TVL11BM

Tirunelveli District
Common Half Yearly Examination - 2024

Standard 11
BUSINESS MATHEMATICS AND STATISTICS

Time: 3.00 Hours Marks: 90

I. Choose the best answer from the following. 20×1=20

1) The value of the determinant $\begin{vmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{vmatrix}^2$ is
a) abc b) 0 c) $a^2b^2c^2$ d) −abc

2) If A is 3×3 matrix and $|A|=4$ then $|A^{-1}|$ is equal to
a) $\frac{1}{4}$ b) $\frac{1}{16}$ c) 2 d) 4

3) The greatest positive integer which divide n(n+1)(n+2)(n+3) for all n∈N is
a) 2 b) 6 c) 20 d) 24

4) The total number of 9 digit number which have all different digit is
a) 10! b) 9! c) 9×9! d) 10×10!

5) If the lines 2x−3y−5=0 and 3x−4y−7=0 are the diameters of a circle, then its centre is
a) (−1, 1) b) (1, 1) c) (1,−1) d) (−1, −1)

6) Combined equation of coordinate axes is
a) $x^2-y^2=0$ b) $x^2+y^2=0$ c) xy=c d) xy=0

7) The value of sin 15° is
a) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ b) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ c) $\frac{\sqrt{3}}{\sqrt{2}}$ d) $\frac{\sqrt{3}}{2\sqrt{2}}$

8) The value of $\text{cosec}^{-1}\left(\frac{2}{\sqrt{3}}\right)$ is
a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{6}$

9) The graph of $y=2x^2$ is passing through
a) (0, 0) b) (2, 1) c) (2, 0) d) (0, 2)

10) If y=x and $z=\frac{1}{x}$, then $\frac{dy}{dz}$ =
a) x^2 b) 1 c) $-x^2$ d) $-\frac{1}{x^2}$

11) Instantaneous rate of change of $y=2x^2+5x$ with respect ot x at x=2 is
a) 4 b) 5 c) 13 d) 9

12) The maximum value of f(x) = sinx is
a) 1 b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{\sqrt{2}}$ d) $-\frac{1}{\sqrt{2}}$

13) The % of income on 7% stock at ₹ 80 is
a) 9% b) 8.75% c) 8% d) 7%

14) The present value of the perpetual annuity of ₹2000 paid monthly at 10% compound interest is
a) ₹2,40,000 b) ₹6,00,000 c) ₹20,40,000 d) ₹2,00,400

15) Median is same as
a) Q_1 b) Q_2 c) Q_3 d) D_2

16) The probability of obtaining an even prime number on each die, when a pair of dice is rolled is
a) $\frac{1}{36}$ b) 0 c) $\frac{1}{3}$ d) $\frac{1}{6}$

17) When one regression coefficient is negative, then other would be
a) Negative b) Positive c) zero d) None of them

18) If Cov(x,y)=−16.5, $\sigma_x^2 = 2.89$, $\sigma_y^2 = 100$. Find correlation coefficient
a) −0.12 b) 0.001 c) −1 d) −0.97

19) The maximum value of the objective function z=3x+ 5y subject to the constrains x≥0, y≥0 and 2x + 5y≤0 is
a) 6 b) 15 c) 25 d) 31

20) Network problems have advantages interms of project
a) Scheduling b) Planning c) controlling d) All the above

II. Answer any seven questions. Q.No. 30 is compulsory. **7×2=14**

21) If $A = \begin{bmatrix} 2 & 4 \\ -3 & 2 \end{bmatrix}$, then find A^{-1}

22) If $nP_r = 720$, $nC_r = 120$, find r

23) Find the equation of the circle when the end points of the diameter are (2, 4) and (3, −2)

24) Find the value of tan 75°

25) If $f(x)=2^x$, then show that $f(x).f(y)=f(x+y)$

26) Find the market value of 325 shares of face value ₹100 at a permium ₹18

27) Let $P(A)= \frac{3}{5}$ and $P(B) = \frac{1}{5}$. Find $P(A \cap B)$ if A and B are independent events

28) For the given lines of regression 3x−2y=5 and x−4y=7. Find regression coefficients

29) Draw the network for the project whose activities with their relationships are given below. Activities A, D, E can start simultaneously. B, C > A, G, F> D, C; H>E, F.

