3.1: Reciprocal of a Linear Funcon

Raonal Funcon:

- A funcon of the form $\frac{p(x)}{q(x)}$, where *p(x)* and *q(x)* are both polynomial funcons, *q(x)* cannot be zero.

Asymptote:

- A line that a curve approaches more and more closely but does **not** intersect. The line may be a vercal asymptote, a horizontal asymptote, or an oblique asymptote.

Reciprocal Funcon:

- If *y = g(x),* then its reciprocal funcon is $f(x) = \frac{1}{g(x)}$. When *g(x) = 0,* then there is a vercal asymptote for *f(x).*

Example 1: Characteriscs of a Reciprocal of a Linear Funcon

Consider the funcon $f(x) = \dfrac{1}{2x+1}$

$F(x) = 1/g(x)$

$g(x) = 2x+1$

$0 = 2x+1$

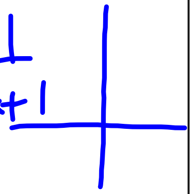
$\frac{-1}{2} = x$

$1/x$

(a) State the domain

$D: \{x \in \mathbb{R}, x \neq -1/2\}$

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



(b) Determine the x-intercept

$\frac{0}{1} = \frac{1}{2x-1}$ no x-int.

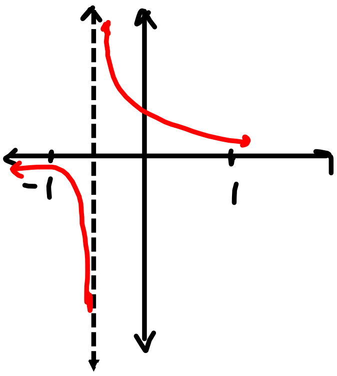
$0 = 1$ } not possible.

(c) Determine the y-intercept

$f(x) = \frac{1}{2x+1}$ $f(0) = \frac{1}{2(0)+1} = \frac{1}{+1}$ y-int is +1.

(d) Describe the behaviour of the funcon near the vercal asymptote

$f(x) = \frac{1}{2x+1}$ vertical asymptote at $x = -1/2$



$x \to -\frac{1}{2}^{+}$, $y \to +\infty$

$x \to -\frac{1}{2}^{-}$, $y \to -\infty$

w/o graph,

$x \to -\frac{1}{2}^{+}$, $f(0) =$

$f(-0.25) =$

$f(-0.49) =$

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

$f(-3/4) =$

$f(-0.51) =$

(e) Describe the end behaviour

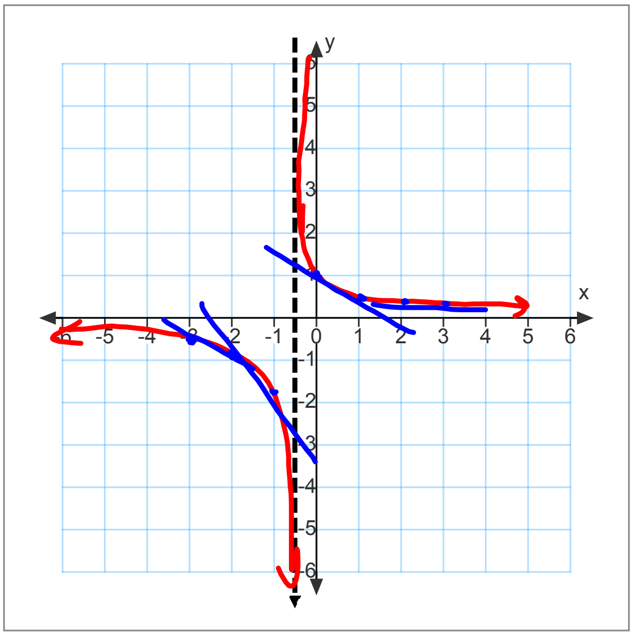
$x \to \infty,\ y \to 0$

$x \to -\infty,\ y \to 0$

$\therefore$ There is a horizontal asymptote at $y=0$

(f) Sketch the graph of the funcon

$y = \frac{1}{x}$



D: $\{x \in \mathbb{R}, x \neq -1/2\}$

R: $\{y \in \mathbb{R}, y \neq 0\}$

(g) State the range

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(h) Describe the intervals where the slope is increasing and the intervals where the slope is decreasing in the two branches of *f(x).*

slope is increasing on the interval
$(-1/2, \infty)$.

slope is decreasing on the interval
$(-\infty, -1/2)$.

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