Objective Questions

Question 1.
Mark (√) against the correct answer in the following:

$f : N \rightarrow N : f(x) = 2x$ is

A. one - one and onto

B. one - one and into

C. many - one and onto

D. many - one and into

Answer:
$f(x) = 2x$

For One - One

$f(x_1) = 2x_1$

$f(x_2) = 2x_2$

put $f(x_1) = f(x_2)$ we get

$2x_1 = 2x_2$

Hence, if $f(x_1) = f(x_2)$, $x_1 = x_2$

Function f is one - one

For Onto

$f(x) = 2x$

let $f(x) = y$, such that $y \in N$

$2x = y$

$\Rightarrow x = \frac{y}{2}$

If y = 1

x = $\frac{1}{2} = 0.5$

which is not possible as x∈N

Hence, f is not onto., f is into

Hence, option b is correct

Question 2.
Mark (√) against the correct answer in the following:

f : N → N : f(x) = x^2 + x + 1 is

A. one - one and onto

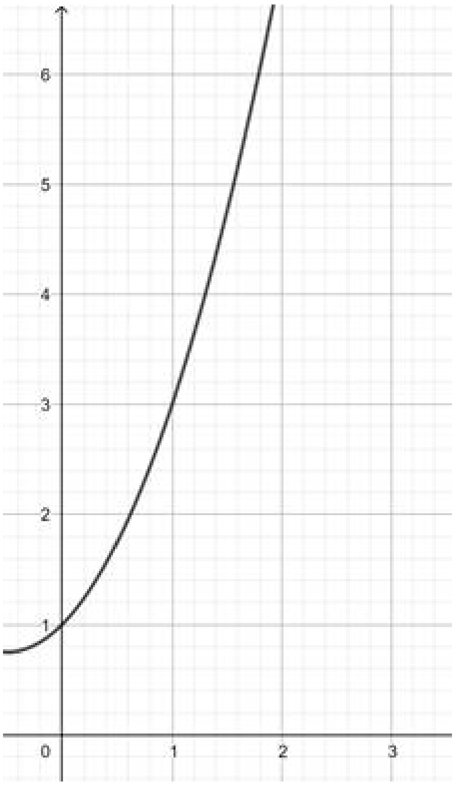
B. one - one and into

C. many - one and onto

D. many - one and into

Answer:
In the given range of N f(x) is monotonically increasing.

∴f(x) = x^2 + x + 1 is one one.



But Range of f(n) = $[0.75,\infty) \neq N$(codomain)

Hence, f(x) is not onto.

Hence, the function $f : N \to N : f(x) = (x^2 + x + 1)$ is one - one but not onto. i.e. into

Question 3.
Mark (√) against the correct answer in the following:

$f : R \to R : f(x) = x^2$ is

A. one - one and onto

B. one - one and into

C. many - one and onto

D. many - one and into

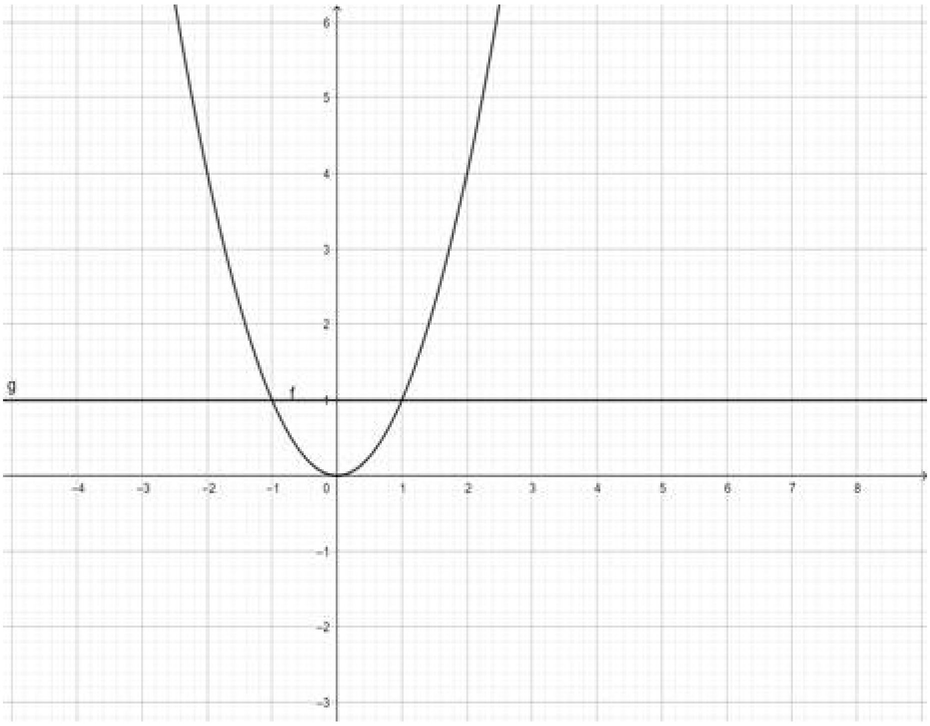
Answer:
$f(x) = x^2$

$\Rightarrow y = x^2$

in this range the lines cut the curve in 2 equal valued points of y, therefore, the function $f(x) = x^2$ is many - one .

