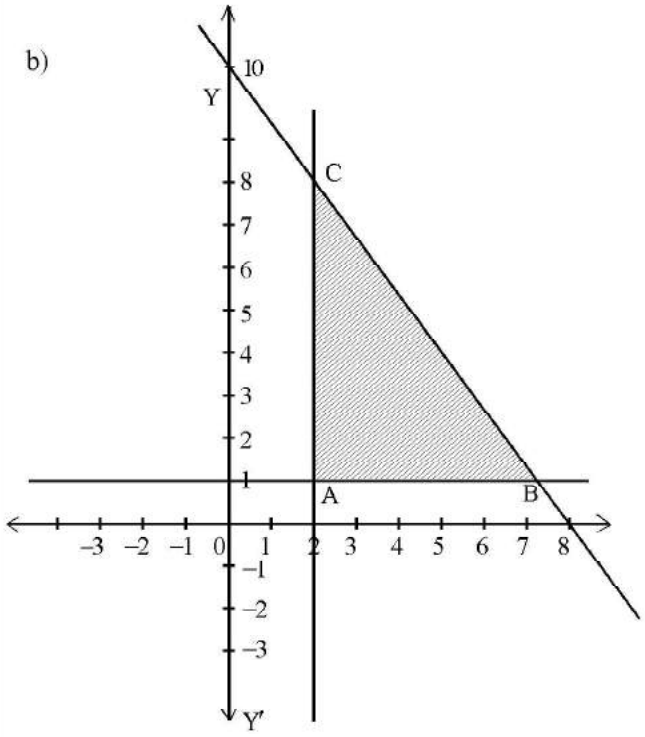
6.	a) $3x - 5 > 5x - 1$ $-2x > 4$ $2x < -4$ $x < -2$	½ ½	1	
	b) 	4		5
7.	a) $4! - 3! = 18$	1	1	
	b) $6! \times 2!$	2	2	
	c) ${}^5C_2 \times {}^5C_4 + {}^5C_3 \times {}^5C_3 + {}^5C_4 \times {}^5C_2$	2		
	$= 10 \times 5 + 10 \times 10 + 5 \times 10 = 200$	1	3	6
	OR			
	a) 10	1	1	
	b) $4 \times 3 \times 2 \times 2 = 48$	1		
	c) ${}^7C_5 \times {}^8C_6 + {}^7C_6 \times {}^8C_5$	1	2	
	$= 21 \times 28 + 7 \times 56 = 980$	1	3	6
8.	a) $(n + 1)^{th}$ term	1	1	
	b) $T_{r+1} = {}^{2n}C_n (1)^{2n-n} x^n$			
	$= {}^{2n}C_n x^n$	½		
	$= \frac{(2n)!}{n!n!} x^n$			
	$= \frac{[1.3.5....(2n-1)][(2.4.6...(2n)].x^n}{n!n!}$	½		

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	$= \frac{[1.3.5.7...(2n-1)]2^n n! x^n}{(n!)^2}$	1		
	$= \frac{1.3.5.7...(2n-1)\,2^n x^n}{n!}$	1	3	4
9.	a) $a_n = \frac{5}{6}$	1	1	
	b) $\frac{a+b}{2} = 10$	1		
	$\sqrt{ab} = 8$ $a + b = 20$ $ab = 64$ $a - b = \pm 12$ $a = 4 \quad b = 16$ or $a = 16 \quad b = 4$	1	2	
	c) $S_n = \frac{a}{1-r} = \frac{1}{1\ \frac{1}{3}} = \frac{3}{2}$	1 + 1	2	5
10.	a) $\lvert x \rvert$	1	1	
	b) $4x + 3y + k = 0$	1		
	$\frac{-k}{3} = 2$			
	$k = -6$	½		
	$4x + 3y - 6 = 0$	½	2	
	c) $x + 2y - 3 + k(4x - y + 7) = 0$	1		
	$(1 + 4k)x + (2 - k)y + (-3 + 7k) = 0$			
	Slope $= \frac{1+4k}{k-2}$	1		
	Slope of parallel line $= \frac{-5}{7}$			
	$k = \frac{2}{7}$			
	$15x + 12y - 7 = 0$	1	3	6
11.	i) Here $a = 3, \ b = 4$	1		
	$c = \sqrt{a^2 + b^2} = 5$			
	Co-ordinates of foci $(\pm 5, 0)$	1		
	Co-ordinates of vertices are $(\pm 3, 0)$			
	$e = \frac{c}{a} = \frac{5}{3}$	1		
	latus rectum $= \frac{2b^2}{a} = \frac{32}{3}$	1		4

