RD Sharma Solutions Class 12 Maths Chapter 17 Ex 17.1

Increasing and Decreasing Functions Ex 17.1 Q1

Let $x_1,\ x_2 \in (0,\infty)$

We have,

$x_1 < x_2$

$\Rightarrow \quad \log_e x_1 < \log_e x_2$

$\Rightarrow \quad f(x_1) < f(x_2)$

So, $f(x)$ is increasing in $(0,\infty)$.

Increasing and Decreasing Functions Ex 17.1 Q2

Case I

When $a > 1$

Let $x_1, x_2 \in (0,\infty)$

We have

$x_1 < x_2$

$\Rightarrow \quad \log_a x_1 < \log_a x_2$

$\Rightarrow \quad f(x_1) < f(x_2)$

Thus, $f(x)$ is increasing on $(0,\infty)$

Case II

When $0 < a < 1$

$f(x) = \log_a x = \dfrac{\log x}{\log a}$

When $a < 1 \Rightarrow \log a < 0$

Let $x_1 < x_2$

$\Rightarrow \quad \log x_1 < \log x_2$

$\Rightarrow \quad \dfrac{\log x_1}{\log a} > \dfrac{\log x_2}{\log a} \qquad [\because \log a < 0]$

$\Rightarrow \quad f(x_1) > f(x_2)$

So, $f(x)$ is decreasing on $(0,\infty)$.

Increasing and Decreasing Functions Ex 17.1 Q3

We have,

$f(x) = ax + b,\ a > 0$

Let $x_1, x_2 \in R$ and $x_1 > x_2$

$\Rightarrow \quad ax_1 > ax_2$ for some $a > 0$

$\Rightarrow \quad ax_1 + b > ax_2 + b$ for some b

$\Rightarrow \quad f(x_1) > f(x_2)$

$\therefore$ $f(x)$ is increasing function of R.

Increasing and Decreasing Functions Ex 17.1 Q4

We have,

$$f(x) = ax + b,\ a < 0$$

Let $x_1, x_2 \in R$ and $x_1 > x_2$

$\Rightarrow \quad ax_1 < ax_2$ for some $a < 0$

$\Rightarrow \quad ax_1 + b < ax_2 + b$ for some b

$\Rightarrow \quad f(x_1) < f(x_2)$

Hence, $x_1 > x_2 \Rightarrow f(x_1) < f(x_2)$

$\therefore$ $f(x)$ is decreasing function of R.

Increasing and Decreasing Functions Ex 17.1 Q5

We have,

$$f(x) = \frac{1}{x}$$

Let $x_1, x_2 \in (0, \infty)$ and $x_1 > x_2$

$\Rightarrow \quad \frac{1}{x_1} < \frac{1}{x_2}$

$\Rightarrow \quad f(x_1) < f(x_2)$

Thus, $x_1 > x_2 \Rightarrow f(x_1) < f(x_2)$

So, $f(x)$ is decreasing function.

Increasing and Decreasing Functions Ex 17.1 Q6

We have,

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

Case I

When $x \in [0, \infty)$

Let $x_1, x_2 \in (0, \infty]$ and $x_1 > x_2$

$\Rightarrow \quad x_1^2 > x_2^2$

$\Rightarrow \quad 1 + x_1^2 > 1 + x_2^2$

$\Rightarrow \quad \frac{1}{1+x_1^2} < \frac{1}{1+x_2^2}$

$\Rightarrow \quad f(x_1) < f(x_2)$

So, $f(x)$ is decreasing on $[0, \infty)$

Case II

When $x \in (-\infty, 0]$

Let $x_1 > x_2$

$\Rightarrow \quad x_1^2 < x_2^2 \qquad [\because -2 > -3 \Rightarrow 4 < 9]$

$\Rightarrow \quad 1 + x_1^2 < 1 + x_2^2$

$\Rightarrow \quad \frac{1}{1+x_1^2} > \frac{1}{1+x_2^2}$

$\Rightarrow \quad f(x_1) > f(x_2)$

So, $f(x)$ is increasing on $(-\infty, 0]$

Increasing and Decreasing Functions Ex 17.1 Q7

We have,

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

Case I

When $x \in [0,\infty)$

Let $x_1 > x_2$

$\Rightarrow \quad x_1^2 > x_2^2$

$\Rightarrow \quad 1+x_1^2 > 1+x_2^2$

$\Rightarrow \quad \frac{1}{1+x_1^2} < \frac{1}{1+x_2^2}$

$\Rightarrow \quad f(x_1) < f(x_2)$

$\therefore$ $f(x)$ is decreasing on $[0,\infty)$.

Case II

When $x \in (-\infty,0]$

Let $x_1 > x_2$

$\Rightarrow \quad x_1^2 < x_2^2$

$\Rightarrow \quad 1+x_1^2 < 1+x_2^2$

$\Rightarrow \quad \frac{1}{1+x_1^2} > \frac{1}{1+x_2^2}$

$\Rightarrow \quad f(x_1) > f(x_2)$

So, $f(x)$ is increasing on $(-\infty,0]$

Thus, $f(x)$ is neither increasing nor decreasing on R.

Increasing and Decreasing Functions Ex 17.1 Q8

We have,

$$f(x) = |x| = \begin{cases} x, & x > 0 \\ -x, & x < 0 \end{cases}$$

(a)

Let $x_1, x_2 \in (0,\infty)$ and $x_1 > x_2$

$\Rightarrow \quad f(x_1) > f(x_2)$

So, $f(x)$ is increasing in $(0,\infty)$

(b)

Let $x_1, x_2 \in (-\infty,0)$ and $x_1 > x_2$

$\Rightarrow \quad -x_1 < -x_2$

$\Rightarrow \quad f(x_1) < f(x_2)$

$\therefore$ $f(x)$ is strictly decreasing on $(-\infty,0)$.

Increasing and Decreasing Functions Ex 17.1 Q9

$$f(x) = 7x - 3$$

Let $x_1, x_2 \in R$ and $x_1 > x_2$

$\Rightarrow \quad 7x_1 > 7x_2$

$\Rightarrow \quad 7x_1 - 3 > 7x_2 - 3$

$\Rightarrow \quad f(x_1) > f(x_2)$

$\therefore$ $f(x)$ is strictly increasing on R.