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VIVEKANANDA MATRIC HR SEC SCHOOL

GNT ROAD, ELAVUR BAZAR, GUMMIDIPOONDI, THIRUVALLUR DIST - 601201

Chapter - 1

BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks

Answer all the questions in brief

22 X 5 = 110

- Solve by matrix inversion method :
(i) $3x - y + 2z = 13$; $2x + y - z = 3$; $x + 3y - 5z = -8$
(ii) $x - y + 2z = 3$; $2x + z = 1$; $3x + 2y + z = 4$.
(iii) $2x - z = 0$; $5x + y = 4$; $y + 3z = 5$
- A sales person Ravi has the following record of sales for the month of January , February and March 2009 for three products A , B and C He has been paid a commission at fixed rate per unit but at varying rates for products A , B and C

Months	Sales in Units		Commission
	A	B	
January	9 2	10	800
February	15 4	5	900
March	6 3	10	850

Find the rate of commission payable on A, B and C per unit sold using matrix inversion method .

- Evaluate : $\begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix}$
- Find the inverse of each of the following matrices (i) $\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$ (ii) $\begin{bmatrix} 3 & 1 \\ -1 & 3 \end{bmatrix}$ (iii) $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 4 \\ 0 & 0 & 5 \end{bmatrix}$ (iv) $\begin{bmatrix} -3 & -5 & 4 \\ -2 & 3 & -1 \\ 1 & -4 & -6 \end{bmatrix}$
- If $A = \begin{bmatrix} -1 & 2 & -2 \\ 4 & -3 & 4 \\ 4 & -4 & 5 \end{bmatrix}$ then , show that the inverse of A is A itself .
- If $A = \begin{bmatrix} 2 & -2 & 2 \\ 2 & 3 & 0 \\ 9 & 1 & 5 \end{bmatrix}$ then , show that $(\text{adj } A) A = O$
- The cost of 4 kg onion , 3 kg wheat and 2 kg rice is Rs. 320 . The cost of 2kg onion , 4 kg wheat and 6 kg rice is Rs. 560 . The cost of 6 kg onion , 2 kg wheat and 3 kg rice is Rs. 380 . Find the cost of each item per kg by matrix inversion method .
- The prices of three commodities A , B and C are Rs. x , Rs. y and Rs. z per unit respectively. P purchases 4 units of C and sells 3 units of A and 5 units of B . Q purchases 3 units of B and sells 2 units of A and 1 unit of C . R purchases 1 unit of A and sells 4 units of B and 6 units of C . In the process P , Q and R earn Rs. 6,000 , Rs. 5,000 and Rs. 13,000 respectively . By using matrix inversion method , find the prices per unit of A , B and C.
- Prove that $\begin{vmatrix} \frac{1}{a} & bc & b+c \\ \frac{1}{b} & ca & c+a \\ \frac{1}{c} & ab & a+b \end{vmatrix} = 0$
- In an economy there are two industries P_1 and P_2 and the following table gives the supply and the demand position in crores of rupees .

Production sector	Consumption sector		Final demand Gross output	
	P_1	P_2		
P_1	10	25	15	50
P_2	20	30	10	60

Determine the outputs when the final demand changes to 35 for P_1 and 42 for P_2 .

11.

If $A = \begin{bmatrix} 2 & 4 & 4 \\ 2 & 5 & 4 \\ 2 & 5 & 3 \end{bmatrix}$ then find A^{-1}

12.

Show that the matrices $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$ $B = \begin{bmatrix} \frac{-4}{35} & \frac{11}{35} & \frac{-5}{35} \\ \frac{-1}{35} & \frac{-6}{35} & \frac{25}{35} \\ \frac{6}{35} & \frac{1}{35} & \frac{-10}{35} \end{bmatrix}$ are inverses of each other .

13.

If $A^{-1} = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ then , find A .

14.

If $X = \begin{bmatrix} 8 & -1 & -3 \\ -5 & 1 & 2 \\ 10 & -1 & -4 \end{bmatrix}$ and $Y = \begin{bmatrix} 2 & 1 & -1 \\ 0 & 2 & 1 \\ 5 & p & q \end{bmatrix}$ then , find p , q if $Y = X^{-1}$

15.

If $A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -1 \\ 1 & 2 \end{bmatrix}$ then , show that $(AB)^{-1} = B^{-1} A^{-1}$.

16.

Weekly expenditure in an office for three weeks is given as follows . Assuming that the salary in all the three weeks of different categories of staff did not vary , calculate the salary for each type of staff , using matrix inversion method.

week	Number of employees			Total weekly Salary (in rupees)
	A	B	C	
1st week	4	2	3	4900
2nd week	3	3	2	4500
3rd week	4	3	4	5800

17. Solve by using matrix inversion method :

$$3x - 2y + 3z = 8 ; 2x + y - z = 1 ; 4x - 3y + 2z = 4$$

18.

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

19.

Prove that $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix} = 4a^2 b^2 c^2$

20.

An economy produces only coal and steel. These two commodities serve as intermediate inputs in each other's production. 0.4 tonne of steel and 0.7 tonne of coal are needed to produce a tonne of steel. Similarly 0.1 tonne of steel and 0.6 tonne of coal are required to produce a tonne of coal. No capital inputs are needed. Do you think that the system is viable? 2 and 5 labour days are required to produce a tonne of coal and steel respectively . If economy needs 100 tonnes of coal and 50 tonnes of steel , calculate the gross output of the two commodities and the total labour days required.

21.

Show that the matrices $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} \frac{4}{5} & -\frac{2}{5} & -\frac{1}{5} \\ -\frac{1}{5} & \frac{3}{5} & -\frac{1}{5} \\ -\frac{1}{5} & -\frac{2}{5} & \frac{4}{5} \end{bmatrix}$ are inverses of each other .

