BYJU'S Part Test for Board Term I
(CBSE Grade 12)

Date: 17/11/2021
Subject: Mathematics **Class:** Standard XII

Time Allowed: 90 minutes **Maximum Marks: 40**

General Instructions:

1. The question paper contains **three sections - A, B and C.** Each part is compulsory.
2. **Section A** consists of 20 MCQs, attempt **any 16 out of 20.**
3. **Section B** consists of 20 MCQs, attempt **any 16 out of 20.**
4. **Section C** consists of 10 MCQs, attempt **any 8 out of 10.**
5. There is no negative marking.
6. All questions carry equal marks.

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Date: 17/11/2021

Subject: Mathematics

Topic : Section A

Class: Standard XII

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1. Let $\mathbb{N}$ be the set of all natural numbers and let R be a relation on $\mathbb{N} \times \mathbb{N}$ defined by $(a, b)R(c, d) \Leftrightarrow ad = bc$ for all $(a, b), (c, d) \in \mathbb{N} \times \mathbb{N}$. Then R is

   A. an equivalence relation

   B. reflexive but not transitive

   C. symmetric but not reflexive

   D. both reflexive and symmetric but not transitive

2. If $f(x) = x \sin\left(\frac{1}{x}\right), x \neq 0$ is continuous at $x = 0$, then the value of $f(0)$ is

   A. 1

   B. 0

   C. 2

   D. -1

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3. If a matrix $A = [a_{ij}]_{2\times 2}$ is given by $a_{ij} = \dfrac{(i+j)+(i\cdot j)}{2}$, then the matrix A is

A. $\begin{bmatrix} \frac{3}{2} & \frac{5}{2} \\ \frac{3}{2} & 4 \end{bmatrix}$

B. $\begin{bmatrix} \frac{3}{2} & \frac{5}{2} \\ \frac{5}{2} & 4 \end{bmatrix}$

C. $\begin{bmatrix} \frac{3}{2} & \frac{3}{2} \\ \frac{3}{2} & 4 \end{bmatrix}$

D. $\begin{bmatrix} \frac{3}{2} & 3 \\ 3 & 8 \end{bmatrix}$

4. The principal value of $\tan^{-1}\left(-\sqrt{3}\right)$ is

A. $\dfrac{2\pi}{3}$

B. $\dfrac{\pi}{3}$

C. $-\dfrac{\pi}{3}$

D. $-\dfrac{\pi}{6}$

5. Minor M_{33} (Minor of the element of i^{th} row and j^{th} column) of the determinant $\begin{vmatrix} 2 & 3 & 5 \\ 2 & -1 & 8 \\ 1 & 2 & 4 \end{vmatrix}$ is

A. 1

B. -32

C. -15

D. -8

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6. Let $f : \mathbb{N} \to \mathbb{N}$ be defined by $f(x) = x^2 + x + 1$. Then f is

   A. a one-one onto function

   B. a many-one onto function

   C. a one-one but not an onto function

   D. None of these

7. If $\begin{bmatrix} 2a+b & a-2b \\ 5c-d & 4c+3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$, then b is

   A. 1

   B. 2

   C. -2

   D. -3

8. If $f(x) = \begin{cases} x^2 + 3x + a, & x \leq 1 \\ bx + 2, & x > 1 \end{cases}$ is a differentiable function, then which of the following is correct about a and b?

   A. $a = 1, b = 3$

   B. $a = 5, b = 3$

   C. $a = 3, b = 5$

   D. $a = 3, b = 1$

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9. If $2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$, then (x, y) is

   A. $(2, 6)$

   B. $(1, 6)$

   C. $(2, 9)$

   D. $(3, 6)$

10. Let $\sin^{-1} x + \cos^{-1} y = \lambda\pi$, where $x + \frac{1}{x} = 2$ and $y + \frac{1}{y} = -2$. Then λ is equal to

   A. -1

   B. 1

   C. $\frac{1}{2}$

   D. $\frac{3}{2}$

11. If $A = \begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ and $A + A^T = I$, where I is 2×2 unit matrix and A^T is the transpose of A, then the value of θ is equal to

