Date: 30/03/2022

Subject: Mathematics Class: Standard XII

1. If $A = \{x \in R : |x| < 2\}$ and $B = \{x \in R : |x-2| \geq 3\}$ then :

   **A.** $A - B = [-1, 2]$

   **B.** $B - A = R - (-2, 5)$

   **C.** $A \cup B = R - (2, 5)$

   **D.** $A \cap B = (-2, -1)$

2. The sum of the solutions of the equation $|\sqrt{x} - 2| + \sqrt{x}(\sqrt{x} - 4) + 2 = 0,\ (x > 0)$ is equal to:

   **A.** $4$

   **B.** $9$

   **C.** $10$

   **D.** $12$

3. A survey shows that $63\%$ of the people in a city read newspaper $A$ whereas $76\%$ read newspaper $B$. If $x\%$ of the people read both the newspapers, then a possible value of $x$ can be

   **A.** $37$

   **B.** $29$

   **C.** $65$

   **D.** $55$

4. Let $A, B$ and $C$ be sets such that $\phi \neq A \cap B \subseteq C$. Then which of the following statements is not true ?

**A.** $B \cap C \neq \phi$

**B.** $(C \cup A) \cap (C \cup B) = C$

**C.** If $(A - B) \subseteq C$, then $A \subseteq C$

**D.** If $(A - C) \subseteq B$, then $A \subseteq B$

5. Let $Z$ be the set of integers. If $A = \left\{x \in Z : 2^{(x+2)(x^2-5x+6)} = 1\right\}$ and $B = \{x \in Z : -3 < 2x - 1 < 9\}$, then the number of subsets of the set $A \times B$, is :

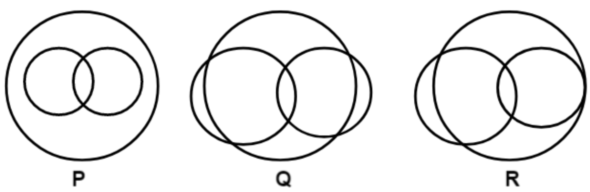
**A.** $2^{10}$

**B.** $2^{12}$

**C.** $2^{15}$

**D.** $2^{18}$

6. In a school, there are three types of games to be played. Some of the students play two types of games, but none play all the three games. Which Venn diagrams can justify the above statements.




**A.** $P$ and $R$

**B.** $P$ and $Q$

**C.** $Q$ and $R$

**D.** None of these

7. Out of all the patients in a hospital $89\%$ are found to be suffering from heart ailment and $98\%$ are suffering from lungs infection. If $K\%$ of them are suffering from both ailments, then $K$ can **not** belong to the set:

**A.** $\{84, 87, 90, 93\}$

**B.** $\{84, 86, 88, 90\}$

**C.** $\{79, 81, 83, 85\}$

**D.** $\{80, 83, 86, 89\}$

8. Two newspapers $A$ and $B$ are published in a city. It is known that $25\%$ of the city population reads $A$ and $20\%$ reads $B$ while $8\%$ reads both $A$ and $B$. Further, $30\%$ of those who read $A$ but not $B$ look into advertisements and $40\%$ of those who read $B$ but not $A$ also look into advertisements, while $50\%$ of those who read both $A$ and $B$ look into advertisements. Then the percentage of the population who look into advertisements is :

**A.** $12.8$

**B.** $13$

**C.** $13.5$

**D.** $13.9$

9. In a class of $140$ students numbered $1$ to $140$, all even numbered students opted Mathematics course, those whose number is divisible by $3$ opted Physics course and those whose number is divisible by $5$ opted Chemistry course. Then the number of students who did not opt for any of the three courses is :

**A.** $1$

**B.** $102$

**C.** $38$

**D.** $42$

10. A survey shows that $73\%$ of the persons working in an office like coffee, whereas $65\%$ like tea. If $x$ denotes the percentage of them, who like both coffee and tea, then $x$ cannot be:

