PREVIOUS YEAR QUESTIONS

1. Let W denotes the words in the English dictionary.
Define the relation R by R = {(x, y) $\in$ W x W} the words x and y have at least one letter in common}. Then R is: **[2006]**

(A) Reflexive, symmetic and not transitive
(B) reflexive, symmetric and transitive
(C) Reflexive, not symmentric and transitive
(D) not reflexive, symmetric and transitive

2. The largest interval lying in $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ for which the function

$f(x)=4^{-x^2}+\cos^{-1}\left(\frac{x}{2}-1\right)+\log(\cos x)$ is defined, is: **[2007]**

(A) $[0, \pi]$ (B) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ (C) $\left[-\frac{\pi}{4},\frac{\pi}{2}\right)$ (D) $\left[0,\frac{\pi}{2}\right)$

3. Let R be the real line. consider the following subsets of the plane R x R **[2008]**
S = {(x, y): y = x + 1 and 0 < x < 2} T = {(x, y): x - y is an integer}
Which one of the following is true?
(A) T is an equivalence relation on R but S is not
(B) neither S nor T is an equivalence relation on R
(C) Both S and T are equivalence relations on R
(D) S is an equivalence relation on R but T is not

4. Let $f : N \longrightarrow Y$ be a function defined as f (x) = 4x + 3 where
Y = {y $\in$ N : y = 4x + 3 for some x $\in$ N}.
Show that f is invertible and its inverse is: **[2008]**

(A) $g(y)=\frac{y-3}{4}$ (B) $g(y)=\frac{3y+4}{3}$

(C) $g(y)=4+\frac{y+3}{4}$ (D) $g(y)=\frac{y+3}{4}$

5. For real x let f(x) = $x^3 + 5x + 1$, then: **[2009]**
(A) f is one - one but not onto R (B) f is onto R but not one- one
(C) f is one one and onto R (D) f is neither one - one nor onto R

Directions: Statement I (Assertion) and Statement II (Reason).
(A) Statement I is true, Statement II is true; Statement II is a correct explanation for Statement I.
(B) Statement I is ture, Statement II is true; Statement II is not a correct explanation for Statement I.
(C) Statement I is true, Statement II is false.
(D) Statement I is false, Statement II is true.
Each of these questions also have four alternative choices, only one of which is the correct answer. You have to select the correct choice.

6. Let f(x) = $(x + 1)^2 - 1$, $x \geq -1$.
Statement I the set $\{x: f(x) = f^{-1}(x)\} = \{0, -1\}$
Statement II f is a bijection **[2009]**

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7. Let f(x) = x|x| and g(x) = sin x
Statement I gof is differentiable at x = 0 and its derivative is continuous at that point.
Statement II gof is twice differentiable at x = 0 **[2009]**

8. Consider the following relations:
R = {(x, y)/x, y are real numbers and x = ωy for some rational number ω};
S = $\left\{\left(\frac{m}{n},\frac{p}{q}\right)\right.$ m, n, p and q are integers such that n, q $\neq$ 0 and qm = pn}. then **[2010]**

(A) R is an equivalence relation but S is not an equivalence relation
(B) neither R nor S is an equivalence relation
(C) S is an equivalence relation but R is not an equivalence relation
(D) R and S both are equivalence relations

9. If two tangents drawn from a point P to the parabola $y^2 = 4x$ are at right angles, then the locus of P is: **[2010]**
(A) 2x - 1 = 0 (B) x = 1 (C) 2x + 1 = 0 (D) x = - 1

10. Let S be a non - empty subset of R. Consider the following statement:
P: There is a rational number x $\in$ S such that x > 0.
Which of the following statements is the negation of the statement P? **[2010]**
(A) x $\in$ S and $x \leq 0 \Rightarrow$ x is not rational
(B) There is a rational number x $\in$ S such that $x \leq 0$
(C) There is no rational number x $\in$ S such that $x \leq 0$
(D) Every rational number x $\in$ S satisfies $x \leq 0$.