22.

Find the minor and cofactor of each element of the determinant $\begin{vmatrix} 3 & 1 & 2 \\ 2 & 2 & 5 \\ 4 & 1 & 0 \end{vmatrix}$

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Chapter - 2

BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks

Answer all the questions in brief

22 X 5 = 110

- Resolve into partial fractions for the following $\frac{x^2-3}{(x+2)(x^2+1)}$:
- Prove that the term independent of x in the expansion of $\left(x + \frac{1}{x}\right)^{2n}$ is $\frac{1.3.5.....(2n-1)2^n}{n!}$
- Find the term independent of x in the expansion of
(i) $\left(x^2 - \frac{2}{3x}\right)^9$ (ii) $\left(x - \frac{2}{x^2}\right)^{15}$ (iii) $\left(2x^2 + \frac{1}{x}\right)^{12}$
- Using mathematical induction method, Prove that $1 + 2 + 3 + + n = \frac{n(n+1)}{2} n \in N$.
- Resolve into partial fractions for the following : $\frac{4x+1}{(x-2)(x+1)}$
- By the principle of mathematical induction, prove the following $1^3 + 2^3 + 3^3 + + n^3 = \frac{n^2(n+1)^2}{4}$ for all $n \in N$.
- By the principle of mathematical induction, prove the following $1 + 4 + 7 + + (3n-2) = \frac{n(3n-1)}{2}$, for all $n \in N$.
- Show that the middle term in the expansion of $(1+x)^{2n}$ is $\frac{1.3.5.....(2n-1)2^n x^n}{n!}$
- By the principle of mathematical induction prove that $n^2 + n$ is an even number, for all $n \in N$.
- Find the middle terms in the expansion of
(i) $\left(x + \frac{1}{x}\right)^{11}$ (ii) $\left(3x + \frac{x^2}{2}\right)^8$ (iii) $\left(2x^2 - \frac{3}{x^3}\right)^{10}$
- In how many different ways, 2 Mathematics, 2 Economics and 2 History books can be selected from 9 Mathematics, 8 Economics and 7 History books?
- By Mathematical Induction, prove that $1^2 + 2^2 + 3^2 + + n^2 = \frac{n(n+1)(2n+1)}{6}$, for all $n \in N$.
- Decompose into Partial Fractions : $\frac{6x^2-14x-27}{(x+2)(x-3)^2}$
- Evaluate the following expression.
(i) $\frac{7!}{6!}$ (ii) $\frac{8!}{5!}$ (iii) $\frac{9!}{6!3!}$
- Resolve into partial fractions for the following : $\frac{2x^2-5x-7}{(x-2)^3}$
- How many code symbols can be formed using 5 out of 6 letters A, B, C, D, E, F so that the letters a) cannot be repeated b) can be repeated c) cannot be repeated but must begin with E d) cannot be repeated but end with CAB.
- Resolve into partial fractions for the following : $\frac{x^2-6x+2}{x^2(x+2)}$
- By the principle of mathematical induction, prove the following $1.2 + 2.3 + 3.4 + + n(n+1) = \frac{n(n+1)(n+2)}{3}$, for all $n \in N$.
- Decompose into Partial Fractions : $\frac{5x^2-8x+5}{(x-2)(x^2-x+1)}$
- Resolve into partial fractions for the following : $\frac{3x+7}{x^2-3x+2}$
- Show by the principle of mathematical induction that $2^{3n} - 1$ is a divisible by 7, for all $n \in N$.
- Find the values of A, B and C if $\frac{x}{(x-1)(x+1)^2} = \frac{A}{x-1} + \frac{B}{x+1} + \frac{C}{(x+1)^2}$

VIVEKANANDA MATRIC HR SEC SCHOOL

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Chapter - 3

BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks

Answer all the questions in brief

4 X 5 = 20

1. Show that the pair of straight lines $4x^2 - 12xy + 9y^2 + 18x - 27y + 8 = 0$ represents a pair of parallel straight lines and find their separate equations .
2. Find the equation of the parabola whose focus is (1,3) and whose directrix is $x - y + 2 = 0$.
3. Find the centre and radius of the circle
 - (i) $x^2 + y^2 = 16$
 - (ii) $x^2 + y^2 - 22x - 4y + 25 = 0$
 - (iii) $5x^2 + 5y^2 + 4x - 8y - 16 = 0$
 - (iv) $(x + 2)(x - 5) + (y - 2)(y - 1) = 0$
4. Show that the equation $2x^2 + 7xy + 3y^2 + 5x + 5y + 2 = 0$ represent two straight lines and find their separate equations .

5 Marks

Answer all the questions in short

10 X 3 = 30

5. Find the equation of the circle passing through the points (0,0), (1, 2) and (2,0) .
6. Show that the pair of straight lines $4x^2 + 12xy + 9y^2 - 6x - 9y + 2 = 0$ represents two parallel straight lines and also find the separate equations of the straight lines .
7. Show that the equation $12x^2 - 10xy + 2y^2 + 14x - 5y + 2 = 0$ represents a pair of straight lines and also find the separate equations of the straight lines .
8. Determine whether the points P(1, 0), Q(2, 1) and R(2, 3) lie outside the circle , on the circle or inside the circle $x^2 + y^2 - 4x - 6y + 9 = 0$
9. Find the axis , vertex , focus , equation of directrix and length of latus rectum for the parabola $x^2 + 6x - 4y + 21 = 0$
10. Find the vertex , focus , axis , directrix and the length of latus rectum of the parabola $y^2 - 8y - 8x + 24 = 0$
11. Find whether the points (-1,-2) , (1,0) and (-3,-4) lie above , below or on the line $3x + 2y + 7 = 0$
12. Find the focus , the vertex , the equation of the directrix , the axis and the length of the latus rectum of the parabola $y^2 = -12x$
13. 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 .
14. A private company appointed a clerk in the year 2012 , his salary was fixed as Rs. 20,000. In 2017 his salary raised to Rs. 25,000.
 - (i) Express the above information as a linear function in x and y where y represent the salary of the clerk and x-represent the year
 - (ii) What will be his salary in 2020?

