J.K. SHAH CLASSES

SOLUTION SET

MATHEMATICS & STATISTICS

FYJC TERMINAL TEST - 02

DURATION - 2 HR MARKS - 50

Q1. (A) Attempt ANY **THREE OF** THE FOLLOWING (09)

Q-1A

01. $kx + 3y + 4 = 0$; $x + ky + 3 = 0$; $3x + 4y + 5 = 0$ are consistent . Find k

$kx + 3y = -4$

$x + ky = -3$

$3x + 4y = -5$ are consistent

$$\begin{vmatrix} k & 3 & -4 \\ 1 & k & -3 \\ 3 & 4 & -5 \end{vmatrix} = 0$$

taking – common from C_1

$$\begin{vmatrix} \overset{+}{k} & \overset{-}{3} & \overset{+}{4} \\ 1 & k & 3 \\ 3 & 4 & 5 \end{vmatrix} = 0$$

$k(5k - 12) - 3(5 - 9) + 4(4 - 3k)) = 0$

$5k^2 - 12k - 3(-4) + 16 - 12k = 0$

$5k^2 - 12k + 12 + 16 - 12k = 0$

$5k^2 - 24k + 28 = 0$

$5k^2 - 10k - 14k + 28 = 0$

$5k(k - 2) - 14(k - 2) = 0$

$k = 14/5$, $k = 2$

02. Find two numbers whose sum is 100 and the ratio of whose AM to GM is 5 : 4

$a + b = 100$ ...... (1)

$$\frac{A.M.}{G.M} = \frac{5}{4}$$

$$\frac{\frac{a+b}{2}}{\sqrt{ab}} = 5/4$$

$$\frac{50}{\sqrt{ab}} = \frac{5}{4} \quad \text{...... from 1}$$

$\sqrt{ab} = 40$

$ab = 1600$

$a(100 - a) = 1600$

$100a - a^2 = 1600$

$a^2 - 100a - 1600 = 0$

$(a - 80)(a - 20) = 0$

$a = 80$; $a = 20$

$b = 20$; $b = 80$

two numbers are : 20, 80

03. $\sqrt{3} + 3 + 3\sqrt{3} + \ldots\ldots = 39 + 13\sqrt{3}$.

Find n

$a = \sqrt{3}\ ; \quad r = \sqrt{3}\ ; \quad S_n = 39 + 13\sqrt{3}$

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$39 + 13\sqrt{3} = \frac{\sqrt{3}(\sqrt{3}^n - 1)}{\sqrt{3} - 1}$$

$$13(3 + \sqrt{3}) = \frac{\sqrt{3}(\sqrt{3}^n - 1)}{\sqrt{3} - 1}$$

$$13\cancel{\sqrt{3}}(\sqrt{3} + 1) = \frac{\cancel{\sqrt{3}}(\sqrt{3}^n - 1)}{\sqrt{3} - 1}$$

$$13(\sqrt{3} + 1) = \frac{\sqrt{3}^n - 1}{\sqrt{3} - 1}$$

$$13(\sqrt{3} + 1)(\sqrt{3} - 1) = \sqrt{3}^n - 1$$

$$13(3 - 1) = \sqrt{3}^n - 1$$

$$26 = \sqrt{3}^n - 1$$

$$27 = \sqrt{3}^n$$

$$3^3 = \sqrt{3}^n$$

$$\sqrt{3}^6 = \sqrt{3}^n$$

$$n = 6$$

04. sum is 60 and the ratio of the product of the second and third term to the product of the first and the fourth term is 3 : 2

SOLUTION

let 4 nos in AP : $a - 3d\ ,\ a - d\ ,\ a + d\ ,\ a + 3d$

sum = 60

$4a = 60 \qquad \therefore\ a = 15$

ratio of the product of the second and third term to the product of the first and the fourth term is 3 : 2

