XI Business Maths

(Public Exam Answer Key)

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Part - I

1) b 0, 1

2) b 18

3) a 5

4) d n^r

5) a $\frac{1}{3}$

6) b 3

7) d $22^{\circ}30'$

8) b $\frac{5\pi}{24}$

9) b 2

10) b $f(x) = x^3 + 5$

11) a $-x^2$

12) b $|\eta_d| > 1$

13) b $\eta_d = \frac{AR}{AR-MR}$

14) a 91

15) b 11:25

16) b $\frac{1}{36}$

17) c) Independent

18) b) Negative

19) b) Income and Expenditure

20) a) $E_j - E_i = L_j - L_i = t_{ij}$

Part - II

21) $A^{-1} = \frac{1}{|A|} \text{adj} A$

$|A| = \begin{vmatrix} 2 & 4 \\ -3 & 2 \end{vmatrix}$

$|A| = 16 \neq 0$

$\text{adj} A = \begin{bmatrix} 2 & -4 \\ 3 & 2 \end{bmatrix}$

$\boxed{A^{-1} = \frac{1}{16}\begin{bmatrix} 2 & -4 \\ 3 & 2 \end{bmatrix}}$

22) $n = 10$

$r = 4$

Required number $= nP_r$

$= 10P_4$

$= 10 \times 9 \times 8 \times 7$

$\boxed{\text{Required number} = 5040}$

(Reduced portion)

23) $OP = 3AP$

$OP^2 = 9AP^2$

$(x_1 - 0)^2 + (y_1 - 0)^2 = 9x_1^2$

$x_1^2 + y_1^2 = 9x_1^2$

$\boxed{8x_1^2 - y_1^2 = 0}$

24) $\cot 75^{\circ}$

$\boxed{\tan 75^{\circ} = \frac{\sqrt{3}+1}{\sqrt{3}-1}}$

$\cot 75^{\circ} = \frac{1}{\tan 75^{\circ}}$

$= \frac{1}{\left(\frac{\sqrt{3}+1}{\sqrt{3}-1}\right)}$

$\boxed{\cot 75^{\circ} = \frac{\sqrt{3}-1}{\sqrt{3}+1}}$

25) $y = x^3 + 19$

$\frac{dy}{dx} = 3x^2$ — (1)

$\frac{dy}{dx} = 27$ — (2)

$3x^2 = 27$

$x^2 = 27/3$

$x^2 = 9$ $\boxed{x = \pm 3}$

26) Market Value = No of Shares × M.V of shares

$= 132 \times 62$

$\boxed{\text{M.V} = \text{Rs } 8{,}184}$

27) $P(A \cap B) = P(A) \times P(B)$

$= \frac{3}{5} \times \frac{1}{5}$

$\boxed{P(A \cap B) = \frac{3}{25}}$

28) $r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{N\Sigma x^2 - (\Sigma x)^2}\sqrt{N\Sigma y^2 - (\Sigma y)^2}}$

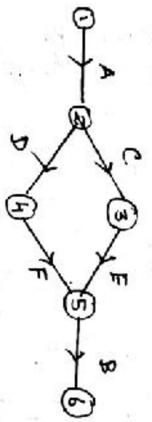
$= \frac{10(115) - (50)(-30)}{\sqrt{10(290) - (50)^2}\sqrt{10(300) - (-30)^2}}$

$= \frac{-1150 + 1500}{\sqrt{2900 - 2500}\sqrt{3000 - 900}}$

$= \frac{350}{\sqrt{400}\sqrt{2100}}$

$\boxed{r = 0.3818}$

29,



30, $x = \frac{1}{t}$ $\quad y = \cos t$

$\frac{dx}{dt} = -\frac{1}{t^2}$ $\quad \frac{dy}{dt} = -\sin t$

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$$

$$= \frac{-\sin t}{-1/t^2}$$

$$\boxed{\frac{dy}{dx} = t^2 \sin t}$$

Part - III

31, $AB = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$BA = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$AB = BA = I$

32, 3 consonant from 7 $\Big\} = 7C_3$

2 Vowels from 4 $\Big\} = 4C_3$

No of ways $\Big\} = 5! \times 7C_3 \times 4C_2$

$= 120 \times \frac{7 \times 6 \times 5}{1 \times 2 \times 3} \times \frac{4 \times 3}{2 \times 1}$