11. The domain of the function f(x) = $\frac{1}{\sqrt{|x|-x}}$ is: **[2011]**

(A) $(-\infty, \infty)$ (B) $(0, \infty)$ (C) $(-\infty, 0)$ (D) $(-\infty, \infty) - \{0\}$

12. Let R be the set of real numbers. **[2011]**
Statement-1: A = {(x, y) $\in$ R $\times$ R : y - x is an integer} is an equivalence relation on R.
Statement-2: B = {(x, y) $\in$ R $\times$ R : x = αy for some rationalnumber α} is an equivalence relation on R.
(A) Statement-1 is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1
(B) Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1
(C) Statement-1 is true, Statement-2 is false.
(D) Statement-1 is false, Statement-2 is true.

13. Let A and B be two sets containing four and two elements respectively. Then the number of subsets of the set A $\times$ B each having at least three elements is **[2015]**

(C) Statement-1 is true, Statement-2 is false.
(D) Statement-1 is false, Statement-2 is true.

13. Let A and B be two sets containing four and two elements respectively. Then the number of subsets of the set $A \times B$ each having at least three elements is **[2015]**

(A) 219 (B) 256 (C) 275 (D) 510

14. For $x \in R, x \neq 0, x \neq 1$, let $f_0(x) = \frac{1}{1-x}$ and $f_{n+1}(x) = f_0(f_n(x)), n = 0, 1, 2, \ldots$ Then the value of $f_{100}(3) + f_1\left(\frac{2}{3}\right) + f_2\left(\frac{3}{2}\right)$ is equal to: **[2016]**

8 5 4 1

15. If $f(x) + 2f\left(\frac{1}{x}\right) = 3x, x \neq 0$ and $S = \{x \in R : f(x) = f(-x)\}$; then S: **[2016]**

(A) Is an empty set. (B) Contains exactly one element
(C) Contains exactly two elements (D) Contains more than two elements

16. The function $f : R \to \left[-\frac{1}{2}, \frac{1}{2}\right]$ defined as $f(x) = \frac{x}{1+x^2}$, is **[2017]**

(A) Injective but not surjective (B) Surjective but not injective
(C) Neither injective nor surjective (D) Invertible

17. Let $f(x) = 2^{10}x + 1$ and $g(x) = 3^{10}x - 1$. If $(fog)(x) = x$, then x is equal to: **[2017]**

(A) $\frac{3^{10}-1}{3^{10}-2^{-10}}$ (B) $\frac{2^{10}-1}{2^{10}-3^{-10}}$ (C) $\frac{1-3^{-10}}{2^{10}-3^{-10}}$ (D) $\frac{1-2^{-10}}{3^{10}-2^{-10}}$.

18. The function $f : N \to N$ defined by $f(x) = x - 5\left[\frac{x}{5}\right]$, where N is the set of natural numbers and $[x]$ denotes the greatest integer less than or equal to x, is: **[2017]**

(A) One – One and onto (B) One – One but not onto
(C) Onto but not one – one (D) Neither one – one nor onto.

19. Let $f : A \to B$ be a function defined as $f(x) = \frac{x-1}{x-2}$, where $A = R - \{2\}$ and $B = R - \{1\}$. Then f is: **[2018]**

(A) Invertible and $f^{-1}(y) = \frac{3y-1}{y-1}$ (B) Invertible and $f^{-1}(y) = \frac{2y-1}{y-1}$.

(C) Invertible and $f^{-1}(y) = \frac{2y+1}{y-1}$ (D) Not invertible

20. Consider the following two binary relations on the set $A = \{a, b, c\}$: **[2018]**

$R_1 = \{(c,a), (b,b), (a,c), (c,c), (b,c), (a,a)\}$ and

$R_2 = \{(a,b), (b,a), (c,c), (c,a), (a,a), (b,b), (a,c)\}$.

