AGS 3 Name: ______________________________ Period: _____ Date: ___________

Notes 4.2 – Transformation of Rational Functions

Warmup

Find the zeroes (roots) for each polynomial.

1. $p(x) = (x+4)(x-2)(x-7)$

$x = -4, 2, 7$

2. $p(x) = (2x-6)(8x-1)(x-5)$

$x = 3, \frac{1}{8}, 5$

3. $p(x) = (9x+3)(x^2-9)$

$x = -\frac{1}{3}, 3, -3$

4. $p(x) = x^2 + 25$

$x = \pm 5i$ (no real roots)

Use the values that you found in #1-4 to help you write the domain of each function.

5. $q(x) = \frac{1}{(x+4)(x-2)(x-7)}$

D: $x \neq -4, 2, 7$

6. $q(x) = \frac{1}{(2x-6)(8x-1)(x-5)}$

D: $x \neq 3, \frac{1}{8}, 5$

7. $q(x) = \frac{1}{(9x+3)(x^2-9)}$

D: $x \neq -\frac{1}{3}, 3, -3$

8. $q(x) = \frac{1}{x^2+25}$

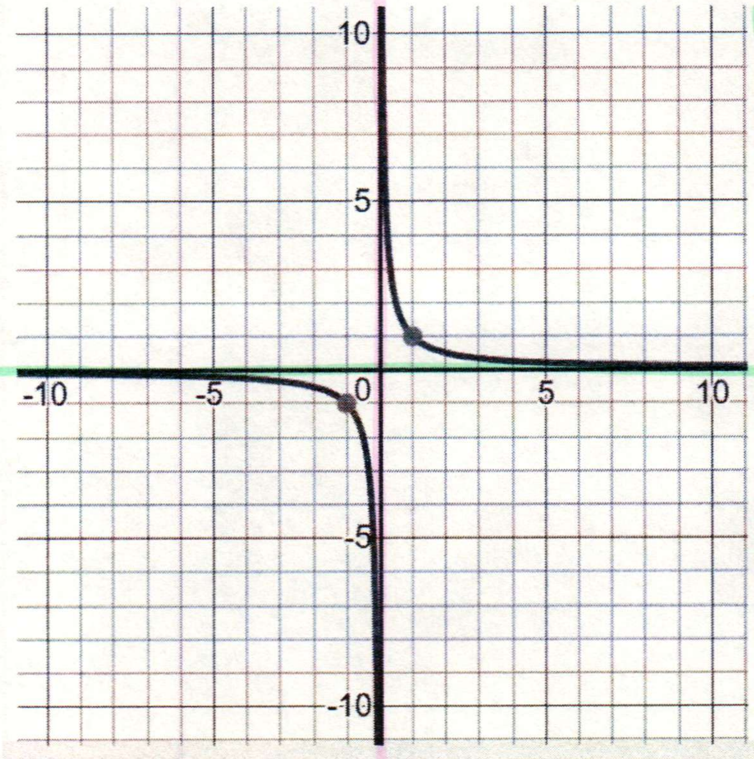
D: $\mathbb{R}$

9. What is general rule for finding the domain of a rational function?

The domain can be any number except a value that makes the denominator equal to zero.

Investigation – Transformations of Rational Functions

Here is the graph of $y = \frac{1}{x}$



Horizontal Asymptote: $y = 0$

Vertical Asymptote: $x = 0$

Anchor Points:

$(1, \underline{1})$ and $(-1, \underline{-1})$

$(\frac{1}{2}, \underline{2})$ and $(-\frac{1}{2}, \underline{-2})$

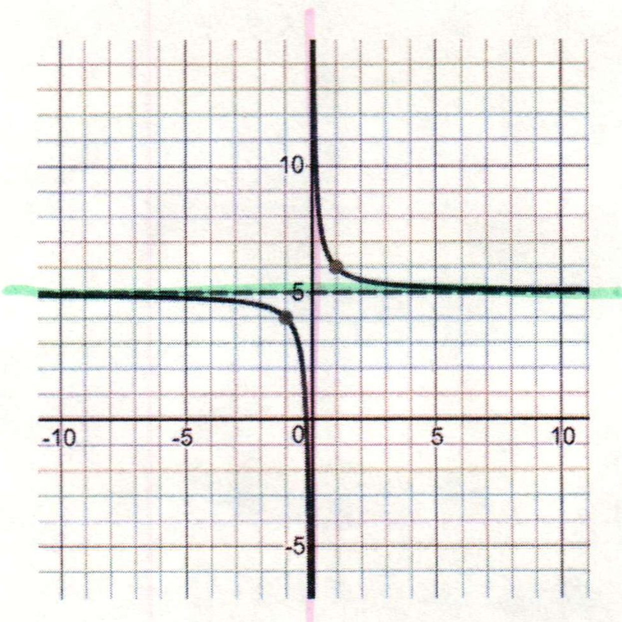
$(2, \underline{\frac{1}{2}})$ and $(-2, \underline{-\frac{1}{2}})$

Domain: $x \neq 0$

Range: $y \neq 0$

Now use what you know about transformations and the anchor points from above to write equations for each given graph or description.

a.

