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HALF YEARLY EXAMINATION -2019

XI – BUSINESS MATHEMATICS **TENTATIVE ANSWER KEY**

Q.No	PART – A
1.	c) $\frac{1}{ad-bc}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$
2.	$b)\lvert A\rvert^{n-1}$
3.	$a)2^n$
4.	a)20
5.	b) latus rectum
6.	c)a+b=0
7.	$b)-\sqrt{3}/2$
8.	a)[-1,1]
9.	d)(0,1)
10.	a)5
11.	$b)\frac{1}{5}e^{5x}$
12.	a) 1Quadrant
13.	c) perpetual annuity
14.	a)added
15.	a)speed or rates
16.	b)0
17.	d)-0.97
18.	c)no correlation
19.	b)independent variable
20.	b) minimize total project duration
	PART – B
21.	$\begin{vmatrix} x & x+1 \\ x-1 & x \end{vmatrix} = x^2-(x-1)(x+1)=1$
22.	Distance of the point (x_1, y_1)From the line ax+by+c=0 is $\left\lvert\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\rvert$ Distance of (4,1) from 3x-4y+121=0 $d=\left\lvert\frac{3(4)+4(1)+12}{\sqrt{3^2+(-4)^2}}\right\rvert=4units$

23.	combined equation is (2x+y-7)(x+2y-1)=0 $2x^2+2y^2+5xy-9x-15y+7=0$
24.	$y=x^6-4\sin x+7\cos x+e^{-4x}$ $\frac{dy}{dx}=6x^5-4\cos x-7\sin x-4e^{-4x}$
25.	Investment R.S(140× 70) (i)20% stock at R.S140 $=\frac{20}{140}\times(140\times 70)$=R.S1400 (ii)10% stock at R.S 70 $=\frac{10}{70}\times(140\times 70)$=R.S1400 Both the invesments are same
26.	GM = Antilog $\left(\frac{\sum \log x}{n}\right)$ = Antilog $\left(\frac{6.3026}{3}\right)$ =Antilog(2.1009) =126.2 increase of the commodity from 2004-2007 = 126.2-100 = 26.2%
27.	$A=\{G_1G_2\}$ $B=\{G_1G_2,G_1B_1,G_2B_2\}$ $n(B)=3$ $A\cap B=\{G_1G_2\}\Rightarrow n(A\cap B)=1$ $p(A\cap B)=\frac{1}{3}$.
28.	$\sum xy=120,\sum x^2=90,\sum y^2=640,$ $r=\frac{\sum xy}{\sqrt{\sum x^2\sum y^2}}=0.5$
29.	(i)Regression Equation of X on Y: $X-\bar{X}=b_{xy}(Y-\bar{Y})$ (ii)Regression Equation of Y on X; $Y-\bar{Y}=b_{yx}(X-\bar{X})$
30.	$C=10-4x^5+3x^6$ $(i)AVC=\frac{c}{x}=\frac{10}{x}-4x^4+3x^5$ $(ii)MC=\frac{d}{dx}(AC)=-\frac{10}{x^2}-16x^3+15x^4$
	PART – C
31.	In part A, out of 10 questions 8 can be selected in $10C_8$ ways. In part B out of 10 questions 5 can be selected in $10C_5$ ways. $10C_8\times 10C_5$= 11340 ways.
32.	The condition for the tangency is $c^2=a^2(1+m^2)$ $a^2=64$, $m=\frac{-3}{4}$ and $c=\frac{k}{4}$

