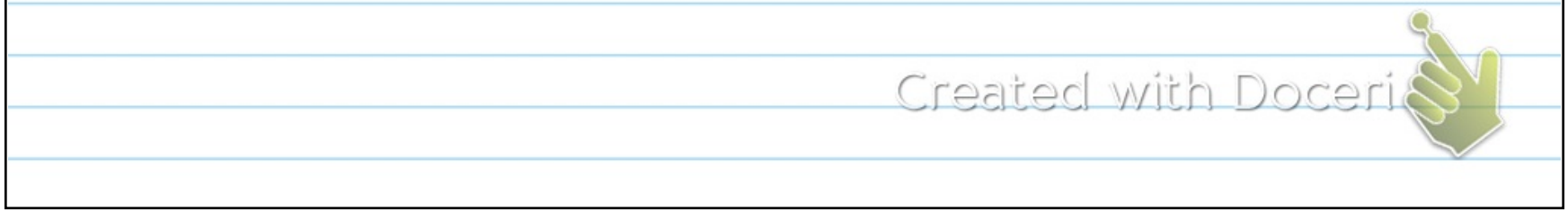
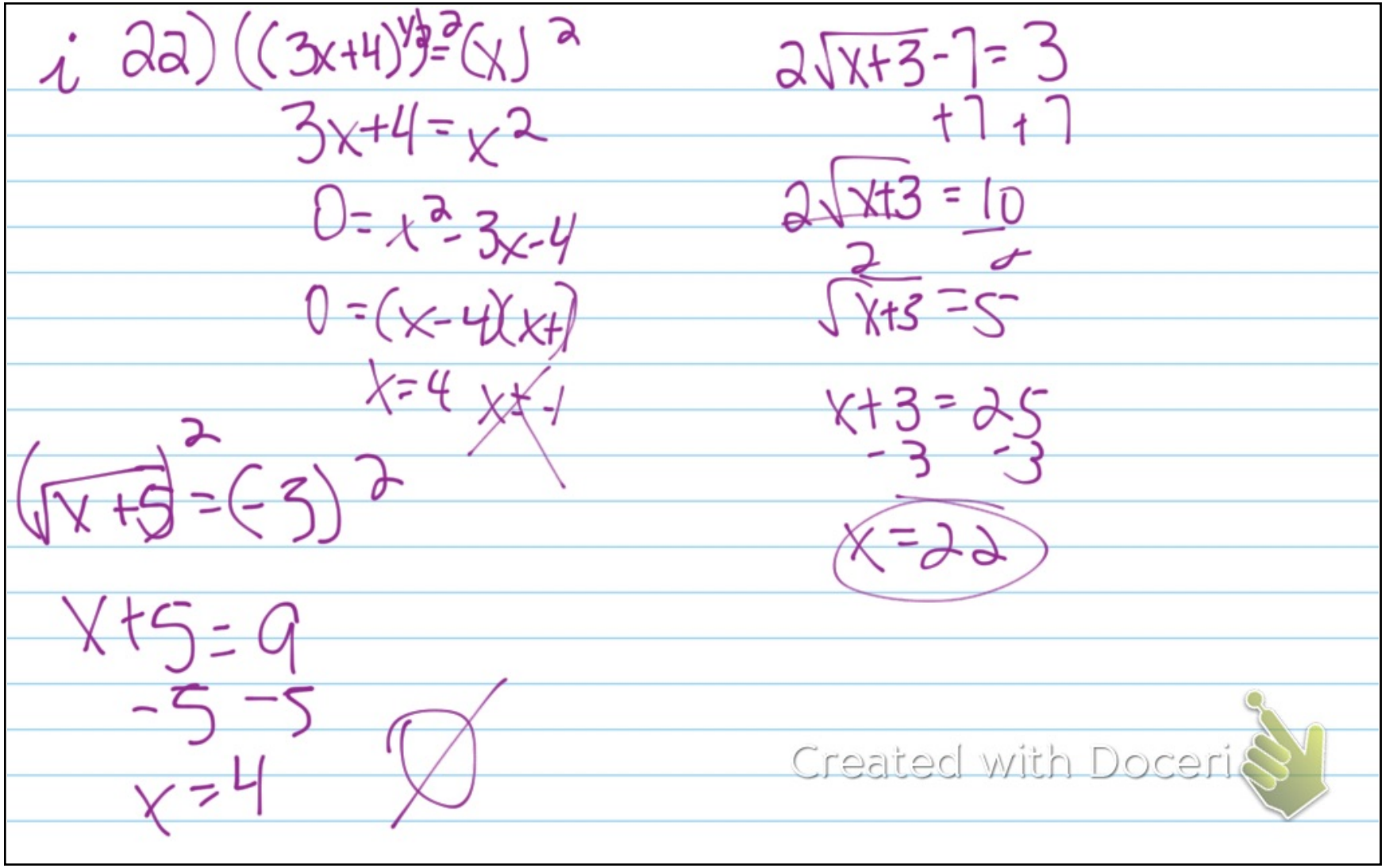
# Unit 4
# Lesson 5