**A.** $63$

**B.** $54$

**C.** $38$

**D.** $36$

11. The number of real solutions of the equation, $x^2 - |x| - 12 = 0$ is

**A.** $4$

**B.** $2$

**C.** $1$

**D.** $3$

1. The number of solutions of the equation $\log_4(x-1)=\log_2(x-3)$ is

2. Let $X=\{n \in N: 1 \leq n \leq 50\}$. If $A=\{n \in X: n \text{ is a multiple of } 2\}$ and $B=\{n \in X: n \text{ is a multiple of } 7\}$, then the number of elements in the smallest subset of $X$ containing both $A$ and $B$ is

3. If $A=\{x \in \mathbb{R}:|x-2|>1\}, B=\{x \in \mathbb{R}: \sqrt{x^2-3}>1\}$, $C=\{x \in \mathbb{R}:|x-4| \geq 2\}$ and $\mathbb{Z}$ is the set of all integers, then the number of subsets of the set $(A \cap B \cap C)^c \cap \mathbb{Z}$ is

4. Set $A$ has $m$ elements and set $B$ has $n$ elements.If the total number of subsets of $A$ is $112$ more than the total number of subsets of $B$, then the value of $m \times n$ is

5. The number of solutions of the equation $\log_{(x+1)}(2x^2+7x+5)+\log_{(2x+5)}(x+1)^2-4=0, x>0$, is

1. Let $p, q \in R$. If $2-\sqrt{3}$ is a root of the quadratic equation $x^2+px+q=0$, then

**A.** $p^2-4q+12=0$

**B.** $q^2-4p-16=0$

**C.** $p^2-4q-12=0$

**D.** $q^2+4p+14=0$

2. If $\alpha$ and $\beta$ are the roots of the equation, $x^2+x\sin\theta-2\sin\theta=0, \theta\in\left(0,\frac{\pi}{2}\right)$, then $\dfrac{\alpha^{12}+\beta^{12}}{(\alpha^{-12}+\beta^{-12})(\alpha-\beta)^{24}}$ is equal to

**A.** $\dfrac{2^6}{(\sin\theta+8)^{12}}$

**B.** $\dfrac{2^{12}}{(\sin\theta-8)^6}$

**C.** $\dfrac{2^{12}}{(\sin\theta+8)^{12}}$

**D.** $\dfrac{2^{12}}{(\sin\theta-4)^{12}}$

3. Let $\alpha$ and $\beta$ are two real roots of the equation $(k+1)\tan^2 x-\sqrt{2}\lambda\tan x=1-k$, where $k\neq-1$ and $\lambda$ are real numbers. If $\tan^2(\alpha+\beta)=50$, then the value of $\lambda$ is

**A.** $5\sqrt{2}$

**B.** $10\sqrt{2}$

**C.** $10$

**D.** $5$

4. The number of integral values of $m$ for which the quadratic expression, $(1+2m)x^2-2(1+3m)x+4(1+m),\ x\in\mathbb{R}$, is always positive, is

**A.** $8$

**B.** $7$

**C.** $6$

**D.** $3$

5. Let $S$ be the set of all real roots of the equation, $3^x(3^x-1)+2=|3^x-1|+|3^x-2|$. Then $S$ :

**A.** is a singleton.

**B.** is an empty set.

**C.** contains at least four elements.

**D.** contains exactly two elements.

6. The number of real roots of the equation $5+|2^x-1|=2^x(2^x-2)$ is

**A.** $4$

**B.** $1$

**C.** $2$

**D.** $3$

7. Let $\alpha$ and $\beta$ be the roots of $x^2-6x-2=0$. If $a_n=\alpha^n-\beta^n$ for $n\geq 1$, then the value of $\dfrac{a_{10}-2a_8}{3a_9}$ is:

**A.** $4$

**B.** $1$

**C.** $2$

**D.** $3$

8. If $m$ is choosen in the quadratic equation $(m^2+1)x^2-3x+(m^2+1)^2=0$ such that the sum of its roots is greatest, then the absolute difference of the cubes of its roots is :

**A.** $8\sqrt{5}$

**B.** $4\sqrt{3}$

**C.** $10\sqrt{5}$

**D.** $8\sqrt{3}$

9. The number of all possible positive integral values of $\alpha$ for which the roots of the quadratic equation, $6x^2-11x+\alpha=0$ are rational numbers is :