30) Calculate the correlation coefficient from the following data
N=9, $\Sigma x = 45, \Sigma y = 108, \Sigma x^2 = 285, \Sigma y^2 = 1356, \Sigma xy = 597$.

III. Answer any seven questions. Q.No. 40 is compulsory. **7×3=21**

31) Find adjoint of $A = \begin{bmatrix} 1 & -2 & -3 \\ 0 & 1 & 0 \\ -4 & 1 & 0 \end{bmatrix}$

32) Using binomial theorem, expand $\left(x^2 + \frac{1}{x^2}\right)^4$

33) Find the centre and radius of the circle (x+2) (x−5)+ (y−2)(y−1)=0

34) If $\lim_{x \to 2} \frac{x^n - 2^n}{x - 2} = 448$, then find the least positive integer n.

35) Given $C(x)= \frac{x^2}{6} + 5x + 200$ and P(x)=40−x are the cost price and selling price when x units of commodity are produced. Find the level of the production that maximize the profit.

36) Find the annual rate of interest, to get a perpetuity of ₹675 for every half yearly from the present value of ₹30,000.

37) Calculate the Harmonic Mean of the following values
1, 0.5, 10, 45.0, 175.0, 0.01, 4.0, 11.2

38) The equations of two lines of regression obtained in a correlation analysis are the following 2x = 8 − 3y and 2y=5−x obtain the value of the regression coefficients andn correlation coefficient

39) Solve the following LPP by graphical method Minimize $z=5x_1+4x_2$ subject to constraints $4x_1+x_2 \geq 0$, $2x_1+3x_2 \geq 90$ and $x_1, x_2 \geq 0$

40) Show that the straight lines x+y−4=0, 3x+2=0 and 3x−3y+16=0 are concurrent

IV. Answer all the questions. **7×5=35**

41) Solve by matrix inversion method. 3x−y+2z=13, 2x+y−z=3, x+3y−5z=−8

(OR)

Show that sin 20 sin 40 sin 80 = $\frac{\sqrt{3}}{8}$

42) By the principle of Mathematical Induction, Prove that $1^3+2^3+3^3+\ldots n^3=\frac{n^2(n+1)^2}{4}$ for all $n\in N$

(OR)

If the payment of ₹2000 is made at the end of every quarter for 10 years at the rate of 8% per year, then find the amount of annuity $[(1.02)^{40} = 2.2080]$

43) Show that the equation $2x^2+5xy+3y^2+6x+7y+4=0$ represents a pair of straight lines. Also find the angle between them

(OR)

If $y=\sin(\log x)$, then show that $x^2y_2+xy_1+y=0$

44) Find the equation of the circle passing through the points (0,0) (1,2) and (2,0)

(OR)

The demand for a commodity x is $q=5-2p_1+P_2-P_1^2 P_2$. Find the partial elasticities $\frac{E_q}{E_{P_1}}$ and $\frac{E_q}{E_{P_2}}$ when $P_1 = 3$ and $P_2 = 7$.

45) Find out the coefficient of mean deviation about median in the following series

Age in years	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**
No.of persons	8	12	16	20	37	25	19	13

(OR)

A project has the following time schedule

Activity	**1-2**	**1-6**	**2-3**	**2-4**	**3-5**	**4-5**	**6-7**	**5-8**	**7-8**
Duration	7	6	14	5	11	7	11	4	18

construct the network and calcuate the earliest start time, earliest finish time, latest start time and latest finish time of each activity and determine the critical path of the project and duration to complete the project

46) Bag I contains 3 Red and 4 Black balls while another Bag II contains 5 Red and 6 Black balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from Bag I.