## Graphs of Rational Functions




i 22) $((3x+4)^{1/2})^2 = (x)^2$
$3x+4 = x^2$
$0 = x^2 - 3x - 4$
$0 = (x-4)(x+1)$
$x = 4$ $x \neq -1$
$(\sqrt{x+5})^2 = (-3)^2$
$x+5 = 9$
$-5 \quad -5$
$x = 4$
$2\sqrt{x+3} - 7 = 3$
$+7 \quad +7$
$\frac{2\sqrt{x+3}}{2} = \frac{10}{2}$
$\sqrt{x+3} = 5$
$x+3 = 25$
$-3 \quad -3$
$x = 22$
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Math 2 – Honors
Unit 4 –Radical & Rational Functions
Lesson 5 → Graphs of Rational Functions

Name_____
Date_____ Pd__

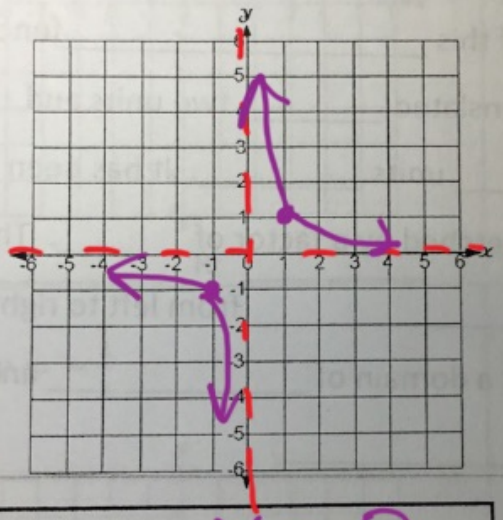
- A rational function is a function that can be written as the ratio of two polynomials where the denominator does not equal zero.
- $f(x) = \frac{p(x)}{q(x)}$ where $q(x) \neq 0$

$(x-h)^2+k$
L, R
up & down
0

❖ **Steps to graph a rational function:** $y = \frac{n}{x-h} + k$

1) Determine the location of the asymptotes based on the transformations:
   A) Vertical asymptotes are placed based on the **horizontal translation**: $x = h$
   B) Horizontal asymptotes are placed based on the **vertical translation**: $y = k$
2) **Vertical Stretch or Compression**: $n$ tells us how far the branches have been stretched from the asymptotes. We can use it to help us find out corner points to start our branches.
   **Distance from asymptotes** = $\sqrt{n}$
3) Look at the table on the calculator for other points and then sketch the two branches.