VIVEKANANDA MATRIC HR SEC SCHOOL

GNT ROAD, ELAVUR BAZAR, GUMMIDIPOONDI

Chapter - 4 BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks

Answer all the questions in brief

7 X 5 = 35

- Convert the following into the product of trigonometric functions.
(i) $\sin 9A + \sin 7A$ (ii) $\cos 7\theta - \sin 4\theta$ (iii) $\cos 8A + \cos 12A$
(iv) $\cos 4\alpha - \cos 8\alpha$ (v) $\cos 20^\circ - \cos 30^\circ$ (vi) $\cos 75^\circ + \cos 45^\circ$
(vii) $\cos 55^\circ + \sin 55^\circ$
- Find the principal value of the following :
(i) $\sin^{-1}\left(-\frac{1}{2}\right)$
(ii) $\tan^{-1}(-1)$
(iii) $\operatorname{cosec}^{-1}(2)$
(iv) $\sec^{-1}(-\sqrt{2})$
- Express each of the following as the sum or difference of sine or cosine :
(i) $\sin \frac{A}{8} \sin \frac{3A}{8}$ (ii) $\cos(60^\circ + A) \sin(120^\circ + A)$
(iii) $\cos \frac{7A}{3} \sin \frac{5A}{3}$ (iv) $\cos 7\theta \sin 3\theta$
- Find the values of the following
(i) $\sin 76^\circ \cos 16^\circ - \cos 76^\circ \sin 16^\circ$
(ii) $\sin \frac{\pi}{4} \cos \frac{\pi}{12} + \cos \frac{\pi}{4} \sin \frac{\pi}{12}$
(iii) $\cos 70^\circ \cos 10^\circ - \sin 70^\circ \sin 10^\circ$
(iv) $\cos^2 15^\circ - \sin^2 15^\circ$
- Express each of the following as the product of sine and cosine :
(i) $\sin A + \sin 2A$ (ii) $\cos 2A + \cos 4A$
(iii) $\sin 6\theta - \sin 2\theta$ (iv) $\cos 2\theta - \cos \theta$
- Express the following as sum or difference:
(i) $2\sin 2\theta \cos \theta$ (ii) $2\cos 3\theta \cos \theta$ (iii) $2\sin 4\theta \sin 2\theta$
(iv) $\cos 7\theta \cos 5\theta$ (v) $\cos \frac{3A}{2} \cos \frac{5A}{2}$ (vi) $\cos 9\theta \sin 6\theta$
(vii) $2\cos 13A \sin 15A$
- Prove that :
(i) $\tan(-225^\circ) \cot(-405^\circ) - \tan(-765^\circ) \cot(675^\circ) = 0$
(ii) $2 \sin^2 \frac{\pi}{6} + \cos \sec^2 \frac{7\pi}{6} \cos^2 \frac{\pi}{3} = \frac{3}{2}$
(iii) $\sec\left(\frac{3\pi}{2} - \theta\right) \sec\left(\theta - \frac{5\pi}{2}\right) + \tan\left(\frac{5\pi}{2} + \theta\right) \tan\left(\theta - \frac{5\pi}{2}\right) = -1$

5 Marks

Answer all the questions in short

10 X 3 = 30

- If $\sin \theta = \frac{3}{5}$, $\tan \varphi = \frac{1}{2}$ and $\frac{\pi}{2} < \theta < \pi < \varphi < \frac{3\pi}{2}$, then find the value of $8 \tan \theta - \sqrt{5} \sec \varphi$
- If $\sin A = \frac{3}{5}$, $0 < A < \frac{\pi}{2}$ and $\cos B = \frac{-12}{13}$, $\pi < A < \frac{3\pi}{2}$
find the values of the following :
(i) $\cos(A+B)$ (ii) $\sin(A-B)$ (iii) $\tan(A-B)$
- Prove that (i) $\sin(A + 60^\circ) + \sin(A - 60^\circ) = \sin A$
(ii) $\tan 4A \tan 3A \tan A + \tan 3A + \tan A - \tan 4A = 0$
- If $\tan A - \tan B = x$ and $\cot B - \cot A = y$ prove that $\cot(A - B) = \frac{1}{x} + \frac{1}{y}$.
- Prove that $\frac{\sin(B-C)}{\cos B \cos C} + \frac{\sin(C-A)}{\cos C \cos A} + \frac{\sin(A-B)}{\cos A \cos B} = 0$
- Prove that $\cos^2 A + \cos^2(A + 120^\circ) + \cos^2(A - 120^\circ) = \frac{3}{2}$
- Prove that
(i) $(\cos \alpha - \cos \beta)^2 + (\sin \alpha - \sin \beta)^2 = 4 \sin^2\left(\frac{\alpha - \beta}{2}\right)$
(ii) $\sin A \sin(60^\circ + A) \sin(60^\circ - A) = \frac{1}{4} \sin 3A$
- If $\sin(y + z - x)$, $\sin(z + x - y)$, $\sin(x + y - z)$ are in A.P, then prove that $\tan x$, $\tan y$ and $\tan z$ are in A.P
- If $\tan \alpha = \frac{1}{7}$, $\sin \beta = \frac{1}{\sqrt{10}}$ Prove that $\alpha + 2\beta = \frac{\pi}{4}$ where $0 < \alpha < \frac{\pi}{2}$ and $0 < \beta < \frac{\pi}{2}$.
- If $\cot \alpha = \frac{1}{2}$, $\sec \beta = \frac{-5}{3}$, where $\pi < \alpha < \frac{3\pi}{2}$ and $\frac{\pi}{2} < \beta < \pi$, find the value of $\tan(\alpha + \beta)$. State the quadrant in which $\alpha + \beta$ terminates.