   A. $\frac{\pi}{6}$

   B. $\frac{\pi}{2}$

   C. $\frac{\pi}{3}$

   D. $\frac{3\pi}{2}$

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12. The function $f(x) = \dfrac{1}{x^4 + x^2 + 1}$ is

A. Discontinuous at $x = 0$

B. Discontinuous at $x = 1$

C. Discontinuous at $x = -1$

D. Continuous everywhere

13. If relation R on the set $A = \{1, 2, 3, 4, 5\}$ is defined as $R = \{(a, b) : a + b \text{ is even}\}$, then $[2]$, the equivalence class of 2 is

A. $\{2, 3\}$

B. $\{2, 3, 4\}$

C. $\{2, 4\}$

D. $\{1, 2, 3, 4, 5\}$

14. The domain of the function $y = \sin^{-1}\left(-x^2\right)$ is

A. $[0, 1]$

B. $(0, 1)$

C. $[-1, 1]$

D. $(-\infty, -1) \cup (1, \infty)$

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15. If A and B are symmetric matrices of the same order and $X = AB + BA$ and $Y = AB - BA$, then XY^T is equal to

    A. XY

    B. YX

    C. $-XY$

    D. None of these

16. A relation R is defined as aRb if "a is the father of b". Then R is

    A. reflexive

    B. symmetric

    C. transitive

    D. none of these

17. If $f(x) = \begin{cases} 4^x, & -1 \leq x < 1 \\ 5 - x, & 1 \leq x \leq 5 \end{cases}$, then

    A. $f(x)$ is discontinuous at $x = 1$

    B. $f(x)$ is differentiable at $x = 1$

    C. $f(x)$ is continuous but not differentiable at $x = 1$

    D. None of these

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18. If $\begin{bmatrix} 1 & -1 & x \\ 1 & x & 1 \\ x & -1 & 1 \end{bmatrix}$ has no inverse, then the possible real value of x is

A. 2

B. 3

C. 0

D. 1

19. If $f(x) = a|\sin x| + be^{|x|} + c|x|^3$, where $a, b, c \in \mathbb{R}$ is differentiable at $x = 0$, then

A. $a + b = 0, c \in \mathbb{R}$

B. $c = 0, a = 0, b \in \mathbb{R}$

C. $b = 0, c = 0, a \in \mathbb{R}$

D. $a = 0, b = 0, c = 0$

20. Let $f(x) = \cot^{-1}(2x - x^2), x \in \mathbb{R}$. Then the range of $f(x)$ is

A. $(0, \pi)$

B. $\left[0, \frac{\pi}{4}\right]$

C. $\left[\frac{\pi}{4}, \pi\right]$

D. $\left[\frac{\pi}{4}, \pi\right)$

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Subject: Mathematics

Topic : Section B

Class: Standard XII

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1. If $\begin{bmatrix} \sin\theta & -\cos\theta \\ \cos\theta & \sin\theta \end{bmatrix} \begin{bmatrix} \sin\theta & \cos\theta \\ -\cos\theta & \sin\theta \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then the value of $a+b+c+d$ is

   A. 0

   B. $\sin\theta + \cos\theta + 1$

   C. 2

   D. 1

2. If $f(x) = \dfrac{\log_e(1+x^2\tan x)}{\sin x^3}, x \neq 0$ is continuous at $x = 0$, then the value of $f(0)$ is

   A. -1

   B. 0

   C. $\dfrac{1}{2}$

   D. 1

3. The number of value(s) of x satisfying $\sin\left(\dfrac{1}{3}\cos^{-1}x\right) = 1$ is

   A. 0

   B. 1

   C. 2

   D. 3

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4. Let R be a relation defined on $\mathbb{N}$ as $R = \{(x, y) : x, y \in \mathbb{N}, 2x + y = 41\}$. Then R is

   A. a symmetric relation

   B. both symmetric and transitive relation

   C. neither reflexive nor symmetric nor transitive relation

   D. symmetric relation but not transitive relation

5. The domain of the function $f(x) = \sin^{-1} x + \cos x$ is

   A. $[-1, 1]$

   B. $[-1, \pi + 1]$

   C. $(-\infty, \infty)$

   D. $(-\infty, -1) \cup (1, \infty)$

6. Let S be the set of all real values of k for which the system of linear equations
   $x + y + z = 2$
   $2x + y - z = 3$
   $3x + 2y + kz = 4$
   has a unique solution. Then S is

