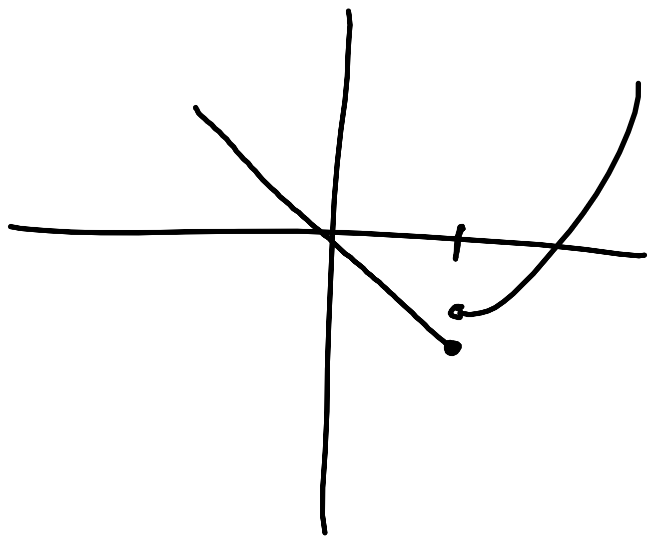
48

$$f(x) = \begin{cases} -2x & x \le 2 \\ x^2 - 4x + 1 & x > 2 \end{cases}$$

$-2(2) = -4$

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

$-4 \neq -3 \rightarrow$ non-removable discontinuity @ $x=2$



100

$V = \frac{4}{3}\pi(1)^3$

$= \frac{4}{3}\pi = 4.189$

$V = \frac{4}{3}\pi(5)^3$

$= \frac{500}{3}\pi = 523.599$

b/c 275 is b/w 4.189 + 523.599, by IVT there is a sphere w/ vol. 275 cm^3

76

$f(0) = 0^3 + 3(0) - 2 = -2$

$f(1) = 1^3 + 3(1) - 2 = 2$

b/c $-2 < 0 < 2$, by IVT there is a 0 in interval

78

$f(1) = -\frac{4}{1} + \tan\left(\frac{\pi \cdot 1}{8}\right) = -4 + 0.414 = -3.586$

$f(3) = -\frac{4}{3} + \tan\left(\frac{3\pi}{8}\right) = 1.081$

b/c 0 is b/w -3.586 + 1.081, by IVT there is a 0 in int.

- A limit in which $f(x)$ keeps increasing or decreasing toward $\pm\infty$ is known as an <u>infinite limit</u> (asymptotes !!!)

- While limits that keep going to $\pm\infty$ are infinite limits, what about limits where x approaches $\pm\infty$? Consider horizontal asymptotes. The line $y=b$ is a horizontal asymptote if

$$\lim_{x\to\infty} f(x) = b \quad \underline{\text{OR}} \quad \lim_{x\to-\infty} f(x) = b$$

<u>EX</u> → What are horizontal asymptotes of $f(x) = 2 + \frac{1}{x}$

$$\left.\begin{aligned} \lim_{x\to\infty} 2 + \frac{1}{x} &= 2 \\ \lim_{x\to-\infty} 2 + \frac{1}{x} &= 2 \end{aligned}\right\} \text{horizontal asymptote @ } y=2$$

|

- The line $x=a$ is a vertical asymptote if

$$\lim_{x\to a^+} f(x) = \pm\infty \quad \underline{\text{OR}} \quad \lim_{x\to a^-} f(x) = \pm\infty$$

<u>EX</u> → Vertical asymptotes of $f(x) = \dfrac{x^2+7x+10}{x^2-4} = \dfrac{(x+5)\cancel{(x+2)}}{\cancel{(x+2)}(x-2)}$

vertical asymptote @ $x=2$

hole @ $x=-2$

- Finding Limits of Rational Functions as $x \to \pm\infty$
  - General Rules
    1) Degree of Numerator < Degree of Denominator ⇒ limit = 0
    2) Degree of Numerator = Degree of Denominator ⇒ limit = ratio of leading coefficients
    3) Degree of Numerator > Degree of Denominator ⇒ limit = $\pm\infty$

<u>EX</u> → A) $\displaystyle\lim_{x\to\infty} \frac{5-2x^{3/2}}{3x^2-4} = 0$ B) $\displaystyle\lim_{x\to\infty} \frac{5-2x^{3/2}}{3x^{3/2}-4} = -\frac{2}{3}$ C) $\displaystyle\lim_{x\to\infty} \frac{5-2x^{3/2}}{3x-4} = -\infty$

HW: p. 88 → 4–52 mult. 4
p. 205 → 15–20, 35–38