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Chapter - 5 BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks

Answer all the questions in brief

10 X 5 = 50

- Differentiate the following with respect to x ,
 - $x^{\sin x}$
 - $(\sin x)^x$
 - $(\sin x)^{\tan x}$
 - $\sqrt{\frac{(x-1)(x-2)}{(x-3)(x^2+x+1)}}$
- Examine the following functions for continuity at indicated points
 - $f(x) = \begin{cases} \frac{x^2-4}{x-2}, & \text{if } x \neq 2 \\ 0, & \text{if } x = 2 \end{cases}$ at $x = 2$
 - $f(x) = \begin{cases} \frac{x^2-9}{x-3}, & \text{if } x \neq 3 \\ 6, & \text{if } x = 3 \end{cases}$ at $x = 3$
- Evaluate the following :
 - $\lim_{x \rightarrow 2} \frac{x^3+2}{x+1}$
 - $\lim_{x \rightarrow \infty} \frac{2x+5}{x^2+3x+9}$
 - $\lim_{x \rightarrow \infty} \frac{\sum n}{x^2}$
 - $\lim_{x \rightarrow 0} \frac{\sqrt{1+x}-\sqrt{1-x}}{\frac{5}{8}-a\frac{5}{8}}$
 - $\lim_{x \rightarrow a} \frac{\frac{2}{x^3}-\frac{2}{a^3}}{\frac{2}{\sin^3 x}-\frac{2}{\sin^3 a}}$
 - $\lim_{x \rightarrow 0} \frac{x^2}{\sin^3 x}$
- Draw the graph of the following functions :
 - $f(x) = 16 - x^2$
 - $f(x) = |x - 2|$
 - $f(x) = x |x|$
 - $f(x) = e^{2x}$
 - $f(x) = e^{-2x}$
 - $f(x) = \frac{|x|}{x}$
- Find $\frac{dy}{dx}$ of the following functions .
 - $x = ct, y = \frac{c}{t}$
 - $x = \log t, y = \sin t$
 - $x = a \cos^3 \theta, y = a \sin^3 \theta$
 - $x = a(\theta - \sin \theta), y = a(1 - \cos \theta)$
- Differentiate the following with respect to x.
 - $x \sin x$ (ii) $e^x \sin x$ (iii) $e^x (x + \log x)$
 - $\sin x \cos x$ (v) $x^3 e^x$
- Differentiate the following with respect to x .
 - $3x^4 - 2x^3 + x + 8$ (ii) $\frac{5}{x^4} - \frac{2}{x^3} + \frac{5}{x}$ (iii) $\sqrt{x} + \frac{1}{\sqrt[3]{x}} + e^x$
 - $\frac{3+2x-x^2}{x}$ (v) $x^3 e^x$ (vi) $(x^2 - 3x + 2)(x + 1)$
 - $x^4 - 3 \sin x + \cos x$ (viii) $\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2$
- Differentiate the following with respect to x.
 - $\sin^2 x$ (ii) $\cos^2 x$ (iii) $\cos^3 x$
 - $\sqrt{1+x^2}$ (v) $(ax^2 + bx + c)^n$ (vi) $\sin(x^2)$
 - $\frac{1}{\sqrt{1+x^2}}$
- Differentiate the following functions with respect to x .
 - $x^{\frac{3}{2}}$
 - $7e^x$
 - $\frac{1-3x}{1+3x}$
 - $x^2 \sin x$
 - $\sin^3 x$
 - $\sqrt{x^2 + x + 1}$

10. Determine whether the following functions are odd or even?

(i) $f(x) = \left(\frac{a^x - 1}{a^x + 1}\right)$

(ii) $f(x) = \log(x^2 + \sqrt{x^2 + 1})$

(iii) $f(x) = \sin x + \cos x$

(iv) $f(x) = x^2 - |x|$

(v) $f(x) = x + x^2$

5 Marks

Answer all the questions in short

5 X 3 = 15

11. Differentiate : $\sqrt{\frac{(x-3)(x^2+4)}{3x^2+4x+5}}$

12. If $x^y = y^x$, then prove that $\frac{dy}{dx} = \frac{y}{x} \left(\frac{x \log y - y}{y \log x - x} \right)$

13. If $xy^2 = 1$, then prove that $2\frac{dy}{dx} + y^3 = 0$.

14. find $\frac{dy}{dx}$ for the following functions .

(i) $xy = \tan(xy)$

(ii) $x^2 - xy + y^2 = 7$

(iii) $x^3 + y^3 + 3axy = 1$

15. Show that $f(x) = \begin{cases} 5x - 4, & \text{if } 0 < x \leq 1 \\ 4x^3 - 3x, & \text{if } 1 < x < 2 \end{cases}$ is continuous at $x = 1$.