   A. an empty set

   B. equal to $\{0\}$

   C. equal to $\mathbb{R}$

   D. equal to $\mathbb{R} - \{0\}$

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7. For any two real numbers θ and ϕ where $\theta, \phi \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$, we define $\theta R \phi$ if and only if $\sec^2\theta - \tan^2\phi = 1$. Then relation R is

   A. Reflexive but not transitive relation.

   B. Symmetric but not reflexive relation.

   C. Both reflexive and symmetric relation but not transitive relation.

   D. An equivalence relation

8. The principal value of $\sec^{-1}\left(\frac{-2}{\sqrt{3}}\right)$ is

   A. $\frac{\pi}{6}$

   B. $\frac{\pi}{3}$

   C. $\frac{5\pi}{6}$

   D. $\frac{7\pi}{6}$

9. Let A and B be two square matrices of order 3 such that $\det(A) = 5$ and $\det(B) = 2$. Then the value of $\det(\det(B) \cdot A)$ is

   A. 40

   B. 20

   C. 8

   D. 10

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10. The principal value of $\tan^{-1}\left[2\cos\left[2\sin^{-1}\frac{1}{2}\right]\right]$ is

A. $\frac{\pi}{3}$

B. $\frac{\pi}{2}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{6}$

11. If $A=[a_{ij}]$ is a 2×2 matrix such that $A=\text{Adj}(A)$, then which of the following can be matrix A?

A. $\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}$

B. $\begin{bmatrix}0 & -2\\ -2 & 0\end{bmatrix}$

C. $\begin{bmatrix}2 & 0\\ 0 & 2\end{bmatrix}$

D. $\begin{bmatrix}0 & 0\\ 1 & 0\end{bmatrix}$

12. If the function $f(x)=\begin{cases}\frac{\sin 4x+\sin 2x}{x}, & x<0\\ a, & x=0\\ \frac{b\ln(1+2x^2)}{x^2}, & x>0\end{cases}$ is continuous at $x=0$, then which of the following is correct?

A. $a=3, b=3$

B. $a=3, b=4$

C. $a=6, b=6$

D. $a=6, b=3$

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13. If $f(x) = \begin{cases} x+1, & x \leq 1 \\ 2x-1, & x > 1 \end{cases}$, then which of the following is true?

A. $f(x)$ is continuous at $x = 1$

B. $f(x)$ is discontinuous at $x = 1$

C. $\lim\limits_{x \to 1^+} f(x) = 2$

D. $\lim\limits_{x \to 1^-} f(x) = 1$

14. Let the function $f : \mathbb{R} - \{-b\} \to \mathbb{R} - \{1\}$ be defined by $f(x) = \dfrac{x+a}{x+b}, a \neq b.$ Then

A. f is one–one but not onto function

B. f is onto but not one–one function

C. f is bijective function

D. f is neither one–one nor onto function

15. If $\sin^{-1}\left(-\dfrac{\sqrt{3}}{2}\right) + \cos^{-1}\left(-\dfrac{1}{2}\right) = \tan^{-1} x$, then the value of x is equal to

A. $\dfrac{1}{\sqrt{3}}$

B. 0

C. 1

D. $\sqrt{3}$

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16. The trace of a square matrix is defined as the sum of the principal diagonal elements. For real numbers a and b, if the trace of matrices $A = \begin{bmatrix} 2a^2 & 5 \\ 3 & 9-6b \end{bmatrix}$ and $B = \begin{bmatrix} -b^2 & 2 \\ 3 & 8a-8 \end{bmatrix}$ are equal, then $2a - b$ is equal to

