

Class - 12TH

MATHEMATICS

MOCK EXAMS

Serial Number: 01

Time: 3 Hours

Maximum Marks: 80

Exam Date: _____



CLASS 12TH
MATHEMATICS

EXAM ID 0641

PAPER - 1

DURATION 3 HOURS

MM. 80

General Instructions:

Read the following instructions carefully and follow them:

1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study-based questions carrying 4 marks each with sub-parts of the values of 1, 1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Questions of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Use of calculators is not allowed.

SECTION – A (1 MARKS EACH)

1. The number of all possible matrices of order 3×3 with each entry 0 or 1 is
a. 18 b. 27 c. 512 d. 81
2. For non-singular square matrices A and B of the same order, we have $\text{adj}(AB) = ?$
a. $(\text{adj } B)(\text{adj } A)$ b. $|AB|$ c. $(\text{adj } B) \cdot |A|$ d. $(\text{adj } A) \cdot |B|$
3. If $\Delta = \begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$, then the cofactor A_{21} is
a. $hc - fg$ b. $-(hc + fg)$ c. $fg - hc$ d. $fg + hc$
4. Which of the following statements is true for the function $f(x) = \begin{cases} x^2 + 3, & x \neq 0, \\ 1, & x = 0 \end{cases}$?
a. $f(x)$ is continuous and differentiable $\forall x \in \mathbb{R}$ b. $f(x)$ is continuous and differentiable $\forall x \in \mathbb{R} - \{0\}$
c. $f(x)$ is discontinuous at infinitely many d. $f(x)$ is continuous $\forall x \in \mathbb{R}$ points
5. The angle between the lines $\frac{x}{2} = \frac{y}{2} = \frac{z}{1}$ and $\frac{x-5}{4} = \frac{y-2}{1} = \frac{z-3}{8}$ is
a. $\cos^{-1}\left(\frac{3}{4}\right)$ b. $\cos^{-1}\left(\frac{2}{3}\right)$ c. $\frac{\pi}{3}$ d. $\cos^{-1}\left(\frac{5}{6}\right)$
6. The order and degree (if defined) of the differential equation, $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 = x \sin\left(\frac{dy}{dx}\right)$ respectively are:
a. 2, degree not defined b. 2, 2 c. 2, 3 d. 1, 3
7. Maximize $Z = 50x + 60y$, subject to constraints $x + 2y \leq 50, x + y \geq 30, x, y \geq 0$.
a. 2500 b. 1600 c. 1547 d. 1525
8. The 2 vectors $\hat{j} + \hat{k}$ and $3\hat{i} - \hat{j} + 4\hat{k}$ represents the two sides AB and AC, respectively of a $\triangle ABC$. The length of the median through A is
a. $\frac{\sqrt{48}}{2}$ b. $\frac{\sqrt{34}}{2}$ c. $\sqrt{18}$ d. $\sqrt{22}$
9. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos x dx = ?$
a. 2 b. -1 c. 1 d. 0
10. If A and B are matrices of same order, then $(AB' - BA')$ is a
a. skew-symmetric matrix b. unit matrix c. symmetric matrix d. null matrix