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Chapter - 6

BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks

Answer all the questions in brief

14 X 5 = 70

- A company has to supply 1000 item per month at a uniform rate and for each time , a production run is started with the cost of Rs. 200. Cost of holding is Rs. 20 per item per month. The number of items to be produced per run has to be ascertained. Determine the total of setup cost and average inventory cost if the run size is 500 , 600 , 700 , 800. Find the optimal production run size using EOQ formula.
- The demand function of a commodity is $p = 200 - \frac{x}{100}$ and its cost is $C = 40x + 12000$ where p is a unit price in rupees and x is the number of units produced and sold. Determine
 - profit function
 - average profit at an output of 10 units
 - marginal profit at an output of 10 units and
 - marginal average profit at an output of 10 units.
- A firm produces x tonnes of output at a total cost of $C(x) = \frac{1}{10}x^3 - 4x^2 - 20x + 7$ find the
 - average cost
 - average variable cost
 - average fixed cost
 - marginal cost and
 - marginal average cost.
- Find the absolute (global) maximum and absolute minimum of the function $f(x) = 3x^5 - 25x^3 + 60x + 1$ in the interval $[-2, 2]$
- The manufacturing cost of an item consists of Rs. 1, 600 as over head material cost Rs. 30 per item and the labour cost $Rs(\frac{x^2}{100})$ for x items produced. Find how many items be produced to have the minimum average cost.
- The following table gives the annual demand and unit price of 3 items

Items	Annual Demand (units)	Unit Price Rs.
A	800	0.02
B	400	1.00
C	13,800	0.20

Ordering cost is Rs. 5 per order and holding cost is 10% of unit price.

Determine the following:

- EOQ in units
 - Minimum average cost
 - EOQ in rupees
 - EOQ in years of supply
 - Number of orders per year.
- A company buys in lots of 500 boxes which is a 3 month supply. The cost per box is Rs. 125 and the ordering cost in Rs. 150. The inventory carrying cost is estimated at 20% of unit value.
 - Determine the total amount cost of existing inventory policy
 - How much money could be saved by applying the economic order quantity?
 - The total cost of x units of output of a firm is given by $C = \frac{2}{3}x + \frac{35}{2}$. find the
 - cost when output is 4 units
 - average cost when output is 10 units
 - marginal cost when output is 3 units
 - The total cost function of a firm is $C(x) = \frac{x^3}{3} - 5x^2 + 28x + 10$, where x is the output. A tax at the rate of Rs. 2 per unit of output is imposed and the producer adds it to his cost. If the market demand function is given by $p = 2530 - 5x$, where p is the price per unit of output , find the profit maximizing the output and price.
 - Verify the relationship of elasticity of demand , average revenue and marginal revenue for the demand law $p = 50 - 3x$.
 - A company uses 48000 units of a raw material costing Rs. 2.5 per unit. Placing each order costs Rs. 45 and the carrying cost is 10.8 % per year of the average inventory. Find the EOQ , total number of orders per year and time between each order. Also verify that at EOQ carrying cost is equal to ordering cost.
 - Find the extremum values of the function $f(x) = 2x^3 + 3x^2 - 12x$.

13. Revenue function ' R ' and cost function ' C ' are $R = 14x - x^2$ and $C = x(x^2 - 2)$. Find the
- average cost
 - marginal cost
 - average revenue and
 - marginal revenue.
14. The total cost function for the production of x units of an item is given by $C(x) = \frac{1}{3}x^3 + 4x^2 - 25x + 7$. Find
- Average cost
 - Average variable cost
 - Average fixed cost
 - Marginal cost and
 - Marginal Average cost



VIVEKANANDA MATRIC HR SEC SCHOOL

GNT ROAD, ELAVUR BAZAR, GUMMIDIPOONDI

Chapter - 7

BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks**Answer all the questions in brief**

6 X 5 = 30

1. The capital of a company is made up of 50, 000 preferences shares with a dividend of 16% and 2, 500 ordinary shares. The par value of each of preference and ordinary shares is Rs. 10. The company had a total profit of Rs. 1,60,000. If Rs. 20, 000 were kept in reserve and Rs. 10, 000 in depreciation, what percent of dividend is paid to the ordinary share holders
2. A man sells 2000 ordinary shares (par value Rs. 10) of a tea company which pays a dividend of 25% at Rs. 33 per share. He invests the proceeds in cotton textiles (par value Rs. 25) ordinary shares at Rs. 44 per share which pays a dividend of 15%. Find (i) the number of cotton textiles shares purchased and (ii) change in his dividend income.
3. Vijay wants to invest Rs. 27, 000 in buying shares. The shares of the following companies are available to him. Rs. 100 shares of company A at par value ; Rs. 100 shares of company B at a premium of Rs. 25. Rs. 100 shares of company C at a discount of Rs. 10. Rs. 50 shares of company D at a premium of 20%. Find how many shares will he get if he buys shares of company
(i) A (ii) B (iii) C (iv) D
4. (i) Find the amount of an ordinary annuity of Rs. 500 payable at the end of each year for 7 years at 7% per year compounded annually.
(ii) Calculate the amount of an ordinary annuity of Rs. 10, 000 per annum for 5 years at 10% per year compounded half - yearly.
(iii) Find the amount of an ordinary annuity of Rs. 600 is made at the end of every quarter for 10 years at the rate of 4% per year compounded quarterly.
(iv) Find the amount of an annuity of Rs. 2000 payable at the end of every month for 5 years if money is worth 6% per annum compounded monthly.
5. Gopal invested Rs. 8, 000 in 7% of Rs. 100 shares at Rs. 80. After a year he sold these shares at Rs. 75 each and invested the proceeds (including his dividend) in 18% for Rs. 25 shares at Rs. 41. Find
(i) his dividend for the first year
(ii) his annual income in the second year
(iii) The percentage increase in his return on his original investment
6. An equipment is purchased on an installment basis such that Rs. 5000 on the signing of the contract and four yearly installments of Rs. 300 each payable at the end of first, second, third and the fourth year. If the interest is charged at 5% p.a find the cash down price. [$\log(1.05) = 0.0212$; $\text{antilog}(1.9152) = 0.8226$]

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GNT ROAD, ELAVUR BAZAR, GUMMIDIPOONDI