(OR)

Calculate Karl Pearson's coefficient of correlation from the following table

X	6	8	12	15	18	20	24	28	31
Y	10	12	15	15	18	25	22	26	28

47) Calculate the regression coefficient and obtain the lines of regression for the following data

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(OR)

If $\sin y = x \sin(a+y)$, then prove that $\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$

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Tiruvallur District
Common half yearly Examination - 2024
Business Maths and Statistics
Class : XI

I.

1. c) $a^2b^2c^2$
2. a) $\frac{1}{4}$
3. d) 24
4. c) $9 \times 9!$
5. c) $(1, -1)$
6. d) $xy = 0$
7. b) $\frac{\sqrt{3}-1}{2\sqrt{2}}$
8. c) $\frac{\pi}{3}$
9. a) $(0,0)$
10. c) $-x^2$
11. c) 13
12. a) 1
13. b) 8·75%
14. a) ₹ 2,40,000
15. b) Q_2
16. a) $\frac{1}{36}$
17. a) negative
18. d) −0·97
19. b) 15
20. d) All the above

II.

21. $|A| = \begin{vmatrix} 2 & 4 \\ -3 & 2 \end{vmatrix} = 16 \neq 0$

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

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

22. $\frac{{}^nP_r}{{}^nC_r} = \frac{720}{120}$

$\frac{{}^nP_r}{\frac{{}^nP_r}{r!}} = 6$

$r! = 6$

$r! = 3!$

$\boxed{r = 3}$

23. $(x-x_1)(x-x_2)+(y-y_1)(y-y_2)=0$

$(x-2)(x-3)+(y-4)(y+2)=0$

$x^2-5x+6+y^2-2y-8=0$

$x^2+y^2-5x-2y-2=0$

24. $\tan 75^\circ = \tan(45+30)$

$= \frac{\tan 45 + \tan 30}{1 - \tan 45 \tan 30}$

$= \frac{1+\frac{1}{\sqrt{3}}}{1-\frac{1}{\sqrt{3}}} = \frac{\sqrt{3}+1}{\sqrt{3}-1} = 2+\sqrt{3}$

25. $f(x) = 2^x$

$f(x+y) = 2^{x+y} = 2^x \cdot 2^y$

$= f(x) \cdot f(y)$

26. M.V of a share = ₹ 118

M.V of 325 share = 325×118

= ₹ 38,350

27. A and B are independent events

$P(A \cap B) = P(A) \cdot P(B)$

$= \frac{3}{5}\left(\frac{1}{6}\right) = \frac{3}{25}$

28. $3x - 2y = 5$

$3x = 2y + 5$

$x = \frac{2y}{3} + 5$

$b_{xy} = \frac{2}{3}$

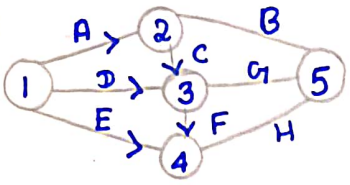
$x - 4y = 7$

$4y = x - 7$

$y = \frac{1}{4}x - \frac{7}{4}$

$b_{yx} = \frac{1}{4} < 1$

29.



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

$= \frac{9(597) - 45(108)}{\sqrt{9 \times 285 - (45)^2} \times \sqrt{9(1356) - (108)^2}}$

$= 0.95$

III.