$$\frac{(a - d)(a + d)}{(a - 3d)(a + 3d)} = \frac{3}{2}$$

$$\frac{a^2 - d^2}{a^2 - 9d^2} = \frac{3}{2}$$

$$2a^2 - 2d^2 = 3a^2 - 27d^2$$

$$25d^2 = a^2$$

$$25d^2 = 225$$

$$d^2 = 9 \qquad \therefore\ d = \pm 3$$

$a = 15\ ,\ d = 3$

nos are : $a - 3d\ ,\ a - d\ ,\ a + d\ ,\ a + 3d$

$15 - 9\ ,\ 15 - 3\ ,\ 15 + 3\ ,\ 15 + 9$

$6\ ,\ 12\ ,\ 18\ ,\ 14$

$a = 15\ ,\ d = -3$

nos are : $a - 3d\ ,\ a - d\ ,\ a + d\ ,\ a + 3d$

$15 + 9\ ,\ 15 + 3\ ,\ 15 - 3\ ,\ 15 - 9$

$24\ ,\ 18\ ,12\ ,\ 6$

(B) Attempt ANY **ONE OF** THE FOLLOWING (04)

Q-1B

01. $$\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix} = abc(a-b)(b-c)(c-a)$$

taking 'a ', 'b' & 'c' common from C_1, C_2 & C_3 respectively

$$= abc\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}$$

$C_1 - C_2$, $C_2 - C_3$

$$= abc\begin{vmatrix} 0 & 0 & 1 \\ a-b & b-c & c \\ a^2-b^2 & b^2-c^2 & c^2 \end{vmatrix}$$

Taking (a – b) common from C1 & (b – c) common from C_2

$$= abc(a-b)(b-c)\begin{vmatrix} 0 & 0 & 1 \\ 1 & 1 & c \\ a+b & b+c & c^2 \end{vmatrix}$$

$C_1 - C_2$

$$= abc(a-b)(b-c)\begin{vmatrix} 0 & 0 & 1 \\ 0 & 1 & c \\ a-c & b+c & c^2 \end{vmatrix}$$

Taking (a – c) common from C_1

$$= abc(a-b)(b-c)(a-c)\begin{vmatrix} 0 & 0 & 1 \\ 0 & 1 & c \\ 1 & b+c & c^2 \end{vmatrix}$$

Expanding the determinant

$$= abc(a-b)(b-c)(a-c)\left[1(0-1)\right]$$

$$= abc(a-b)(b-c)(a-c)\ (-1)$$

$$= abc(a-b)(b-c)(c-a)$$

02. $$\begin{vmatrix} x+y & y+z & z+x \\ z+x & x+y & y+z \\ y+z & z+x & x+y \end{vmatrix} = 2\begin{vmatrix} x & y & z \\ z & x & y \\ y & z & x \end{vmatrix}$$

LHS

$C_1 - C_2$

$$= \begin{vmatrix} x-z & y+z & z+x \\ z-y & x+y & y+z \\ y-x & z+x & x+y \end{vmatrix}$$

$C_1 + C_3$

$$= \begin{vmatrix} 2x & y+z & z+x \\ 2z & x+y & y+z \\ 2y & z+x & x+y \end{vmatrix}$$

Taking '2' common from C_1

$$= 2\begin{vmatrix} x & y+z & z+x \\ z & x+y & y+z \\ y & z+x & x+y \end{vmatrix}$$

$C_3 - C_1$

$$= 2\begin{vmatrix} x & y+z & z \\ z & x+y & y \\ y & z+x & x \end{vmatrix}$$

$C_2 - C_3$

$$= 2\begin{vmatrix} x & y & z \\ z & x & y \\ y & z & x \end{vmatrix} = RHS$$

Q-2A

Q2. (A) Attempt ANY TWO OF THE FOLLOWING

01. Find equation of the line passing through centroid of triangle ABC whose vertices are A(1,6) , B(−2,9) and C(−2 , 3) such that sum of its intercepts on the coordinate axes is 6 .