Chapter - 8

BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks

Answer all the questions in brief

13 X 5 = 65

- Gun 1 and Gun 2 are shooting at the same target. Gun 1 shoots on the average nine shots during the same time Gun 2 shoots 10 shots. The precision of these two guns is not the same. On the average, out of 10 shots from Gun 2 seven hit the target. In the course of shooting the target has been hit by a bullet, but it is not known which Gunshot this bullet. Find the chance that the target was hit by Gun 2?
- A factory has 3 machines A_1 , A_2 , A_3 producing 1000, 2000, 3000 screws per day respectively. A_1 produces 1% defectives, A_2 produces 1.5% and A_3 produces 2% defectives. A screw is chosen at random at the end of a day and found defective. What is the probability that it comes from machines A_1 ?
- Compute mean deviation about median from the following data :

Height in inches	No. of students	Height in inches	No. of students
58	15	63	22
59	20	64	20
60	32	65	10
61	35	66	8
62	35		

- Find out the GM for the following

Yield of Rice (tones)	No. of farms
7.5 - 10.5	5
10.5 - 13.5	9
13.5 - 16.5	19
16.5 - 19.5	23
19.5 - 22.5	7
22.5 - 25.5	4
25.5 - 28.5	1

- Calculate the geometric mean of the data given below giving the number of families and the income per head of different classes of people in a village of Kancheepuram District.

Class of people	No. of Families	Income per head in 1990 (Rs)
Landlords	1	1000
Cultivators	50	80
Landless labourers	25	40
Money - lenders	2	750
School teachers	3	100
Shop - keepers	4	150
Carpenters	3	120
Weavers	5	60

- In a screw factory machines A, B, C manufacture respectively 30%, 40% and 30% of the total output of these 2%, 4% and 6% percent are defective screws. A screws is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by Machine C?
- 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	20	25	32	40	42	35	10	8

- Data on readership of a magazine indicates that the proportion of male readers over 30 years old is 0.30 and the proportion of male reader under 30 is 0.20. If the proportion of readers under 30 is 0.80. What is the probability that a randomly selected male subscriber is under 30?
- Calculate GM for the following table gives the weight of 31 persons in sample survey.

Weight (lbs) :	130	135	140	145	146	148	149	150	157
Frequency	3	4	6	6	3	5	2	1	1

- Compute Quartile deviation from the following data

CI	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	60 - 70
f	12	19	5	10	9	6	6

11. Verify the relationship among AM , GM and HM for the following data

X	7	10	13	16	19	22	25	28
f	10	22	24	28	19	9	12	16

12. Calculate the Mean deviation about median and its relative measure for the following data.

X	15	25	35	45	55	65	75	85
frequency	12	11	10	15	22	13	18	19

13. Compute upper Quartiles , lower Quartiles , D_4 and P_{60} , P_{75} from the following data

CI	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
Frequency	12	19	5	10	9	6	6



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GNT ROAD, ELAVUR BAZAR, GUMMIDIPOONDI

Chapter - 9 BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

Chapter - 9

Answer all the questions in brief

19 X 5 = 95

1. Calculate the coefficient of correlation between X and Y series from the following data

	X	Y
Number of pairs of observation	15	15
Arithmetic mean	25	18
Standard deviation	3.01	3.03
Sum of squares of deviation from the arithmetic mean	136	138

Summation of product deviations of X and Y series from their respective arithmetic means is 122.

2. The two regression lines are $3X + 2Y = 26$ and $6X + 3Y = 31$. Find the correlation coefficient.
3. Obtain regression equation of Y on X and estimate Y when $X = 55$ from the following

X	40	50	38	60	65	50	35
Y	38	60	55	70	60	48	30

Estimate the likely demand when the price is Rs. 20.

4. Calculate the two regression equations of X on Y and Y on X from the data given below, taking deviations from a actual means of X and Y.

Price(Rs.)	10	12	13	12	16	15
Amount demanded	40	38	43	45	37	43

Estimate the likely demand when the price is Rs. 20.

5. A survey was conducted to study the relationship between expenditure on accommodation (X) and expenditure on Food and Entertainment (Y) and the following results were obtained :

	Mean	SD
Expenditure on Accommodation	Rs. 178	63.15
Expenditure on Food and Entertainment	Rs 47.8	22.98
Coefficient of Correlation	0.43	

Write down the regression equation and estimate the expenditure on Food and Entertainment , if the expenditure on accommodation is Rs. 200.

6. The following data give the height in inches (X) and the weight in lb. (Y) of a random sample of 10 students from a large group of students of age 17 years :

X	61	68	68	64	65	70	63	62	64	67
Y	112	123	130	115	110	125	100	113	116	125

Estimate weight of the student of a height 69 inches.

7. Find the means of X and Y variables and the coefficient of correlation between them from the following two regression equations :

$$4X - 5Y + 33 = 0$$

$$20X - 9Y - 107 = 0$$

8. From the data given below

Marks in Economics :	25	28	35	32	31	36	29	38	34	32
Marks in Statistics:	43	46	49	41	36	32	31	30	33	39

Find (a) The two regression equations , (b) The coefficient of correlation between marks in Economics and statistics , (c) The mostly likely marks in Statistics when the marks in Economics is 30.

9. Find out the coefficient of correlation in the following case and interpret.

Height of father (in inches)	65	66	67	67	68	69	71	73
Height of son (in inches)	67	68	64	68	72	70	69	70

10. Using the following information you are requested to (i) obtain the linear regression of Y on X (ii) Estimate the level of defective parts delivered when inspection expenditure amounts to Rs. 28, 000 $\Sigma X = 424$, $\Sigma Y = 363$, $\Sigma X^2 = 21926$, $\Sigma Y^2 = 15123$, $\Sigma XY = 12815$, $N = 10$. Here X is the expenditure on inspection , Y is the defective parts delivered

11. The following data pertains to the marks in subjects A and B in a certain examination. Mean marks in A = 39.5 , Mean marks in B = 47.5 standard deviation of marks in A = 10.8 and Standard deviation of marks in B = 16.8. coefficient of correlation between marks in A and marks in B is 0.42. Give the estimate of marks in B for candidate who secured 52 marks in A.

