JHARKHAND Rai University RANCHI

PRACTICE SET
End Semester Examination, December, 2025

Program: Diploma (Mining/CSE)
Semester: I
Subject: BASIC MATHEMATICS
Subject Code: 8DBSC101 & 3DBSC101

UNIT - 1

Section A (5 Marks Questions)

1. If $\tan\theta + \cot\theta = 2$, then $\theta = ?$

A. 45° B. 30° C. 60° D. 90°

2. If $\cos(\theta - 30°) = \sqrt{3}/2$, then $\theta = ?$

A. 60° or 0° B. 90° or 30° C. 75° or –? D. 30° only

3. If $\sec\theta - \tan\theta = 1/4$, find $\sec\theta + \tan\theta$.

A. 4 B. 8 C. 16 D. 1/8

4. If $\tan\theta = 1$, then $\theta = ?$

A. 30° B. 45° C. 60° D. 90°

5. If $\cos\theta = 0$, then $\theta = ?$

A. 0° B. 45° C. 60° D. 90°

6. If $\sec\theta = 5/4$, then $\cos\theta = ?$

A. 4/5 B. 5/4 C. 1 D. 3/5

7. The value of $(\sin^2\theta + \cos^2\theta)$ is:

A. 0 B. 1 C. θ D. 2

8. If $\sin\theta = 3/5$, then $\cos\theta = ?$

A. 4/5 B. 5/3 C. $\sqrt{(1 - 3/5)}$ D. $\sqrt{5}/3$

9. If $\cos3\theta = 0$, smallest positive $\theta = ?$

A. 30° B. 45° C. 60° D. 90°

10. $\sin(90° - \theta)$ equals:

A. $\sin\theta$ B. $\cos\theta$ C. $\tan\theta$ D. $\cot\theta$

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Section B 10 Marks Question

11.Use the formula and Prove that $\frac{1+\sin 2\theta - cos2\theta}{1+\sin 2\theta - cos2\theta} = \tan\theta$ [Apply]

12. Use the formula and$Prove\ that$ tan 3A. tan2A. tan A = tan 3A - tan 2A – tan A

13. Use the formula and p$rove\ that\ tan(45+A)+tan(45-A)=2Sec2A$

14. Use the formula and$Prove\ that\ i)\ cos20°cos40°\cos 60°\cos 80° = \frac{1}{16}$

15. **Reframe,** If $A+B=45^0$, then prove that
$(i)\ (1+tanA)(1+tanB)=2 \quad (ii)\ (cotA-1)(cotB-1)=2$

Section C 20 Marks Questions

16. (a) Show that $\sqrt{2+\sqrt{2+\sqrt{2+2cos8\theta}}} = 2\ cos\theta$

(b) Use the formula and $Prove\ that\ tan\ 20^0.tan\ 40^0.tan\ 80^0 = tan\ 60^0$

17. Prove, If in a triangle ABC,
(i) A = $tan^{-1}2$ and B = $tan^{-1}3$ Prove that C = $\frac{\pi}{4}$
(ii) Use the formula and Prove that $2\ tan^{-1}\frac{1}{3}+tan^{-1}\frac{1}{7}=\frac{\pi}{4}$

UNIT - 2

Section A 5 Marks Questions

18. $Solve\ the\ value\ of\ \lim_{x\to 0}\frac{\sqrt{1+x}-\sqrt{1-x}}{x}$

19. $Explain,\ If\ y = x^4+4x^3+5x-6, then\ find\ \frac{dy}{dx}$

20. $Evaluate\ a)\int 3x^2\,dx \quad b)\int(sin3x+secx+tan2x)dx$

21. $Evaluate:-a)\int(4\sin x-4\,cosx+5sec^2x-2cosec^2x)\,dx$

$b)\ If\ xy = x^3+y^3\ find\ \frac{dy}{dx}.$

Section B 10 Marks Questions

22. $Solve\ (a)\int \cos x\cos 2x\cos 3x\,dx$

$(b)\ If\ x^3+y^3=sin\,(x+y), find\ \frac{dy}{dx}$

23. $Solve\ (a)\ Evaluate\colon \int \frac{x}{(x^2+1)^3}dx$

$(b)\ If\ x^3+y^3=3axy, find\ \frac{dy}{dx}$

24. $Describe\ (a)$ If $y = x\ log\ x\ -\ x\ then\ find\ \frac{dy}{dx}$.

(b) If x Cos y = Sin (x+ y), find $\frac{dy}{dx}$

25. Develop the (a) Find $\frac{dy}{dx}\ if\ y\ =\ \frac{1-Cos\ x}{1\_+cos\ x}$

$(b)\ Find\ \frac{dy}{dx}, when\ x = a(t+\sin t)\ and\ y = a(1-\cos t)$

Section C 20 Marks Questions

26. . $Write\ the\ diffentation\ \ (a)\ If\ y = \sqrt{sin\ x+\sqrt{\sin x+\sqrt{\sin x+\sqrt{\sin x+\ \ldots\ldots\ldots\infty}}}}\ find\ \frac{dy}{dx}$.