Then:

(A) Both R_1 and R_2 are not symmetric (B) R_1 is not symmetric but it is transitive
(C) R_2 is symmetric but it is not transitive (D) Both R_1 and R_2 are transitive

21. Let N denote the set of all natural numbers. Define two binary relations on N as $R_1 = \{(x,y) \in N \times N : 2x + y = 10\}$ and $R_2 = \{(x,y) \in N \times N : x + 2y = 10\}$.
Then: **[2018]**

(A) Range of R_1 is $\{2, 4, 8\}$
(B) Range of R_2 is $\{1, 2, 3, 4\}$.
(C) Both R_1 and R_2 are symmetric relations
(D) Both R_1 and R_2 are transitive relations.

22. For $x \in R-\{0,1\}$, let $f_1(x)=\frac{1}{x}, f_2(x)=1-x$ and $f_3(x)=\frac{1}{1-x}$ be three given functions. If a function, $J(x)$ satisfies $(f_2 \circ J \circ f_1)(x)=f_3(x)$ then $J(x)$ is equal to: [2019]

(A) $f_1(x)$ (B) $\frac{1}{x}f_3(x)$ (C) $f_2(x)$ (D) $f_3(x)$.

23. Let $A=\{x \in R : x \text{ is not a positive integer}\}$. Define a function $f : A \to R$ as $f(x)=\frac{2x}{x-1}$, then f is: [2019]

(A) Surjective but not injective (B) Not injective
(C) Injective but not surjective (D) Neither injective nor surjective

24. Let N be the set of natural numbers and two functions f and g be defined as $f, g : N \to N$ such that [2019]

$$f(n)=\begin{cases} \frac{n+1}{2} & \text{if } n \text{ is odd} \\ \frac{n}{2} & \text{if } n \text{ is even} \end{cases}$$

and $g(n)=n-(-1)^n$. Then fog is:

(A) Both one – one and onto (B) One – one but not onto
(C) onto but not one – one (D) Neither one – one nor onto

25. Let $f : R \to R$ be defined by $f(x)=\frac{x}{1+x^2}, x \in R$. Then the range of f is: [2019]

(A) $\left[-\frac{1}{2},\frac{1}{2}\right]$ (B) $R-[-1,1]$ (C) $(-1,1)-\{0\}$ (D) $R-\left[-\frac{1}{2},\frac{1}{2}\right]$.

26. Let $f:(1,3) \to R$ be a function defined by $f(x)=\frac{x[x]}{1+x^2}$, where [x] denotes the greatest integer $\le x$. Then the range of f is: [2020]

(A) $\left(\frac{3}{4},\frac{4}{5}\right)$ (B) $\left(\frac{2}{5},\frac{1}{2}\right)\cup\left(\frac{3}{5},\frac{4}{5}\right]$

(C) $\left(\frac{2}{5},\frac{3}{5}\right]\cup\left(\frac{3}{4},\frac{4}{5}\right)$ (D) $\left(\frac{2}{5},\frac{4}{5}\right]$.

27. The inverse function of $f(x)=\frac{8^{2x}-8^{-2x}}{8^{2x}+8^{-2x}},\ x \in (-1, 1)$ is [2020]

(A) $\frac{1}{4}\log_e\left(\frac{1+x}{1-x}\right)$ (B) $\frac{1}{4}\log_e\left(\frac{1-x}{1+x}\right)$

(C) $\frac{1}{4}(\log_8 e)\log_e\left(\frac{1+x}{1-x}\right)$ (D) $\frac{1}{4}(\log_8 e)\log_e\left(\frac{1-x}{1+x}\right)$

28. If $g(x)=x^2+x-1$ and $(gof)(x)=4x^2-10x+5$, then $f\left(\frac{5}{4}\right)$ is equal to: [2020]

(A) $\frac{1}{2}$ (B) $-\frac{3}{2}$ (C) $-\frac{1}{2}$ (D) $\frac{3}{2}$

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	A	D	A	A	C	C	C	C	D	D
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	C	C	A	B	C	B	D	D	B	C
Que.	21	22	23	24	25	26	27	28		
Ans.	B	D	C	C	A	B	C	C		