% in rise	x	log x
5	105	2.0212
8	108	2.0334
77	177	2.2480
		6.3026

	$c^2 = a^2(1+m^2) \Rightarrow \frac{k^2}{16}\left(1+\frac{9}{16}\right)$ $k = \pm 40$
33.	$\sin^2\frac{\pi}{6}+\cos^2\frac{\pi}{3}-\tan^2\frac{\pi}{4} = -\frac{1}{2}$ $L.H.S \Rightarrow \left(\frac{1}{2}\right)^2+\left(\frac{1}{2}\right)^2-(1)^2$ $= -\frac{1}{2} \Rightarrow R.H.S$
34.	$y = x^2\sin x$ $\frac{dy}{dx} = x^2\cos x + 2x\sin x$ $= x(x\cos x + 2\sin x)$
35.	$u = \sin^2 x$ and $v = x^2$ $\frac{du}{dx} = 2\sin x\cos x$ $\frac{dv}{dx} = 2x$ $\therefore \frac{du}{dv} = \frac{\sin 2x}{2x}$
36.	Demand x = 100-2p Supply x = 3p-50 Demand = Supply $100-2p = 3p-50$ $p = 30$ demand x = 100-2(30) x=40 $\therefore p_E = x_E$
37.	$a = 5000$ $n = 4$ $r = \frac{10}{100} = 0.1$ $A = \frac{a}{i}\left[(1+i)^n - 1\right]$ $= \frac{5000}{0.1}\left[(1+0.1)^4 - 1\right]$ $=23200$
38.	Let A, B be the events of getting a black ball in the first and second d raw $P(A) = \frac{3}{8}$ $P(B) = \frac{2}{7}$ $P(A\cap B) = \frac{3}{28}$

39.	(i)Variables: Let $x_1$and x_2 denote the type of products A and B respectively. (ii)Objective function: $A=30x_1$ $B=40x_2$ Total profit$=30x_1+40x_2$ $Z=30x_1+40x_2$ is the Objective function We have yo maximize $Z=30x_1+40x_2$ (iii)Constraints: Raw material required for A and B product is $60x_1+120x_2$ Capacity avaiable is 12000 per month $60x_1+120x_2\le 12000$ Capacity avaiable is 600 per month $8x_1+5x_2\le 600$ Capacity avaiable is 500 per month $3x_1+4x_2\le 500$ (iv)NOn negative restructions: $x_1,x_2\ge 0$ LPP is $Z=30x_1+40x_2$ Subject to the constraints $60x_1+120x_2\le 12000$ $8x_1+5x_2\le 600$ $3x_1+4x_2\le 500$ $x_1,x_2\ge 0$
40.	$3x-2y+1=0$.....................(1) $2x-y-2=0$.....................(2) from(1)&(2)solve x=5,y=8 $\therefore\ \bar{X}=5\ ,\ \bar{Y}=8$
	PART – D
41.	(a) Given x+y+z=20 2x+y-z=23 3x+y+z=46 $A=\begin{bmatrix}1&1&1\\2&1&-1\\3&1&1\end{bmatrix},X=\begin{bmatrix}x\\y\\z\end{bmatrix},B=\begin{bmatrix}20\\23\\46\end{bmatrix}$ $\lvert A\rvert=-4\neq 0$ $\text{adj}A=\begin{bmatrix}2&0&-2\\-5&-2&3\\-1&2&-1\end{bmatrix}$ $X=A^{-1}B=\frac{-1}{4}\begin{bmatrix}-52\\-8\\-20\end{bmatrix}$ $\therefore$ The required numbers are 13,2,5

	(b) The given equation is $4x^2-12xy+9y^2+18x-27y+8=0$ $a=4,\ b=9$ and $h=-6$ $h^2-ab=36-36=0$ a pair of parallel straight lines $4x^2-12xy+9y^2=(2x-3y)^2$ $4x^2-12xy+9y^2+18x-27y+8=0$ $(2x-3y)^2+9(2x-3y)+8=0$ Put $2x-3y=z$ $z^2+9z+8=0$ $z+1=0$ $z+8=0$ the separate equations are $2x-3y+1=0$ and $2x-3y+8=0$
42.	(a) (i)The total numbers of ways of selecting 11 players out of 15 is $15C_{11}=1365$ (ii)10 players are to be selected out of the remaining 14 players $14C_{10}=1365$ (iii)11 players are to be selected from the remaining 14 players $14C_{11}=364$
	(b) $A+B=45^0$ $\tan(A+B)=\tan 45^0$ $\frac{\tan A+\tan B}{1-\tan A\tan B}=1$ $\tan A+\tan B+\tan A\tan B=1$ Add 1 on both side $1+\tan A+\tan B+\tan A\tan B=2$ $(1+\tan A)(1+\tan B)=2$ put A=B=$22\frac{1}{2}^0 \Rightarrow (1+\tan 22\frac{1}{2}^0)(1+\tan 22\frac{1}{2}^0)=2$ $\left(1+\tan 22\frac{1}{2}^0\right)^2=2$ $\tan 22\frac{1}{2}^0=\pm\sqrt{2}-1$
43	(a) $X=\begin{bmatrix}8&-1&-3\\-5&1&2\\10&-1&-4\end{bmatrix}$, B=$\begin{bmatrix}2&1&-1\\0&2&1\\5&p&q\end{bmatrix}$ Given Y=X^{-1} XY=XX^{-1} XY=I