31. $A_{ij} = \begin{bmatrix} 0 & 0 & 4 \\ -3 & -12 & 7 \\ 0 & 0 & 1 \end{bmatrix}$

$\text{adj } A = (A_{ij})^T$

$= \begin{bmatrix} 0 & -3 & 0 \\ 0 & -12 & 0 \\ 4 & 7 & 1 \end{bmatrix}$

32. $\left(x^2 + \frac{1}{x^2}\right)^4 = (x^2)^4 + 4(x^2)^3\left(\frac{1}{x^2}\right) + 6(x^2)^2\left(\frac{1}{x^2}\right)^2 + 4(x^2)\left(\frac{1}{x^2}\right)^3 + \left(\frac{1}{x^2}\right)^4$

$= x^8 + 4x^4 + 6 + \frac{4}{x^2} + \frac{4}{x^4} + \frac{1}{x^8}$

33. $x^2 - 3x - 10 + y^2 - 3y + 2 = 0$

$x^2 + y^2 - 3x - 3y - 8 = 0$

$2g = -3 \mid 2f = -3 \mid c = -8$

$g = -3/2 \mid f = -3/2$

centre $(-g, -f)$ ie, $\left(\frac{3}{2}, \frac{3}{2}\right)$

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

$= \sqrt{\frac{9}{4} + \frac{9}{4} + 8} = \sqrt{\frac{50}{4}} = \frac{5}{\sqrt{2}}$

34. $\lim_{x \to 2} \frac{x^n - 2^n}{x - 2} = 448$

$n2^{n-1} = 7 \times 2^{7-1}$

$\boxed{n = 7}$

2	448
2	224
2	112
2	56
2	28
7	14
	2

35. $C(x) = \frac{x^2}{6} + 5x + 200$

$R(x) = xp = 40x - x^2$

profit maximum,

$C'(x) = R'(x)$

$\frac{x}{3} + 5 = 40 - 2x$

$x + 15 = 120 - 6x$

$7x = 105$

$x = \frac{105}{7} = 15$

36. $P = 30000$

$a = 675$, $K = 2$

$i = ?$

$P = \frac{a}{i/K}$

$30000 = \frac{675}{i/2}$

$i = \frac{1350}{30000} = 0.045$

$= 4.5\%$

31.

x	$\frac{1}{x}$
1	1.0000
0.5	2.0000
10	0.1000
45	0.0222
175	0.0057
0.01	100.0000
4.0	0.2500
11.2	0.0893
	$\Sigma(\frac{1}{x})$ = 103.6472

$$HM = \frac{n}{\Sigma(\frac{1}{x})} = \frac{8}{103.6472} = 0.077$$

38. $2x = 8 - 3y$

$$x = -\frac{3}{2}y + 4$$

$$b_{xy} = -\frac{3}{2} < 1$$

$$2y = 5 - x$$

$$y = -\frac{1}{2}x + \frac{5}{2}$$

$$b_{yx} = -\frac{1}{2} < 1$$

both negative

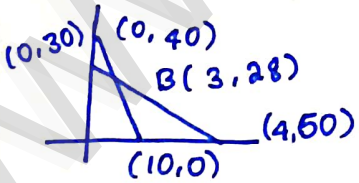
$$r = -\sqrt{b_{xy} \times b_{yx}}$$

$$= -\sqrt{(\frac{1}{2})(\frac{3}{2})} = -\frac{\sqrt{3}}{2}$$

$$= -0.866$$

39. $4x_1 + x_2 = 40$ | $2x_1 + 3x_2 = 90$

(0,40) (10,0) (0,30) (45,0)



A (45,0)	$z = 5x_1 + 4x_2$
B (3,28)	$z = 25$
C(0,40)	127
	160

minimum value of z at B(3,28)

optimal solution $x_1 = 3, x_2 = 28$

$z_{min} = 127$

40. condition for concurrent line is

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0 \quad \begin{vmatrix} 1 & 1 & -4 \\ 3 & 0 & 2 \\ 3 & -3 & 16 \end{vmatrix}$$

$= 1(0+6) - 1(48-6) - 4(-9-0)$

$= 6 - 42 + 36 = 0$

∴ The lines are concurrent

IV.