$(\ b)\quad Evaluate\colon\ \int_0^{\pi} Cos2x.log\ sin\ x\ dx$

27. $Find\ the\ Value\ of\ Integration$

$(i)\ \int \sqrt{1-sin2x}\ dx$

(ii) $\int \frac{secx}{secx+tanx}dx$

UNIT- 3

Section A 5 Marks Questions

28. If A is a 2×3 matrix and B is a 3×2 matrix, then AB is of order

A. 2×2 B. 2×3 C. 3×3 D. 3×2

29. The determinant of a 2×2 matrix | a b | | c d | is

A. ab – cd B. ad – bc C. ac – bd D. ab + cd

30. If A is the zero matrix, then A + I = ?

A. A B. I C. Zero matrix D. Not defined

31. The determinant of identity matrix I_3 is

A. 0 B. 1 C. 2 D. 3

32. If A = [[2, 3], [4, 5]], then det(A) =

A. 10 B. 7 C. −2 D. −7

33. Two matrices can be added only when

A. They have same number of rows B. They have same number of columns

C. They are square D. Their orders are equal

34. If A is a 3×3 matrix, then the determinant of A is

A. A number B. A 3×3 matrix C. A 1×3 matrix D. Not defined

35. If A = [[k, 0], [0, k]], then det(A) equals

A. k B. k^2 C. 2k D. 0

36. If A + B = B + A, then matrix addition is

A. Non-commutative B. Commutative C. Not defined D. Multiplication

37. If A = [[1,2], [3,4]], then the adjoint of A is

A. [[4, −2], [−3, 1]] B. [[4, 3], [2, 1]]

C. [[1, −3], [−2, 4]] D. [[4, −3], [−2, 1]]

Section B 10 Marks Questions

38. Explain the matrix Let $A = \begin{bmatrix} 1 & -2 \\ 5 & 4 \\ 3 & 0 \end{bmatrix}, B = \begin{bmatrix} 3 & 1 \\ 0 & 2 \\ -3 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & 3 \\ -2 & 2 \\ 1 & 6 \end{bmatrix}$

$Verify\ that\ (A + B) + C = A + (B + C)$ [Knowledge]

39. Interpret $(a)\ If \begin{vmatrix} 3x & 7 \\ -2 & 4 \end{vmatrix} = \begin{vmatrix} 8 & 7 \\ 6 & 4 \end{vmatrix}, find\ the\ value\ of\ x.$

(b) $If \begin{vmatrix} x+1 & x-1 \\ x-3 & x+2 \end{vmatrix} = \begin{vmatrix} 4 & -1 \\ 1 & 3 \end{vmatrix}, find\ the\ value\ of\ x.$

40. Correlate the (a) ${}^{10}C_3$ AND ${}^{12}P_4$.

(b) Using properties of determinant show that $\begin{vmatrix} a+x & y & z \\ x & a+y & z \\ x & y & a+z \end{vmatrix} = a^2(a + x + y + z)$

41. Solve the , If ${}^{n}P_r = 720$ and ${}^{n}C_r = 120$, find r.

42. Explain the, Let A = $\begin{bmatrix} 2 & 3 & 5 \\ -1 & 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & -2 & 3 \\ 2 & 6 & -1 \end{bmatrix}$. $Verify\ that\ A + B = B + A$

UNIT – 4

Section A 5- Marks question

43. A quantity having both magnitude and direction is called

A. Scalar B. Vector C. Tensor D. Constant

44. The magnitude of vector a = 3i + 4j is

A. 5 B. 7 C. 1 D. 12

45. If a = i + j and b = i − j, then a + b =

A. j B. I C. 2i D. 2j

46. The unit vector in the direction of i + j is

A. (i + j)/2 B. (i + j)/√2 C. (i + j)/√3 D. (i + j)/√5

47. Dot product of two perpendicular vectors is

A. 1 B. −1 C. 0 D. ∞

48. If a = 2i + 3j and b = 4i − j, then a • b =

A. 5 B. 8 C. 2 D. 11

49. If |a| = 6, |b| = 8 and angle between them is 60°, then a • b =

A. 24 B. 48 C. 12 D. 36

50. The cross product of parallel vectors is

A. Maximum B. Minimum C. Zero D. Undefined

51. The value of i × j is

A. k B. –k C. I D. j

52. The value of j × i is

A. k B. –k C. I D. –i

Section B 10 Marks Question

53. Relate the Let $\vec{a} = (\hat{\imath} + \hat{\jmath} + \hat{k}), \vec{b} = (4\hat{\imath} - 2\hat{\jmath} + 3\hat{k})$ *and* $\vec{c} = (\hat{\imath} - \hat{2J} + \hat{k})$,

find a vector of magnitude 6 *units which is parallel to the vector* $(2\hat{\vec{a}} - \hat{b} + 3\,\vec{c})$.

54. Prove the points $A(-2\hat{\imath} - 3\,\hat{\jmath} + 5\,\hat{k}), B(\hat{\imath} + 2\hat{\jmath} + 3\,\hat{k})$ *and* $C(7\hat{\imath} - \hat{k})$ *are collinear*.

55. Explain the a unit vector parallel to the sum of the vectors $(\hat{\imath} + \hat{\jmath} + \hat{k})$ and $(2\hat{\imath} - 3\hat{\jmath} + 5\hat{k})$.

56. Devise that the points with position vectors $\vec{a} = (3\hat{\imath} - 4\,\hat{\jmath} - 4\,\hat{k}), \hat{b} = (2\hat{\imath} - \hat{\jmath} + \hat{k})$ *and*

$\vec{c} = (\hat{\imath} - \widehat{3J} - \widehat{5k})$ *respectively, form the vertices of right − angled triangle.*

20 Marks Questions

57. (a) Write the value of λ *so that the vectors* $\vec{a} = (\widehat{2\imath} + \lambda\hat{\jmath} + \hat{k})$ *and* $\vec{b} = (\hat{\imath} - \widehat{2J} + \widehat{3k})$

are perpendicular to each other.

(*b*) Find a unit vector in the direction of $\overrightarrow{AB}$, *where* $A\ (1,2,3)$ *and* $B(4,5,6)$ *are the given points.*

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