Range of f(x) = $(0,\infty) \neq R$(codomain)

$\therefore$f(x) is into



$\therefore$ f : R → R: f(x) = x^2 is many - one into

Question 4.
Mark (√) against the correct answer in the following:

f : R → R : f(x) = x^3 is

A. one - one and onto

B. one - one and into

C. many - one and onto

D. many - one and into

Answer:
f(x) = x^3

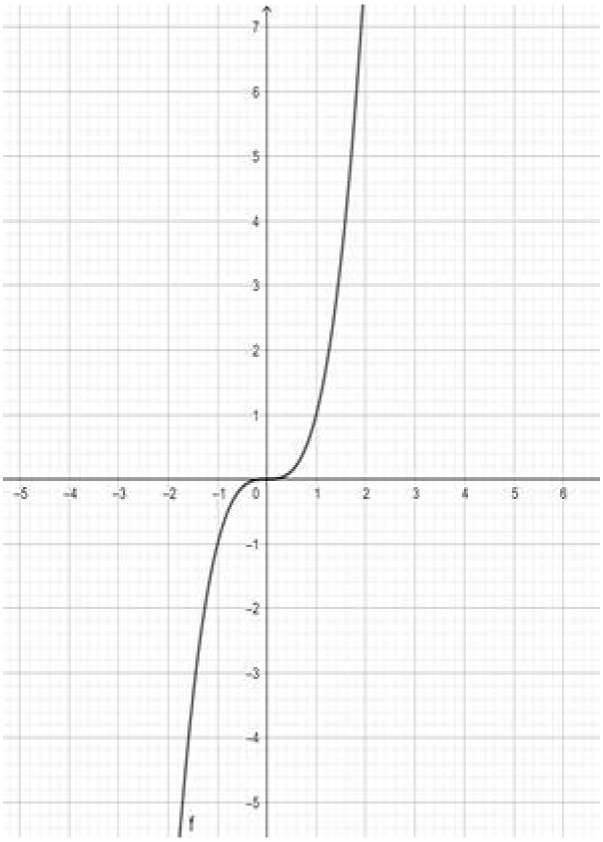
Since the function f(x) is monotonically increasing from the domain R → R

$\therefore$f(x) is one –one

Range of f(x) = $(-\infty,\infty) \neq R$(codomain)

∴f(x) is into

∴ f : R → R: f(x) = x^3 is one - one into.



Question 5.
Mark (√) against the correct answer in the following:

f : R^+ → R^+ : f(x) = e^x is

A. many - one and into

B. many - one and onto

C. one - one and into

D. one - one and onto

Answer:
f(x) = e^x

Since the function f(x) is monotonically increasing from the domain R^+ → R^+

∴f(x) is one –one

Range of f(x) = (1,∞) = R^+ (codomain)

∴f(x) is onto

∴ f : $R^+ \rightarrow R^+$: f(x) = e^x is one - one onto.

Question 6.
Mark (√) against the correct answer in the following:

$f:\left[\frac{-\pi}{2},\frac{\pi}{2}\right]\rightarrow[-1,1]:f(x)=\sin x$ is

A. one - one and into

B. one - one and onto

C. many - one and into

D. many - one and onto

Answer:

$$f:\left[\frac{-\pi}{2},\frac{\pi}{2}\right]\rightarrow[-1,1]:f(x)=\sin x$$

Here in this range, the function is NOT repeating its value,

Therefore it is one - one.

Range = Codomain

∴Function is onto

Hence, option B is the correct choice.

Question 7.
Mark (√) against the correct answer in the following:

f : R → R : f(x) = cos x is

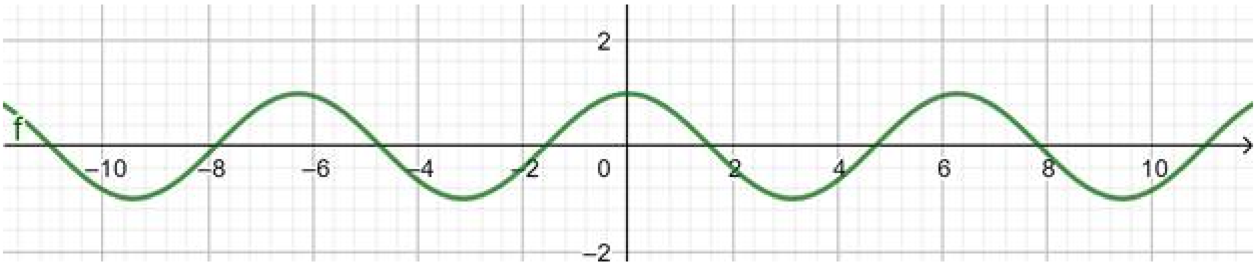
A. one - one and into

B. one - one and onto

C. many - one and into

D. many - one and onto

Answer:



f(x) = cosx

y = cosx

Here in this range the lines cut the curve in many equal valued points of y therefore the function f(x) = cosx is not one - one.