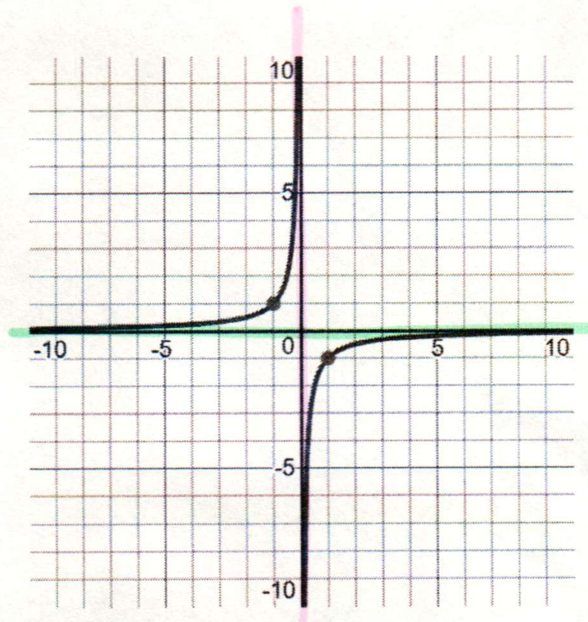


up 5

y=

$y = \frac{1}{x} + 5$

b.



reflect

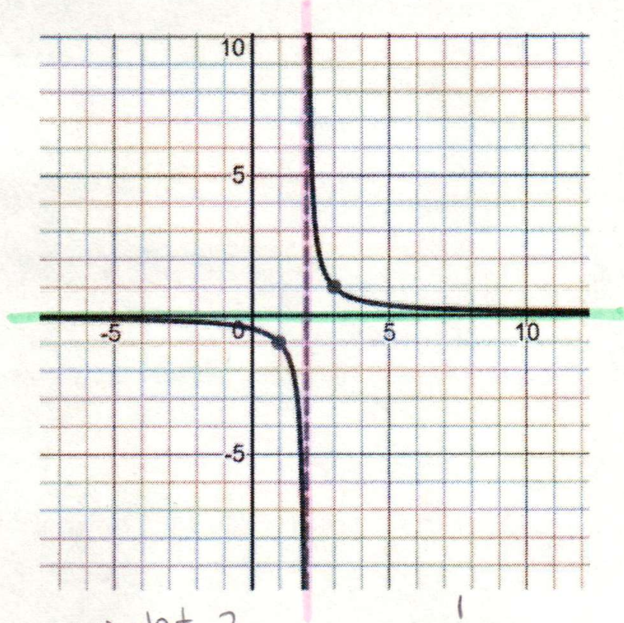
$y = -\frac{1}{x}$

c. Vertical Asymptote: $x = -3$
Horizontal Asymptote: $y = 0$
Points: $(-2, 1)$ and $(-4, -1)$
y-int: $\left(0, \frac{1}{3}\right)$

left 3

$y = \frac{1}{x+3}$

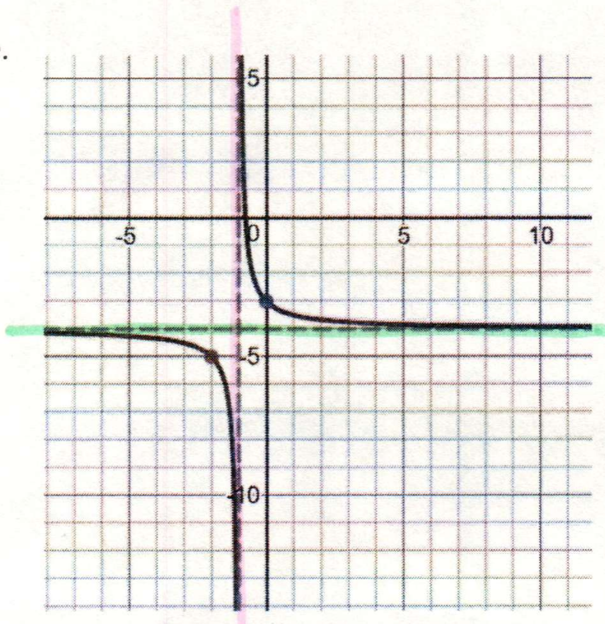
d.