1. $y = \frac{1}{x+0} + 0$



Equation of VA: $x = 0$

Equation of HA: $y = 0$

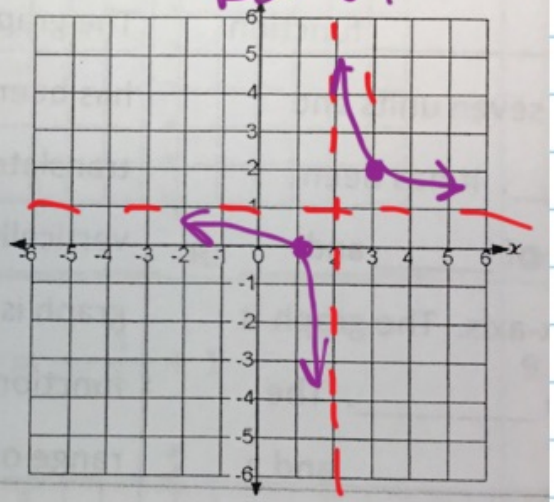
Describe ~~translations~~ transformations: N/A

Domain: $(-\infty, 0) \cup (0, \infty)$ $x \neq 0$

Range: $(-\infty, 0) \cup (0, \infty)$ $y \neq 0$

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

R2 U1



Equation of VA: $x = 2$

Equation of HA: $y = 1$

Describe ~~translations~~ transformations: R2, U1

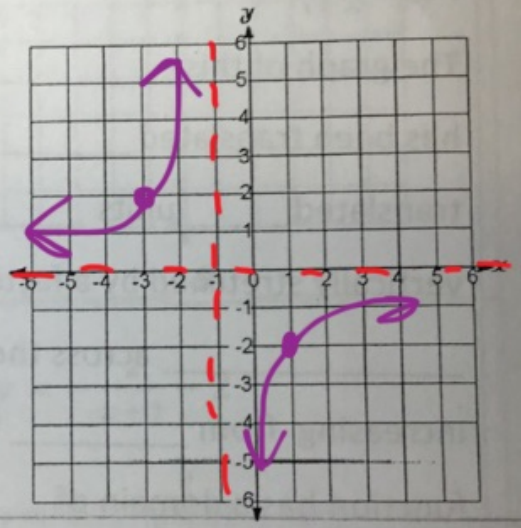
Domain: $(-\infty, 2) \cup (2, \infty)$ $x \neq 2$