$$G \equiv \left(\frac{1-2-2}{3}, \frac{6+9+3}{3}\right) \equiv (-1\ ,\ 6)$$

$a + b = 6$ …….. given

$b = 6 - a$ ….. (1)

let the equation of the line be

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$\frac{x}{a} + \frac{y}{6-a} = 1$$

since the line passes through (−1,6) , it must satisfy the equation

$$\frac{-1}{a} + \frac{6}{6-a} = 1$$

$$-6 + a + 6a = a(6 - a)$$

$$-6 + 7a = 6a - a^2$$

$$a^2 + a - 6 = 0$$

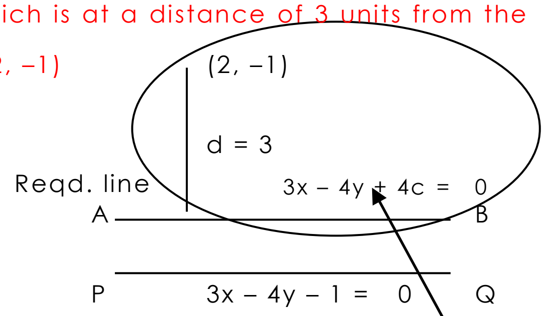
$$a^2 + 3a - 2a - 6 = 0$$

$$(a + 3)(a - 2) = 0$$

$a = -3$	$a = 2$
$b = 6 - a$	$b = 6 - a$
$= 6 + 3$	$= 6 - 2$
$= 9$	$= 4$
Equation	Equation
$\frac{x}{a} + \frac{y}{b} = 1$	$\frac{x}{a} + \frac{y}{b} = 1$
$\frac{x}{-3} + \frac{y}{9} = 1$	$\frac{x}{2} + \frac{y}{4} = 1$
$9x - 3y = -27$	$\frac{2x + y}{4} = 1$
$3x - y + 9 = 0$	$2x + y = 4$

02.

Find equation of line parallel to $3x - 4y - 1 = 0$ and which is at a distance of 3 units from the point (2, −1)



STEP 1 : PQ

$3x - 4y - 1 = 0$ $\quad m = \frac{-a}{b} = \frac{-3}{-4} = \frac{3}{4}$

STEP 2 : AB

$m_{AB} = \frac{3}{4}$ (AB//PQ)

equation of AB : $y = mx + c$

$$y = \frac{3x}{4} + c$$

$$y = \frac{3x + 4c}{4}$$

$$4y = 3x + 4c$$

$$3x - 4y + 4c = 0$$

STEP 3 :

$d = 3$

$$\left|\frac{3(2) - 4(-1) + 4c}{\sqrt{3^2 + 4^2}}\right| = 3$$

$$\left|\frac{6 + 4 + 4c}{5}\right| = 3$$

$$\left|\frac{10 + 4c}{5}\right| = 3$$

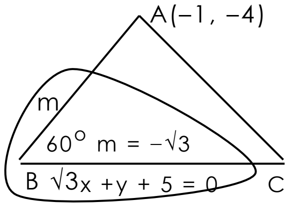
$$\frac{10 + 4c}{5} = \pm 3$$

$$10 + 4c = \pm 15$$

$10 + 4c = 15$	$10 + 4c = -15$
$4c = 5$	$4c = -25$
Equation of AB	Equation of AB
$3x - 4y + 5 = 0$	$3x - 4y - 25 = 0$

03.

find equation of the lines which pass through point $(-1, -4)$ and inclined at an angle of 60° to the line $\sqrt{3}x + y + 5 = 0$



STEP 1 :

$\sqrt{3}x + y + 5 = 0$

$$m = \frac{-a}{b} = \frac{-\sqrt{3}}{1} = -\sqrt{3}$$

STEP 2 :

$$\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1.m_2}\right|$$

$$\tan 60 = \left|\frac{m + \sqrt{3}}{1 + m(-\sqrt{3})}\right|$$

$$\sqrt{3} = \left|\frac{m + \sqrt{3}}{1 - \sqrt{3}m}\right|$$

$$\frac{m + \sqrt{3}}{1 - \sqrt{3}m} = \sqrt{3}$$

$$m + \sqrt{3} = \sqrt{3} - 3m$$

$$m + 3m = \sqrt{3} - \sqrt{3}$$

$$4m = 0$$

$$m = 0$$

$$\frac{m + \sqrt{3}}{1 - \sqrt{3}m} = -\sqrt{3}$$

$$m + \sqrt{3} = -\sqrt{3} + 3m$$

$$m - 3m = -\sqrt{3} - \sqrt{3}$$

$$-2m = -2\sqrt{3}$$

$$m = \sqrt{3}$$

STEP 3

Equation of AB : $m = 0$, $A(-1, -4)$

$$y - y_1 = m(x - x_1)$$

$$y + 4 = 0(x + 1)$$

$$y + 4 = 0$$

Equation of AC : $m = \sqrt{3}$, $A(-1, -4)$

$$y - y_1 = m(x - x_1)$$

$$y + 4 = \sqrt{3}(x + 1)$$

$$y + 4 = \sqrt{3}x + \sqrt{3}$$

$$\sqrt{3}x - y + \sqrt{3} - 4 = 0$$

B) Attempt ANY **TWO OF** THE FOLLOWING (06)

Q-2B

01.