12. Ten competitors in a beauty contest are ranked by three judges in the following order

First judge	1	4	6	3	2	9	7	8	10	5
Second judge	2	6	5	4	7	10	9	3	8	1
Third judge	3	7	4	5	10	8	9	2	6	1

Use the method of rank correlation coefficient to determine which pair of judges has the nearest approach to common taste in beauty?

13. An examination of 11 applicants for a accountant post was taken by a finance company. The marks obtained by the applicants in the reasoning and aptitude tests are given below.

Applicant	A	B	C	D	E	F	G	H	I	J	K
Reasoning test	20	50	28	25	70	90	76	45	30	19	26
Aptitude test	30	60	50	40	85	90	56	82	42	31	49

Calculate Spearman's rank correlation coefficient from the data given above.

14. For the given lines of regression $3X - 2Y = 5$ and $X - 4Y = 7$. Find

- (i) Regression coefficients
(ii) Coefficient of correlation

15. 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

16. In a laboratory experiment on correlation research study the equation of the two regression lines were found to be $2X - Y + 1 = 0$ and $3X - 2Y + 7 = 0$. Find the means of X and Y. Also work out the values of the regression coefficient and correlation between the two variables X and Y.

17. For 5 pairs of observations the following results are obtained

$\sum X = 15, \sum Y = 25, \sum X^2 = 55, \sum Y^2 = 135, \sum XY = 83$ Find the equation of the lines of regression and estimate the value of X on the first line when Y = 12 and value of Y on the second line if X = 8.

18. The heights (in cm.) of a group of fathers and sons are given below

Heights of fathers :	158	166	163	165	167	170	167	172	177	181
Heights of Sons :	163	158	167	170	160	180	170	175	172	175

Find the lines of regression and estimate the height of son when the height of the father is 164 cm.

19. Calculate Karl Pearson's coefficient of correlation from the following data :

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

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GNT ROAD, ELAVUR BAZAR, GUMMIDIPOONDI

Chapter - 10 BUSINESS MATHEMATICS

Total Marks: 200 Marks

Class: 11

Duration: 3 Hrs 20 Min

5 Marks

Answer all the questions in brief

25 X 5 = 125

1. Solve the following LPP by graphical method.

Maximize $Z = 22x_1 + 18x_2$ subject to constraints $960x_1 + 640x_2 \leq 15360$; $x_1 + x_2 \leq 20$ and $x_1, x_2 \geq 0$.

2. Draw the network diagram for the following activities

Activity	1 - 2	2 - 3	2 - 4	3 - 5	4 - 6	5 - 6
Duration (in days)	6	8	4	9	2	7

Draw the network for the project, calculate the earliest start time, earliest finish time, latest start time and latest finish time of each activity and find the critical path. Compute the project duration.

3. Solve the following linear programming problem graphically. Maximise $Z = 4x_1 + x_2$ subject to the constraints $x_1 + x_2 \leq 50$; $3x_1 + x_2 \leq 90$ and $x_1 \geq 0, x_2 \geq 0$

4. Solve the following LPP by graphical method.

Maximize $Z = 20x_1 + 30x_2$ subject to constraints $3x_1 + 3x_2 \leq 36$; $5x_1 + 2x_2 \leq 50$; $2x_1 + 6x_2 \leq 60$ and $x_1, x_2 \geq 0$

5. Solve the following LPP

Maximize $Z = 2x_1 + 5x_2$ subject to the conditions $x_1 + 4x_2 \leq 24$

$3x_1 + x_2 \leq 21$

$x_1 + x_2 \leq 9$ and $x_1, x_2 \geq 0$

6. A firm manufactures pills in two sizes A and B. Size A contains 2 mgs of aspirin, 5 mgs of bicarbonate and 1 mg of codeine. Size B contains 1 mg. of aspirin, 8 mgs. of bicarbonate and 6 mgs. of codeine. It is found by users that it requires atleast 12 mgs. of aspirin, 74 mgs. of bicarbonate and 24 mgs. of codeine for providing immediate relief. It is required to determine the least number of pills a patient should take to get immediate relief. Formulate the problem as a standard LLP.

7. Compute the earliest start time, earliest finish time, latest start time and latest finish time of each activity of the project given below :

Activity	1 - 2	1 - 3	2 - 4	2 - 5	3 - 4	4 - 5
Duration(in days)	8	4	10	2	5	3

8. Solve the following linear programming problem graphically. Maximise $Z = 200x_1 + 500x_2$ subject to the constraints : $x_1 + 2x_2 \geq 10$; $3x_1 + 4x_2 \leq 24$ and $x_1 \geq 0, x_2 \geq 0$

9. The following table gives the characteristics of project

Activity	1 - 2	1 - 3	2 - 3	3 - 4	3 - 5	4 - 6	5 - 6	6 - 7
Duration (in days)	5	10	3	4	6	6	5	5

Draw the network for the project, calculate the earliest start time, earliest finish time, latest start time and latest finish time of each activity and find the critical path. Compute the project duration.

10. Solve the following LPP by graphical method Minimize $z = 5x_1 + 4x_2$ Subject to constraints $4x_1 + x_2 \geq 40$; $2x_1 + 3x_2 \geq 90$ and $x_1, x_2 \geq 0$

11. Solve the following LPP by graphical method.

Minimize $Z = 3x_1 + 2x_2$ subject to the constraints $5x_1 + x_2 \geq 10$; $x_1 + x_2 \geq 6$; $x_1 + 4x_2 \geq 12$ and $x_1, x_2 \geq 0$.