⇒f(x) = many one

Range of f(x) = [- 1,1]≠R(codomain)

∴f(x) is not onto.

⇒f(x) = into

Hence,f(x) = cosx is many one and into

Ans: (c) many - one and into

Question 8.
Mark (√) against the correct answer in the following:

f : C → R : f(z) = |z| is

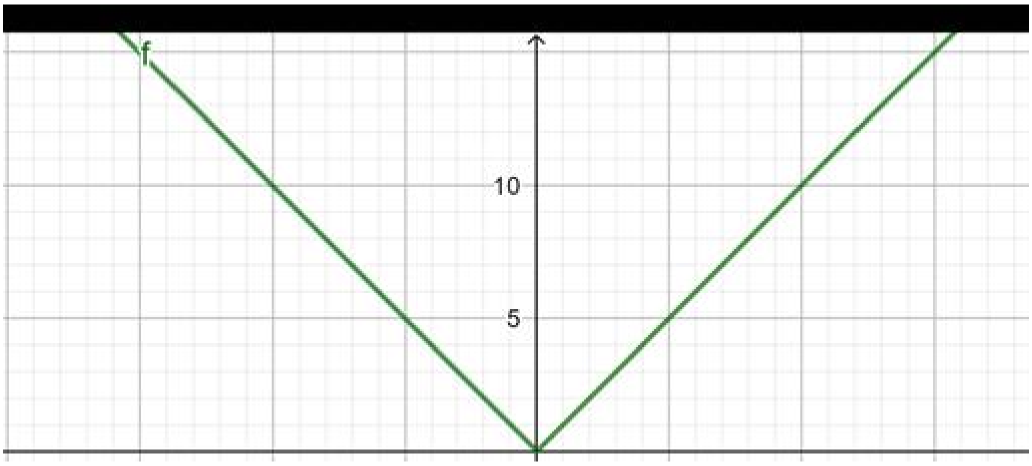
A. one - one and into

B. one - one and onto

C. many - one and into

D. many - one and onto

Answer:



Here in this range the lines cut the curve in 2 equal valued points of y therefore the function f(z) = |z| is not one - one

⇒f(z) = many one.

Range of f(z) = $[0,\infty) \neq R$(codomain)

∴f(z) is not onto.

⇒f(z) = into

Hence, f(z) = |z| is many one and into

Question 9.
Mark (√) against the correct answer in the following:

Let A = R – {3} and B = R – {1}. Then $f : A \rightarrow A : f(x) = \frac{(x-2)}{(x-3)}$ is

A. one - one and into

B. one - one and onto

C. many - one and into

D. many - one and onto

Answer:

$$f : A \rightarrow A : f(x) = \frac{(x-2)}{(x-3)}$$

In this function

$x = 3$ and $y = 1$ are the asymptotes of this curve and these are not included in the functions of the domain and range respectively therefore the function f(x) is one one sice there are no different values of x which has same value of y.

and the function has no value at y = 1 here range = codomain

∴f(x) is onto

Question 10.
Mark (√) against the correct answer in the following:

Let A and B be two non - empty sets and let

f : (A × B) → (B × A) : f(a, b) = (b, a). Then, f is

A. one - one and into

B. one - one and onto

C. many - one and into

D. many - one and onto

Answer:
SINCE, f(a, b) = (b, a).There is no same value of y at different values of x ∴function is one one

∴Range(A×B)≠Codomain(B × A)

⇒function is into

Question 11.
Mark (√) against the correct answer in the following:

Let f : Q → Q : f(x) = (2x + 3). Then, $f^{-1}(y)$ = ?

A. (2y - 3)

B. $\frac{1}{(2y-3)}$

C. $\frac{1}{2}(y-3)$

D. none of these

Answer:
f(x) = 2x + 3

$\Rightarrow y = 2x + 3$

$x \Longleftrightarrow y$

$\Rightarrow x = 2y + 3$

$\Rightarrow x - 3 = 2y$

$\Rightarrow \frac{x-3}{2} = y$

$x \Longleftrightarrow y$

$\Rightarrow \frac{y-3}{2} = x$

Question 12.
Mark (√) against the correct answer in the following:

Let $f : R - \left\{\frac{-4}{3}\right\} \rightarrow - \left\{\frac{4}{3}\right\} : f(x) = \frac{4x}{(3x+4)}$. Then $f^{-1}(y) = ?$

A. $\frac{4y}{(4-3y)}$

B. $\frac{4y}{(4y+3)}$

C. $\frac{4y}{(3y-4)}$

D. None of these

Answer:
$f(x) = \frac{4x}{3x+4}$

$\Rightarrow y = \frac{4x}{3x+4}$

$x \Longleftrightarrow y$

$\Rightarrow x = \frac{4y}{3y+4}$

$\Rightarrow 3yx + 4x = 4y$

$\Rightarrow y(3x - 4) = - 4x$

$\Rightarrow y = \frac{4x}{4-3x}$

$x \Longleftrightarrow y$

$\Rightarrow x = \frac{4y}{4-3y}$

Question 13.
Mark (√) against the correct answer in the following:

If $f(x) = \frac{(4x+3)}{(6x-4)}, x \neq \frac{2}{3}$ then (f o f) (x) = ?