$8\sin x - \cos x = 4$

$8\sin x - 4 = \cos x$

$(8\sin x - 4)^2 = \cos^2 x$

$64 \sin^2 x - 64 \sin x + 16 = 1 - \sin^2 x$

$65 \sin^2 x - 64 \sin x + 15 = 0$

$65 \sin^2 x - 39 \sin x - 25 \sin x + 15 = 0$

$13\sin x\,(5\sin x - 3) - 5(5\sin x - 3) = 0$

$(13\sin x - 5)(5\sin x - 3) = 0$

$\sin x = \frac{5}{13}$ OR $\sin x = \frac{3}{5}$

02

$$\frac{1}{\tan 3\theta - \tan \theta} + \frac{1}{\cot \theta - \cot 3\theta} = \cot 2\theta$$

LHS

$$= \frac{1}{\tan 3\theta - \tan \theta} + \frac{1}{\cot \theta - \cot 3\theta}$$

$$= \frac{1}{\tan 3\theta - \tan \theta} + \frac{1}{\frac{1}{\tan \theta} - \frac{1}{\tan 3\theta}}$$

$$= \frac{1}{\tan 3\theta - \tan \theta} + \frac{\tan 3\theta \, . \tan \theta}{\tan 3\theta - \tan \theta}$$

$$= \frac{1 + \tan 3\theta \, . \tan \theta}{\tan 3\theta - \tan \theta}$$

$$= \frac{1}{\frac{\tan 3\theta - \tan \theta}{1 + \tan 3\theta \, . \tan \theta}}$$

$$= \frac{1}{\tan (3\theta - \theta)}$$

$$= \frac{1}{\tan 2\theta}$$

$= \cot 2\theta = \text{RHS}$

03.

$$\frac{\cos 15^\circ + \sin 15^\circ}{\cos 15^\circ - \sin 15^\circ} = \sqrt{3}$$

$\tan 60^\circ = \tan (45 + 15)$

$$\sqrt{3} = \frac{\tan 45^\circ + \tan 15^\circ}{1 - \tan 45^\circ . \tan 15^\circ}$$

$$= \frac{1 + \tan 15^\circ}{1 - \tan 15^\circ}$$

$$= \frac{1 + \frac{\sin 15^\circ}{\cos 15^\circ}}{1 - \frac{\sin 15^\circ}{\cos 15^\circ}}$$

$$\sqrt{3} = \frac{\cos 15^\circ - \sin 15^\circ}{\cos 15^\circ - \sin 15^\circ}$$

Q3. (A) Attempt ANY **ONE OF** THE FOLLOWING (04)

01. How many different arrangements can be made using all letters of the word 'ENGLISH'

'ENGLISH ' : 7 – LETTER WORD

VOWELS : - E , 1 ; CONSONANTS : - N , G , L , S , H

Q-3A

a) how many of them begin with N and end with L

1^{ST} place can be filled by letter 'N' in 1 way

Last place can be filled by letter 'L' in 1 way

Having done that ,

Remaining 5 places can be filled by remaining 5 letters in $^5P_5$ = 5! ways

By fundamental principle of Multiplication

Total arrangements = 1 x 1 x 5! **= 120**

b) in how many of them do vowel occupy even places

2 vowels can be arranged into any 2 out of the 3 even places in $^3P_2$ ways

Having done that

Remaining 5 places can be filled by remaining 5 consonants in $^5P_5$ = 5! ways

By fundamental principle of Multiplication

Total arrangements = $^3P_2$ x 5! **=** 6 x 120 = 720

c) in how many of these vowels are always together

consider 2 vowels as 1 set .