$\boxed{\text{No. of Ways} = 25200}$

33,

$$\frac{\sin A - \sin C}{\cos C - \cos A} = \frac{2\sin\left(\frac{A-C}{2}\right)\cos\left(\frac{A+C}{2}\right)}{2\sin\left(\frac{A+C}{2}\right)\sin\left(\frac{A-C}{2}\right)}$$

$$= \frac{\cos\left(\frac{A+C}{2}\right)}{\sin\left(\frac{A+C}{2}\right)}$$

$$= \cot\left(\frac{A+C}{2}\right)$$

$\boxed{\frac{\sin A - \sin C}{\cos C - \cos A} = \cot B}$

Hence proof

34,

$$\frac{dy}{dx} = \frac{(1+3x)(-3) - (1-3x)(3)}{(1+3x)^2}$$

$$\boxed{\frac{dy}{dx} = \frac{-6}{(1+3x)^2}}$$

35, $y = x^3 + 10x^2 - 48x + 8$

$\frac{dy}{dx} = 3x^2 + 20x - 48$

M.F is Twice the x.

$3x^2 + 20x - 48 = 2x$

$3x^2 + 20x - 2x - 48 = 0$

$3x^2 + 18x - 48 = 0$

$\div 3$ $\quad x^2 + 6x - 16 = 0$

$\boxed{x = -8}$ $\quad \boxed{x = 2}$

36, Face Value = 100

M.V = (100 − 17 + 1)

M.V = 84

% of income = $\frac{12 \times 100}{84}$

% of income = $\frac{100}{7}$

$\boxed{\text{\% of income} = 14\tfrac{2}{7}\,\%}$

37, Mean = $\frac{\Sigma x}{n}$

$= \frac{22000}{5}$

$\boxed{\text{Mean} = 4400}$

x	$\lvert D \rvert = (x - 4400)$
4000	400
4200	200
4400	0
4600	200
4800	400

$\Sigma\lvert D\rvert = 1200$

MD = $\frac{\Sigma\lvert D\rvert}{n} = \frac{1200}{5}$

$\boxed{\text{MD} = 240}$

Coefficient = $\frac{240}{4400}$

$\boxed{\text{Coeff} = 0.055}$

38,

R_x	R_y	$d = R_x - R_y$	d^2
1	6	−5	25
2	7	−5	25
3	5	−2	4
4	10	−6	36
5	3	2	4
6	9	−3	9
7	4	3	9
8	1	7	49
9	8	1	1
10	2	8	64

$\Sigma d^2 = 226$

N = 10

$$\rho = 1 - \frac{6\Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6 \times 226}{10(100-1)}$$

$$= 1 - \frac{6 \times 226}{10 \times 99}$$

$\boxed{\rho = -0.37}$

39) $B = \begin{bmatrix} 0.6 & 0.9 \\ 0.2 & 0.8 \end{bmatrix}$

$I - B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 0.6 & 0.9 \\ 0.2 & 0.8 \end{bmatrix}$

$I - B = \begin{bmatrix} 0.4 & -0.9 \\ -0.2 & 0.2 \end{bmatrix}$

$|I - B| = \begin{vmatrix} 0.4 & -0.9 \\ -0.2 & 0.2 \end{vmatrix}$

$= 0.08 - 0.18$

$|I - B| = -0.1$

$\boxed{\text{The System is not Viable}}$

40) $6x^2 + 6y^2 + 4x - 8y - 16 = 0$

G.F $x^2 + y^2 + 2gx + 2fy + c = 0$.

$2g = 4 \quad 2f = -8 \quad c = -16$

$\boxed{g = 2} \quad \boxed{f = -4}$

Centre $(-g, -f) = (-2, 4)$

radius $r = \sqrt{g^2 + f^2 - c}$

$= \sqrt{4 + 16 - (-16)}$

$= \sqrt{20 + 16}$

$= \sqrt{36}$

$\boxed{\text{radius} = 6 \text{units}}$

Part - IV

41) (a) $(AB)^{-1} = B^{-1}A^{-1}$

LHS

$(AB)^{-1} = \frac{1}{|AB|} \text{adj} AB$

$[AB] = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 0 & -1 \\ 1 & 2 \end{bmatrix}$