A. x

B. (2x - 3)

C. $\frac{4x-6}{3x+4}$

D. None of these

Answer:
$f(x) = \frac{4x + 3}{6x - 4}$

$\Rightarrow f(f(x)) = \frac{4f(x) + 3}{6f(x) - 4} = (f \circ f)(x)$

$\Rightarrow f(f(x)) = \frac{4\left(\frac{4x + 3}{6x - 4}\right) + 3}{6\left(\frac{4x + 3}{6x - 4}\right) - 4}$

$$\Rightarrow f(f(x)) = \frac{16x + 12 + 18x - 12}{24x + 18 - 24x + 16} = \frac{34x}{34} = x$$

Question 14.
Mark (√) against the correct answer in the following:

If f(x) = (x^2 – 1) and g(x) = (2x + 3) then (g o f) (x) = ?

A. ($2x^2$ + 3)

B. ($3x^2$ + 2)

C. ($2x^2$ + 1)

D. None of these

Answer:
f(x) = (x^2 – 1)

g(x) = (2x + 3)

∴(g o f) (x) = g(f(x))

$$\Rightarrow g(f(x)) = 2f(x) + 3$$

$$\Rightarrow g(f(x)) = 2((x^2 - 1)) + 3 = 2x^2 - 2 + 3 = 2x^2 + 1$$

Question 15.
Mark (√) against the correct answer in the following:

If $f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2}$ then f(x) = ?

A. x^2

B. (x^2 – 1)

C. (x^2 – 2)

D. None of these

Answer:
$$f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2$$

$$\Rightarrow f(x) = x^2 - 2$$

Question 16.
Mark (√) against the correct answer in the following:

If $f(x) = \frac{1}{(1-x)}$ then (f o f o f) (x) = ?

A. $\frac{1}{(1-3x)}$

B. $\frac{x}{(1+3x)}$

C. x

D. None of these

Answer:
$$f(x) = \frac{1}{1-x}$$

$$\Rightarrow (f \circ f \circ f)(x) = f\Big(f\big(f(x)\big)\Big)$$

$$\Rightarrow f\big(f(x)\big) = \frac{1}{1-f(x)} = \frac{1}{1-\frac{1}{1-x}} = \frac{1-x}{1-x-1} = \frac{x-1}{x} = 1-\frac{1}{x}$$

$$\Rightarrow f\Big(f\big(f(x)\big)\Big) = \frac{1}{1-f\big(f(x)\big)} = \frac{1}{1-\left(1-\frac{1}{x}\right)} = \frac{1}{\frac{1}{x}} = x$$

Question 17.
Mark (√) against the correct answer in the following:

If $f(x) = \sqrt[3]{3-x^3}$ then (f o f) (x) = ?

A. $x^{1/3}$

B. x

C. $\left(1-x^{1/3}\right)$

D. None of these

Answer:
$f(x) = \sqrt[3]{3 - x^3}$

$\Rightarrow f(f(x)) = \sqrt[3]{3 - f(x)^3} = \sqrt[3]{3 - \left(\sqrt[3]{3 - x^3}\right)^3}$

$\Rightarrow f(f(x)) = \sqrt[3]{3 - (3 - x^3)}$

$\Rightarrow f(f(x)) = \sqrt[3]{x^3} = x$

Question 18.
Mark (√) against the correct answer in the following:

If $f(x) = x^2 – 3x + 2$ then $(f \circ f)(x) = ?$

A. x^4

B. $x^4 – 6x^3$

C. $x^4 – 6x^3 + 10x^2$

D. None of these

Answer:
$f(x) = x^2 – 3x + 2$

$\Rightarrow f(x) = x^2 - 2x - x + 2 = x(x - 2) - 1(x - 2)$

$\Rightarrow f(x) = (x - 2)(x - 1)$

$\Rightarrow f(x) = (x - 2)(x - 1)$

$\Rightarrow f(f(x)) = (f(x) - 2)(f(x) - 1)$

$\Rightarrow f(f(x)) = ((x - 2)(x - 1) - 2) ((x - 2)(x - 1) - 1)$

$\Rightarrow f(f(x)) = (x^2 – 3x + 2 - 2) (x^2 – 3x + 2 - 1)$

$\Rightarrow f(f(x)) = (x^2 - 3x)(x^2 - 3x + 1)$

$\Rightarrow f(f(x)) = x^4 - 3x^3 + x^2 - 3x^3 + 9x^2 - 3x$

$\Rightarrow f(f(x)) = x^4 - 6x^3 + 10x^2 - 3x$

Question 19.
Mark (√) against the correct answer in the following:

