1	b
2	a
3	d
4	a
5	c
6	b
7	d
8	a
9	a
10	d
11	b
12	c
13	c
14	b
15	a
16	b
17	a
18	b
19	a
20	a
21	{2,8,9}
22	4c3 . 4c2. 5! = 2880 OR 11!/4!2!4! - 8!/2!4!
23	D = {10,12,14} R = {1,4,7) CODOMAIN =A OR R= [0,1)
24	[-7,11]
25	x ϵ (8 , 22]
26	$\frac{(\sin 7x + \sin 5x) + (\sin 9x + \sin 3x)}{(\cos 7x + cos\ 5x) + (\cos 9x + \cos 3x)}$ = $\frac{2 \sin\left(\frac{12x}{2}\right) . \cos\left(\frac{2x}{2}\right) + 2\sin\left(\frac{12x}{2}\right) \cos\left(\frac{6x}{2}\right)}{2 \cos\left(\frac{12x}{2}\right) . \cos\left(\frac{2x}{2}\right) + 2 \cos\left(\frac{12x}{2}\right) \cos\left(\frac{6x}{2}\right)}$ $= \frac{2\ sin\ 6x\ (cos\ x + cos\ 3x)}{2\ cos\ 6x\ (cos\ x + cos\ 3x)}$ $= \frac{\sin 6x}{\cos 6x}$ **= tan 6x**

	OR $\text{L.H.S.} = \frac{1+\cos 2x}{2} + \frac{1+\cos\left(2x+\frac{2\pi}{3}\right)}{2} + \frac{1+\cos\left(2x-\frac{2\pi}{3}\right)}{2}$ $= \frac{1}{2}\left[3+\cos 2x+\cos\left(2x+\frac{2\pi}{3}\right)+\cos\left(2x-\frac{2\pi}{3}\right)\right]$ $= \frac{1}{2}\left[3+\cos 2x+2\cos 2x\cos\frac{2\pi}{3}\right]$ $= \frac{1}{2}\left[3+\cos 2x+2\cos 2x\cos\left(\pi-\frac{\pi}{3}\right)\right]$ $= \frac{1}{2}\left[3+\cos 2x-2\cos 2x\cos\frac{\pi}{3}\right]$ $= \frac{1}{2}\left[3+\cos 2x-\cos 2x\right] = \frac{3}{2} = \text{R.H.S.}$
27.	Given, $x-iy = \sqrt{\frac{a-ib}{c-id}}$ $= \sqrt{\frac{a-ib}{c-id}\times\frac{c+id}{c+id}}$ [On multiplying numerator and denominator by $(c+id)$] $= \sqrt{\frac{(ac+bd)+i(ad-bc)}{c^2+d^2}}$ So, $(x-iy)^2 = \frac{(ac+bd)+i(ad-bc)}{c^2+d^2}$ $x^2-y^2-2ixy = \frac{(ac+bd)+i(ad-bc)}{c^2+d^2}$ On comparing real and imaginary parts, we get $x^2-y^2 = \frac{ac+bd}{c^2+d^2},\ -2xy = \frac{ad-bc}{c^2+d^2}$ (1)

	$\left(x^2+y^2\right)^2=\left(x^2-y^2\right)^2+4x^2y^2$ $=\left(\frac{ac+bd}{c^2+d^2}\right)^2+\left(\frac{ad-bc}{c^2+d^2}\right)^2 \qquad [\text{Using }(1)]$ $=\frac{a^2c^2+b^2d^2+2acbd+a^2d^2+b^2c^2-2adbc}{\left(c^2+d^2\right)^2}$ $=\frac{a^2c^2+b^2d^2+a^2d^2+b^2c^2}{\left(c^2+d^2\right)^2}$ $=\frac{a^2\left(c^2+d^2\right)+b^2\left(c^2+d^2\right)}{\left(c^2+d^2\right)^2}$ $=\frac{\left(c^2+d^2\right)\left(a^2+b^2\right)}{\left(c^2+d^2\right)^2}$ $=\frac{a^2+b^2}{c^2+d^2}$ - Hence Proved
28	Case (i) When all vowels occur together : Let us assume (AUE) as a single letter. Then, this letter (AUE) along with 5 other letters can be arranged in $^6P_6$ = (ways = (6 × 5 × 4 × 3 × 2 × 1) ways = 720 ways. These 3 vowels may be arranged among themselves in 3 ! = 6 ways. Hence, the required number of words with vowels together = (6 !) × (3 !) = (720 × 6) = 4320. Case (ii) When all vowels do not occur together. Number of words formed by using all the 8 letters of the given word = $^8P_8$ = 8 ! = (8 × 7 × 6 × 5 × 4 × 3 × 2 × 1) = 40320. Number of words in which all vowels are never together = (total number of words) - (number of words with all vowels together) =(40320 − 4320) = 36000.
29	$\left(\frac{x}{3}+9y\right)^5$ = $\frac{x^5}{243}+\frac{5}{9}x^4y+30x^3y^2+810x^2y^3+10935xy^4+59049y^5$

30

Let $\frac{a}{r}$, a and ar be the first three terms of the G.P.