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12.	i) $(2, 3, -4)$	1	1	
	ii) $\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}, \frac{mz_2 + nz_1}{m+n}\right)$	1½		
	$\left(\frac{2-6}{5}, \frac{-8+9}{5}, \frac{12+15}{5}\right)$	½	2	
	$\left(\frac{-4}{5}, \frac{1}{5}, \frac{27}{5}\right)$	1		
13.	i) $\lim_{x \to 0} \frac{\sin x}{x} = 1$	1	1	
	ii) $\lim_{x \to 1^-} f(x) = \lim_{x \to 1} a + bx$			
	$= a + b$	½		
	$\lim_{x \to 1^+} f(x) = \lim_{x \to 1^+} b - ax = b - a$	½	1	
	$a + b = 1$			
	$b - a = 1 \; 2b = 2 \quad b = 1$	½		
	$a = 0$	½		
	iii) $y = \tan x$			
	$\frac{dy}{dx} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$	1		
	$= \lim_{h \to 0} \frac{\tan(x+h) - \tan x}{h}$	½		
	$= \lim_{h \to 0} \frac{1}{h}\left(\frac{\sin(x+h)}{\cos(x+h)} - \frac{\sin x}{\cos x}\right)$	½		
	$= \lim_{h \to 0} \frac{1}{h}\left(\frac{\sin(x+h)\cos x - \cos(x+h)\sin x)}{\cos(x+h)\cos x}\right)$	½		
	$= \lim_{h \to 0} \frac{\sin h}{h} \cdot \lim_{h \to 0} \frac{1}{\cos(x+h)\cos x}$			
	$= \frac{1}{\cos^2 x} = \sec^2 x$	½	3	6
	OR			
	i) na^{n-1}	1	1	
	ii) $\lim_{x \to 0} \frac{e^{3x} - 1}{3x} \cdot 3 = 3 \cdot \lim_{x \to 0} \frac{e^{3x} - 1}{3x}$	1		
	$= 3 \cdot 1 = 3$	½		
	iii) $\frac{dy}{dx} = \frac{\tan x(1 - \sin x) - (x + \cos x)\sec^2 x}{\tan^2 x}$	½		
	$= \frac{\tan x - \tan x \sin x - (x + \cos x)\sec^2 x}{\tan^2 x}$ (For formula give 1)	3		6

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14.	i) If the number is not divisible by 5 then it is not divisible by 10	1	1	
	ii) $x, y \in z$			
	We have to prove x and y are not odd integers then xy is not an odd integer	1		
	i.e., $x = 2n \quad y = 2n$	1		
	$xy = (2n)(2n)$	1	3	4
	$= 4n^2$ is an even integer			
15.	i) $\bar{x} = \frac{\Sigma x_i f_i}{N} = \frac{16+40+90+80+60}{26}$			
	$= \frac{286}{26} = 11$	2	2	
	$x_i \quad f_i \quad x_i f_i \quad x_i^2 \quad x_i^2 f_i$			
	4 4 16 16 64			
	8 5 40 64 320			
	10 9 90 100 900			
	16 5 80 256 1280			
	20 3 60 400 1200			
	26 286 3764	1		
	$\sigma = \frac{1}{N}\sqrt{N\left(\Sigma x_i^2 f_i\right) - \left(x_i f_i\right)^2}$ or $\sqrt{\frac{1}{N}\Sigma x_i f_i^2 - (\bar{x})^2}$			
	$= \sqrt{\frac{1}{26} \times 3764 - (11)^2}$	1	2	
	$= \sqrt{144.76 - 121} = \sqrt{23.76} = 4.87$			
	ii) C.V $= \frac{SD}{\bar{x}} \times 100$	½		
	$= \frac{4.87}{11} \times 100 = 44.27$	½	1	4
16.	i) 2^4	1	1	
	ii) P (selection of NCC) $= \frac{30}{60}$			
	P (selection of NSS) $= \frac{32}{60}$			
	P (NCC or NSS) $= \frac{24}{60}$	1		
	a) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$	½		

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	$= \frac{30}{60} + \frac{32}{60} - \frac{24}{60} = \frac{19}{30}$	1		
	b) $P(A' \cap B') = P(A \cup B)' = 1 - P(A \cup B)$	½		
	$= 1 - \frac{19}{30} = \frac{11}{30}$	1	4	5