If $f(x) = 8x^3$ and $g(x) = x^{1/3}$ then $(g \circ f)(x) = ?$

A. x

B. 2x

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

D. $3x^2$

Answer:
$f(x) = 8x^3$

$g(x) = x^{1/3}$

$$\Rightarrow (g \circ f)(x) = (f(x))^{\frac{1}{3}} = (8x^3)^{\frac{1}{3}} = 2x$$

Question 20.
Mark (√) against the correct answer in the following:

If $f(x) = x^2$, $g(x) = \tan x$ and $h(x) = \log x$ then $\{h \circ (g \circ f)\}\left(\sqrt{\frac{\pi}{4}}\right) = ?$

A. 0

B. 1

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

D. $\frac{1}{2}\log\frac{\pi}{4}$

Answer:
$f(x) = x^2$, $g(x) = \tan x$ and $h(x) = \log x$

$$\Rightarrow g(f(x)) = \tan(f(x)) = \tan(x^2)$$

$$\Rightarrow h(g(f(x))) = \log(g(f(x))) = \log(\tan(x^2))$$

$$\Rightarrow h\left(g\left(f\left(\sqrt{\frac{\pi}{4}}\right)\right)\right) = \log\left(\tan\left(\sqrt{\frac{\pi}{4}}^2\right)\right) = \log\left(\tan\left(\frac{\pi}{4}\right)\right) = \log(1) = 0$$

Question 21.
Mark (√) against the correct answer in the following:

If f = {(1, 2), (3, 5), (4, 1)} and g = {(2, 3), (5, 1), (1, 3)} then (g o f) = ?

A. {(3, 1), (1, 3), (3, 4)}

B. {(1, 3), (3, 1), (4, 3)}

C. {(3, 4), (4, 3), (1, 3)}

D. {(2, 5), (5, 2), (1, 5)}

Answer:
g = {(2, 3), (5, 1), (1, 3)}

(g o f) = {(dom(f), 3), (dom(f), 1), (dom(f), 3)}

⇒(g o f) = {(1, 3), (3, 1), (4, 3)}

Question 22.
Mark (√) against the correct answer in the following:

Let $f(x) = \sqrt{9 - x^2}$. Then, dom (f) = ?

A. [- 3, 3]

B. [- ∞, - 3]

C. [3, ∞)

D. (- ∞, - 3] ∪ (4, ∞)

Answer:
F(x) = $\sqrt{9-x^2}$

$\sqrt{9-x^2}$ should be ≥ 0

$\Rightarrow 9-x^2 \geq 0$

$\Rightarrow x^2 \leq 9$

$\Rightarrow -3 \leq x \leq 3$

∴dom(f) = [- 3, 3]

Question 23.
Mark (√) against the correct answer in the following:

Let $f(x)\sqrt{\frac{x-1}{x+4}}$. Then, dom (f) - ?

A. [1, 4)

B. [1, 4]

C. (- ∞, 4]

D. (- ∞, 1] ∪ (4, ∞)

Answer:

$f(x) = \sqrt{\frac{x-1}{x-4}}$

$\sqrt{\frac{x-1}{x-4}} \geq 0$

$\Rightarrow x-1 \geq 0$

$\Rightarrow x \geq 1$

And x≠4

$x > 4$ and $x \leq 1$

$\Rightarrow \text{dom}(f) = (-\infty, 1] \cup (4, \infty)$

Question 24.
Mark (√) against the correct answer in the following:

Let $f(x) = e^{\sqrt{x^2-1}}.\log(x-1)$. Then, dom (f) = ?

A. (- ∞, 1]

B. [- 1, ∞)

C. (1, ∞)

D. (- ∞, - 1] ∪ (1, ∞)

Answer:
$f(x) = e^{\sqrt{x^2-1}}\log(x-1)$

$x - 1 > 0$

$\Rightarrow x > 1$

And

$\Rightarrow x^2 - 1 \geq 0$

$\Rightarrow x^2 \geq 1$

$\Rightarrow -1 \leq x \geq 1$

Taking the intersection we get

Dom(f) = (1, ∞)

Question 25.

Mark (√) against the correct answer in the following:

Let $f(x) = \frac{x}{(x^2 - 1)}$. Then, dom (f) = ?

A. R

B. R – {1}

C. R – { - 1}

D. R – { - 1, 1}

Answer:

$f(x) = \frac{x}{x^2 - 1}$

$X^2 - 1 \neq 0$

$x \neq (1, - 1)$

∴ Dom(f) = R - { - 1,1}

Question 26.

Mark (√) against the correct answer in the following:

Let $f(x) = \frac{\sin^{-1} x}{x}$. Then, dom (f) = ?

