

Series-B

Term-1-Exam.-2022

T-1-857-B

Roll No.

Total No. of Questions-28] [Total No. of Printed Pages-12

T-1-857-B-XII-2022

MATHEMATICS

(English Versior)

Time Allowed-3 Hours

Maximum Marks-50

*Candidates are required to give their answers in
their own words as far as practicable.*

*Marks allotted to each question are indicated
against it.*

Special Instructions :

- (i) *You must write question-paper series in the circle
at the top left side of title page of your answer-
book.*

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[P.T.O.]

- (ii) *While answering your questions, you must indicate on your answer-book the same question no. as appears in your question-paper.*
- (iii) *Do not leave blank page/pages in your answer-book.*
- (iv) *All questions are compulsory.*
- (v) *Internal Choices have been provided in some questions. Attempt only one of the choices in such questions.*
- (vi) *Question No. 1 to 20 are M.C.Q. (Multiple Choice Questions) carrying 1 mark each, Question No. 21 to 26 are of 3 marks each. Question No. 27 to 28 are of 6 marks each.*

1. Let R be the relation in the set N given by
 $R = \{(a, b) : a = b - 2, b > 6\}$

Choose the correct answer :

1

- (a) $(2, 4) \in R$
- (b) $(3, 8) \in R$
- (c) $(6, 8) \in R$
- (d) $(8, 7) \in R$

2. For the function, $f : \mathbb{R} \rightarrow \mathbb{R}$ given by $f(x) = x^2$.
Choose the correct answer :

- (a) Both one-one and onto
- (b) One-one, but not onto
- (c) Onto, but not one-one
- (d) Neither one-one nor onto

3. Let $f : \mathbb{R} - \left\{ -\frac{4}{3} \right\} \rightarrow \mathbb{R}$ be a function defined as

$$f(x) = \frac{4x}{3x + 4}. \text{ The inverse of } f \text{ is the map : } g : \text{Range}$$

$$f \rightarrow \mathbb{R} - \left\{ -\frac{4}{3} \right\} \text{ given by : } \quad 1$$

(a) $g(y) = \frac{3y}{3 - 4y}$

(b) $g(y) = \frac{4y}{4 - 3y}$

(c) $g(y) = \frac{4y}{3 - 4y}$

(d) $g(y) = \frac{3y}{4 - 3y}$

4. For a binary operation $*$ on Q , defined $a * b = ab + 1$. Choose the correct answer :

- (a) Associative and commutative
- (b) Commutative but not associative
- (c) Associative but not commutative
- (d) Neither commutative nor associative

5. The Principal value of $\operatorname{cosec}^{-1}(2)$ is

- (a) $\frac{\pi}{2}$
- (b) $\frac{\pi}{3}$
- (c) $\frac{\pi}{4}$
- (d) $\frac{\pi}{6}$

6. The Range of $\cos^{-1} x$ is :

- (a) $[0, \pi]$
- (b) $(0, \pi)$
- (c) $[-1, 1]$
- (d) $(-1, 1)$

7. $\sin^{-1}\left(\sin \frac{3\pi}{5}\right)$ equal to :

- (a) $\frac{3\pi}{5}$
- (b) $-\frac{3\pi}{5}$
- (c) $\frac{2\pi}{5}$
- (d) None of these

8. The value of $\operatorname{cosec}^{-1} x + \sec^{-1} x$ is : 1

(a) 0

(b) 1

(c) -1

(d) $\frac{\pi}{2}$

9. The element a_{21} of a 3×2 matrix $A = (a_{ij})$ whose

$a_{ij} = \frac{|i - 3j|}{2}$ is :

1

(a) $\frac{5}{2}$

(b) $-\frac{1}{2}$

(c) $\frac{1}{2}$

(d) None of these

10. Assume Y, Z, W and P are the matrices of order $3 \times k, 2 \times p, n \times 3$ and $p \times k$ respectively the restriction on n, k and p so that $PY + WY$ will be defined are 1