Range: $(-\infty, 1) \cup (1, \infty)$ $y \neq 1$

$(x+3)^2 - 2$

L3 down2

3. $y = -\frac{4}{x+1} + 0$



Equation of VA: $x = -1$

Equation of HA: $y = 0$

Describe ~~translations~~: reflect across x-axis, Stretch by 4, left 1

Domain: $(-\infty, -1) \cup (-1, \infty)$

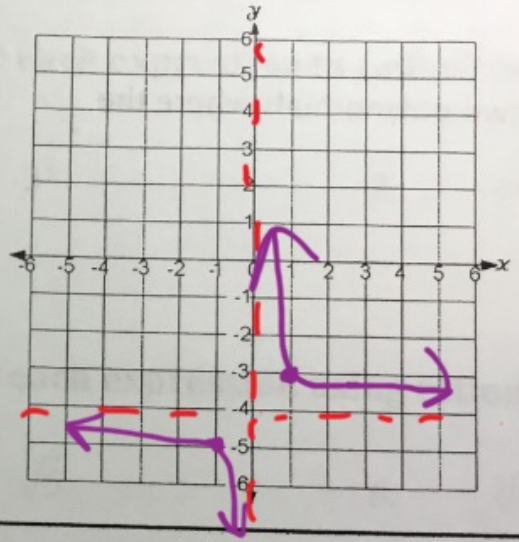
Range: $(-\infty, 0) \cup (0, \infty)$

$x \neq -1$

$y \neq 0$

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

$x \neq 0$



Equation of VA: $x = 0$

Equation of HA: $y = -4$

Describe ~~translations~~: D4

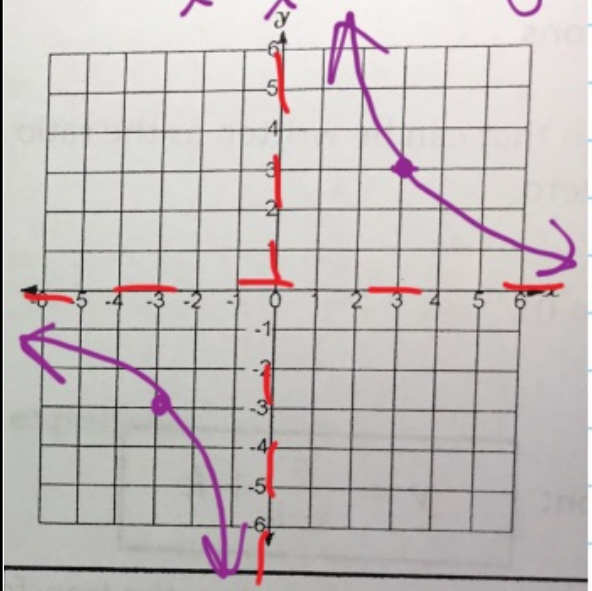
Domain: $x \neq 0$ $(-\infty, 0) \cup (0, \infty)$

Range: $y \neq -4$ $(-\infty, -4) \cup (-4, \infty)$

5. $xy = 9$

$\frac{xy}{x} = \frac{9}{x}$

$y = \frac{9}{x}$



Equation of VA: $x = 0$

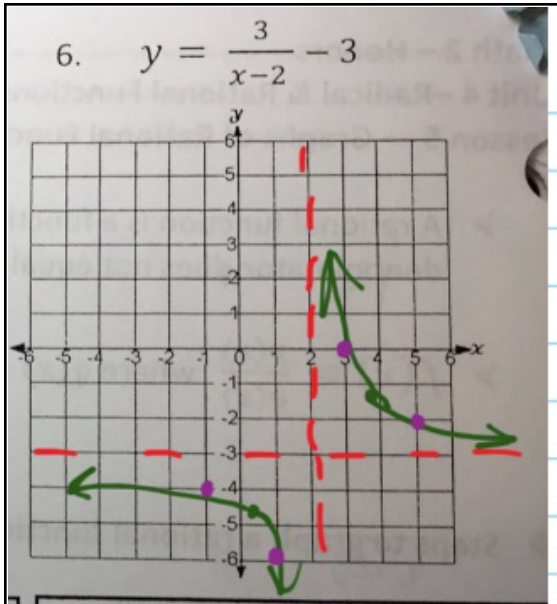
Equation of HA: $y = 0$

Describe translations: stretch by 9

Domain: $x \neq 0$

Range: $y \neq 0$

6. $y = \frac{3}{x-2} - 3$



Equation of VA: $x = 2$

Equation of HA: $y = -3$

Describe ~~translations~~: S by 3, R2, D3

Domain: $x \neq 2$

Range: $y \neq -3$

7. Describe each graph as compared to the parent graph $y = \frac{1}{x}$.

$y = \frac{-2}{x-7} + 5$

The graph of this rational function has been translated right seven units and translated 5 units up. It has been vertically stretched by a factor of 2 and reflected across the x-axis. The graph is increasing from left to right. The function has a domain of $x \neq 7$ and a range of $y \neq 5$.

$y = \frac{7}{x+2} - 4$

The graph of this rational function has been translated left two units and translated 4 units down. It has been vertically stretched by a factor of 7. The graph is decreasing from left to right. The function has a domain of $x \neq -2$ and a range of $y \neq 4$.

8. Write the equation of a rational function $y = \frac{1}{x}$ with following transformations:

A. Right 4 and Down 5 $y = \frac{1}{x-4} - 5$

B. Left 3 and Up 2 and Reflected across $x - axis$. $y = -\frac{1}{x+3} + 2$

C. Left 6 and Vertically Stretched by a factor of 4. $y = \frac{4}{x+6}$

D. Right 5 and graph will be in II & IV quadrants $y = \frac{-1}{x-5}$

HW: Pg 20-21