A. (-1, 1)

B. [-1, 1]

C. [-1, 1] – {0}

D. none of these

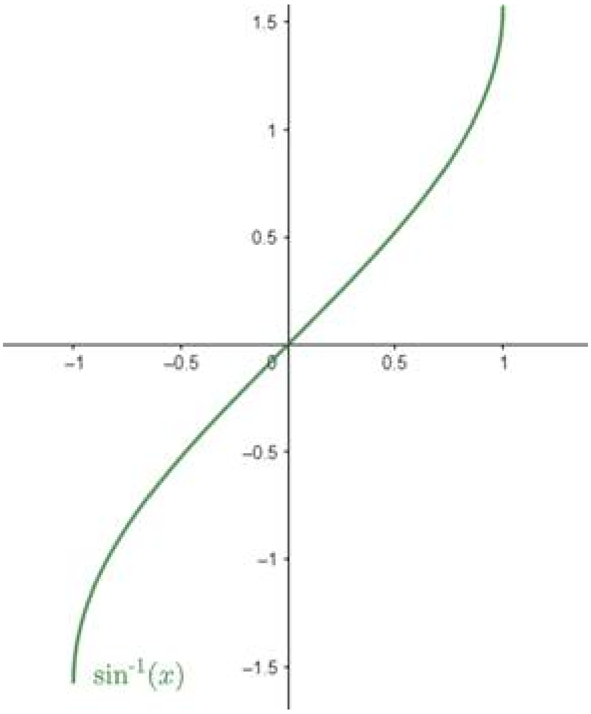
Answer:

Given: $f(x) = \frac{\sin^{-1} x}{x}$

From f(x), $x \neq 0$

Now, domain of $\sin^{-1}x$ is [-1, 1] as the values of $\sin^{-1}x$ lies between -1 and 1.

We can see that from this graph:



Domain of f(x) = [-1, 1] – 0

Hence, B is the correct answer.

Question 27.
Mark (√) against the correct answer in the following:

Let f(x) = $\cos^{-1} 2x$. Then, dom (f) = ?

A. [- 1, 1]

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

C. $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$

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

Answer:
f(x) = $\cos^{-1} 2x$.

domain of $\cos^{-1}x$ = [- 1,1]

on multiplying by an integer the domain decreases by same number

$\Rightarrow$domain of $\cos^{-1}2x = [-1/2, 1/2]$

Question 28.
Mark (√) against the correct answer in the following:

Let $f(x) = \cos^{-1}(3x - 1)$. Then, dom (f) = ?

A. $\left(0, \frac{2}{3}\right)$

B. $\left[0, \frac{2}{3}\right]$

C. $\left[\frac{-2}{3}, \frac{2}{3}\right]$

D. None of these

Answer:
$f(x) = \cos^{-1}(3x - 1)$.

domain of $\cos^{-1}x = [-1, 1]$

on multiplying by an integer the domain decreases by same number

$\Rightarrow$domain of $\cos^{-1}3x = [-1/3, 1/3]$

$\Rightarrow$domain of $\cos^{-1}(3x - 1) = [1/3 - 1/3, 1/3 + 1/3] = [0, 2/3]$

Question 29.
Mark (√) against the correct answer in the following:

Let $f(x) = \sqrt{\cos x}$. Then, dom (f) = ?

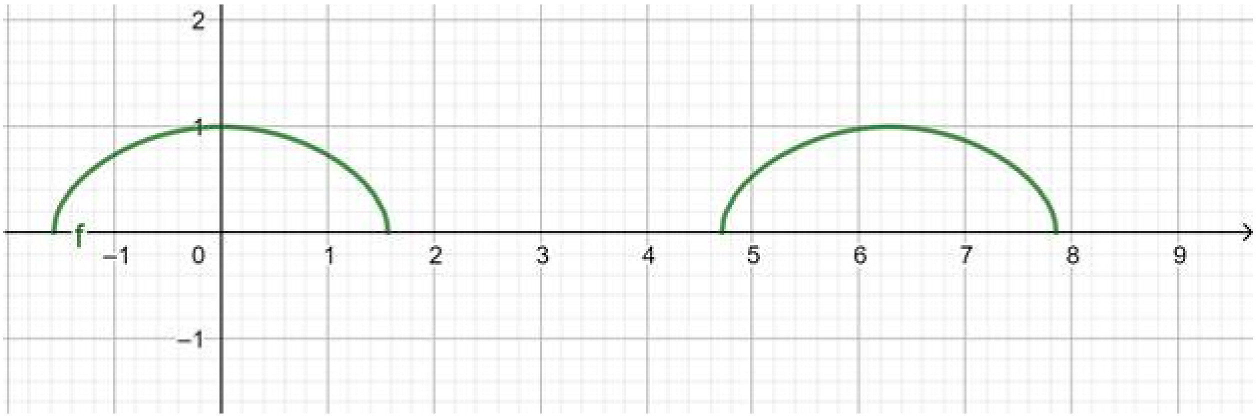
A. $\left[0, \frac{\pi}{2}\right]$

B. $\left[\frac{3\pi}{2}, 2\pi\right]$

C. $\left[0, \frac{\pi}{2}\right] \cup \left[\frac{3\pi}{2}, 2\pi\right]$

D. none of these

Answer:
$f(x) = \sqrt{\cos x}$



As per the diagram

We can imply that domain of √cosx

is $\left[0, \frac{\pi}{2}\right] [\frac{3\pi}{2}, 2\pi]$

Question 30.
Mark (√) against the correct answer in the following:

Let f(x) = √log $(2x - x^2)$. Then, dom (f) = ?

