

## Step-1

We have to verify which of the given transformations are invertible.

a) Given transformation is  $T(x) = x^3$ .

Let  $x^3 = b$

$$\Rightarrow x = b^{\frac{1}{3}}$$

$$\text{Now } T\left(b^{\frac{1}{3}}\right) = b$$

$$\Rightarrow T^{-1}(b) = b^{\frac{1}{3}}, \quad b \in \mathbb{R}$$

Hence  $\boxed{T(x) = x^3}$  is invertible.

## Step-2

(b) Given transformation is  $T(x) = e^x$ .

Suppose  $T(x) = y$

$$\Rightarrow e^x = y$$

$$\Rightarrow x \log_e e = \log_e y$$

$$\Rightarrow x = \log_e y$$

We know that the logarithms are not defined for negative values

Hence the given transformation  $T$  is not invertible.

## Step-3

(c) Given transformation is  $T(x) = x + 11$ .

Let  $T(x) = y$

$$\Rightarrow x + 11 = y$$

$$\Rightarrow x = y - 11$$

$$\Rightarrow T^{-1}(y) = y - 11$$

Hence  $\boxed{T(x) = x + 11}$  is invertible.

### Step-4

(d) Given transformation is  $T(x) = \cos x$ .

Let  $T(x) = y$

$$\cos x = y$$

If  $y = 2$ , there is no  $x$  in  $\mathbf{R}$  such that  $\cos x = 2$

Hence  $T$  is not invertible.