II

21 $=6\begin{vmatrix}1&3&4\\17&3&6\\17&3&6\end{vmatrix}=6(0)=0$ 1+1

22 $n=10$, $12C_{10}=66$ 1+1

23 $f\left(\frac{1}{x}\right)=\frac{1}{x^3}-x^3$

$f(x)-f\left(\frac{1}{x}\right)=0$ 1

24 $D_2=2^{nd}$ Term $=4$

$D_6=7^{th}$ Term $=14$ 1

25 20% shares $=\frac{20}{140}\times140\times70=1400$

10% shares $=\frac{10}{70}\times140\times70=1400$

They are equivalent shares 1

26. $R=4000$, $C_1=50$, $C_3=160$

$EOQ=\sqrt{\frac{2RC_3}{C_1}}$, $EOQ=160$ 1+1

27 Centre $=(-1,3)$

$\Rightarrow a(-1)+2(3)+2=0\Rightarrow a=8$ 1

28. $T_{r+1}=nCr\,x^{n-r}a^r$ (OR)

$t_{4+1}=13C_4\,x^{13-4}(-2y)^4$

$t_5=13C_4\,x^9(16y^4)$ (OR)

$t_5=11440x^9y^4$ 1

29. $f(x+y)=2^{x+y}=2^x2^y$

$f(x+y)=f(x).f(y)$ 1

30 Alphabetical order

A, B, E, L, T

4! 4! 4! 4! 0!

$24+24+24+24+1+1=98$ 1

III

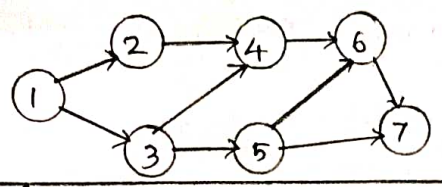
31 coefficient of $xy=0$

$b=8$, $a=9$ 1+1

32 $\lim_{x\to0}\frac{\sqrt{1+x}-\sqrt{1-x}}{x}\times\frac{\sqrt{1+x}+\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}$

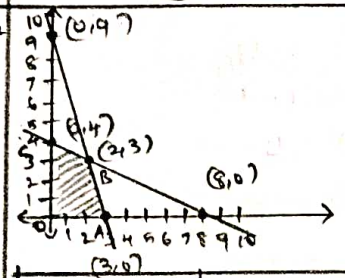
$\lim\frac{2x}{x(\sqrt{1+x}+\sqrt{1-x})}=1$ 1+1

33



3

34



corner point	$z=40x_1+50x_2$
O(0,0)	0
A(3,0)	120
B(2,3)	230
C(0,4)	200

$z_{max}=230$ at (2,3) 1

35 $f'(x)=2x-4$

$f'(x)=0\Rightarrow x=2$

Interval	sign of $f'(x)$	nature of the function
$(-\infty,2)$	<0	strictly decreasing in $(-\infty,2)$
$(2,\infty)$	>0	strictly increasing $(2,\infty)$

1

36 $\tan75^\circ=\tan(45^\circ+30^\circ)$

$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$ (OR)

$\tan(45^\circ+30^\circ)=\frac{\tan45^\circ+\tan30^\circ}{1-\tan45^\circ\tan30^\circ}$

$=\frac{\sqrt3+1}{\sqrt3-1}$ (OR) $2+\sqrt3$ 1

37 $H.M=\frac{n}{\frac1a+\frac1b+\frac1c+\frac1d}=\frac{4}{\frac11+\frac12+\frac13+\frac14}$ 1+1

$=1.92$ kg per rupee

38 $I-B=\begin{pmatrix}0.2&-0.2\\-0.9&0.3\end{pmatrix}$

$|I-B|=-0.12<0$

not satisfied 1

39 $a=₹2000$, $i=0.02$, $n=40$ (or)

$a=₹2000$, $k=4$, $\frac{i}{k}=0.02$, $n=10$

$A=\frac{a}{i}((1+i)^n-1)$ (OR)

$=\frac{2000}{0.02}(1+0.02)^{40}-1=1,20800$ 1

40 $\tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\frac{x+y}{1-xy}\right)$

$\tan^{-1}\left(\frac{2}{11}\right)+\tan^{-1}\left(\frac{7}{24}\right)=\tan^{-1}\left(\frac{\frac{2}{11}+\frac{7}{24}}{1-\frac{2}{11}\times\frac{7}{24}}\right)$