1 set of 2 vowels & 5 consonants can be arranged in $^6P_6$ = 6! Ways

Having done that ;

The 2 vowels can then be arranged amongst themselves in $^2P_2$ = 2! ways

By fundamental principle of Multiplication

Total arrangements = 6! x 2!

= 720 x 2

= 1440

02. A family of 3 sisters and 5 brothers is to be arranged for a photograph in one row . In how many ways can they be seated if

a) all the sisters sit together b) no two sisters sit together

a) all the sisters sit together

Consider 3 sisters as 1 set

1 set of 3 sisters & 5 Brothers can be arranged in $^6P_6 = 6!$ ways

Having done that ;

3 sisters can then be arranged among themselves in $^3P_3 = 3!$ ways

By fundamental principle of Multiplication

Total arrangements $= 6! \times 3!$

$= 720 \times 6 = 4320$

b) no two sisters sit together

* B * B * B * B * B *

3 sisters can be arranged into any 3 of the 6 positions marked '*' in $^6P_3$ ways

Having done that ;

5 Brothers can then be arranged in $^5P_5 = 5!$ ways

By fundamental principle of Multiplication

Total arrangements $= {^6P_3} \times 5!$

$= 120 \times 120 = 14400$

(B) Attempt ANY **THREE OF** THE FOLLOWING (09)

01. From the following data , how many values of the given data are more than 28

CI	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
No. of worker :	7	11	20	8	4

Q-3B

SOLUTION :

CI	f	cf
0 – 10	7	7
10 – 20	11	18
20 – 30	20	38 ←
30 – 40	8	46
40 – 50	4	50

let nth observation have the value '28'

Its in the class 20 – 30

$$28 = 20 + \frac{n - 18}{20}(30 - 20)$$

$$8 = \frac{n - 18}{20} . (10)$$

$$8 = \frac{n - 18}{2}$$

$$16 = n - 18 \qquad \therefore n = 34$$

34^{th} observation has the value 28

$\therefore$ no. of observations having value more than 28 = 50 – 34 = 16

02.

Marks	no of students
more that 0	50
more that 10	46
more that 20	40
more that 30	20
more that 40	10
more that 50	3

CI	f	cf
0 – 10	4	4
10 – 20	6	10
20 – 30	20	30
30 – 40	10	40
40 – 50	7	47
50 – 60	3	50

$$d_7 = 4\frac{N}{10} = \frac{4(50)}{10} = 20$$

$$D_4 = L_1 + \frac{d_4 - c}{f}(L_2 - L_1)$$

$$= 20 + \frac{20 - 10}{20}(30 - 20)$$

$$= 20 + \frac{10}{20}(10)$$

$$= 20 + 5 \qquad = 25 \text{ marks}$$

03. $\dfrac{\log_2 a}{4} = \dfrac{\log_2 b}{6} = \dfrac{\log_2 c}{3k}$ and $a^3.b^2.c = 1$. Find k

SOLUTION

$$\frac{\log_2 a}{4} = \frac{\log_2 b}{6} = \frac{\log_2 c}{3k} = m$$

$\log_2 a = 4m \quad \therefore a = 2^{4m}.$

$\log_2 b = 6m \quad \therefore b = 2^{6m}.$

$\log_2 c = 3km \quad \therefore c = 2^{3km}.$

$a^3.b^2.c = 1$

$2^{4m.3}.\ 2^{6m.2}.\ 2^{3km} = 1$

$2^{12m}.\ 2^{12m}.\ 2^{3km} = 1$

$2^{12m + 12m + 3km} = 1$

$2^{24m + 3km} = 2^0$

EQUATING THE POWERS

$24m + 3km = 0$

$3km = -24m$

$3k = -24$

$k = -8$

04. if $a^x = b^y = c^z$ and $b^2 = ac$ then prove that $y = \dfrac{2xz}{x+z}$

SOLUTION

$a^x = b^y = c^z$

$\log a^x = \log b^y = \log c^z$

$x \log a = y \log b = z \log c = k$

$\log a = \dfrac{k}{x}$, $\log b = \dfrac{k}{y}$; $\log c = \dfrac{k}{z}$

NOW

$b^2 = ac$

$\log b^2 = \log ac$

$2 \log b = \log a + \log c$

$2 \dfrac{k}{y} = \dfrac{k}{x} + \dfrac{k}{z}$

$\dfrac{2}{y} = \dfrac{1}{x} + \dfrac{1}{z}$

$\dfrac{2}{y} = \dfrac{x + z}{xz}$

$y = \dfrac{2xz}{x + z}$ .... PROVED

Q4. (A) Attempt ANY **TWO OF** THE FOLLOWING (06)

