TVL12BM

Common Half Yearly Examination - December 2025

Standard 12

BUSINESS MATHS

Time Allowed: 3.00 Hours | Maximum Marks: 90

I. Choose the correct answer: **20×1=20**

1) The rank of m×n matrix whose elements are unity is
a) 0 b) 1 c) m d) n

2) If $\Delta \neq 0$, then the system has
a) only one solution b) infinitely many solutions
c) no solution d) none of these

3) $\int \sqrt{e^x}\,dx$ is
a) $\sqrt{e^x} + c$ b) $2\sqrt{e^x} + c$ c) $\frac{1}{2}\sqrt{e^x} + c$ d) $\frac{1}{2\sqrt{e^x}} + c$

4) The value of $\int_2^3 f(5-x)dx - \int_2^3 f(x)dx$ is
a) 1 b) 0 c) -1 d) 5

5) The demand and supply functions are given by $D(x) = 16-x^2$ and $S(x) = 2x^2+4$ are under perfect competition, then the equilibrium price x is
a) 2 b) 3 c) 4 d) 5

6) The marginal cost function is $MC = 100\sqrt{x}$ and AC given that TC = 0 when the output is zero
a) $\frac{200}{3}x^{1/2}$ b) $\frac{200}{3}x^{3/2}$ c) $\frac{200}{3x^{3/2}}$ d) $\frac{200}{3x^{3/1}}$

7) The integrating factor of the differential equation $\frac{dx}{dy} + Px = Q$ is
a) e^{pdx} b) pdx d) y d) e^{pdy}

8) The complementary function of $\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$ is
a) A+Be^x b) (A+B)e^x c) (Ax+B)e^x d) Ae^x+B

9) If h = 1, then $\Delta(x^2)$ =
a) 2x b) 2x-1 c) 2x+1 d) 1

10) $\Delta\nabla \equiv$
a) 1 b) Δ c) $\Delta - \nabla$ d) $\nabla - \Delta$

11) If c is a constant, then E(c) is
a) 0 b) 1 c) cf(c) d) c

12) A discrete probability function p(x) is always non-negative and always lies between
a) 0 and ∞ b) 0 and 1 c) -1 and +1 d) $-\infty$ and $+\infty$

13) Let z be a standard normal variable. If the area to the right of z is 0.8413, then the value of z must be
a) 1.00 b) -1.00 c) 0.00 d) -0.41

14) The mean and variance of poisson distribution are
a) np, npq b) np, $\sqrt{npq}$ c) λ, λ d) λ, $e^{-\lambda}$

15) In simple random sampling from a population of N units, the probability of drawing and unit at the first draw is
a) $\frac{n}{N}$ b) $\frac{1}{N}$ c) $\frac{N}{n}$ d) 1

16) The standard error of sample mean is

a) $\frac{\sigma}{\sqrt{2n}}$ b) $\frac{\sigma}{n}$ c) $\frac{\sigma}{\sqrt{n}}$ d) $\frac{\sigma^2}{\sqrt{n}}$

17) The upper control limit for $\bar{x}$ chart is given by

a) $\bar{\bar{x}} + A_2\bar{R}$ b) $\bar{X} + A_2R$ b) $\bar{\bar{X}} + A_2\bar{R}$ d) $\bar{\bar{X}} + A_2\bar{\bar{R}}$

18) The formula for cost of living index number is

a) $\frac{p_1q_0}{p_0q_0} \times 100$ b) $\frac{p_1q_1}{p_0q_1} \times 100$ c) $\sqrt{p_{01}^L \times p_{01}^P}$ d) $\frac{p_1q_1}{p_1q_0} \times 100$

19) In a degenerate solution number of allocations is
a) equal to m+n-1 b) not equal to m+n-1
c) less than m+n-1 d) greater than m+n-1

20) A type of decision making environment is
a) certainty b) uncertainty c) risk d) all of the above

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

21) Find the rank of the matrix $\begin{pmatrix} 1 & 5 \\ 3 & 9 \end{pmatrix}$

22) Evaluate: $\int (2\sin x - 5\cos x)\,dx$

23) Find the producer's surplus defined by the supply curve $g(x) = 4x+8$ when $x_0 = 5$.

24) Find the order and degree of the differential equation $\frac{d^3y}{dx^3} + 3\left(\frac{dy}{dx}\right)^3 + 2\frac{dy}{dx} = 0$

25) If $p(x) = \begin{cases} x/20 & , x = 0,1,2,3,4,5 \\ 0 & , \text{otherwise} \end{cases}$ find (i) $P(x < 3)$

26) In a poisson distribution the first probability term is 0.2725. Find the next probability term.