$AB = \begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix}$

$|AB| = \begin{vmatrix} 2 & 3 \\ 1 & 1 \end{vmatrix}$

$|AB| = -1$

$\text{adj} AB = \begin{bmatrix} 1 & -3 \\ -1 & 2 \end{bmatrix}$

$(AB)^{-1} = \frac{1}{-1} \begin{bmatrix} 1 & -3 \\ -1 & 2 \end{bmatrix}$

$(AB)^{-1} = \begin{bmatrix} -1 & 3 \\ 1 & -2 \end{bmatrix}$ — (1)

RHS

$B^{-1} = \frac{1}{|B|} \text{adj} B$

$|B| = \begin{vmatrix} 0 & -1 \\ 1 & 2 \end{vmatrix} = 1$

$\text{adj} B = \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$

$B^{-1} = \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$

$A^{-1} = \frac{1}{|A|} \text{adj} A$

$|A| = \begin{vmatrix} 1 & 2 \\ 1 & 1 \end{vmatrix} = -1$

$\text{adj} A = \begin{bmatrix} 1 & -2 \\ -1 & 1 \end{bmatrix}$

$A^{-1} = \begin{bmatrix} -1 & 2 \\ 1 & -1 \end{bmatrix}$

$B^{-1}A^{-1} = \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} -1 & 2 \\ 1 & -1 \end{bmatrix}$

$B^{-1}A^{-1} = \begin{bmatrix} -1 & 3 \\ 1 & -2 \end{bmatrix}$ — (2)

(1) = (2)

$(AB)^{-1} = B^{-1}A^{-1}$

Hence proof.

41 (b)

LHS, $\dfrac{\sin(180^\circ + A)\cos(90 - A)\tan(270 - A)}{\sec(540 - A)\cos(360 - A)\operatorname{cosec}(270 + A)}$

$= \dfrac{(-\sin A)(\sin A)(\cot A)}{(-\sec A)\cos A(-\sec A)}$

$= \dfrac{-\sin A \sin A \frac{\cos A}{\sin A}}{-\frac{1}{\cos A}\cos A\left(-\frac{1}{\cos A}\right)}$

$= -\sin A \times \cos A \times \cos A$

$= -\sin A \cos^2 A$

$= \text{RHS}$

LHS = RHS

Hence proof.

42 (a)

i) 3 bowler, 1 W.C, 7 O.P

$4C_3 \times 2C_1 \times 10C_7$

$= 4C_1 \times 2C_1 \times 10C_3$

$= \frac{4}{1} \times \frac{2}{1} \times \frac{10 \times 9 \times 8}{1 \times 2 \times 3}$

$= 960$ Ways.

ii) 3 Bowl, 2 W.C, 6 O.P

$4C_1 \times 2C_2 \times 10C_6 =$

$= 4C_1 \times 2C_2 \times 10C_4$

$= \frac{4}{1} \times \frac{2 \times 1}{1 \times 2} \times \frac{10 \times 9 \times 8 \times 7}{1 \times 2 \times 3 \times 4}$

$= 840$ Ways

iii) 4 Bowl, 1 W.C, 6 O.P

$4C_4 \times 2C_1 \times 10C_6$

$= 4C_4 \times 2C_1 \times 10C_4$

$= \frac{4 \times 3 \times 2 \times 1}{1 \times 2 \times 3 \times 4} \times \frac{2}{1} \times \frac{10 \times 9 \times 8 \times 7}{1 \times 2 \times 3 \times 4}$

$= 420$ Ways

iv) 4 Bowl, 2 W.C, 5 O.P

$4C_4 \times 2C_2 \times 10C_5$

$= 4C_4 \times 2C_2 \times 10C_5$

$$= \frac{4\times3\times2\times1}{1\times2\times3\times4} \times \frac{2\times1}{1\times2} \times \frac{10\times9\times8\times7\times6}{1\times2\times3\times4\times5}$$

$= 252$ Ways.