Q-4A

01.

the mean and standard deviation of 100 observations were found to be 6 and 2 respectively . If at the time of calculation , one observation was wrongly taken as 17 instead of 7 . Find the correct standard deviation

$\bar{x} = 6$ & $\sigma = 2$, n = 100

incorrect x = 17 ,

correct x = 7

STEP 1 : CORRECTION OF MEAN

$$\bar{x} = \frac{\Sigma x}{n}$$

$$6 = \frac{\Sigma x}{100}$$

Σx	=	600
– incorrect x	–	17
+correct x	+	7
Σx correct	=	590

$$\bar{x}_{correct} = \frac{\Sigma x}{n}$$

$$= \frac{590}{100}$$

$$= 5.9$$

STEP 2 : CORRECTION OF S.D.

$$\sigma = \sqrt{\frac{\Sigma x^2}{n} - \bar{x}^2}$$

$$\sigma^2 = \frac{\Sigma x^2}{n} - \bar{x}^2$$

$$\Sigma x^2 = n(\sigma^2 + \bar{x}^2)$$

$$= 100(2^2 + 6^2)$$

$$= 100(4 + 36)$$

$$= 4000$$

Now

Σx^2	=	4000
– incorrect x^2	–	289
+ correct x^2	+	49
Σx^2 correct	=	3760

$$\sigma_{correct} = \sqrt{\frac{\Sigma x^2}{n} - \bar{x}^2}$$

CORRECT MEAN

$$= \sqrt{\frac{3760}{100} - 5.9^2}$$

$$= \sqrt{37.60 - 34.81}$$

$$= \sqrt{2.79}$$

taking log on both sides

$$\log \sigma = \frac{1}{2}(\log 2.79)$$

$$= \frac{1}{2}(0.4456)$$

$$= \frac{0.4456}{2}$$

$$\log \sigma = 0.2228$$

σ correct= AL(0.2228)

= 1.670

02.

first 3 moments about 7 calculated from a set of 9 observations are 0.2 ; 19.4 and –41 respectively . Find the mean , variance and the second raw moment of the distribution

A = 7 ,

$\mu_1(a) = 0.2$, $\mu_2(a) = 19.4$, $\mu_3(a) = -41$

$\mu_1(a) = \bar{x} - A$

$0.2 = \bar{x} - 7$

$\bar{x} = 7.2$ (mean)

$\mu_2 = \mu_2(a) - \mu_1(a)^2$

$= 19.4 - 0.2^2$

$= 19.4 - 0.04$

$= 19.36$

variance $(\sigma^2) = \mu_2 = 19.36$

Now

$$\sigma^2 = \frac{\sum x^2}{n} - \bar{x}^2$$

$$19.36 = \frac{\sum x^2}{n} - 7.2^2$$

$$19.36 = \frac{\sum x^2}{n} - 51.84$$

$$\frac{\sum x^2}{n} = 19.36 + 51.84 = 71.2$$

SECOND RAW MOMENT

$$\mu_2' = \frac{\sum x^2}{n} = 71.2$$

03.

the mean & variance of a distribution are 50 and 400 respectively . Find the mode and the median if SKp = –0.4

Mean = 50 , $\sigma^2 = 400$, SKp = –0.4

STEP 1 : MODE

$$SkP = \frac{\text{Mean} - \text{Mode}}{\sigma}$$

$$-0.4 = \frac{50 - \text{Mode}}{20}$$

$-8 = 50 - \text{Mode}$

Mode = 50 + 8

= 58

STEP 2 : MEDIAN

Mean – mode = 3(mean - median)

,50 – 58 = 3(50 – median)

$$-\frac{8}{3} = 50 - \text{median}$$

– 2.67 = 50 – median

median = 52,67

(B) Attempt ANY **TWO OF** THE FOLLOWING (06)