27) Define level of significance.

28) State the two normal equations used in fitting a straight line.

29) Given the following pay-off matrix (in rupees) for three strategies and two states of nature

Strategy	States of nature	
	E_1	E2
S_1	40	60
S_2	10	-20
S_3	-40	150

Select a strategy using each of the following rule (i) maximin (ii) minimax

30) Evaluate: $\Delta(\log ax)$

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

31) Akash bats according to the following traits. If he makes a hit (S), there is a 25% chance that he will make a hit his next time at bat. If he fails to hit (F) there is a 35% chance that he will make a hit his next time at bat. Find the transition probability matrix for the data and determine Akash's long-range batting average.

32) Integrate with respect to x: $\int x^3e^{3x}\,dx$

33) Find the area of the region bounded by the line $x-2y-12 = 0$, the y-axis and the lines $y = 2$, $y = 5$

34) Solve: $(D^2-3D-4)y = 0$.

35) Given $y_3 = 2$, $y_4 = -6$, $y_5 = 8$, $y_6 = 9$ and $y_7 = 17$ calculate $\Delta^4 y_3$.

36) A fair die is thrown. Find out the expected value of its outcomes.

37) Mention the properties of binomial distribution.

38) A server channel monitored for an hour was found to have an estimated mean of 20 transactions transmitted per minute. The variance is known to be 4. Find the standeard error.

39) Solve the following assignment problem

		Men		
		1	2	3
Task	P	9	26	15
	Q	13	27	6
	R	35	20	15
	S	18	30	20

40) The following data gives the readings for 8 samples of size 6 each in the production of a certain product. Find the control limits using mean chart

Sample	1	2	3	4	5	6
Mean	300	342	351	319	326	333
Range	25	37	20	28	30	22

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

41) Two types of soaps A and B are in the market. Their present market shares are 15% for A and 85% for B of those who bought A the previous year 65% continue to buy it again while 35% switch over to B of those who bought B the previous year, 55% buy it again and 45% switch over to A. Find their market shares after one year and when is the equilibrium reached?

(OR)

If the heights of 500 students are normally distributed with mean 68.0 inches and standard deviation 3.0 inches, how many students have height (a) greater than 72 inches (b) less than or equal to 64 inches (c) between 65 and 71 inces.

42) Solve the equations $x+4y+3z = 2$, $2x-6y+6z = -3$, $5x-2y+3z = -5$ by Cramer's rule.

(OR)

Consider a random variable X with probability density function

$f(x) = \begin{cases} 4x^3, & \text{if } 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$. Find E(x) and V(x).

43) Evaluate: $\int \frac{3x+2}{(x-2)^2(x-3)}\,dx$

(OR)

Estmate the production for 1964 and 1966 from the following data:

Year	1961	1962	1963	1964	1965	1966	1967
Production	200	220	260	-	350	-	430

44) Find the consumer's surplus producer's surplus for the demand function $P_d = 25-3x$ and supply function $P_s = 5+2x$.

(OR)

An ambulance service claims that it takes on the average 8.9 minutes to reach its destination in emergency calls. To check on this claim, the agency which licenses ambulance services has then timed on 50 emergency calls, getting a mean of 9.3 minutes with a standard deviation of 1.6 minutes. What can they conclude at 5% level of significance.

45) Evaluate the intergral as the limit of a sum $\int_0^1 (x+4)dx$

(OR)

Construct Fisher's price index number and prove that it astisfies both Time Reversal Test and Factor Reversal Test for data following data:

Commodities	Base Year		Current Year	
	Price	Quantity	Price	Quantity
Rice	40	5	48	4
Wheat	45	2	42	3
Rent	90	4	95	6
Fuel	85	3	80	2
Transp	50	5	65	8
	65	1	72	3

46) Using Lagrange's interpolation formula find y(10) from the following table:

x	5	6	9	11
y	12	13	14	16

(OR)

Calculate the seasonal index for the quarterly production of a product using the method of simple averages

Year	I Quarter	II Quarter	III Quarter	IV Quarter
2005	255	351	425	400
2006	269	310	396	410
2007	291	332	358	395
2008	198	289	310	357
2009	200	290	331	359
2010	250	300	350	400

47) Solve: $\frac{dy}{dx} + \frac{3x^2}{1+x^3} y = \frac{1+x^2}{1+x^3}$

(OR)

Find an initial basic feasible solution of the following problem using north west corner rule:

	D_1	D_2	D_3	D_4	Supply
O_1	5	3	6	2	19
O_2	4	7	9	1	37
O_3	3	4	7	5	34
Demand	16	18	31	25	

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