$$XY = \begin{bmatrix} 1 & 6-3p & -9-3p \\ 0 & -3+2p & 6+2q \\ 0 & 8-4p & -11-4q \end{bmatrix}$$

$$XY=I \Rightarrow \begin{bmatrix} 1 & 6-3p & -9-3p \\ 0 & -3+2p & 6+2q \\ 0 & 8-4p & -11-4q \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Equating both sides $\therefore$ p=2 and q=-3

(b)

$$y = \sqrt{\frac{(x+2)(x^2-8)}{(4x^2-6x-7)}} = \left(\frac{(x+2)(x^2-8)}{(4x^2-6x-7)}\right)^{1/2}$$

tacking log on both side

$$\log y = \frac{1}{2}\left[\log(x+2)+\log(x^2-8)-\log(4x^2-6x-7)\right]$$

$$\text{Diff w.r.t.x} \Rightarrow \frac{1}{y}\frac{dy}{dx} = \frac{1}{2}\left[\frac{1}{(x+2)}+\frac{1}{(x^2-8)}(2x)-\frac{1}{(4x^2-6x-7)}(8x-6)\right]$$

$$\frac{dy}{dx} = \frac{1}{2}\sqrt{\frac{(x+2)(x^2-8)}{(4x^2-6x-7)}}\left[\frac{1}{(x+2)}+\frac{(2x)}{(x^2-8)}-\frac{(8x-6)}{(4x^2-6x-7)}\right]$$

44. (a)

$p = 550-3x-6x^2$

$R = px$

$R = 550x-3x^2-6x^3$

$\therefore\ MR = 550-6x-18x^2$ ....(1)

$$\frac{dp}{dx} = -3-12x \Rightarrow \frac{dx}{dp} = \frac{1}{-3-12x}$$

$$\therefore\ \eta_d = -\frac{p}{x}\frac{dx}{dp} \Rightarrow \frac{550-3x-6x^2}{x(3+12x)}$$

$$\frac{1}{\eta_d} = \frac{x(3+12x)}{550-3x-6x^2}$$

$$\therefore\ p\left[1-\frac{1}{\eta_d}\right] = 550-6x-18x^2 \text{.................(2)}$$

$$1\ \&\ 2 \Rightarrow MR = p\left[1-\frac{1}{\eta_d}\right]$$

(b)

E_1 = Bolt is manufactured by machine A

E_2 = Bolt is manufactured by machine B

E_3 = Bolt is manufactured by machine C

A = Bolt is defective

$$P(E_1)=\frac{20}{100},\ P(E_2)=\frac{30}{100},\ P(E_3)=\frac{50}{100}$$

$$P(A/E_1)=\frac{7}{100},\ P(A/E_2)=\frac{3}{100},\ P(A/E_3)=\frac{5}{100}$$

$$\text{Required probability}=P\left(E_3/A\right)=\frac{P(E_3)P(A/E_3)}{P(E_1)P(A/E_1)+P(E_2)P(A/E_2)+P(E_3)P(A/E_3)}$$

$$=\frac{25}{48}$$

$$P\left(E_3/A\right)=0.5208$$

45. (a)

7% Stock

Stock (Rs.)	Income (Rs.)
100	7
9000	?

$$\text{Income} = \frac{9000}{100}\times 7 = \text{Rs.}630 \quad \ldots\ldots\ldots\ldots(1)$$

Stock (Rs.)	Sale Proceeds (Rs.)
100	80
9000	?

$$\text{Sale Proceeds} = \frac{9000}{100}\times 80$$
$$= \text{Rs.}7,200$$

15% Stock

Investment (Rs.)	Income (Rs.)
120	15
7,200	?

$$\text{Income} = \frac{7200}{120}\times 15$$
$$= \text{Rs.}900 \quad \ldots\ldots\ldots\ldots(2)$$

comparing (1) and (2), we conclude that the change in income (increase). = Rs. 270

(b)

