MARQUESES, LORENZ BERNARD B.
CSMATH1-S16

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

VERTICAL ASYMPTOTES

$\text{dom } f = (-\infty, \infty) = \mathbb{R}$

∴ There are no vertical asymptotes.

HORIZONTAL ASYMPTOTES

$$\lim_{x\to+\infty} f(x) = \lim_{x\to+\infty} \frac{-3x}{\sqrt{x^2+3}}$$

$$= \lim_{x\to+\infty} \frac{-\sqrt{9x^2}}{\sqrt{x^2+3}}$$

$$= \lim_{x\to+\infty} -\sqrt{\frac{9x^2}{x^2+3}} = -\sqrt{\lim_{x\to+\infty} \frac{9x^2}{x^2+3}}$$

$$= -\sqrt{\lim_{x\to+\infty} \frac{9}{1+\frac{3}{x^2}}}$$

$$= -\sqrt{\frac{9}{1+0}} \text{ by Theorem 22} = -3$$

∴ There is a horizontal asymptote at $y = -3$

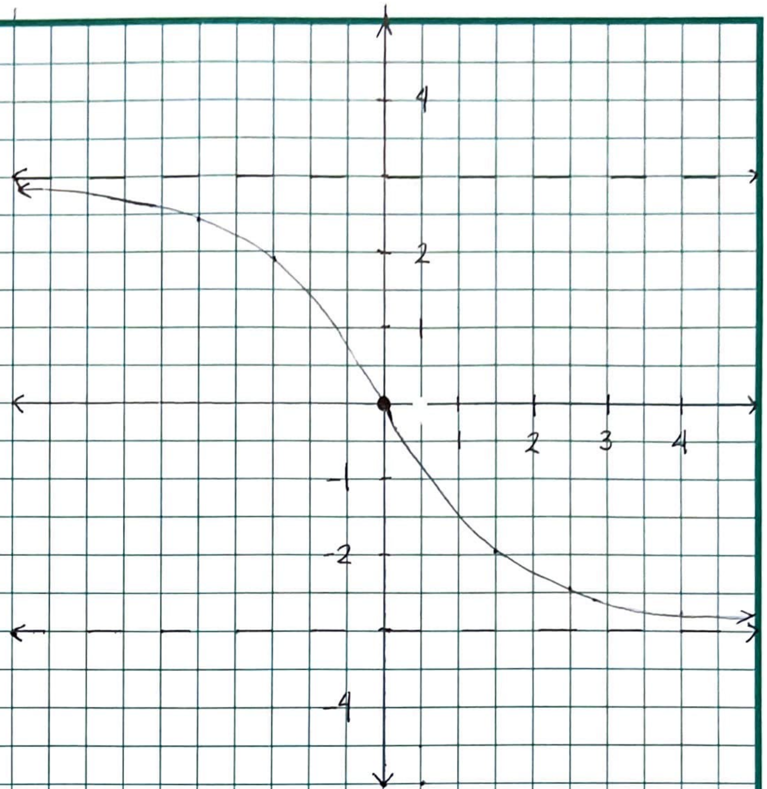
Investigate $\lim_{x\to-\infty} f(x)$, considering $x < 0 \rightarrow -x = \sqrt{x^2}$
$\leftrightarrow x = -\sqrt{x^2}$

$$\lim_{x\to+\infty} f(x) = \lim_{x\to+\infty} \frac{-3(-\sqrt{x^2})}{\sqrt{x^2+3}} = \lim_{x\to+\infty} \sqrt{\frac{9x^2}{x^2+3}}$$

$$= \sqrt{\lim_{x\to+\infty} \frac{9x^2}{x^2+3}}$$

$$= \sqrt{\frac{9}{1+0}} \text{ by Theorem 22} = 3$$

∴ There is a horizontal asymptote at $y = 3$



X-INTERCEPTS

$$\frac{-3x}{\sqrt{x^2+3}} = 0$$

$$-3x = 0$$

$$x = 0$$

∴ There is an x-intercept at (0, 0)

Y-INTERCEPTS

$$f(0) = \frac{-3(0)}{\sqrt{0^2+3}}$$

$$= 0$$

∴ There is a y-intercept at (0, 0)