A. (0, 2)

B. [1, 2]

C. (- ∞, 1]

D. None of these

Answer:
f(x) = √log $(2x - x^2)$.

$2x - x^2 > 1$

$\Rightarrow x^2 - 2x + 1 < 0$

$\Rightarrow (x-1)^2 < 0$

$\Rightarrow x - 1 < 0$

$\Rightarrow x < 1$

$\log(2x - x^2) > 0$

$\Rightarrow 2x - x^2 > e^0 = 1$

$\Rightarrow x < 1$

Dom(f) = (- ∞, 1)

Question 31.
Mark (√) against the correct answer in the following:

Let f(x) = x^2. Then, dom (f) and range (f) are respectively.

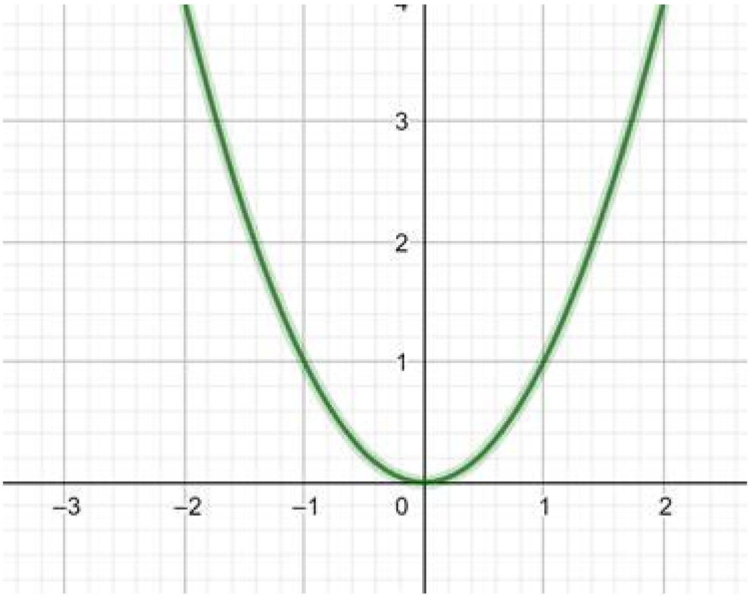
A. R and R

B. R^+ and R^+

C. R and R^+

D. R and R – {0}

Answer:



According to sketched graph of x^2

Domain of f(x) = R

And Range of f(x) = R^+

Question 32.
Mark (√) against the correct answer in the following:

Let $f(x) = x^3$. Then, dom (f) and range (f) are respectively

A. R and R

B. R^+ and R^+

C. R and R^+

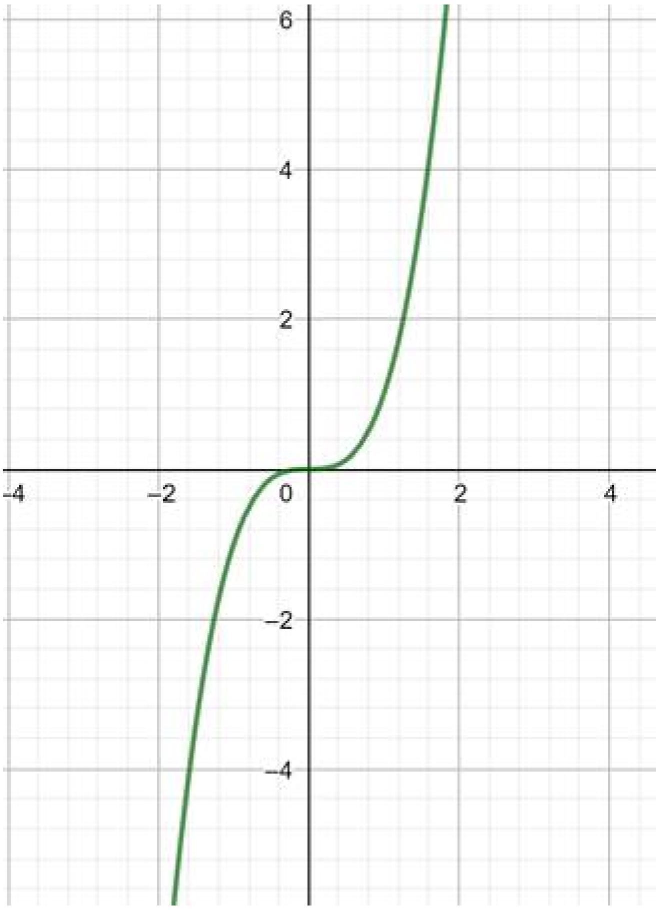
D. R^+ and R

Answer:
According to sketched graph of x^3

Domain of f(x) = R

And Range of f(x) = R

Since x^3 is a, monotonically increasing function



Question 33.
Mark (√) against the correct answer in the following:

Let f(x) = log (1 – x) + $\sqrt{x^2 - 1}$. Then, dom (f) = ?