**A.** $2$

**B.** $3$

**C.** $4$

**D.** $5$

10. The value of $\lambda$ such that sum of the squares of the roots of the quadratic equation, $x^2+(3-\lambda)x+2=\lambda$ has the least value is:

**A.** $\frac{4}{9}$

**B.** $2$

**C.** $1$

**D.** $\frac{15}{8}$

11. Consider the quadratic equation $(c-5)x^2 - 2cx + (c-4) = 0$. Let $S$ be the set of all integral values of $c$ for which one root of the equation lies in the interval $(0,2)$ and another root lies in the interval $(2,3)$. The number of elements in $S$ is

**A.** $18$

**B.** $12$

**C.** $11$

**D.** $10$

12. If both the roots of the quadratic equation $x^2 - mx + 4 = 0$ are real and distinct and they lie in the interval $[1,5]$, then $m$ lies in the interval :

**A.** $(4,5)$

**B.** $(3,4)$

**C.** $(4,5]$

**D.** $(5,6)$

13. The number of elements in the set $\{x \in \mathbb{R} : (|x|-3)|x+4| = 6\}$ is equal to

**A.** $2$

**B.** $1$

**C.** $3$

**D.** $4$

14. The value of $4+\cfrac{1}{5+\cfrac{1}{4+\cfrac{1}{5+\cfrac{1}{4+\cdots\infty}}}}$ is:

A. $2+\frac{4}{\sqrt{5}}\sqrt{30}$

B. $4+\frac{4}{\sqrt{5}}\sqrt{30}$

C. $2+\frac{2}{5}\sqrt{30}$

D. $5+\frac{2}{5}\sqrt{30}$

15. Let $f(x)$ be a quadratic polynomial such that $f(-1)+f(2)=0$. If one of the roots of $f(x)=0$ is $3$, then its other root lies in:

A. $(0,1)$

B. $(1,3)$

C. $(-1,0)$

D. $(-3,-1)$

16. If $\alpha$ and $\beta$ are the roots of the equation $x^2+px+2=0$ and $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ are the roots of the equation $2x^2+2qx+1=0$, then $\left(\alpha-\frac{1}{\alpha}\right)\left(\beta-\frac{1}{\beta}\right)\left(\alpha+\frac{1}{\beta}\right)\left(\beta+\frac{1}{\alpha}\right)$ is equal to

A. $\frac{9}{4}(9+p^2)$

B. $\frac{9}{4}(9+q^2)$

C. $\frac{9}{4}(9-p^2)$

D. $\frac{9}{4}(9-q^2)$

17. Let $[t]$ denote the greatest integer $\leq t$. Then the equation in $x$, $[x]^2 + 2[x+2] - 7 = 0$ has

**A.** Exactly four integral solutions

**B.** infinitely many solutions

**C.** no integral solution

**D.** exactly two solutions

18. Let $\lambda \neq 0$ be in $\mathbb{R}$. If $\alpha$ and $\beta$ are the roots of the equation, $x^2 - x + 2\lambda = 0$ and $\alpha$ and $\gamma$ are the roots of the equation, $3x^2 - 10x + 27\lambda = 0$, then $\dfrac{\beta\gamma}{\lambda}$ is equal to

**A.** $27$

**B.** $9$

**C.** $18$

**D.** $36$

19. The product of the roots of the equation $9x^2 - 18|x| + 5 = 0$ is :

**A.** $\dfrac{25}{81}$

**B.** $\dfrac{5}{9}$

**C.** $\dfrac{5}{27}$

**D.** $\dfrac{25}{9}$

20. Let $\alpha = \max_{x \in \mathbb{R}} \left\{ 8^{2 \sin 3x} \cdot 4^{4 \cos 3x} \right\}$ and $\beta = \min_{x \in \mathbb{R}} \left\{ 8^{2 \sin 3x} \cdot 4^{4 \cos 3x} \right\}$.