A. 0

B. 1

C. 2

D. 4

17. If $f(x) = \begin{cases} \dfrac{|x+2|}{\tan^{-1}(x+2)}, & x \neq -2 \\ 2, & x = -2 \end{cases}$, then

A. f is continuous at $x = -2$ but not differentiable

B. f is neither continuous nor differentiable at $x = -2$

C. f is continuous at $x = -2$

D. f is continuous and differentiable at $x = -2$

18. Let matrix $A = \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}$. Then inverse of matrix A is

A. $\begin{bmatrix} 3 & 1 \\ -5 & -2 \end{bmatrix}$

B. $\begin{bmatrix} -5 & -2 \\ 3 & 1 \end{bmatrix}$

C. $\begin{bmatrix} -5 & 1 \\ 3 & -2 \end{bmatrix}$

D. $\begin{bmatrix} 5 & 2 \\ -3 & -1 \end{bmatrix}$

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19. The range of the function $f(x) = \left(1 + \sec^{-1} x\right)\left(1 + \cos^{-1} x\right)$ is

A. $\left\{2,\ (1+\pi)^2\right\}$

B. $(-\infty, 0] \cup [4, \infty)$

C. $\left\{1,\ (1+\pi)^2\right\}$

D. $\left[1,\ (1+\pi)^2\right]$

20. If $A = \begin{bmatrix} 1 & -3 & 2 \\ 2 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \end{bmatrix}$, then the matrix C such that $A + B + C$ is a zero matrix, is

A. $\begin{bmatrix} -1 & 4 & -1 \\ -1 & 0 & -1 \end{bmatrix}$

B. $\begin{bmatrix} -3 & 4 & -1 \\ -3 & 0 & -1 \end{bmatrix}$

C. $\begin{bmatrix} -1 & 1 & -1 \\ -1 & 0 & -1 \end{bmatrix}$

D. $\begin{bmatrix} -1 & 3 & -1 \\ -3 & 0 & -1 \end{bmatrix}$

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Topic : Section C

Class: Standard XII

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1. Consider a triangle whose vertices are $(1, 1)$, $(4, 2)$ and $(3, 5)$. Then the area this triangle is

   A. 3 sq. units

   B. 7 sq. units

   C. 5 sq. units

   D. 10 sq. units

2. The domain of the function $\cos^{-1}\left(\frac{1}{1-x}\right)$ is equal to

   A. $[0, 2]$

   B. $\mathbb{R} - [0, 2]$

   C. $\mathbb{R} - (0, 2)$

   D. $[-1, 1]$

3. A function $f : \mathbb{R} \to \mathbb{R}$ is defined as $f(x) = -x^3 + 3x^2 - 2x + 4$. Which of the following is true about the function $f(x)$?

   A. $f(x)$ is an onto function

   B. $f(x)$ is an into function

   C. $f(x)$ is a one-one function

   D. $f(x) = 4$ has only one solution

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4. The principal value of $\sin^{-1}(-1)$ is

   A. $\frac{\pi}{2}$

   B. $\frac{3\pi}{2}$

   C. $-\frac{\pi}{2}$

   D. $\frac{5\pi}{2}$

5. If $f(x) = \begin{cases} \frac{\sin 5x}{x^2 + 2x}, & x \neq 0 \\ k + \frac{1}{2}, & x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k is

   A. -2

   B. $\frac{1}{2}$

   C. 1

   D. 2

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6. Consider two families A and B. Suppose there are 4 men, 4 women and 4 children in family A and 2 men, 2 women and 2 children in family B. The recommended daily amount of calories is 2400 for a man, 1900 for a woman, 1800 for a child and 45 grams of proteins for a man, 55 grams for a woman and 33 grams for a child.
The requirement of calories and proteins for each person is given by matrix R and the number of family members in each family is given by matrix F.

Matrix R is

A.
$$\begin{matrix} \text{Calories} & \text{Proteins} \\ \end{matrix}$$
$$\begin{bmatrix} 2400 & 45 \\ 1900 & 55 \\ 1800 & 33 \end{bmatrix} \begin{matrix} \text{Men} \\ \text{Women} \\ \text{Children} \end{matrix}$$

B.
$$\begin{matrix} \text{Calories} & \text{Proteins} \\ \end{matrix}$$
$$\begin{bmatrix} 1900 & 55 \\ 2400 & 45 \\ 1800 & 33 \end{bmatrix} \begin{matrix} \text{Men} \\ \text{Women} \\ \text{Children} \end{matrix}$$

C.
$$\begin{matrix} \text{Calories} & \text{Proteins} \\ \end{matrix}$$
$$\begin{bmatrix} 1800 & 33 \\ 1900 & 55 \\ 2400 & 45 \end{bmatrix} \begin{matrix} \text{Men} \\ \text{Women} \\ \text{Children} \end{matrix}$$