$\left.\begin{array}{l}\text{Total no}\\ \text{of Ways}\end{array}\right\} = 960+840+420+252$

$\boxed{\text{Total Ways} = 2472}$

42 (b) E_1 : x speak truth

E_2 : x tells lie

E : x report a six

$P[E_1] = 4/5 \quad P[E_2] = 1/5$

$P(E/E_1) = 1/6 \quad P(E/E_2) = 5/6$

$$P(E_1/E) = \frac{P(E_1)P(E/E_1)}{P(E_1)P(E/E_1)+P(E_2)P(E/E_2)}$$

$$= \frac{4/5 \times 1/6}{\left(4/5\times 1/6\right)+\left(1/5\times 5/6\right)}$$

$\boxed{P(E_1/E) = 4/9}$

43 (a) (Reduced Portion).

$PA : PB = 2 : 1$

$\frac{PA}{PB} = \frac{2}{1}$

$PA = 2PB$

$PA^2 = 4PB^2$

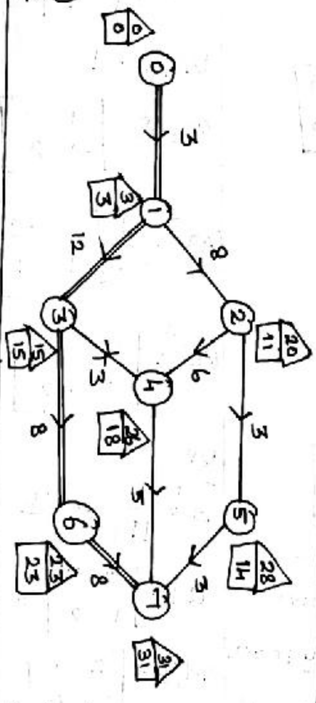
$(x_1-2)^2+(y_1-1)^2 = 4\left[(x_1-1)^2+(y_1-2)^2\right]$

$x_1^2-4x_1+4+y_1^2-2y_1+1 = 4\left[x_1^2-2x_1+1+y_1^2-4y_1+4\right]$

$-3x_1^2-3y_1^2+4x_1+14y_1-15=0$

$\boxed{3x^2+3y^2-4x-14y+15=0}$

43 (b)



Critical path is

$0-1-3-6-7$

$\left.\begin{array}{l}\text{Project}\\ \text{Completion}\\ \text{time}\end{array}\right\} = 31$ Weeks.

44 (a)

$y = a\cos mx + b\sin mx$

$y_1 = a(-\sin mx)m + bm\cos mx$

$y_2 = -am^2\cos mx - bm^2\sin mx$

$y_2 = -m^2\left[a\cos mx + \sin mx\right]$

$y_2 = -m^2 y$

$y_2 + m^2 y = 0$

Hence proof.

44 (b)

Put $n=1$

$n^2+n = 1^2+1$

$= 2$ even number.

$P(k)$ is true

Let $n=k$.

$k^2+k = 2m \quad \text{—} (1)$

Let $n = k+1$

$n^2+n = (k+1)^2+(k+1)$

$= k^2+2k+1+k+1$

$= \underline{k^2+k}+2k+2$

In (1) $= 2m+2(k+1)$

$= 2(m+k+1)$

$(k+1)^2+(k+1)$ is even number.

$P(k+1)$ is true where $P(k)$ is true.

$\therefore P(n)$ is true $n \in N$.

45 (a)

$f(x) = 2x^3+9x^2+12x+1$

$f'(x) = 6x^2+18x+12$

$= 6(x^2+3x+2)$

$= 6(x+2)(x+1)$

$f'(x) = 0$

$6(x+2)(x+1) = 0$

$\boxed{x=-2} \quad \boxed{x=-1}$

$\left.\begin{array}{l}\text{stationary}\\ \text{~~Points~~ Value}\end{array}\right\} x = -2, -1$