$=\tan^{-1}(1/2)$ 1

IV

41 a. $B=\begin{bmatrix}0.4&0.1\\0.7&0.6\end{bmatrix}$

$I-B=\begin{bmatrix}0.6&-0.1\\-0.7&0.4\end{bmatrix}$, $|I-B|=0.17>0$

$X=(I-B)^{-1}D$ (OR)

$X=\frac{1}{0.17}\begin{pmatrix}0.4&0.1\\0.7&0.6\end{pmatrix}\begin{pmatrix}30\\95\end{pmatrix}=\begin{pmatrix}176.5\\558.8\end{pmatrix}$

Steel output $=176.5$ Tonnes

coal output $=558.8$ Tonnes

Total labour $=2000$ labour days 1

b. **41** $n=3$

$x\frac{\partial y}{\partial x}+y\frac{\partial y}{\partial y}=3u$

$\frac{\partial y}{\partial x}=3x^2+3y^2$, $\frac{\partial y}{\partial y}=3y^2+6xy$ 1+1

$x\frac{\partial y}{\partial x}+y\frac{\partial y}{\partial y}=3u$

42 a. $a=2$, $b=3$, $h=\frac72$, $g=\frac52$, $f=\frac52$, $c=2$

$\begin{vmatrix}a&h&g\\h&b&f\\g&f&c\end{vmatrix}=0$, $\begin{vmatrix}2&7/2&5/2\\7/2&3&5/2\\5/2&5/2&2\end{vmatrix}=0$

pair of straight lines.

$2x^2+7xy+3y^2+5x+5y+2$

$=(x+3y+l)(2x+y+m)$

$m=1$, $l=2$

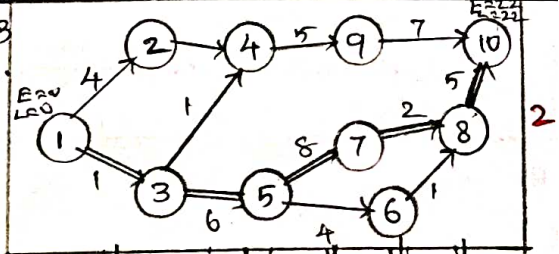
$x+3y+2=0$, $2x+y+1=0$ 1

b. **42** $\tan^{-1}\left(\frac{x+1+x-1}{1-(x+1)(x-1)}\right)=\tan^{-1}\frac47$ 2*

$\frac{2x}{2-x^2}=\frac47\Rightarrow2x^2+7x-4=0$

$(2x-1)(x+4)=0$, $x\neq-4$, $\boxed{x=1/2}$ 1+1

43 a.



2

Activity	Duration	EST	EFT	LFT	LST
1-2	4	0	4	9	5
1-3	1	0	1	1	0
2-4	1	4	5	10	9
3-4	1	1	2	10	9
3-5	6	1	7	7	1
4-9	5	5	10	15	10
5-6	4	7	11	16	12
5-7	8	7	15	15	7
6-8	1	11	12	17	16
7-8	2	15	17	17	15
8-10	5	17	22	22	17
9-10	7	10	17	22	15

2

Critical path : 1-3-5-7-8-10

Project completion time : 22

b. **43**

CI	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	

$Q_1=l+\left(\frac{\frac{N}{4}-pcf}{f}\right)\times c$

$=20+\left(\frac{16.75-12}{19}\right)\times10$

$=22.5$

$Q_3=l+\left(\frac{3N}{4}-pcf\right)\times c$

$=50+\left(\frac{50.25-46}{9}\right)\times10$

$=54.72$

$QD=\frac12(Q_3-Q_1)=16.11$

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44 a. $P(n): 1^2+2^2+3^2+\cdots+n^2 = \frac{n(n+1)(2n+1)}{6}$

$n=1$ P(1) is true

$n=k$ P(k) is true.

$P(k+1) = \frac{(k+1)(k+2)(2k+3)}{6}$

P(k+1) is true

$\therefore 1^2+2^2+3^2+\cdots+n^2 = \frac{n(n+1)(2n+1)}{6}$ (or)

P(n) is true for all $n \in N$

b. $x = \frac{\sin y}{\sin(a+y)}$

$\frac{dx}{dy} = \frac{\sin(a+y)\cos y - \sin y \cos(a+y)}{(\sin(a+y))^2}$ 2*

$\frac{dx}{dy} = \frac{\sin(a+y-y)}{\sin^2(a+y)} = \frac{\sin a}{\sin^2(a+y)}$

$\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$

45 a.