D.
$$\begin{matrix} \text{Calories} & \text{Proteins} \\ \end{matrix}$$
$$\begin{bmatrix} 2400 & 33 \\ 1900 & 55 \\ 1800 & 45 \end{bmatrix} \begin{matrix} \text{Men} \\ \text{Women} \\ \text{Children} \end{matrix}$$

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7. Consider two families A and B. Suppose there are 4 men, 4 women and 4 children in family A and 2 men, 2 women and 2 children in family B. The recommended daily amount of calories is 2400 for a man, 1900 for a woman, 1800 for a child and 45 grams of proteins for a man, 55 grams for a woman and 33 grams for a child.
The requirement of calories and proteins for each person is given by matrix R and the number of family members in each family is given by matrix F.

Matrix F is

A.
$$\begin{matrix} \text{Men} & \text{Women} & \text{Children} \\ \end{matrix}$$
$$\begin{bmatrix} 4 & 4 & 4 \\ 2 & 2 & 2 \end{bmatrix} \begin{matrix} \text{Family } A \\ \text{Family } B \end{matrix}$$

B.
$$\begin{matrix} \text{Men} & \text{Women} & \text{Children} \\ \end{matrix}$$
$$\begin{bmatrix} 4 & 2 & 4 \\ 2 & 4 & 2 \end{bmatrix} \begin{matrix} \text{Family } A \\ \text{Family } B \end{matrix}$$

C.
$$\begin{matrix} \text{Men} & \text{Women} & \text{Children} \\ \end{matrix}$$
$$\begin{bmatrix} 4 & 4 & 2 \\ 2 & 2 & 4 \end{bmatrix} \begin{matrix} \text{Family } A \\ \text{Family } B \end{matrix}$$

D.
$$\begin{matrix} \text{Men} & \text{Women} & \text{Children} \\ \end{matrix}$$
$$\begin{bmatrix} 2 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix} \begin{matrix} \text{Family } A \\ \text{Family } B \end{matrix}$$

8. Consider two families A and B. Suppose there are 4 men, 4 women and 4 children in family A and 2 men, 2 women and 2 children in family B. The recommended daily amount of calories is 2400 for a man, 1900 for a woman, 1800 for a child and 45 grams of proteins for a man, 55 grams for a woman and 33 grams for a child.
The requirement of calories and proteins for each person is given by matrix R and the number of family members in each family is given by matrix F.

Requirement of calories of family A is

A. 24000

B. 24400

C. 15000

D. 15800

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9. Consider two families A and B. Suppose there are 4 men, 4 women and 4 children in family A and 2 men, 2 women and 2 children in family B. The recommended daily amount of calories is 2400 for a man, 1900 for a woman, 1800 for a child and 45 grams of proteins for a man, 55 grams for a woman and 33 grams for a child.
The requirement of calories and proteins for each person is given by matrix R and the number of family members in each family is given by matrix F.

Requirement of proteins of family B is

A. 560 grams

B. 332 grams

C. 266 grams

D. 532 grams

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10. Consider two families A and B. Suppose there are 4 men, 4 women and 4 children in family A and 2 men, 2 women and 2 children in family B. The recommended daily amount of calories is 2400 for a man, 1900 for a woman, 1800 for a child and 45 grams of proteins for a man, 55 grams for a woman and 33 grams for a child.
The requirement of calories and proteins for each person is given by matrix R and the number of family members in each family is given by matrix F.

If F^T represents the transpose of matrix F, then $R + 100F^T$ is equal to

A. $\begin{bmatrix} 280 & 245 \\ 1900 & 230 \\ 2200 & 233 \end{bmatrix}$

B. $\begin{bmatrix} 2800 & 255 \\ 2400 & 255 \\ 2200 & 233 \end{bmatrix}$

C. $\begin{bmatrix} 2800 & 45 \\ 2300 & 55 \\ 2200 & 33 \end{bmatrix}$

D. $\begin{bmatrix} 2800 & 245 \\ 2300 & 255 \\ 2200 & 233 \end{bmatrix}$