

Finding Increasing and Decreasing Intervals

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For each problem, find the open intervals where the function is increasing and decreasing.

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

3) $y = -\frac{3x}{x+2}$

4) $y = -x^2$

5) $f(x) = \csc(x); [-\pi, \pi]$

6) $f(x) = 2x^2 - 4x + 4$

7) $f(x) = -x^5 + 3x^3$

8) $f(x) = -(6x+6)^{\frac{1}{2}}$

9) $y = -x^5 + 3x^3 + 1$

10) $y = x^4 + 4x^3 + 2x^2 - 4x - 5$

11) $y = -x^5 + 2x^3 + 3$

12) $f(x) = -(3x-9)^{\frac{1}{3}}$


13) $y = x^2 + 4x - 2$

~~$10) y' = 4x^3 + 12x^2 + 4x - 4 = 0$~~

2. $f'(x) = \frac{(x-1)(-2) - (-2x)(1)}{(x-1)^2} = 0/DNE$

~~$\frac{-2x+2+2x}{(x-1)^2} = 0/DNE$~~

$x = 1$

$f'(x)$ 

incr: $(-\infty, \infty)$
decr: none

3. $y' = \frac{(x+2)(-3) - (-3x)(1)}{(x+2)^2} = 0/DNE$

~~$\frac{-3x-6+3x}{(x+2)^2} = 0/DNE$~~

$x = -2$

y' 

dec: $(-\infty, \infty)$
inc: none

4. $y' = -2x = 0/DNE$

$x = 0$

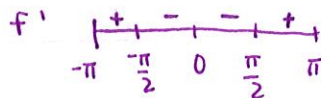
y' 

inc: $(-\infty, 0)$
decr: $(0, \infty)$

5. $f'(x) = -\csc x \cot x = 0/DNE$

~~$\frac{-1}{\sin x} \cdot \frac{\cos x}{\sin x} = 0/DNE$~~

$x = -\pi, -\pi/2, 0, \pi/2, \pi$

f' 

inc: $(-\pi, -\pi/2)$ $(\pi/2, \pi)$
decr: $(-\pi/2, \pi/2)$

6. $f' = 4x - 4 = 0/DNE$

$4(x-1) = 0/DNE$

$x = 1$

f' 

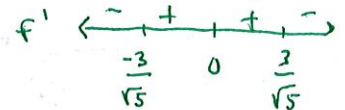
inc: $(1, \infty)$
decr: $(-\infty, 1)$

7. $f' = -5x^4 + 9x^2 = 0/DNE$

$x^2(-5x^2+9) = 0/DNE$

$x = 0, \pm\sqrt{9/5}$

$= 0, \pm\frac{3}{\sqrt{5}}$

f' 

8. $f'(x) = -\frac{1}{2}(6x+b)^{-1/2} \cdot 6 = 0$
inc: $(-\frac{3}{\sqrt{5}}, \frac{3}{\sqrt{5}})$
decr: $(-\infty, -\frac{3}{\sqrt{5}})$ $(\frac{3}{\sqrt{5}}, \infty)$

8. $f'(x) = -\frac{1}{2}(6x+b)^{-1/2} \cdot 6 = 0$

~~$\frac{-3}{\sqrt{6x+b}} = 0/DNE$~~

$x = -1$

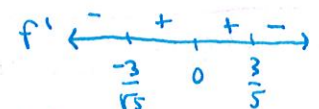
f' 

inc: none
decr: $(-1, \infty)$

9. $y' = -5x^4 + 9x^2 = 0/DNE$

same as #9

$x = 0, \pm\sqrt{9/5}$

f' 

~~$10) y' = 4x^3 + 12$~~
inc: $(-\frac{3}{\sqrt{5}}, \frac{3}{\sqrt{5}})$
decr: $(-\infty, -\frac{3}{\sqrt{5}})$ $(\frac{3}{\sqrt{5}}, \infty)$

10. $y' = 4x^3 + 12x^2 + 4x - 4 = 0 / \text{DNE}$

$$4(x^3 + 3x^2 + x - 1) = 0$$

$$x = -1$$

now we know $(x+1)$ is a root of y so divide:

$$\begin{array}{r} x^3 + 3x^2 + x - 1 \\ x+1 \overline{) x^3 + 4x^2 + 2x - 1} \\ \underline{x^3 + x^2} \\ 3x^2 + 2x - 1 \\ \underline{3x^2 + 3x} \\ -x - 1 \\ \underline{-x - 1} \\ 0 \end{array}$$

$$\begin{array}{r} x^2 + 2x - 1 \\ x+1 \overline{) x^2 + 3x^2 + x - 1} \\ \underline{x^2 + x^2} \\ 2x^2 + x - 1 \\ \underline{2x^2 + 2x} \\ -x - 1 \\ \underline{-x - 1} \\ 0 \end{array}$$

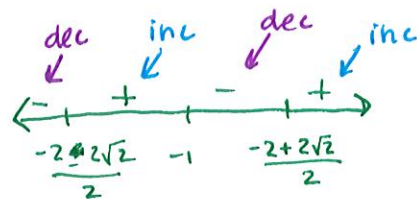
$$y' = 4(x+1)(x^2 + 2x - 1)$$

$$x = -1$$

quadratic formula

$$x = \frac{-2 \pm \sqrt{4 - 4(1)(-1)}}{2(1)}$$

$$= \frac{-2 \pm \sqrt{8}}{2} = \frac{-2 \pm 2\sqrt{2}}{2}$$

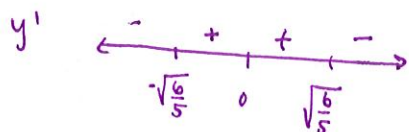


challenge problem

11. $y' = -5x^4 + 6x^2 = 0 / \text{DNE}$

$$x^2(-5x^2 + 6) = 0$$

$$x = 0, \pm \sqrt{6/5}$$



inc: $(-\sqrt{6/5}, \sqrt{6/5})$

dec: $(-\infty, -\sqrt{6/5})$ $(\sqrt{6/5}, \infty)$

12. $f'(x) = -\frac{1}{3}(3x-9)^{-2/3} \cdot 3 = 0 / \text{DNE}$

$$\frac{-1}{(3x-9)^{2/3}} = 0 / \text{DNE}$$

$$x = 3$$



inc: none

dec: $(-\infty, \infty)$

13. $f'(x) = 2x + 4 = 0 / \text{DNE}$

$$x = -2$$



inc: $(-2, \infty)$

dec: $(-\infty, -2)$