R_x	R_y	$d = R_x - R_y$	d^2
6	4	2	4
4	1	3	9
3	6	-3	9
1	7	-6	36
2	5	-3	9
7	8	-1	1
9	10	-1	1
8	9	-1	1
10	3	7	49
5	2	3	9
			$\Sigma d^2 = 128$

$P = 1 - \frac{6\Sigma d^2}{N(N^2-1)} = 1 - \frac{6\times 128}{10(100-1)}$ 2*

$P = 0.2242$

45 b. (i) 20% stocks

Income $= \frac{20}{100}\times 10{,}000 = ₹2000$

Invest = 10,000, FV = 100, M.V = 140

No. of shares $= \frac{10{,}000}{100} = 100$

Sale proceeds $= 100\times 140 = ₹14{,}000$

(ii) 15% stocks

Market value $= 100 - 22 + 2 = 80$

No. of shares $= \frac{14000}{80} = 175$

Income $= 175 \times \frac{15}{100} = ₹2625$

(iii) change in Income

$= ₹2625 - ₹2000 = ₹625$

46 a. $x+y+z = 20$

$2x+y-z = 23$

$3x+y+z = 46$

$|A| = -4 \neq 0$

$A^{-1} = \frac{-1}{4}\begin{pmatrix} 2 & 0 & -2 \\ -5 & -2 & 3 \\ -1 & 2 & -1 \end{pmatrix}$

$X = A^{-1}B$ (OR)

$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \frac{-1}{4}\begin{pmatrix} 2 & 0 & -2 \\ -5 & -2 & 3 \\ -1 & 2 & -1 \end{pmatrix}\begin{pmatrix} 20 \\ 23 \\ 46 \end{pmatrix}$

$= \frac{-1}{4}\begin{pmatrix} -52 \\ -8 \\ -20 \end{pmatrix}$

$x = 13,\ y = 2,\ z = 5$

46 a. $P(A_1) = \frac{1000}{6000} = \frac{1}{6}$

$P(A_2) = \frac{2000}{6000} = \frac{1}{3}$

$P(A_3) = \frac{3000}{6000} = \frac{1}{2}$

$P(B/A_1) = 0.01$,

$P(B/A_2) = 0.015$

$P(A/A_3) = 0.02$

$P(A/B) = \frac{\frac{1}{6}\times 0.01}{\frac{1}{6}\times 0.01 + \frac{1}{3}\times 0.015 + \frac{1}{2}\times 0.02}$ 2*

$= \frac{1}{10}$ or 0.1

47 a. $x^2+y^2+2gx+2fy+c = 0$

$2g+c = -1,\ -2g+c = -1,\ 2f+c = -1$

$c = -1,\ g = 0,\ f = 0$ 2

eqn. of the circle $x^2+y^2-1 = 0$

47 b. $\frac{x-2}{(x+2)(x-1)^2} = \frac{A}{x+2} + \frac{B}{x-1} + \frac{C}{(x-1)^2}$

$x-2 = A(x-1)^2 + B(x+2)(x-1) + C(x+2)$

$A = \frac{-4}{9},\ B = \frac{4}{9},\ C = \frac{-1}{3}$ 3

$\frac{x-2}{(x+2)(x-1)^2} = \frac{-4}{9(x+2)} + \frac{4}{9(x-1)} - \frac{1}{3(x-1)^2}$

PART - I

1	a	Prof. Wassily W. Leontief
2	d	nr
3	b	4
4	b	$r = \pm\sqrt{b_{xy}\times b_{yx}}$
5	b	$\frac{3}{25}$
6	a	3
7	a	± 3
8	d	$A = \frac{a}{i}[(1+i)^n - 1]$
9	c	$\frac{16}{5}$
10	c	$16ae^{4x}$
11	d	$-\frac{\sqrt{3}}{2}$
12	d	$-\frac{2h}{b}$
13	b	$E_j - E_i = L_j - L_i = t_{ij}$
14	d	8
15	b	₹1600
16	d	$\frac{(n-1)!}{2}$
17	a	$\frac{P(A\cap B)}{P(A)}$
18	d	-1 to 1
19	a	$x^2+y^2-8x-10y+32 = 0$
20	b	100

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