41. a) $\begin{pmatrix} 3 & -1 & 2 \\ 2 & 1 & -1 \\ 1 & 3 & -5 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 13 \\ 3 \\ -8 \end{pmatrix}$

$A \quad X \quad B$

$X = A^{-1}B$

$|A| = 3(-5+3) + 1(-10+1) + 2(6-1)$

$= -6 - 9 + 10 = -5 \neq 0$

$(Aij) = \begin{pmatrix} -2 & 9 & 5 \\ 1 & -17 & -10 \\ 5 & -10 & 5 \end{pmatrix}$

$(adj A) = (Aij)^{-1} = \begin{pmatrix} -2 & 1 & -1 \\ 9 & -17 & 7 \\ 5 & -10 & 5 \end{pmatrix}$

$X = A^{-1}B = -\frac{1}{5}\begin{pmatrix} -2 & 1 & -1 \\ 9 & -17 & 7 \\ 5 & -10 & 5 \end{pmatrix}\begin{pmatrix} 13 \\ 3 \\ -8 \end{pmatrix}$

$= -\frac{1}{5}\begin{pmatrix} -26+3+8 \\ 117-51-56 \\ 65-30-40 \end{pmatrix}$

$= -\frac{1}{5}\begin{pmatrix} -15 \\ 10 \\ -5 \end{pmatrix} = \begin{pmatrix} 3 \\ -2 \\ 1 \end{pmatrix}$

b) LHS : $\sin 20^\circ \sin 40^\circ \sin 80^\circ$

$= \sin 20 [\sin^2 60 - \sin^2 20^\circ]$

$= \sin 20 [\frac{3}{4} - \sin^2 20]$

$= \sin 20 [\frac{3 - 4\sin^2 20}{4}]$

$= \frac{1}{4}[3\sin 20 - 4\sin^3 20]$

$= \frac{1}{4}[\sin 3(20)] = \frac{1}{4}\sin(60)$

$= \frac{1}{4}(\frac{\sqrt{3}}{2}) = \frac{\sqrt{3}}{8}$

42. a) Let $P(n) = 1^2+2^2+\cdots n^2 = \frac{n^2(n+1)^2}{4}$

put $n=1$ LHS $= 1^3 = 1$

RHS $= \frac{1(2)^2}{4} = 1$

$P(1)$ is true

Assume $P(K)$ is true

$P(K): 1^3+2^3+\cdots K^3 = \frac{K^2(K+1)^2}{4}$

To prove: $P(K+1)$ is true

$P(K): 1^3+2^3+\cdots K^3+(K+1)^3$

$\frac{K^2(K+1)^2}{4} + (K+1)^3 = \frac{(K+1)^2(K+2)^2}{4}$

$\frac{K^2(K+1)^2}{4} + (K+1)^3$

$\frac{K^2(K+1)^2+4(K+1)^3}{4}$

$\frac{(K+1)^2(K^2+4(K+1)^2)}{4}$

$\frac{(K+1)^2(K^2+4K+4)}{4}$

$= \frac{(K+1)^2(K+2)^2}{4}$

$P(K+1)$ is true where $P(n)$ is true $\forall n \in N$

42. b) $a = 2000$ $i = \frac{8}{100} \times \frac{1}{4} = 0.02$

$n = 10 \times 4 = 40$

$A = \frac{a}{i}\left[(1+i)^n - 1\right] = \frac{2000}{0.02}\left[(1.0)^{40}-1\right]$

$= 100000[2.2080-1]$

$= ₹\ 1,20800$

43. a) $a = 2b = 3$ $h = \frac{5}{2}$

$g = 3$ $f = \frac{7}{2}$ $c = 4$

$abc + 2fgh - af^2 - bg^2 - ch^2$

$= 24 + \frac{105}{2} - \frac{49}{2} - 27 - 25 = 0$

$\theta = \tan^{-1}\left|\frac{2\sqrt{h^2-ab}}{a+b}\right| = \tan^{-1}\left[\frac{2\sqrt{h^2-ab}}{a+b}\right]$