Then, we have

$\frac{a}{r}, a, ar = 1 \Rightarrow a^3 = 1 \Rightarrow a = 1$

Also, since the sum of these three terms is $\frac{39}{10}$,

we have

$\frac{a}{r}, a, ar = \frac{39}{10} \Rightarrow a\left(\frac{1}{r} + 1 + r\right) = \frac{39}{10}$

$\Rightarrow \frac{1}{r} + 1 + r = \frac{39}{10}$ (As a = 1)

$\Rightarrow r + \frac{1}{r} = \frac{39}{10} - 1 = \frac{29}{10}$

$\Rightarrow \frac{r^2+1}{r} = \frac{29}{10}$

$\Rightarrow 10r^2 + 10 = 29r$

$\Rightarrow 10r^2 - 25r - 4r + 10 = 0$

$\Rightarrow 5r(2r - 5) - 2(2r - 5) = 0$

$\Rightarrow (2r - 5)(5r - 2) = 0$

$\Rightarrow 2r - 5 = 0$ or $5r - 2 = 0$

$\Rightarrow r = \frac{5}{2}$ or $r = \frac{2}{5}$

OR

Solution

We have 5 + 55 + 555 + ... to n terms

$= 5 \times \{1 + 11 + 111 + \ldots$ to n terms$\}$

$= \frac{5}{9} \times \{9 + 99 + 999 + \ldots$ to n terms$\}$

$= \frac{5}{9} \times \{(10 - 1) + (10^2 - 1) + (10^3 - 1) + \cdots$ to n terms$\}$

$= \frac{5}{9} \times \{(10 + 10^2 + 10^3 + \cdots$ to n terms$) - n\}$

$= \frac{5}{9} \times \left\{\frac{10 \times (10^n - 1)}{(10-1)} - n\right\} = \frac{5}{81} \times (10^{n+1} - 9n - 10)$

Hence, the required sum is $\frac{5}{81} \times (10^{n+1} - 9n - 10)$

31	So,2nd term =ar and 3rd term =ar^2 A/q, $ar+ar^2=280$ => $ar(1+r)=280$ ---------(1) Similarly, 5th term =ar^4 and 6th term =ar^5 A/q, $ar^4+ar^5=4375$ =>$ar^4(1+r)=4375$ --------(2) Now, dividing eqn (2) by (1) on both sides, $(ar^4(1+r))/(ar(1+r))=4375/280$ =>$r^3=15.625$ =>$r=2.5$ Substituting r in equation 1,we get $a\times2.5(1+2.5)=280$ =>$2.5a\times3.5=280$ =>$a=280/(2.5\times3.5)$ =>$a=32$ Therefore,4th term =$ar^3=32\times2.5^3=500$
32	Here general term in the expansion of $[9x-\frac{1}{3\sqrt{x}}]^{18}$: $T_{r+1}=18_{C_r}(9x)^{18-r}(-\frac{1}{3\sqrt{x}})^r$ ...(i) Putting r=12 in (i) $T_{13}=18_{C_{12}}(9x)^{18-12}(-\frac{1}{3\sqrt{x}})^{12}$ $=18_{C_{12}}9^6x^6.(-1)^{12}.\frac{1}{3^{12}.x^6}$ $=18_{C_{12}}\frac{9^6}{3^{12}}=18_{C_{12}}=18564$
33	Substituting the values we have, we get: $65=(42+18+23)-(n(A\cap B)+n(B\cap C)+n(A\cap C))+4$ Simplifying the above equation, we get: $65=83-(n(A\cap B)+n(B\cap C)+n(A\cap C))$ Solving for $n(A\cap B)+n(B\cap C)+n(A\cap C)$, we get: $n(A\cap B)+n(B\cap C)+n(A\cap C)=83-65=18$ Therefore, the number of students who bagged medals in exactly two sports is 18.

34	$R = \left(\frac{\alpha+3}{2}, \frac{\beta+8}{2}\right)$ and lie on $x + 3y = 7$ $\frac{\alpha+3}{2} + \frac{3\beta+24}{2} = 7$ $\alpha + 3 + 3\beta + 24 = 14$ $\alpha + 3\beta = -13 \qquad \ldots(1)$ And since PQ is perpendicular to $x + 3y = 7$ (Slope of line) × (Slope of PQ) = -1 $\frac{-1}{3} \times \frac{\beta-8}{\alpha-3} = -1$ $\beta - 8 - 3\alpha - 9$ $\beta - 3\alpha = -1 \qquad \ldots(2)$ Solving (1) and (2) $\beta = -4,\ \alpha = -1$ $\therefore$ Q is $(-1,\ -4)$
35	$= \frac{2\cos 2x \sin x + 2\cos 6x \sin 3x}{2\sin 2x \sin x + 2\sin 6x \sin 3x}$ $= \frac{\sin(2x+x) - \sin(2x-x) + \{\sin(6x+3x) - \sin(6x-3x)\}}{\cos(2x-x) - \cos(2x+x) + \cos(6x-3x) - \cos(6x+3x)}$ $= \frac{\sin 3x - \sin x + \sin 9x - \sin 3x}{\cos x - \cos 3x + \cos 3x - \cos 9x}$ $= \frac{\sin 9x - \sin x}{\cos x - \cos 9x}$ $= \frac{2\cos\frac{9x+x}{2}\sin\frac{9x-x}{2}}{-2\sin\frac{x+9x}{2}\sin\frac{x-9x}{2}}$ $= \frac{2\cos\frac{9x+x}{2}\sin\frac{9x-x}{2}}{2\sin\frac{x+9x}{2}\sin\frac{9x-x}{2}}$ $= \frac{\cos 5x \sin 4x}{\sin 5x \cos 4x}$ $= \cot 5x$