12. Solve the following linear programming problem graphically. Maximise $Z = 3x_1 + 5x_2$ subject to the constraints : $x_1 + x_2 \leq 6$; $x_1 \leq 4$; $x_2 \leq 5$, and $x_1, x_2 \geq 0$

13. A dietician wishes to mix two types of food F_1 and F_2 in such a way that the vitamin contents of the mixture contains atleast 6units of vitamin A and 9 units of vitamin B. Food F_1 costs Rs. 50 per kg and F_2 costs Rs. 70 per kg. Food F_1 contains 4 units per kg of vitamin A and 6 units per kg of vitamin B while food F_2 contains 5 units per kg of vitamin A and 3 units per kg of vitamin B. Formulate the above problem as a linear programming problem to minimize the cost of mixture.

14. A company produces two types of pens A and B. Pen A is of superior quality and pen B is of lower quality. Profits on pens A and B are Rs. 5 and Rs. 3 per pen respectively. Raw materials required for each pen A is twice as that of pen B. The supply of raw material is sufficient only for 1000 pens per day. Pen A requires a special clip and only 400 such clips are available per day. For pen B, only 700 clips are available per day. Formulate this problem as a linear programming problem.

15. Solve the following LPP by graphical method.

Maximize $Z = 40x_1 + 50x_2$ subject to constraints $30x_1 + x_2 \leq 9$; $x_1 + 2x_2 \leq 8$ and $x_1, x_2 \geq 0$

16. Calculate the earliest start time, earliest finish time, latest start time and latest finish time of each activity of the project given below and determine the Critical path of the project and duration to complete the project.

Activity	1 - 2	1 - 3	1 - 5	2 - 3	2 - 4	3 - 4	3 - 5	3 - 6	4 - 6	5 - 6
Duration (in week)	8	7	12	4	10	3	5	10	7	4

17. A company manufactures two models of voltage stabilizers viz., ordinary and autotest. All components of the stabilizers are purchased from outside sources, assembly and testing is carried out at company's own works. The assembly and testing time required for the two models are 0.8 hour each for ordinary and 1.20 hours each for auto - cut. Manufacturing capacity 720 hours at present is available per week. The market for the two models has been surveyed which suggests maximum weekly sale of 600 units of ordinary and 400 units of auto - cut. Profit per unit for ordinary and auto - cut models has been estimated at Rs. 100 and Rs. 150 respectively. Formulate the linear programming problem.
18. A company produces two types of products say type A and B. Profits on the two types of product are Rs. 30/- and Rs. 40/- per kg respectively. The data on resources required and availability of resources are given below.

	Requirements		Capacity available	
	Product A	Product B	Product A	Product B per month
Raw material (kgs)	60	120	12000	
Machining hours / piece	8	5	600	
Assembling (man hours)	3	4	500	

Formulate this problem as a linear programming problem to maximize the profit.

19. Solve the following LPP by graphical method.
Maximize $Z = 6x_1 + 8x_2$ subject to constraints $30x_1 + 20x_2 \leq 300$; $5x_1 + 10x_2 \leq 110$; and $x_1, x_2 > 0$.
20. Solve the following LPP by graphical method.
Maximize $Z = 20x_1 + 40x_2$ subject to constraints $36x_1 + 6x_2 \geq 108$; $3x_1 + 12x_2 \geq 36$; $20x_1 + 10x_2 \geq 100$ and $x_1, x_2 \geq 0$
21. Solve the following LPP.
Maximize $Z = 2x_1 + 3x_2$ subject to constraints $x_1 + x_2 \leq 30$; $x_2 \leq 12$; $x_1 \leq 20$ and $x_1, x_2 \geq 0$
22. A company is producing three products P_1 , P_2 and P_3 , with profit contribution of Rs. 20, Rs. 25 and Rs. 15 per unit respectively. The resource requirements per unit of each of the products and total availability are given below.

Product	P_1	P_2	P_3	Total availability
Man hours/unit	6	3	12	200
Machine hours/unit	2	5	4	350
Material/unit	1 kg	2 kg	1 kg	100 kg

Formulate the above as a linear programming model

23. A soft drink company has two bottling plants C_1 and C_2 . Each plant produces three different soft drinks S_1 , S_2 and S_3 . The production of the two plants in number of bottles per day are:

Product	Plant	
	C_1	C_2
S_1	3000	1000
S_2	1000	1000
S_3	2000	6000

A market survey indicates that during the month of April there will be a demand for 24000 bottles of S_1 , 16000 bottles of S_2 and 48000 bottles of S_3 . The operating costs, per day, of running plants C_1 and C_2 are respectively Rs. 600 and Rs. 400. How many days should the firm run each plant in April so that the production cost is minimized while still meeting the market demand? Formulate the above as a linear programming model.

24. A firm manufactures two products A and B on which the profits earned per unit are Rs. 3 and Rs. 4 respectively. Each product is processed on two machines M_1 and M_2 . Product A requires one minute of processing time on M_1 and two minutes on M_2 , While B requires one minute on M_1 and one minute on M_2 . Machine M_1 is available for not more than 7 hrs 30 minutes while M_2 is available for 10 hrs during any working day. Formulate this problem as a linear programming problem to maximize the profit.
25. A furniture dealer deals only two items viz., tables and chairs. He has to invest Rs. 10, 000/- and a space to store atmost 60 pieces. A table cost him Rs. 500/- and a chair Rs. 200/-. He can sell all the items that he buys. He is getting a profit of Rs. 50 per table and Rs.15 per chair. Formulate this problem as an LPP, so as to maximize the profit.