If $8x^2 + bx + c = 0$ is a quadratic equation whose roots are $\alpha^{1/5}$ and $\beta^{1/5}$, then the value of $c - b$ is equal to

**A.** $43$

**B.** $42$

**C.** $50$

**D.** $47$

1. The least positive value of '$a$' for which the equation,
$2x^2 + (a-10)x + \frac{33}{2} = 2a$ has real roots is

2. Let $\alpha$ and $\beta$ be two real numbers such that $\alpha + \beta = 1$ and $\alpha\beta = -1$. Let $P_n = (\alpha)^n + (\beta)^n, P_{n-1} = 11$ and $P_{n+1} = 29$ for some integer $n \geq 1$. Then, the value of $P_n^2$ is

3. The sum of all integral values of $k$ $(k \neq 0)$ for which the equation $\frac{2}{x-1} - \frac{1}{x-2} = \frac{2}{k}$ in $x$ has no real roots, is

4. Let $\lambda \neq 0$ be in $\mathbb{R}$. If $\alpha$ and $\beta$ are the roots of the equation $x^2 - x + 2\lambda = 0$, and $\alpha$ and $\gamma$ are the roots of the equation $3x^2 - 10x + 27\lambda = 0$, then $\frac{\beta\gamma}{\lambda}$ is equal to

5. Let $f(x)$ be a polynomial of degree $3$ such that $f(k) = -\frac{2}{k}$ for $k = 2, 3, 4, 5$. Then the value of $52 - 10f(10)$ is equal to

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1. If $R = \left\{(x, y) : x, y \in \mathbb{Z}, x^2 + 3y^2 \leq 8\right\}$ is a relation on the set of integers $\mathbb{Z}$, then the domain of $\mathrm{R}^{-1}$ is:

   **A.** $\{-1, 0, 1\}$

   **B.** $\{-2, -1, 1, 2\}$

   **C.** $\{0, 1\}$

   **D.** $\{-2, -1, 0, 1, 2\}$

2. Let $f(x) = a^x$ $(a > 0)$ be written as $f(x) = f_1(x) + f_2(x)$, where $f_1(x)$ is an even function and $f_2(x)$ is an odd function. Then $f_1(x + y) + f_1(x - y)$ equals :

   **A.** $2f_1(x)f_1(y)$

   **B.** $2f_1(x + y)f_1(x - y)$

   **C.** $2f_1(x)f_2(y)$

   **D.** $2f_1(x + y)f_2(x - y)$

3. Let $f : \mathbb{R} - \{3\} \to \mathbb{R} - \{1\}$ be defined by $f(x) = \dfrac{x - 2}{x - 3}$.
   Let $g : \mathbb{R} \to \mathbb{R}$ be given as $g(x) = 2x - 3$. Then, the sum of all values of $x$ for which $f^{-1}(x) + g^{-1}(x) = \dfrac{13}{2}$ is equal to

   **A.** $7$

   **B.** $5$

   **C.** $2$

   **D.** $3$

4. The inverse of $y = 5^{\log x}$ is:

**A.** $x = 5^{\log y}$

**B.** $x = y^{\log 5}$

**C.** $x = y^{\frac{1}{\log 5}}$

**D.** $x = 5^{\frac{1}{\log y}}$

5. Let $R = \{(P, Q) \mid P \text{ and } Q \text{ are at the same distance from the origin}\}$ be a relation, then the equivalence class of $(1, -1)$ is the set :

**A.** $S = \left\{(x, y) \mid x^2 + y^2 = 1\right\}$

**B.** $S = \left\{(x, y) \mid x^2 + y^2 = 4\right\}$

**C.** $S = \left\{(x, y) \mid x^2 + y^2 = \sqrt{2}\right\}$

**D.** $S = \left\{(x, y) \mid x^2 + y^2 = 2\right\}$

6. Let $A = \{2, 3, 4, 5, \ldots, 30\}$ and $' \cong '$ be an equivalence relation on $A \times A$, defined by $(a, b) \cong (c, d)$, if and only if $ad = bc$. Then the number of ordered pairs which satisfy this equivalence relation with ordered pair $(4, 3)$ is equal to :