$= \tan^{-1}\left[\frac{2\sqrt{\frac{25}{4}}}{-6}\right]$

$\theta = \tan^{-1}\left(\frac{1}{5}\right)$

43. b) $y = \sin(\log x)$

$y_1 = \cos \log x \left(\frac{1}{x}\right)$

$xy_1 = \cos x \log x$

$xy_2 + y_1 = -\sin \log x \frac{1}{x}$

$x^2y_2 + xy_1 = -\sin \log x$

$x^2y_2 + xy_1 + y = 0$

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

$(0,0) \Rightarrow c = 0$

$(1,2) \Rightarrow 1^2+2^2+2g(1)+2f(2)+c=0$

$2g+2f+c=-5$

$(2,0) \Rightarrow 2^2+0+2g(2)+2f(0)+c=0$

$4g+c=-4$

$g=-1$ $f=-\frac{3}{4}$ and $c=0$

$x^2+y^2+2(-1)x+2\left(-\frac{3}{4}\right)y+0=0$

$2x^2+2y^2-4x-3y=0$

44. b) $\frac{\partial q}{\partial p_1} = -2-2p_1p_2$

$\frac{\partial q}{\partial p_2} = 1-p_1^2$

$\frac{Eq}{Ep_1} = \frac{-p_1}{q}\frac{\partial q}{\partial p_1}$

$= \frac{-p_1}{5-2p_1+p_2-p_1^2p_2}(-2-2p_1p_2)$

$= \frac{2p_1+2p_1^2p_2}{5-2p_1-p_1^2p_2}$

$\frac{Eq}{Ep_1}(3,-1) = \frac{2(3)+2(9)(-1)}{5-6+1-(9)(-1)}$

$= \frac{132}{5} = -\frac{132}{5}$

(ii) $\frac{Eq}{EP_2} = \frac{-P_2}{q}\frac{\partial q}{\partial P_2} = \frac{-P_2(1-P_1^2)}{5-2P_1+P_2-P_1^2P_2}$

$= \frac{-P_2+P_2P_1^2}{5-2P_1+P_2-P_1^2P}$

$\frac{Eq}{EP_2} = \frac{-7+7(9)}{5-6+7-9(7)} = \frac{56}{-67}$

$= \frac{-56}{67}$

45·a)

Mid x	f	cf	$\lvert x-\text{median}\rvert$ D	fD
5	8	8	40·14	321·12
15	12	20	30·14	361·68
25	16	36	20·14	322·24
35	20	56	10·14	202·80
45	37	93	0·14	5·18
55	25	118	9·86	246·50
65	19	137	19·86	377·34
75	13	150	29·86	388·18
				= 2225·04

Median $\left(\frac{N}{2}\right)^{th}$ value = 75

$L + \left(\frac{\frac{N}{2} - cf}{f}\right) \times c$

$= 40 + \left(\frac{75-56}{37}\right) \times 10$

$= 40 + \frac{19}{37} \times 10 = 40 + \frac{190}{37}$

$= 40 + 5·14 = 45·14$

Mean deviation = $\frac{\Sigma fD)}{N}$

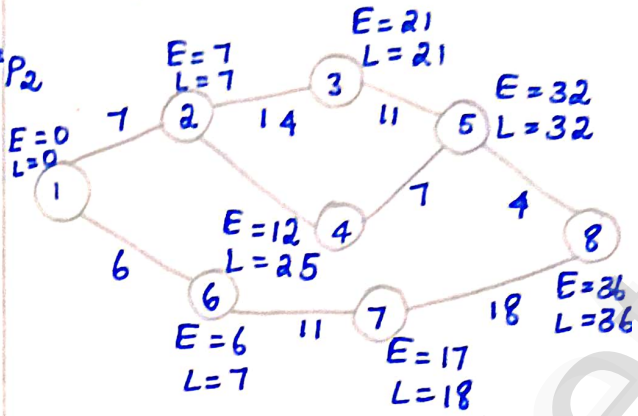
$= \frac{2225·04}{150} = 14·83$

Co·eff·of mean deviation

$= \frac{\text{mean deviation about median}}{\text{median}}$

$= \frac{14·83}{45·14} = 0·3285$

45·b)



