V11BM

Virudhunagar District Common Examinations
Common Half Yearly Examination - December 2022

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Standard 11

BUSINESS MATHEMATICS AND STATISTICS

Time: 3.00 Hrs. Marks: 90

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

1) If A is a square matrix of order 3 then $|KA|$ is _____.
   a) $K|A|$ b) $-K|A|$ c) $K^3|A|$ d) $-K^3|A|$

2) If $A = \begin{pmatrix} -1 & 2 \\ 1 & -4 \end{pmatrix}$ then A(adj A) is _____.
   a) $\begin{pmatrix} -4 & -2 \\ -1 & -1 \end{pmatrix}$ b) $\begin{pmatrix} 4 & -2 \\ -1 & 1 \end{pmatrix}$ c) $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ d) $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$

3) If $\begin{vmatrix} x & 2 \\ 8 & 5 \end{vmatrix} = 0$, then the value of x is _____.
   a) $-5/6$ b) $5/6$ c) $-16/5$ d) $16/5$

4) If $nP_r = 720(nC_r)$, then r is equal to _____.
   a) 4 b) 5 c) 6 d) 7

5) Sum of the binomial coefficients is _____.
   a) 2^n b) n^2 c) 2n d) n+17

6) 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)

7) The eccentricity of the parabola is _____.
   a) 3 b) 2 c) 0 d) 1

8) The degree measure of $\pi/8$ is _____.
   a) 20° 60' b) 22° 30' c) 22° 60' d) 20° 30'

9) The value of $1-2\sin^2 45°$ is _____.
   a) 1 b) $1/2$ c) $1/4$ d) 0

10) $\sec^{-1}\left(\frac{2}{3}\right) + \text{cosec}^{-1}\left(\frac{2}{3}\right) =$ _____.
   a) $-\pi/2$ b) $\pi/2$ c) π d) $-\pi$

11) If $f(x) = \frac{1-x}{1+x}$, $x>1$ then $f(-x)$ is equal to
   a) $-f(x)$ b) $\frac{1}{f(x)}$ c) $\frac{-1}{f(x)}$ d) $f(x)$

12) $\lim_{x\to 0} \frac{e^x - 1}{x} =$ _____.
   a) e b) nx^{n-1} c) 1 d) 0

13) Profit P(x) is maximum when
   a) MR = MC b) MR = 0 c) MC = AC d) TR = AC

14) If $u = e^{x^2}$, then $\frac{\partial u}{\partial x}$ is equal to _____.
a) $2xe^{x^2}$, b) e^{x^2} c) $2e^{x^2}$ d) 0

15) The dividend received on 200 shares of face value ₹ 100 at 8% is _____.
a) ₹ 1,600 b) ₹ 1,000 c) ₹ 1,500 d) ₹ 800

16) An annuity in which payments are made at the beginining of each payment period is called _____.
a) Annuity due b) An immediate annuity
c) Perpectual annuity d) None of these

17) The correct relationship among AM, GM and HM is
a) AM < GM < HM b) GM ≥ AM ≥ HM c) HM ≥ GM ≥ AM d) AM ≥ GM ≥ HM

18) The probability of drawing a spade from a pack of card is _____.
a) $\frac{1}{52}$ b) $\frac{1}{13}$ c) $\frac{4}{13}$ d) $\frac{1}{4}$

19) If r(x, y) = 0 then variables X and Y are said to be
a) Positive correlation b) Negative correlation
c) No correlation d) Perfect positive correlation

20) If Cov(x, y) = −16.5, $\sigma^2 x = 2.89$, $\sigma^2 y = 100$ find correlation coefficient.
a) −0.12 b) −1 c) −0.97 d) 0.001

II. Answer the following in any SEVEN: **7×2=14**
Note: Q.No. 30 is compulsory.

21) Solve: $\begin{vmatrix} x-1 & x & x-2 \\ 0 & x-2 & x-3 \\ 0 & 0 & x-3 \end{vmatrix} = 0$

22) The technology matrix of an economic system of two industries is $\begin{bmatrix} 0.8 & 0.2 \\ 0.9 & 0.7 \end{bmatrix}$.
Test whether the system is viable as per Hawkins - Simon conditions.

23) How many distinct words can be formed using all the betters of the word "MISSISSIPPI"?

24) Find the principle value of (i) $\text{cosec}^{-1}(2)$ (ii) $\tan^{-1}\left(-\sqrt{3}\right)$

25) Find $\frac{dy}{dx}$ if $x = a\cos\theta$, $y = a\sin\theta$.