**A.** $7$

**B.** $5$

**C.** $6$

**D.** $8$

7. Let $\mathbb{N}$ be the set of natural numbers and a relation $R$ on $\mathbb{N}$ be defined by $R = \{(x, y) \in \mathbb{N} \times \mathbb{N} : x^3 - 3x^2y - xy^2 + 3y^3 = 0\}$.
Then the relation $R$ is

**A.** an equivalence relation

**B.** reflexive and symmetric, but not transitive

**C.** reflexive but neither symmetric nor transitive

**D.** symmetric but neither reflexive nor transitive

8. If the function are defined as $f(x) = \sqrt{x}$ and $g(x) = \sqrt{1-x}$, then what is the common domain of the following functions: $f+g, f-g, \frac{f}{g}, \frac{g}{f}, g-f$ where $(f \pm g)(x) = f(x) \pm g(x), \left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$

**A.** $0 < x \leq 1$

**B.** $0 \leq x < 1$

**C.** $0 \leq x \leq 1$

**D.** $0 < x < 1$

9. Let $[x]$ denote the greatest integer $\leq x$, where $x \in \mathbb{R}$. If the domain of the real valued function $f(x) = \sqrt{\frac{|[x]| - 2}{|[x]| - 3}}$ is $(-\infty, a) \cup [b, c) \cup [4, \infty)$, $a < b < c$, then the value of $a + b + c$ is

**A.** $-2$

**B.** $1$

**C.** $8$

**D.** $-3$

10. Let $f : \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = \dfrac{x}{1+x^2}, x \in \mathbb{R}$. Then the range of $f$ is

**A.** $\mathbb{R} - \left[-\frac{1}{2}, \frac{1}{2}\right]$

**B.** $\mathbb{R} - [-1, 1]$

**C.** $(-1, 1) - \{0\}$

**D.** $\left[-\frac{1}{2}, \frac{1}{2}\right]$

11. Let $x$ denote the total number of one-one functions from a set $A$ with $3$ elements to a set $B$ with $5$ elements and $y$ denote the total number of one-one functions from the set $A$ to the set $A \times B$. Then:

**A.** $y = 273x$

**B.** $2y = 91x$

**C.** $y = 91x$

**D.** $2y = 273x$

12. Let $g : \mathbb{N} \to \mathbb{N}$ be defined as
$g(3n+1) = 3n+2$,
$g(3n+2) = 3n+3$,
$g(3n+3) = 3n+1$, for all $n \geq 0$.
Then which of the following statements is true?

**A.** $gogog = g$

**B.** There exists an onto function $f : \mathbb{N} \to \mathbb{N}$ such that $fog = f$

**C.** There exists a one-one function $f : \mathbb{N} \to \mathbb{N}$ such that $fog = f$

**D.** There exists a function $f : \mathbb{N} \to \mathbb{N}$ such that $gof = f$

13. Let $f : \mathbb{N} \to \mathbb{N}$ be a function such that $f(m+n) = f(m) + f(n)$ for every $m, n \in \mathbb{N}$. If $f(6) = 18$, then $f(2) \cdot f(3)$ is equal to

**A.** $54$

**B.** $18$

**C.** $6$

**D.** $36$

14. If $f(x+y) = f(x)f(y)$ and $\sum_{x=1}^{\infty} f(x) = 2, x, y \in \mathbb{N}$, where $\mathbb{N}$ is the set of all natural numbers, then the value of $\frac{f(4)}{f(2)}$ is:

**A.** $\frac{2}{3}$

**B.** $\frac{1}{9}$

**C.** $\frac{1}{3}$

**D.** $\frac{4}{9}$

15. A function $f(x)$ is given by $f(x) = \frac{5^x}{5^x + 5}$, then the sum of the series $f\left(\frac{1}{20}\right) + f\left(\frac{2}{20}\right) + f\left(\frac{3}{20}\right) + \ldots.. + f\left(\frac{39}{20}\right)$ is equal to:

