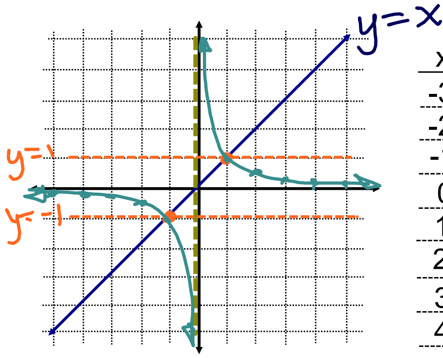
7.4 Reciprocal Functions

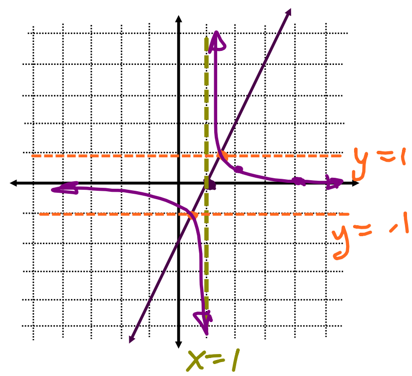
* If $y = f(x)$ is a function, then its reciprocal function is defined by $y = \frac{1}{f(x)}$.
In this case, the reciprocal function has a restriction on its domain everywhere that $f(x)$ = *zero* x-intercepts

* $y = \frac{1}{x}$ is the mother function of all reciprocal functions.

ex. Graph $y = x$ and its reciprocal as well as $y = 2x - 2$ and its reciprocal
mx+b



x	1/x	2x-2	1/(2x - 2)
-3	-1/3	-8	-1/8
-2	-1/2	-6	-1/6
-1	-1	-4	-1/4
0	∅	-2	-1/2
1	1	0	∅
2	1/2	2	1/2
3	1/3	4	1/4
4	1/4	6	1/6



What happens at x = 0?
undefined value

when $x = \frac{3}{2}$
$y = \frac{1}{2(\frac{3}{2})-2} = \frac{1}{1} > 1$

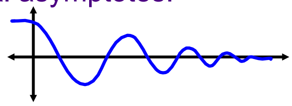
What happens at x = 1?
f(x) is undefined

We call these vertical asymptotes

Do either graphs cross the x-axis? NO

We call these horizontal asymptotes.

$y = e^{-x}\sin x$



Def^n: a vertical asymptote is a line that a function approaches without ever crossing it. A horizontal asymptote is similar but can occasionally be crossed.

* For any reciprocal function, the restrictions on the domain will result in vertical asymptotes (or holes... but we shouldn't see that until PC12).

* To graph an inverse function:

1) graph the base function y = f(x) and determine its zeroes
2) Use a dotted line to show the vertical asymptotes. These will occur wherever f(x) crosses the x-axis.
3) Determine the invariant points. These occur where f(x) crosses the lines y = 1 and y = -1

parent function

4) Do not make a table of values! Remember:
   - When f(x) gets large, the reciprocal function approaches zero
   - When f(x) gets small the reciprocal function approaches infinity
   - When f(x) is positive, the reciprocal function is also positive
   - When f(x) is negative the reciprocal function is also negative
   - Make sure your inverse function never crosses a vertical asymptote

ex. graph $y = \dfrac{1}{2x - 5}$

graph $y = 2x - 5$

draw the invariant lines @ $y = \pm 1$ → place the invariant points where the parent function crosses $y = \pm 1$

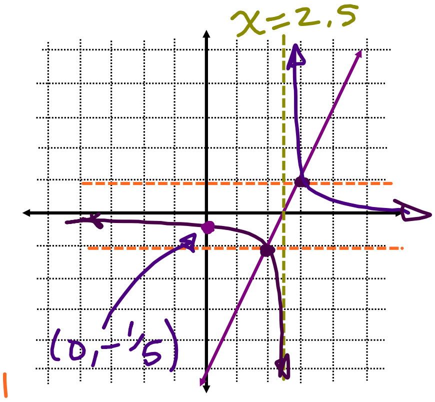
→ vertical asymptote where

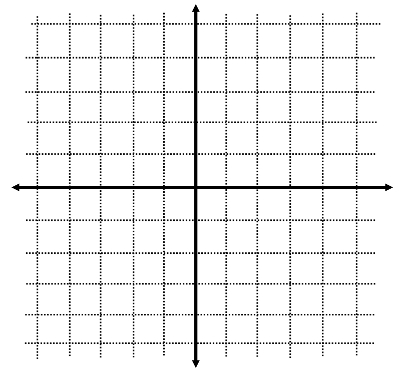
$2x - 5 = 0 \Rightarrow \boxed{x = 5/2}$

$2x = 5$

find y-int: $x = 0$

$y = \dfrac{1}{2(0) - 5} = -\dfrac{1}{5} \Rightarrow (0, -1/5)$





Your turn pg. 398

ex. graph $y = \dfrac{1}{x^2 + 2x - 3}$

graph the denominator

$y = x^2 + 2x - 3$

$= (x-1)(x+3)$

→ zeroes @ $\boxed{x = 1}$ and $\boxed{x = -3}$

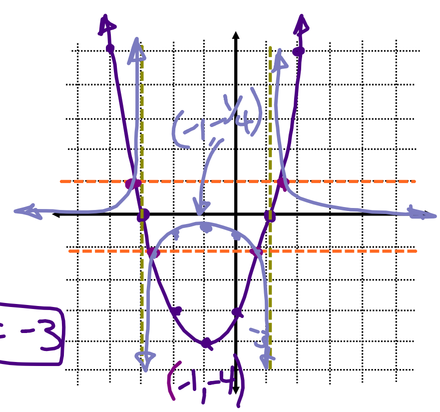
* AOS: $x = \dfrac{-b}{2a} = -1$

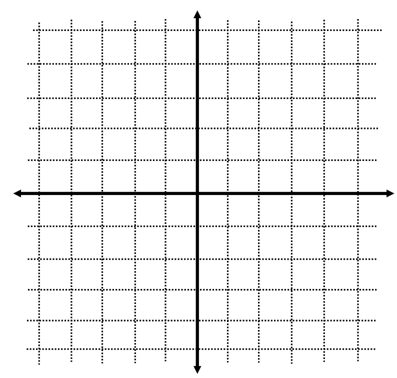
$y_v = (-1)^2 + 2(-1) - 3$

$y_v = -4$

$\Big\}$ v $(-1, -4)$

* y-int: $y = -3$





Your turn pg. 401

Homefun: 7.4 Pg. 403 #1-6, 7ab, 8ab, 9, 10-12, 17, 18