26) Show that the function $f(x) = x^3 - 3x^2 + 4x$, $x \in R$ is strictly increasing function on R.

27) Which is better investment? 20% stock at ₹ 140 (or) 10% stock at ₹ 70.

28) A die is thrown. Find the probability of getting
i) a prime number
ii) a number greater than or equal to 3

29) From the following data calculate the correlation coefficient $\Sigma xy = 120$, $\Sigma x^2 = 90$, $\Sigma y^2 = 640$.

30) If the lines $3x-5y-11 = 0$, $5x+3y-7 = 0$ and $x+ky = 0$ are concurrent, find the value of k.

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III. Answer the following in any SEVEN: **7×3=21**

Note: Q.No. 40 is compulsory.

31) If $A = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 8 \\ 7 & 9 \end{bmatrix}$ then, verify that $(AB)^{-1} = B^{-1}A^{-1}$.

32) Find the 5th term in the expansion of $\left(x - \frac{3}{x^2}\right)^{10}$.

33) For what value of K does $2x^2+5xy+2y^2+15x+18y+K = 0$ represent a pair of straight lines.

34) Find the equation of the tangent to the circle $x^2+y^2-4x+4y-8 = 0$ at $(-2, -2)$.

35) Prove that $\frac{\sin(180^\circ+A)\cos(90^\circ-A)\tan(270^\circ-A)}{\sec(540^\circ-A)\cos(360^\circ+A)\operatorname{cosec}(270^\circ+A)} = -\sin A \cos^2 A$

36) Show that $f(x) = |x|$ is continuous at $x = 0$.

37) The total cost of x units of output of a firm is given by $C = \frac{2}{3}x + \frac{35}{2}$. Find the (i) cost, when output is 4 units (ii) average cost, when output is 10 units (iii) marginal cost, when output is 3 units.

38) Calculate the quartile deviation and its coefficient from the following data:

Age in years	20	30	40	50	60	70	80
No. of members	13	61	47	15	10	18	36

39) The rank of 10 students of same batch in two subjects A and B are given below. Calculate the rank correlation coefficient.

Rank of A	1	2	3	4	5	6	7	8	9	10
Rank of B	6	7	5	10	3	9	4	1	8	2

40) What is the present value of an annuity is due of ₹ 1,500 for 16 years at 8% per annum? $[(1.08)^{-16} = 0.2919]$

IV. Answer the following: **7×5=35**

41) a) Prove that $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$.

(OR)

b) Find the axis, vertex, focus, equation of directrix and the length of latus rectum for the parabola $x^2+6x-4y+21 = 0$.

42) a) By Mathematical Induction, prove that

$$1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}, \text{ for all } n \in N.$$

(OR)

b) If $y = \left(x + \sqrt{1+x^2}\right)^m$, then show that $(1+x^2)y_2+xy_1-m^2y = 0$.

43) a) If $\tan A = m \tan B$, prove that $\frac{\sin(A+B)}{\sin(A-B)} = \frac{m+1}{m-1}$.

(OR)

b) The prices of three commodities A, B and C are ₹ x, ₹ y and ₹ 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 ₹ 6,000, ₹ 5,000 and ₹ 13,000 respectively. By using matrix inversion method, find the prices per unit of A, B and C.

44) a) If $u = xy+\sin(xy)$, then show that $\frac{\partial^2 u}{\partial x\, \partial y} = \frac{\partial^2 u}{\partial y\, \partial x}$.

(OR)

b) A man invest ₹ 96,000 on ₹ 100 shares at ₹ 80. If the company pays him 18% as dividend, find (i) the number of shares he bought (ii) the dividend (iii) percentage of return.

45) a) The demand for a commodity A is $q = 80-p_1^2+5p_2-p_1p_2$. Find the partial elasticities $\frac{Eq}{Ep_1}$ and $\frac{Eq}{Ep_2}$ when $P_1 = 2$, $P_2 = 1$.

(OR)

b) Resolve into partial fractions: $\frac{2x+1}{(x-1)(x^2+1)}$

46) a) 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

(OR)

b) 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?

47) a) Obtain regression equation of Y and 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

(OR)

b) Solve: $\tan^{-1}\left(\frac{x-1}{x-2}\right) + \tan^{-1}\left(\frac{x+1}{x+2}\right) = \frac{\pi}{4}$