right 2

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

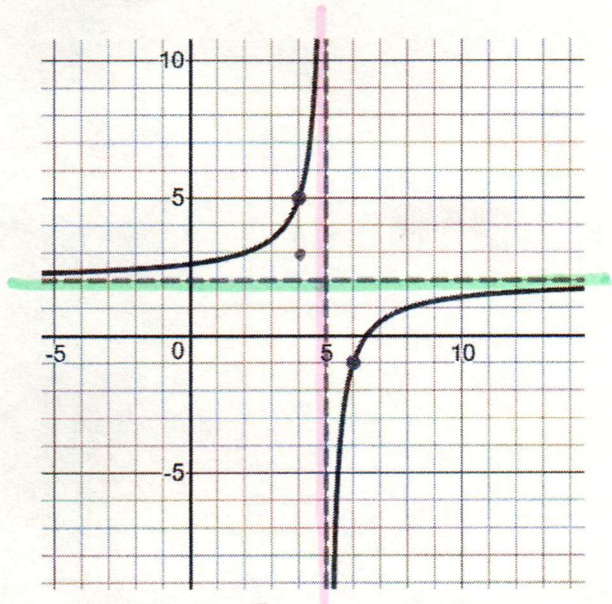
e.



left 1
down 4

$y = \frac{1}{x+1} - 4$

f.



stretch 3
right 5
up 2
reflect

$y = \frac{-3}{x-5} + 2$

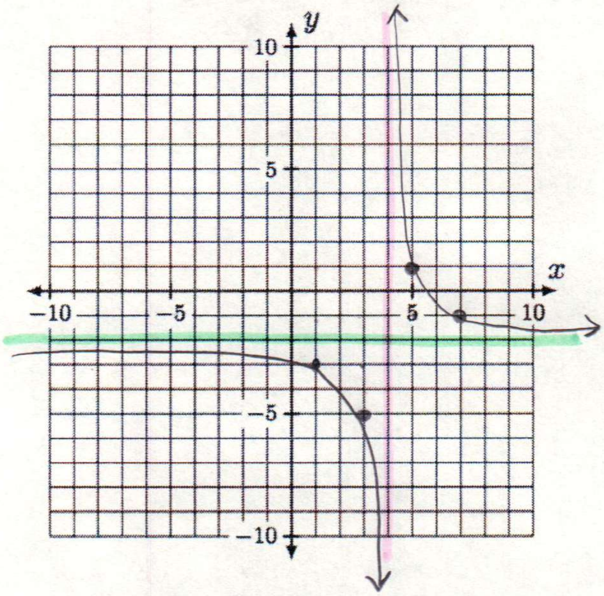
g. Match the transformation with the equation.

$y = \frac{1}{x+b}$	C	A) Reflection over the x-axis.
$y = b + \frac{1}{x}$	B	B) Vertical shift of b, making the horizontal asymptote $y = b$.
$y = \frac{b}{x}$	D	C) Horizontal shift left b, making the vertical asymptote $x = -b$.
$y = \frac{-1}{x}$	A	D) Vertical stretch by a factor of b
$y = \frac{1}{x-b}$	E	E) Horizontal shift right b, making the vertical asymptote $x = b$.

Without using technology, graph the given functions using what you know about transformations.

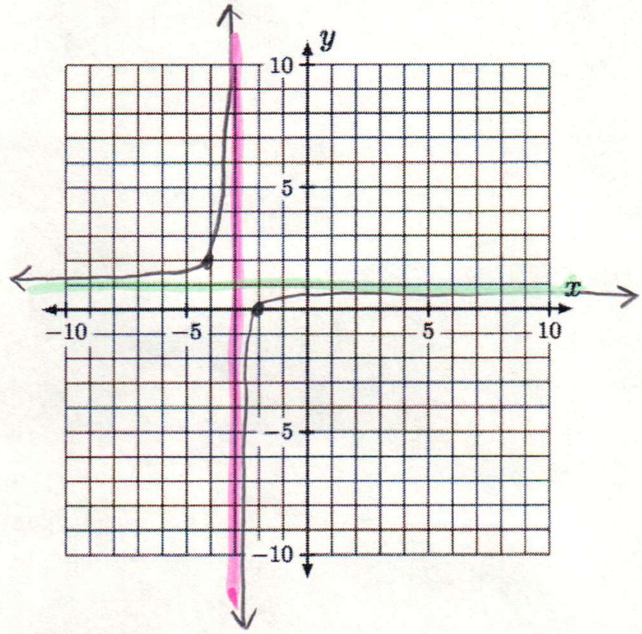
h. $y = -2 + \frac{3}{x-4}$

down 2
right 4
stretch 3



i. $y = 1 - \frac{1}{x+3}$

up 1
reflect
left 3



Describe the features of the function:

$$y = k + \frac{b}{x-h}$$

Vertical Asymptote: $x = h$

Horizontal Asymptote: $y = k$

Vertical Stretch: b

Domain: $x \neq h$ or $(-\infty, h) \cup (h, \infty)$

Range: $y \neq k$ or $(-\infty, k) \cup (k, \infty)$

Anchor Points: $(h+1, k+b)$ and $(h-1, k-b)$