(a) $k = 3, p = n$

(b) k is arbitrary, $p = 2$

(c) p is arbitrary, $k = 3$

(d) $k = 2, p = 3$

11. Choose the correct answer if $A = \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$,

then $A + A' = I$, if the value of α is 1

(a) $\frac{\pi}{6}$

(b) $\frac{\pi}{3}$

(c) π

(d) $\frac{3\pi}{2}$

12. If A and B are invertible matrices then 1

(a) $(AB)^{-1} = B^{-1} A^{-1}$

(b) $(AB)^{-1} = A^{-1} B^{-1}$

(c) $(AB)^{-1} = (BA)^{-1}$

(d) None of these

13. If the area of triangle is 35 sq. units with vertices $(2, -6)$, $(5, 4)$ and $(k, 4)$. Then k is 1

(a) 12

(b) -2

(c) -12, -2

(d) 12, -2

14. If $A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ and A_{ij} is co-factors of a_{ij} ,

then A is given by

1

(a) $a_{11} A_{31} + a_{12} A_{32} + a_{13} A_{33}$

(b) $a_{11} A_{11} + a_{12} A_{21} + a_{13} A_{31}$

(c) $a_{21} A_{11} + a_{22} A_{12} + a_{23} A_{13}$

(d) $a_{11} A_{11} + a_{21} A_{21} + a_{31} A_{31}$

15. If f, g are two continuous functions at a ,
then

1

(a) $(f \pm g)$ is continuous at a

(b) $f.g$ is continuous at a

(c) $\frac{f}{g}$ is continuous at a , provided $g(a) \neq 0$

(d) All of these

16. If $ax + by^2 = \cos y$ then $\frac{dy}{dx}$ is

(a) $\frac{a}{2by + \sin y}$

(b) $\frac{a}{2by - \sin y}$

(c) $\frac{-a}{2by + \sin y}$

(d) $\frac{-a}{2by - \sin y}$

17. The derivative of $\cot^{-1} x$ is :

(a) $\frac{1}{1+x^2}$

(b) $\frac{-1}{1+x^2}$

(c) $\frac{1}{\sqrt{1+x^2}}$

(d) $\frac{-1}{\sqrt{1+x^2}}$

18. The derivative of a^x is :

(a) $a^x \log a$

(b) a^x

(c) $\frac{a^x}{\log a}$

(d) None of these

19. The rate of change of area of a circle with respect to its radius r when $r = 5$ cm is 1

- (a) $8\pi \text{ cm}^2/\text{S}$ (b) $10\pi \text{ cm}^2/\text{S}$
(c) $11\pi \text{ cm}^2/\text{S}$ (d) None of these

20. The slope of the normal to the curve

$y = 2x^2 + 3 \sin x$ at $x = 0$ is 1

- (a) 3 (b) $\frac{1}{3}$
(c) -3 (d) $-\frac{1}{3}$

21. Show that the relation R in the set $A = \{1, 2, 3, 4, 5\}$ given by $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$ is an equivalence relation.

or

Consider $f : \{1, 2, 3\} \rightarrow \{a, b, c\}$ given by $f(1) = a$, $f(2) = b$ and $f(3) = c$. Find f^{-1} and show that $(f^{-1})^{-1} = f$ 3

22. Write in the simplest form

$$\tan^{-1} \left(\frac{\sqrt{1+x^2}-1}{x} \right), x \neq 0$$

3

23. If $A = \begin{bmatrix} -1 & 2 & 3 \\ 5 & 7 & 9 \\ -2 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -4 & 1 & -5 \\ 1 & 2 & 0 \\ 1 & 3 & 1 \end{bmatrix}$, then

verify that $(A - B)' = A' - B'$.

or

Using elementary transformation, find the inverse

of $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$, if it exists.

3

24. By using properties of determinants show that

$$\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix} = k^2(3y+k)$$

3

25. Discuss the continuity of the function
 $f(x) = \sin x - \cos x.$ 3

26. Find $\frac{dy}{dx}$ in the following :

$$y = \sin^{-1} \left[\frac{1-x^2}{1+x^2} \right], 0 < x < 1.$$

or

If $y = 3 \cos (\log x) + 4 \sin (\log x)$, show that
 $x^2 y_2 + xy_1 + y = 0.$ 3

27. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find A^{-1} using A^{-1} , solve the

system of linear equations : $2x - 3y + 5z = 11$,
 $3x + 2y - 4z = -5$, $x + y - 2z = -3.$ 6

3. (a) Show that the tangents to the curve
 $y = 7x^3 + 11$ at the points where $x = 2$ and
 $x = -2$ are parallel.

(b). Using differentials, find the approximate value of $26^{\frac{1}{3}}$ upto 3 places of decimal.

or

(a) Find the equation of tangent and normal to the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 2$ at (1, 1). 3

(b) Find the interval in which the function $f(x) = x^2 + 2x - 5$ is strictly increasing or decreasing. 3