Stationary Value $\}$ $x=-2, x=-1$

$x=-2$

$f(-2) = 2(-8)+9(4)+12(-2)+1$

$f(-2) = -3$

$x=-1$

$f(-1) = 2(-1)+9(1)+12(-1)+1$

$= -4$

$\boxed{\text{Stationary Points} = (-2,-3)(-1,-4)}$

45 (b) $x_1(500)$ $y_1(6000)$

$x_2(1000)$ $y_2(9000)$

$$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

$$\frac{y-6000}{9000-6000} = \frac{x-500}{1000-500}$$

$$\frac{y-6000}{3000} = \frac{x-500}{500}$$

$$\frac{y-6000}{6} = \frac{x-500}{1}$$

$$y-6000 = 6(x-500)$$

$$y = 6x-3000+6000$$

$$\boxed{y = 6x+3000}$$

46 (a) $C = 2x\left(\frac{x+5}{x+2}\right)+7$

$$= \frac{2x^2+10x}{x+2}+7$$

Marginal Cost

$$MC = \frac{dc}{dx} = \frac{(x+2)(4x+10)-(2x^2+10x)}{(x+2)^2}$$

$$\frac{dc}{dx} = \frac{2(x^2+4x+10)}{(x+2)^2}$$

$$= \frac{2\left[(x+2)^2+6\right]}{(x+2)^2}$$

$$= 2\left[\frac{(x+2)^2}{(x+2)^2}+\frac{6}{(x+2)^2}\right]$$

$$\frac{dc}{dx} = 2\left[1+\frac{6}{(x+2)^2}\right]$$

x increase

MC decrease

Hence proof

46 (b)

i) Invesment = 96,000

Face Value = 100

Market Value = 80

No of Shares $\}$ = $\frac{\text{Invesment}}{\text{M.V of one share}}$

$$= \frac{96,000}{80}$$

$\boxed{\text{No of Shares} = 1200 \text{ shares}}$

ii) Total divided $\}$ = No of share × Rate of divided × Face value

$$= 1200 \times \frac{18}{100} \times 100$$

$\boxed{\text{Total dividend} = 21,600}$

iii) Dividend of 96000 = 21600

Percent $= \frac{21600}{96000} \times 100$

$= 22.5$

$\boxed{\text{Return shares} = 22.5\%}$

47 (a)

C.I	f	CF
10-20	12	12
20-30	19	31
30-40	5	36
40-50	10	46
50-60	9	55
60-70	6	61
70-80	6	67

N=67

Q_1 = Size of $\left(\frac{N}{4}\right)^{th}$ Value

= Size of $\left(\frac{67}{4}\right)^{th}$ Value

$= 16.75^{th}$ Value.

$L=20$ $\frac{N}{4}=16.75$

$Pcf=12$ $f=19$ $C=10$

$$Q = L+\left(\frac{\frac{N}{4}-Pcf}{f}\right)\times c$$

$$= 20+\left(\frac{16.75-12}{19}\right)\times 10$$

$$\boxed{Q_1 = 22.5}$$

Q_3 = Size of $\left(\frac{3N}{4}\right)^{th}$ Value

$= 50.25^{th}$ Value

$L=50$ $\frac{3N}{4}=50.25$

$Pcf=46$ $f=9$ $C=10$

$$Q_3 = L+\left(\frac{\frac{3N}{4}-Pcf}{f}\right)\times c$$

$$= 50+\left(\frac{50.25-46}{9}\right)\times 10$$

$$\boxed{Q_3 = 54.72}$$

$$QD = \frac{1}{2}(Q_3 - Q_1)$$

$$= \frac{54.72 - 22.5}{2}$$

$$\boxed{QD = 16.11}$$

47 (b)

x	$dx = (x-67)$	dx^2
65	-2	4
66	-1	1
67	0	0
67	0	0
68	1	1
69	2	4
71	4	16
73	6	36
$\Sigma x = 546$	$\Sigma dx = 10$	$\Sigma dx^2 = 62$

y	$dy = (y-68)$	dy^2	$dxdy$
67	-1	1	2
68	0	0	0
64	-4	16	0
68	0	0	0
72	4	16	4
70	2	4	4
69	1	1	4
70	2	4	12
$\Sigma y = 548$	$\Sigma dy = 4$	$\Sigma dy^2 = 42$	$\Sigma dxdy = 26$

$$r = \frac{N\Sigma dxdy - (\Sigma dx)(\Sigma dy)}{\sqrt{N\Sigma dx^2 - (\Sigma dx)^2}\sqrt{N\Sigma dy^2 - (\Sigma dy)^2}}$$

$$= \frac{8 \times 26 - (10 \times 4)}{\sqrt{(8 \times 62) - (10)^2} \times \sqrt{8 \times 42 - (4)^2}}$$

$$= \frac{168}{\sqrt{396} \times \sqrt{320}}$$

$$= \frac{168}{355.98}$$

$$\boxed{r = 0.472.}$$

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