R= 48,000 , $C_1 = 0.27$, $C_3 = 45$

$EOQ\ (q_0) = \sqrt{\frac{2C_3R}{C_1}} = 4000$ units

Number of order per year = $\frac{R}{q_0} = 12$

Time between orders $t_0 = \frac{q_0}{R} = 0.083$ year

Carrying cost= $\frac{q_0}{2} \times C_1$=Rs.540

Ordering cost= $\frac{R}{q_0} \times C_3$ = Rs.540

$\therefore$ Carrying cost = Ordering cost

46. (a)

$$b_{xy} = \frac{N\sum xy - (\sum x)(\sum y)}{N\sum y^2 - (\sum y)^2}$$

$$= \frac{7(18160)-(338)(361)}{7(19773)-(861)^2}$$

2.1680

$(X-\bar{X}) = b_{xy}(Y-\bar{Y})$

$X - 48.28 = 2.1680(Y-51.57)$

$X = 2.1680Y - 111.80$

X	Y	X²	Y²	xy
40	38	1600	1444	1520
50	60	2500	3600	3000
38	55	1444	3025	2090
60	70	3600	4900	4200
65	60	4025	3600	3900
50	48	2500	2304	2400
35	30	1225	900	1050
$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$
338	361	17094	19773	18160

$$b_{yx} = \frac{N\sum xy - (\sum x)(\sum y)}{N\sum X^2 - (\sum X)^2}$$

=0.942

$(Y-\bar{Y}) = b_{xy}(X-\bar{X})$

$Y = 0.942X + 6.08$

at X=30,

Y=34.34

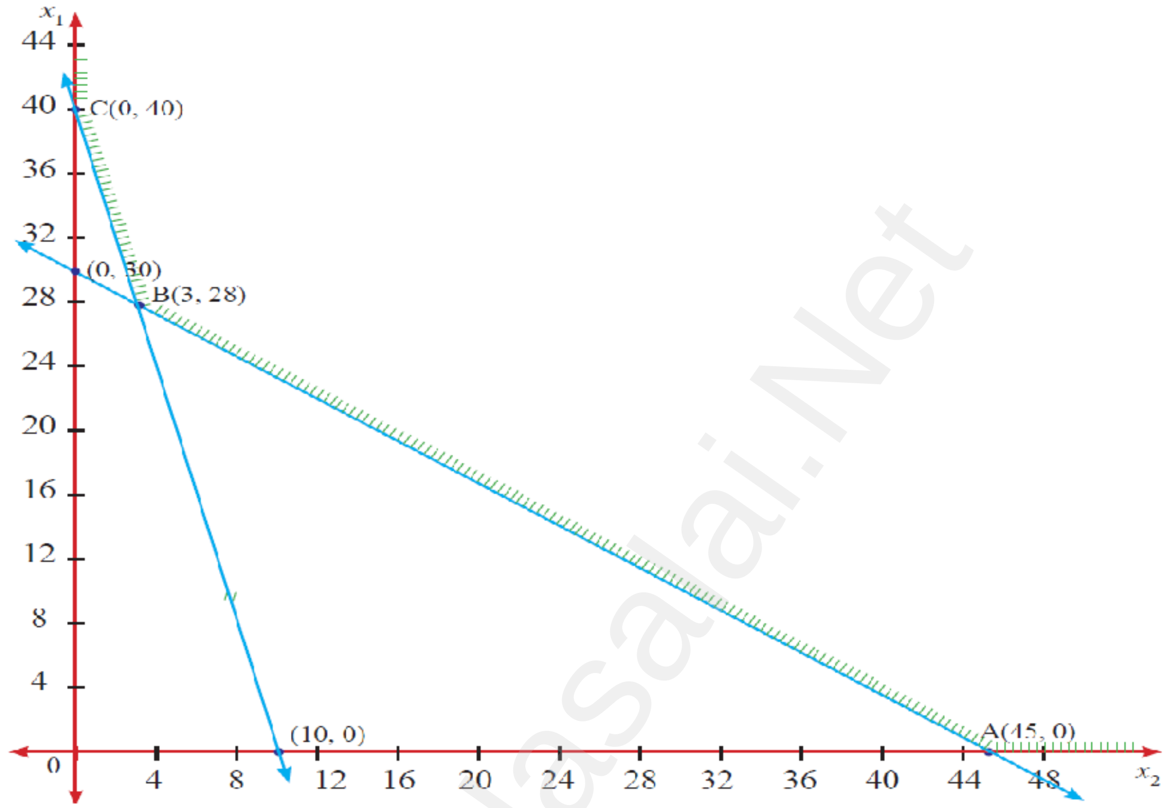
(b)

x_1 and x_2 are non-negative, the solution lies in the first quadrant of the plane.

$$4x_1+x_2 = 40 \text{ and } 2x_1+3x_2 = 90$$

$4x_1+x_2 = 40$ is a line passing through the points (0,40) and (10,0).