11. The linear programming problem minimize $Z = 3x + 2y$ subject to constraints $x + y \geq 8, 3x + 5y \leq 15, x \geq 0$ and $y \geq 0$, has
 a. one solution b. infinitely many solutions c. no feasible solution d. two solutions
12. If $\vec{a} = (2\hat{i} + 4\hat{j} - \hat{k})$ and $\vec{b} = (3\hat{i} - 2\hat{j} + \lambda\hat{k})$ be such that $\vec{a} \perp \vec{b}$ then $\lambda = ?$
 a. 3 b. -3 c. -2 d. 2
13. If $A = \begin{bmatrix} 1 & k & 3 \\ 3 & k & -2 \\ 2 & 3 & -4 \end{bmatrix}$ is singular then $k = ?$
 a. $\frac{16}{3}$ b. $\frac{33}{2}$ c. $\frac{34}{5}$ d. $\frac{33}{4}$
14. If $P(A | B) = P(A | B')$, then which of the following statements is true?
 a. $P(A) = 2P(B)$ b. $P(A \cap B) = 2P(B)$ c. $P(A \cap B) = \frac{1}{2}P(B)$ d. $P(A) = P(A')$
15. A homogeneous equation of the form $\frac{dy}{dx} = h\left(\frac{y}{x}\right)$ can be solved by making the substitution
 a. $y = vx$ b. $v = yx$ c. $x = v$ d. $x = vy$
16. If $|\vec{a}| = 3, |\vec{b}| = 4$ and $|\vec{a} \times \vec{b}| = 6$, then the value of $\vec{a} \cdot \vec{b}$ is
 a. $6\sqrt{3}$ b. $3\sqrt{3}$ c. 6 d. 12
17. If $\sqrt{x} + \sqrt{y} = \sqrt{a}$ then $\frac{dy}{dx} = ?$
 a. $\frac{-\sqrt{x}}{\sqrt{y}}$ b. $\frac{1-\sqrt{y}}{2\sqrt{x}}$ c. $\frac{1\sqrt{y}}{2\sqrt{x}}$ d. $\frac{-\sqrt{y}}{\sqrt{x}}$
18. The direction ratios of two lines are a, b, c and $(b-c), (c-a), (a-b)$ respectively. The angle between these lines is
 a. $\frac{\pi}{3}$ b. $\frac{\pi}{4}$ c. $\frac{3\pi}{4}$ d. $\frac{\pi}{2}$
19. **Assertion (A):** $f(x) = \tan x - x$ always increases.
Reason (R): Any function $y = f(x)$ is increasing if $\frac{dy}{dx} > 0$.
 a. Both A and R are true and R is the correct explanation of A.
 b. Both A and R are true but R is not the correct explanation of A.
 c. A is true but R is false.
 d. A is false but R is true.
20. **Assertion (A):** The Relation R given by $R = \{(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)\}$ on set $A = \{1, 2, 3, 2\}$ is symmetric.
Reason (R): For symmetric Relation $R = R^{-1}$
 a. Both A and R are true and R is the correct explanation of A.
 b. Both A and R are true but R is not the correct explanation of A.
 c. A is true but R is false.
 d. A is false but R is true.

SECTION – B (2 MARKS EACH)

21. Find the value of $\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left[\sin\left(\frac{-\pi}{2}\right)\right]$.

OR

Find the principal value of $\operatorname{cosec}^{-1}(-1)$.

22. The total cost $C(x)$ associated with provision of free mid-day meals to x students of a school in primary classes is given by $C(x) = 0.005x^3 - 0.02x^2 + 30x + 50$.

If the marginal cost is given by rate of change $\frac{dC}{dx}$ of total cost, then write the marginal cost of food for 300 students. What value is shown here?

23. Find the value(s) of 'a' for which $f(x) = x^3 - ax$ is an increasing function on R.

OR

The length x of a rectangle is decreasing at the rate of 5 cm/min and the width y increasing at the rate of 4 cm/min, find the rate of change its area when $x = 5$ cm and $y = 8$ cm.

24. Evaluate $\int \frac{x^3+x}{x^4-9} dx$.

25. Find the absolute maximum and minimum values of the function f given by $f(x) = \cos^2 x + \sin x, x \in [0, \pi]$.

SECTION – C (3 MARKS EACH)

26. Evaluate: $\int \frac{3\sin x + 2\cos x}{3\cos x + 2\sin x} dx$.

27. The contents of three bags I, II and III are as follows:

Bag I : 1 white, 2 black and 3 red balls,

Bag II : 2 white, 1 black and 1 red ball;

Bag III : 4 white, 5 black and 3 red balls.

A bag is chosen at random and two balls are drawn. What is the probability that the balls are white and red?

28. Evaluate $\int \frac{2x}{(x^2+1)(x^2+3)} dx$.

OR

Evaluate $\int_0^{\pi/2} \frac{1}{1+\cot x} dx$

29. $(x^2 + y^2)dy = xydx$. If $y(1) = 1$ and $y(x_0) = e$, then find the value of x_0 .

OR

Show that the differential equation $(y^2 - x^2)dy = 3xydx$ is homogeneous and solve it.

30. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, prove that $(\vec{a} \times \vec{b}) = (\vec{b} \times \vec{c}) = (\vec{c} \times \vec{a})$.

OR

Using vectors, find the area of the $\triangle ABC$, whose vertices are $A(1,2,3)$, $B(2, -1,4)$ and $C(4,5, -1)$.

31. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$ and $x \neq y$, prove that $\frac{dy}{dx} = -\frac{1}{(x+1)^2}$.

SECTION – D (5 MARKS EACH)

32. Evaluate: $\int \frac{(x^2+1)(x^2+2)}{(x^2+3)(x^2+4)} dx$.

33. Let $A = \mathbb{R} - \{3\}$, $B = \mathbb{R} - \{1\}$. If $f: A \rightarrow B$ be defined by $f(x) = \frac{x-2}{x-3} \forall x \in A$. Then, show that f is bijective.

OR

Let $A = \{1, 2, 3, \dots, 9\}$ and R be the relation in $A \times A$ defined by $(a, b) R (c, d)$ if $a + d = b + c$ for $(a, b), (c, d)$ in $A \times A$. Prove that R is an equivalence relation and also obtain the equivalence class $[(2, 5)]$.

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

Using A^{-1} , solve the system of linear equations:

$$x - 2y = 10,$$

$$2x - y - z = 8,$$

$$-2y + z = 7$$

35. Show that the lines $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-1}{5}$ and $\frac{x-2}{2} = \frac{y-1}{3} = \frac{z+1}{-2}$ intersect and find their point of intersection.

OR

Find the length shortest distance between the lines: $\frac{x-3}{3} = \frac{y-8}{-1} = z - 3$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-6}{4}$.

SECTION – E (4 MARKS EACH)

36. Read the following text carefully and answer the questions that follow:

In an office three employees Govind, Priyanka and Tahseen process incoming copies of a certain form. Govind process 50% of the forms, Priyanka processes 20% and Tahseen the remaining 30% of the forms. Govind has an error rate of 0.06, Priyanka has an error rate of 0.04 and Tahseen has an error rate of 0.03.



- i. The manager of the company wants to do a quality check. During inspection he selects a form at random from the days output of processed forms. If the form selected at random has an error, find the probability that the form is NOT processed by Govind. (1)
- ii. Find the probability that Priyanka processed the form and committed an error. (1)
- iii. Find the total probability of committing an error in processing the form. (2)
- iv. Let A be the event of committing an error in processing the form and let E_1 , E_2 and E_3 be the events that Govind, Priyanka and Tahseen processed the form. The value of $\sum_{i=1}^3 P(E_i | A)$? (2)

37. Read the following text carefully and answer the questions that follow:

Priyanka and Renu are playing Ludo at home during Covid-19. While rolling the dice, Priyanka's sister Pummy observed and noted the possible outcomes of the throw every time belongs to set $\{1, 2, 3, 4, 5, 6\}$. Let A be the set of players while B be the set of all possible outcomes.



$A = \{S, D\}$, $B = \{1, 2, 3, 4, 5, 6\}$

- i. Pummy wants to know the number of functions from A to B. How many number of functions are possible? (1)
- ii. Pummy wants to know the number of relations possible from A to B. How many number of relations are possible? (1)
- iii. Let R be a relation on B defined by $R = \{(1, 2), (2, 2), (1, 3), (3, 4), (3, 1), (4, 3), (5, 5)\}$. Is R an equivalence relation? (2)
Show that a relation, $R: B \rightarrow B$ be defined by $R = \{(x, y) : y \text{ is divisible by } x\}$ is a reflexive and transitive but not symmetric.

38. Read the following text carefully and answer the questions that follow:

Let $f(x)$ be a real valued function. Then its

- Left Hand Derivative (L.H.D.): $Lf'(a) = \lim_{h \rightarrow 0} \frac{f(a-h) - f(a)}{-h}$
- Right Hand Derivative (R.H.D.): $Rf'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$

Also, a function $f(x)$ is said to be differentiable at $x = a$ if its L.H.D. and R.H.D. at $x = a$ exist and both are equal.

For the function
$$f(x) = \begin{cases} |x-3|, & x \geq 1 \\ \frac{x^2}{4} - \frac{3x}{2} + \frac{13}{4}, & x < 1 \end{cases}$$

- i. What is R.H.D. of $f(x)$ at $x = 1$? (1)
- ii. What is L.H.D. of $f(x)$ at $x = 1$? (1)
- iii. Check if the function $f(x)$ is differentiable at $x = 1$. (2)

OR

Find $f'(2)$ and $f'(-1)$.