AOD

Ex:- ① $f(x) = \cos x$

a) $(0, \pi) \rightarrow \downarrow$

b) $(\pi, 2\pi) \rightarrow \uparrow$

c) $(0, 2\pi) \rightarrow$ neither $\uparrow$ nor $\downarrow$

Solⁿ:- $\because f(x) = \cos x$

$\therefore f'(x) = -\sin x$

a) $\because$ in $(0, \pi) \rightarrow f'(x) < 0$

it means $f(x)$ stri. $\downarrow$ in $(0, \pi)$ Ans

b) $\because$ in $(\pi, 2\pi) \rightarrow f'(x) > 0$

it mean $(\pi, 2\pi)$ $f(x) = \cos x$ is strictly $\uparrow$. Ans

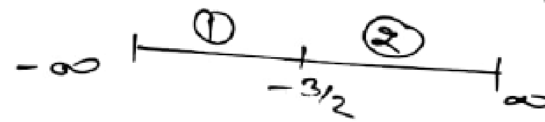
c) $\because$ from point a & b it is clear that b/w $(0, 2\pi) \rightarrow f(x)$ is neither $\uparrow$ nor $\downarrow$. Ans

② $f(x) = 10 - 6x - 2x^2$

③ $f(x) = -2x^3 - 9x^2 - 12x + 1$

Solⁿ:- 2) $f'(x) = -6 - 4x$

$\because f'(x) = -6 - 4x = 0 \Rightarrow \boxed{x = -3/2}$



$\because$ Here on $f'(x) = 0$ we get $x = -3/2$ which divide domain into 2 intervals $(-\infty, -3/2)$ & $(-3/2, \infty)$

$\therefore$ in $(-\infty, -3/2) \rightarrow f'(x) > 0$

So increasing in $(-\infty, -3/2)$

Now in $(-3/4, \infty) \rightarrow f'(x) < 0$

So $\downarrow$ in $(-3/4, \infty)$ Ans

AOD

Ex:- find interval for which sti ↑ or stri ↓.

Ex1. $(x+1)^3(x-3)^3 = f(x)$

Soln:- diff. → $f'(x) = \underline{(x+1)^3} \cdot 3\underline{(x-3)}^2 + \underline{(x-3)}^3 \cdot 3\underline{(x+1)}^2$

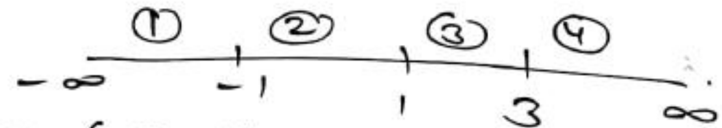
$= 3(x+1)^2(x-3)^2\left[x+1+x-3\right]$

$= 3(x+1)^2(x-3)^2\left[2x-2\right]$

$$\boxed{f'(x) = 6(x+1)^2(x-3)^2(x-1)}$$

Now:- $f'(x) = 0 = 6(x+1)^2(x-3)^2(x-1)$

so:- $\boxed{x = -1,\ 3,\ 1}$



Now interval will divided into 4 parts such as:- $\underline{(-\infty,-1)}$, $\underline{(-1,1)}$ $(1,3)$ $(3,\infty)$

interval	$f'(x)$	nature of fun.
$(-\infty,-1)$	$f'(x)<0$	↓
$(-1,1)$	$f'(x)<0$	↓
$(+1,3)$	$f'(x)>0$	↑
$(3,\infty)$	$f'(x)>0$	↑

so:- in $(-\infty,1)$ $f(x)$ is stri. ↓.

& $(1,\infty)$ $f(x)$ is stri. ↑. Ans

AOD

Ex:- Show that $y = \log(1+x) - \dfrac{2x}{2+x}$, $\boxed{x > -1}$, is an ↑ fun. of x throughout its domain.

Solⁿ:- $\because f(x) = \log(1+x) - \dfrac{2x}{2+x}$

$$\therefore f'(x) = \frac{1}{1+x} - \left\{\frac{(2+x)2 - 2x(0+1)}{(2+x)^2}\right\}$$

$$f'(x) = \frac{1}{1+x} - \left\{\frac{4+\cancel{2x}-\cancel{2x}}{(2+x)^2}\right\}$$

$$f'(x) = \frac{1}{1+x} - \frac{4}{(2+x)^2} = \frac{(2+x)^2 - 4(1+x)}{(1+x)(2+x)^2}$$

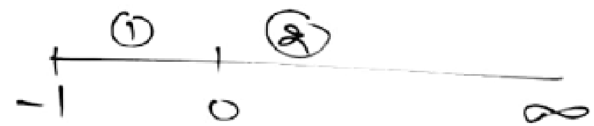
$$\Rightarrow f'(x) = \frac{\cancel{4}+\cancel{4x}+x^2-\cancel{4}-\cancel{4x}}{(1+x)(2+x)^2} = \frac{x^2}{(1+x)(2+x)^2}$$

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

$\Rightarrow$ Now:- $f'(x) = \dfrac{x^2}{(1+x)(2+x^2)} = 0 \Rightarrow \boxed{x = 0}$

$\because$ it is given $f(x)$ is ↑ in its domain.

$\therefore$



Here on $f'(x) = 0$ we get two intervals of domain $(-1, \infty)$ such as:- $(-1, 0)$ & $(0, \infty)$

So in $(-1, 0) \rightarrow f'(x) > 0$

in $(0, \infty) \rightarrow f'(x) > 0$

So in $(-1, \infty)$, $f(x)$ is always stric. ↑. Proved

ABLES KOTA

AOD

H.W.

Ex:- find the values of x for which $y = [x(x-2)]^2$ is an increasing function.

Ex:- prove that the logarithmic fun. is strictly $\uparrow$ on $(0, \infty)$.