**A.** $\frac{19}{2}$

**B.** $\frac{49}{2}$

**C.** $\frac{39}{2}$

**D.** $\frac{29}{2}$

16. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x) = 2x - 1$ and $g : \mathbb{R} - \{1\} \rightarrow \mathbb{R}$ be defined as $g(x) = \frac{x - \frac{1}{2}}{x - 1}$. Then the composition function $f(g(x))$ is:

**A.** both one-one and onto

**B.** onto but not one-one

**C.** neither one-one nor onto

**D.** one-one but not onto

17. Let $f, g : N \rightarrow N$ such that $f(n+1) = f(n) + f(1), \forall\, n \in N$ and $g$ be any arbitrary function. Which of the following statements is $\mathbf{NOT}$ true ?

**A.** $f$ is one -one

**B.** If $fog$ is one-one, then $g$ is one-one

**C.** If $g$ is onto, then $fog$ is one-one

**D.** If $f$ is onto, then $f(n) = n \;\forall\, n \in \mathbb{N}$

18. Let $A = \{1, 2, 3, \ldots., 10\}$ and $f : A \rightarrow A$ be defined as $f(k) = \begin{cases} k+1 & \text{if } k \text{ is odd} \\ k & \text{if } k \text{ is even} \end{cases}$. Then the number of possible functions $g : A \rightarrow A$ such that $gof = f$ is:

**A.** $10^5$

**B.** ${}^{10}C_5$

**C.** $5^5$

**D.** $5!$

19. Let $f : \mathbb{R} - \left\{\frac{\alpha}{6}\right\} \to \mathbb{R}$ be defined by $f(x) = \frac{5x+3}{6x-\alpha}$.
Then the value of $\alpha$ for which $(fof)(x) = x$, for all $x \in \mathbb{R} - \left\{\frac{\alpha}{6}\right\}$, is:

**A.** $5$

**B.** $8$

**C.** No such $\alpha$ exists

**D.** $6$

20. Consider functions $f : A \to B$ and $g : B \to C$ $(A, B, C \subseteq \mathbb{R})$ such that $(gof)^{-1}$ exists, then

**A.** $f$ is one-one and $g$ is onto

**B.** $f$ is onto and $g$ is one-one

**C.** $f$ and $g$ both are one-one

**D.** $f$ and $g$ both are onto

21. The inverse function of $f(x) = \frac{8^{2x} - 8^{-2x}}{8^{2x} + 8^{-2x}}, x \in (-1, 1)$, is

**A.** $\frac{1}{4}(\log_8 e) \log_e\left(\frac{1-x}{1+x}\right)$

**B.** $\frac{1}{4}(\log_8 e) \log_e\left(\frac{1+x}{1-x}\right)$

**C.** $\frac{1}{4}\log_e\left(\frac{1+x}{1-x}\right)$

**D.** $\frac{1}{4}\log_e\left(\frac{1-x}{1+x}\right)$

22. For a suitably chosen real constant $a$, let a function, $f:\mathbb{R}-\{-a\}\rightarrow\mathbb{R}$ be defined by $f(x)=\dfrac{a-x}{a+x}$. Further suppose that for any real number $x\neq -a$ and $f(x)\neq -a,(fof)(x)=x$. Then $f\left(-\dfrac{1}{2}\right)$ is equal to:

**A.** $-3$

**B.** $3$

**C.** $\dfrac{1}{3}$

**D.** $-\dfrac{1}{3}$

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1. Let $A=\{0,1,2,3,4,5,6,7\}$. Then the number of bijective functions $f: A \rightarrow A$ such that $f(1)+f(2)=3-f(3)$ is equal to

2. Let $A=\{a, b, c\}$ and $B=\{1,2,3,4\}$. Then the number of elements in the set $C=\{f: A \rightarrow B \mid 2 \in f(A) \text{ and } f \text{ is not one–one}\}$ is

3. If $a+\alpha=1, b+\beta=2$ and $a f(x)+\alpha f\left(\frac{1}{x}\right)=b x+\frac{\beta}{x}, x \neq 0$, then the value of the expression $\dfrac{f(x)+f\left(\frac{1}{x}\right)}{x+\frac{1}{x}}$ is