Q-4B

01. the first four raw moments are 2, 20 , 40 , 800 respectively . Find the coefficient of kurtosis γ_2

moments about A = 0 ,

$\mu_1(a) = 2$, $\mu_2(a) = 20$, $\mu_3(a) = 40$

$\mu_4(a) = 800$

$\mu_1 = 0$

$$\mu_2 = \mu_2(a) - \mu_1(a)^2$$
$$= 20 - 4$$
$$= 16$$

$$\mu_3 = \mu_3(a) - 3\mu_1(a)\,\mu_2(a) + 2\mu_1(a)^3$$

$$\mu_4 = \mu_4(a) - 4\mu_1(a)\,\mu_3(a) + 6\mu_1(a)^2\mu_2(a) - 3\mu_1(a)^4$$
$$= 800 - 4(2)(40) + 6(4)(20) - 3(16)$$
$$= 800 - 320 + 480 - 48$$
$$= 912$$

$$\beta_2 = \frac{\mu_4}{\mu_2^2}$$
$$= \frac{912}{256}$$
$$= 3.5625$$

$$\gamma_2 = \beta_2 - 3 = 0.5625$$

02.

$${}^{n+2}P_4 : {}^{n+3}P_6 = 1 : 14$$

$$\frac{{}^{n+2}P_4}{{}^{n+3}P_6} = \frac{1}{14}$$

$$\frac{\dfrac{(n+2)!}{(n+2-4)!}}{\dfrac{(n+3)!}{(n+3-6)!}} = \frac{1}{14}$$

$$\frac{\dfrac{(n+2)!}{(n-2)!}}{\dfrac{(n+3)!}{(n-3)!}} = \frac{1}{14}$$

$$\frac{(n+2)!}{(n-2)!} \times \frac{(n-3)!}{(n+3)!} = \frac{1}{14}$$

$$\frac{(n+2)!}{(n+3)!} \times \frac{(n-3)!}{(n-2)!} = \frac{1}{14}$$

$$\frac{(n+2)!}{(n+3)(n+2)!} \times \frac{(n-3)!}{(n-2)(n-3)!} = \frac{1}{14}$$

$$\frac{1}{(n+3)(n-2)} = \frac{1}{14}$$

$$(n+3)(n-2) = 14$$

$$(n+3)(n-2) = 7\,.\,2$$

On Comparing ;

$$n + 3 = 7$$
$$n = 7 - 3 = 4$$

03. How many 5 digit numbers can be formed by using all the digits 2 , 3 , 4 , 0 , 9 . From them how numbers are more than 40000 and divisible by 2 .

ten thousand place must not contain '0' . Hence it can be filled by any one of the remaining 4 digits in ${}^4P_1$ ways

Having done that ,

The remaining 4 places can be filled by the remaining 4 digits in ${}^4P_4$ = 4! Ways

By Fundamental Principle of Multiplication

Total 5 digit numbers formed = ${}^4P_1 \times 4! = 4 \times 24 = 96$

numbers are more than 40000 and divisible by 2

Case 1 : Numbers between 40000 & 50000

Ten thousand place can be filled by digit '4' in 1 way

Unit place can be filled by any one of the digits 0 & 2 in ${}^2P_1$ ways

Having done that ,

The remaining 3 places can be filled by the remaining 3 digits in ${}^3P_3 = 3!$ Ways

By Fundamental Principle of Multiplication

numbers formed = ${}^2P_1 \times 3! = 2 \times 6 = 12$

Case 2 : Numbers exceeding 50000

Ten thousand place can be filled by digit '9' in 1 way

Unit place can be filled by any one of the digits 0 , 2 & 4 in ${}^3P_1$ ways

Having done that ,

The remaining 3 places can be filled by the remaining 3 digits in ${}^3P_3 = 3!$ Ways

By Fundamental Principle of Multiplication

numbers formed = ${}^3P_1 \times 3! = 3 \times 6 = 18$

By Fundamental Principle of ADDITION

Total numbers formed = 12 + 18 = 30

All The Best for Terminal exams ,

Ashish Sir @ JKSC