A. (1, ∞)

B. (- ∞, - 1]

C. [- 1, 1)

D. (0, 1)

Answer:
log (1 – x) + $\sqrt{(x^2 - 1)}$

1 - x>0

$x < 1$

$X^2 - 1 \geq 0$

$X^2 \geq 1$

$\Rightarrow -1 \leq x \geq 1$

Taking intersection of the ranges we get

Dom (f) = (b) (- ∞, - 1]

Question 34.
Mark (√) against the correct answer in the following:

Let $f(x) = \frac{1}{(1-x^2)}$. Then, range (f) = ?

A. (- ∞, 1]

B. [1, ∞)

C. [- 1, 1]

D. none of these

Answer:
$f(x) = \frac{1}{1-x^2}$

$\Rightarrow y = \frac{1}{1-x^2}$

$\Rightarrow y - yx^2 = 1$

$\Rightarrow y - 1 = yx^2$

$\Rightarrow x = \sqrt{\frac{y-1}{y}}$

$\Rightarrow \frac{y-1}{y} \geq 0$

$\Rightarrow y \geq 1$

∴ range (f) = [1, ∞)

Question 35.
Mark (√) against the correct answer in the following:

Let $f\left(x\right)=\frac{x^2}{\left(1+x^2\right)}$. Then, range (f) = ?

A. [1, ∞)

B. [0, 1)

C. [- 1, 1]

D. (0, 1]

Answer:

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

$$\Rightarrow y = \frac{x^2}{1 + x^2}$$

$$\Rightarrow y + yx^2 = x^2$$

$$\Rightarrow y = x^2(1-y)$$

$$\Rightarrow x = \sqrt{\frac{y}{1-y}}$$

$$\frac{y}{1-y} \geq 0$$

$\Rightarrow y \geq 0$

And

$1 - y > 0$

$\Rightarrow y < 1$

Taking intersection we get

range (f) = [0, 1)

Question 36.
Mark (√) against the correct answer in the following:

The range of $f(x) = x + \frac{1}{x}$ is

A. [- 2, 2]

B. [2, ∞)

C. (- ∞, - 2]

D. none of these

Answer:
$f(x) = x + \frac{1}{x}$

For this type

Range is

$-2 \leq y \geq 2$

Question 37.
Mark (√) against the correct answer in the following:

The range of $f(x) = a^x$, where $a > 0$ is

A. [- ∞, 0]

B. [- ∞, 0)

C. [0, ∞)

D. (0, ∞)

Answer:
$f(x) = a^x$

when $x<0$

$0<a^x<1$

When $x \geq 0$

$a^x > 0$

Therefore range of $f(x) = a^x = (0, \infty)$

Question 38.
Mark (√) against the correct answer in the following:

Let $f: N \to N: f(x) = \begin{cases} \frac{1}{2}(n+1), \text{when n is odd} \\ \frac{n}{2}, \text{when n is even.} \end{cases}$

Then, f is

A. one - one and into

B. one - one and onto

C. many - one and into

D. many - one and onto

Answer:
$f(1) = 1$

$f(2) = 1$

$f(3) = 2$

$f(4) = 2$

$f(5) = 3$

$f(6) = 3$

Since at different values of x we get same value of y $\therefore$f(n) is many –one

And range of f(n) = N = N(codomain)

$\therefore$ the function $f: N \to Z$, defined by

$$f : N \rightarrow N : f(x) = \begin{cases} \frac{1}{2}(n+1), \text{when } n \text{ is odd} \\ \frac{n}{2}, \text{when } n \text{ is even.} \end{cases}$$ is both many - one and onto.

Question 39.

Mark (√) against the correct answer in the following:

Let f : N → X : $f(x) = 4x^2 + 12x + 15$. Then, $f^{-1}(y)$ = ?

A. $\frac{1}{2}\left(\sqrt{y-4}+3\right)$

B. $\frac{1}{2}\left(\sqrt{y-6}-3\right)$

C. $\frac{1}{2}\left(\sqrt{y-4}+5\right)$

D. None of these

Answer:

$f(x) = 4x^2 + 12x + 15$

$\Rightarrow y = 4x^2 + 12x + 15$

$\Rightarrow y = (2x + 3)^2 + 6$

$\Rightarrow \sqrt{(y - 6)} = 2x + 3$

$\Rightarrow \frac{1}{2}\left(\sqrt{y-6}-3\right) = x$

$f^{-1}(y) = \frac{1}{2}\left(\sqrt{y-6}-3\right)$