$2x_1+3x_2 = 90$ is a line passing through the points (0,30) and (45,0).



Corner points	$z = 5x_1+4x_2$
A(45,0)	225
B(3,28)	127
C(0,40)	160

The minimum value of Z occurs at B(3,28).

The optimal solution is $x_1 = 3$, $x_2 = 28$ and $Z_{min}=127$

47. (a)

$$\frac{2x+1}{(x-1)(x^2+1)} = \frac{A}{x-1}+\frac{Bx+c}{x^2+1}$$

$$2x+1 = A(x^2+1)+(Bx+c)(x-1)$$

put $x=1 \Rightarrow A=\frac{3}{2}$

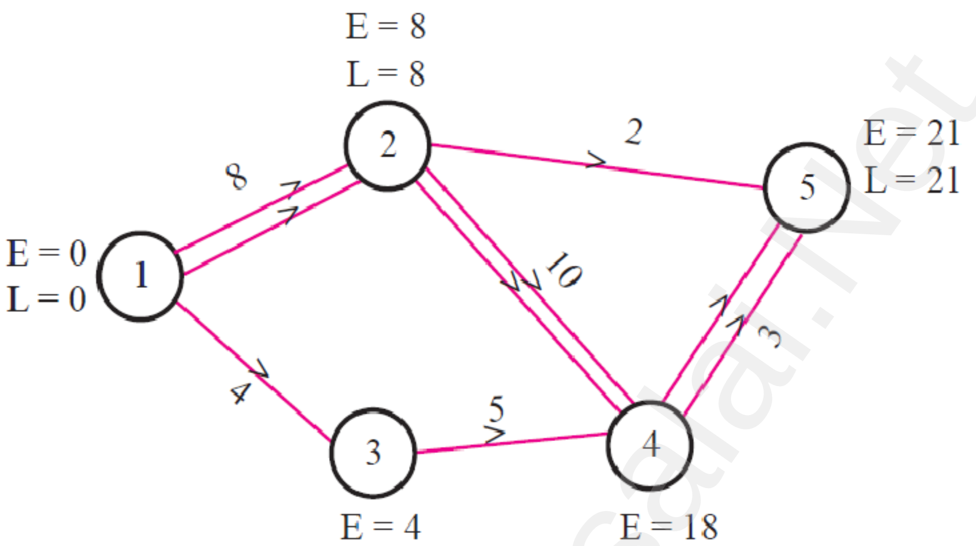
put $x=0 \Rightarrow C=\frac{1}{2}$

Equating the coefficient of x^2 on both the sides

$$B=\frac{-3}{2}$$

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

(b)



$E_1 = 0$

$E_2 = 8$

$E_3 = 4$

$E_4 = 18$

$E_5 = 21$

$L_5 = 21$

$L_4 = 18$

$L_3 = 13$

$L_2 = 8$

$L_1 = 0$

Activity	Duration (t_{ij})	EST	EFT=EST+t_{ij}	LST=LFT−t_{ij}	LFT
1–2	8	0	8	0	8
1–3	4	0	4	9	13
2–4	10	8	18	8	18
2–5	2	8	10	19	21
3–4	5	4	9	13	18
4–5	3	18	21	18	21

the critical path is 1-2-4-5, which is denoted by double lines.

Critical path is 1-2-4-5 and project completion time is 21 days.

MARK ANALYSIS

(WITHOUT CHOICE)

PART	Questions	Total Questions	Book Back Questions	Interior Questions	Total Marks
I	1 Mark	20	14	6	20
II	2 Marks	10	6	4	20
III	3 Marks	10	7	3	30
IV	5 Marks	14	12	2	70
Total Marks			107	33	140
Percentage			77 %	23 %	100%

Department of mathematics
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