critical = 1-2-3-5-8 =

7+14+11+4 = 36

		EST	EFT	LST	LFT
1-2	7	0	7	0	7
1-6	6	0	6	1	7
2-3	14	7	21	7	21
2-4	5	7	12	20	25
3-5	11	21	32	21	32
4-5	7	12	19	25	32
6-7	11	6	17	7	18
5-8	4	32	36	32	36
7-8	18	17	35	18	36

46·a) $E_1 = \frac{1}{2}$, $E_2 = \frac{1}{2}$

$\frac{E}{E_1} = \frac{3}{7}$, $\frac{E}{E_2} = \frac{5}{11}$

$\frac{E_1}{E} = \frac{(E_1)\left(\frac{E}{E_1}\right)}{(E_1)\left(\frac{E}{E_1}\right)+(E_2)\left(\frac{E}{E_2}\right)}$

$= \frac{\left(\frac{1}{2}\right)\left(\frac{3}{7}\right)}{\left(\frac{1}{2}\right)\left(\frac{3}{7}\right)+\left(\frac{1}{2}\right)\left(\frac{5}{11}\right)}$

$= \frac{35}{68}$

46. b)

x	$x=(x-18)$	x^2
6	-12	144
8	-10	100
12	-6	36
15	-3	9
18	0	0
20	2	4
24	6	36
28	10	100
31	13	169
$\Sigma x = 162$	$\Sigma x = 0$	$\Sigma x^2 = 598$

y	$y=(y-19)$	y^2	xy
10	-9	81	108
12	-7	49	70
15	-4	16	24
15	-4	16	12
18	-1	1	0
25	6	36	12
22	3	9	18
26	7	49	70
28	9	81	117
$\Sigma y = 171$	$\Sigma y = 0$	$\Sigma y^2 = 338$	$\Sigma xy = 431$

$N = 9$, $\bar{x} = \frac{\Sigma x}{N} = \frac{162}{9} = 18$

$\bar{y} = \frac{\Sigma y}{N} = \frac{171}{9} = 19$

$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \Sigma y^2}}$

$\Sigma xy = 431$, $\Sigma x^2 = 598$, $\Sigma y^2 = 338$

$r = \frac{431}{\sqrt{598 \times 338}} = \frac{431}{449.582}$

$= 0.95866$

$\simeq 0.959$

47. a)

x	y	x^2	y^2	xy
1	9	1	81	9
2	8	4	64	16
3	10	9	100	30
4	12	16	144	48
5	11	25	121	55
6	13	36	169	78
7	14	49	196	98
$\Sigma x = 28$	$\Sigma y = 77$	$\Sigma x^2 = 140$	$\Sigma y^2 = 875$	$\Sigma xy = 334$

$\bar{x} = \frac{\Sigma x}{N} = \frac{28}{7} = 4$

$\bar{y} = \frac{\Sigma y}{N} = \frac{77}{7} = 11$

(i) Regression coefficient of x on y:

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

$= \frac{7(334) - 28(77)}{7(875) - (77)^2}$

$b_{xy} = 0.929$

Regression equation of x on y:

$x - \bar{x} = b_{xy}(y - \bar{y})$

$x - 4 = 0.929(y - 11)$

$x = 0.929y - 6.219$

(ii) Regression coefficient of y on x:

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

$= \frac{7(334) - 28(77)}{7(140) - (28)^2}$

$b_{yx} = 0.929$

Regression equation of y on x:

$y - \bar{y} = b_{yx}(x - \bar{x})$

$y - 11 = 0.929(x - 4)$

$y = 0.929x + 7.284$

47. b) $\sin y = x \sin(a+y)$

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

diff. w.r.t 'x'

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

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

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

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