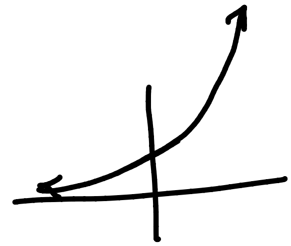
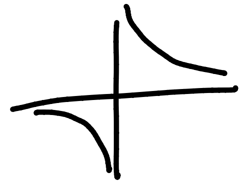
1. Use graphs to determine the limits at infinity below:

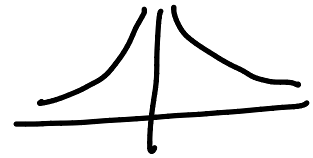


$\lim_{x\to\infty} e^x = +\infty$ $\qquad$ $\lim_{x\to\infty} e^x = 0$

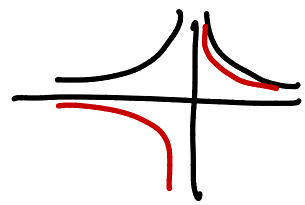
$*$ $\lim_{x\to\infty} e^{-x} = 0$ $\qquad$ $\lim_{x\to\infty} e^{-x} = \infty$



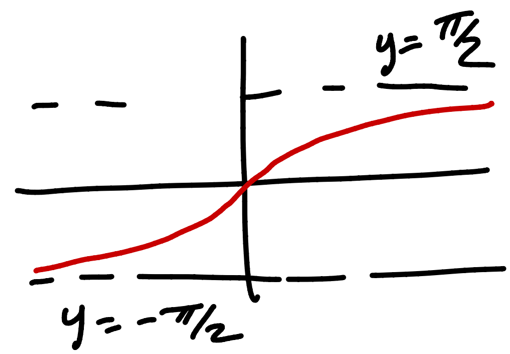
$\lim_{x\to\infty} \frac{1}{x} = 0$ $\qquad$ $\lim_{x\to\infty} \frac{1}{x} = 0$



$\lim_{x\to\infty} \frac{1}{x^2} = 0$ $\qquad$ $\lim_{x\to\infty} \frac{1}{x^2} = 0$



$\lim_{x\to\infty} \frac{1}{x^n} = 0$ $\qquad$ $\lim_{x\to\infty} \frac{1}{x^n} = 0$

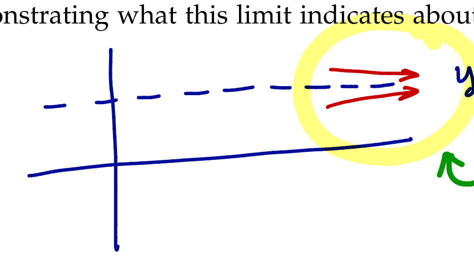


$\lim_{x\to\infty} \arctan(x) = \frac{\pi}{2}$ $\qquad$ $\lim_{x\to\infty} \arctan(x) = -\frac{\pi}{2}$

2. **Algebraically** find the limits below and draw a picture demonstrating what this limit indicates about the graph of the function.

$$\lim_{x\to\infty} \frac{(3x^2+4x)}{(2x^2+7)} \cdot \frac{(1/x^2)}{(1/x^2)} = \lim_{x\to\infty} \frac{3+\frac{4}{x}}{2+\frac{7}{x^2}}$$

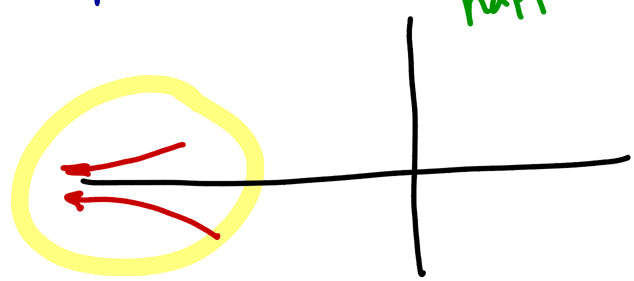
$$= \frac{3+0}{2+0} = \frac{3}{2}$$



something like this is happening

$$\lim_{x\to-\infty} \frac{(3x^2+4x)}{(2x^4+7)} \cdot \frac{(1/x^4)}{(1/x^4)} = \lim_{x\to\infty} \frac{\frac{3}{x^2}+\frac{4}{x^3}}{2+7/x^4}$$

$$= \frac{0+0}{2+0} = \frac{0}{2} = 0$$



something like this is happening.

3. Find all vertical and horizontal asymptotes in the graph of the function $g(s) = \frac{\sqrt{3s^2+1}}{2s+1}$.

Vertical asymptotes: look close to $s = -1/2$

$$\lim_{s \to -\frac{1}{2}^+} \left(\frac{\sqrt{3s^2+1}}{2s+1} \right) = +\infty$$

answer $s = -\frac{1}{2}$ is a vertical asymptote.

thinking: $s \approx -0.4$

as $s \to -0.5^+$, $\sqrt{3s^2+1} \to +\sqrt{5/2} > 0$

and $2s+1 \to 0^+$

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horizontal asymptotes : limits at infinity

- $$\lim_{s \to \infty} \frac{\left(\sqrt{3s^2+1}\right)}{(2s+1)} \frac{(1/s)}{(1/s)} = \lim_{s \to \infty} \frac{\sqrt{\frac{3s^2+1}{s^2}}}{2 + \frac{1}{s}} = \lim_{s \to \infty} \frac{\sqrt{3 + \frac{1}{s^2}}}{2 + \frac{1}{s}} = \frac{\sqrt{3}}{2}$$

answer: $y = \sqrt{3}/2$ is a horizontal asymptote

- $$\lim_{s \to -\infty} \frac{\left(\sqrt{3s^2+1}\right)}{(2s+1)} \frac{(1/s)}{(1/s)} = \lim_{s \to -\infty} \frac{-\sqrt{\frac{3s^2+1}{s^2}}}{2 + \frac{1}{s}} = \lim_{x \to -\infty} \frac{-\sqrt{3 + 1/s^2}}{2 + 1/s}$$

$$= -\sqrt{3}/2$$

answer: $y = -\sqrt{3}/2$ is also an asymptote.