Increasing/Decreasing Intervals

Section 5.2

Analytic Method: 5 steps

a) Domain

b) Find $\frac{dy}{dx}$

c) Find the critical points (when $\frac{dy}{dx} = 0$ and/or $\frac{dy}{dx}$ = undef.)

d) Use a number line to find where $\frac{dy}{dx}$ is + and −

e) Answer

1) $f(x) = \frac{1}{3}x^3 - x^2 - 15x + 3$

a) Domain

$(-\infty, \infty)$

b) f'

$f'(x) = x^2 - 2x - 15$

c) $f' = 0$

$0 = x^2 - 2x - 15$

$0 = (x+3)(x-5)$

$x = -3, 5$

f' = undef.

never

d) # line

f': + (inc.) | −3 | − (dec.) | 5 | + (inc.)

e) Answer

f is increasing on $(-\infty, -3)$ $(5, \infty)$ b/c $f' > 0$

f is decreasing on $(-3, 5)$ b/c $f' < 0$

2) $f(x) = e^{-3x}$

a) Domain

$(-\infty, \infty)$

b) $\frac{dy}{dx}$

$f'(x) = -3e^{-3x}$

c) $f' = 0$

never

f' = undef.

never

d) # line

f': − decreasing

e) Answer

f is always decreasing b/c $f' < 0$

3) $k(x) = \dfrac{x}{x^2 - 4}$

$(x+2)(x-2)$

a) D: $(-\infty,-2)(-2,2)(2,\infty)$

b) k'

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

$$k'(x) = \frac{x^2-4-2x^2}{(x^2-4)^2}$$

$$k'(x) = \frac{-x^2-4}{(x^2-4)^2}$$

c) $k'=0$

$-x^2-4=0$

$-4=x^2$

never

$k' = \text{undef.}$

$x^2-4=0$

$x^2=4$

$x=\pm 2$

d) # line

k': $-$ | -2 | $-$ | 2 | $-$

e) Answer

k is decreasing on $(-\infty,-2)(-2,2)(2,\infty)$ b/c $k'<0$

4) $g(x) = x^{\frac{1}{3}}(x+8)$

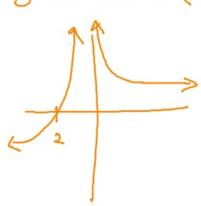
Do graphically

a) Domain

$(-\infty,\infty)$

b) $g'(x)$

$g'(x) = \text{nderiv}(x \wedge (1/3)(x+8), x, x)$



c) $g'=0$

$x=-2$

$g' = \text{undef}$

$x=0$

d) # line

g': $-$ | -2 | $+$ | 0 | $+$

e) Answer

$g(x)$ is inc. on $(-2,0)(0,\infty)$ b/c $g'>0$

$g(x)$ is decreasing on $(-\infty,-2)$ b/c $g'<0$