Chapter 7 Calendar

Name: ____________________

Day	Date	Assignment (Due the next class meeting)
Monday Tuesday	1/3/22 (A) 1/4/22 (B)	7.1 Worksheet Factoring Review
Wednesday Thursday	1/5/22 (A) 1/6/22 (B)	7.2 Worksheet Simplifying Rational Expressions
Friday Monday	1/7/22 (A) 1/10/22 (B)	7.3 Worksheet Multiplying and Dividing Rational Functions
Tuesday Wednesday	1/11/22 (A) 1/12/22 (B)	7.4 Day 1 Extra Worksheet Adding Rational Functions
Thursday Friday	1/13/22 (A) 1/14/22 (B)	7.4 Day 2 Worksheet Adding and Subtracting Rational Functions
Monday	1/17/22	MLK Day
Tuesday Wednesday	1/18/22 (A) 1/19/22 (B)	7.5 Worksheet Solving Rational Equations
Thursday Friday	1/20/22 (A) 1/21/22 (B)	Unit 7 Practice Test
Monday Tuesday	1/24/22 (A) 1/25/22 (B)	Unit 7 Extra Review
Wednesday Thursday	1/26/22 (A) 1/27/22 (B)	**Unit 7 Test**
Friday Monday	1/28/22 (A) 1/31/22 (B)	6.3 Worksheet Polynomial division, remainder and factor theorems
Tuesday Wednesday	2/1/22 (A) 2/2/22 (B)	6.4 Worksheet Rational Roots Theorem
Thursday Friday	2/3/22 (A) 2/4/22 (B)	7.6 Worksheet Inverse Variation and the Reciprocal Function
Monday	2/7/22	PD Day
Tuesday Wednesday	2/8/22 (A) 2/9/22 (B)	7.7 Worksheet Graphing with Rational Functions
Thursday Friday	2/10/22 (A) 2/11/22 (B)	Graphing Review
Monday Tuesday	2/14/22 (A) 2/15/22 (B)	**Unit 7 Graphing Quiz**

- Be prepared for daily quizzes.
- Every student is expected to do every assignment for the entire unit.
- Try www.khanacademy.org if you need help outside of school hours.
- Student who complete 100% of their homework second semester will receive a 2% bonus to their grade! Students with no late homework will receive a pizza party too!

7.1 Notes: Review of Factoring

1) **Create a polynomial that has 3 unique factors.**

2) **Now create a binomial that factors to a pair of conjugates.**

Greatest Common Factor:	**Difference of Squares**	**Trinomials w/ leading coefficient of 1**
Trinomials w/ leading coefficient other than 1.	**Factor by Grouping:**	**Sum/Difference of Cubes**

7.2 Notes: Simplifying Rational Expressions

Factor the following completely:

1) $4x^2 - 25$

2) $x^2 + 8x + 12$

3) $3x^2 - x - 2$

4) $8x^4 + 2x^2$

5) $8x^3 + 16x^2 - 10x$

Things to remember about factoring…

Rational Function:

<u>Domain of a Rational Function:</u>

Examples: Find the domain of the following rational functions (write it in words and in set notation).

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

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

3) $y = \frac{x+4}{(x+3)(x-1)}$

You try! Find the domain of the following rational functions in set notation.

a) $y = \frac{x+2}{5x}$

b) $y = \frac{6}{(x+7)(x-8)}$

Simplified Form of a Rational Expression:

Examples: Simplify the following and state the domain in set notation (or where the expression is undefined).

1) $\frac{x^2+7x+10}{x^2-4}$

2) $\frac{x^2+5x+4}{x^2+x-12}$

3) $\frac{4x^2-1}{6x^2+5x-4}$

4) $\frac{3x^2-24x}{3x^3-15x^2-72x}$

You try! Simplify the following and state the domain in set notation.

Choose one of the following to complete from a – c.

a) $\frac{4x^2+8x}{x^2-4}$

b) $\frac{x^2-x-12}{2x^2-7x-4}$

c) $\frac{2x+3}{2x^2-11x-21}$

d) Create a rational function where the numerator and denominator are quadratic functions that reduce to $\frac{x+6}{x-2}$.

e) Write a rational function that has the following restrictions on the domain: $x \neq -4, 1$.

7.3 Notes: Multiplying and Dividing Rational Functions

Explain how you would multiply $\frac{3}{8} \cdot \frac{12}{9}$. How would you divide $\frac{3}{8} \div \frac{12}{9}$?

Multiplying Rational Expressions:

1) **Factor if possible**
2) **Reduce any common factors from the numerator and denominator**
3) **Multiply the numerators and denominators**

Examples: Simplify and state any restrictions on the domain.

1) $\frac{x^2+4x}{x^2-4x-12} \cdot \frac{x^2-9x+18}{2x}$

2) $\frac{6x^2+18x}{x^2+x-6} \bullet \frac{x^2-x-2}{3x^2+x-2}$

You try! Simplify and state any restrictions on the domain.

a) $\frac{2x-7}{x^2-3x-4} \cdot \frac{x+1}{x^2-16}$

b) $\frac{5x^2-28x-12}{x^2+11x+30} \bullet \frac{x^2-2x-35}{x+4}$

Dividing Rational Expressions:

1) Take the ___________ of the fraction after the division sign

2) Multiply

Examples: Simplify and state any restrictions on the domain.

4) $\frac{2x^2+x-3}{8x^2+12x} \div \frac{x^2-1}{2x+3}$

5) $\frac{x^2-25}{x^2+2x-3} \div \frac{x+5}{x^2-3x-18}$

You try! Simplify and state any restrictions on the domain.

a) $\frac{x^2-9}{x^2-4x-12} \div \frac{x^2+2x-3}{2x^2-15x+18}$

b) $\frac{3x^2-11x-4}{3x-27} \div \frac{x-4}{6}$

Example 6) The area of a rectangle is $x^2 + 13x + 36$ units squared and the height of the rectangle is x + 4 units. Write an expression to represent the base of the rectangle.

7.4 Notes: Adding and Subtracting Rational Functions

Explain how you would simplify: $\frac{2}{3} + \frac{1}{9}$

Explain how you would simplify: $\frac{3}{2} - \frac{5}{4}$

Find a rational expression that when added to $\frac{x+1}{5x}$ would give a common denominator of $5x(x+3)$.

Adding/Subtracting Rational Expressions:

1) **Factor the ____________________ if possible**
2) **Get a ________________ denominator**
3) **Add or subtract the numerators**
4) **Reduce**

Examples: Simplify and state where the domain is undefined.

1) $\frac{9}{x+7} + \frac{2}{x+7}$

2) $\frac{2x}{x+6} - \frac{5}{x+6}$

Examples: Find the Least Common Multiple

3) $2x$ and $3x^2$

4) $2x - 2$ and $x^2 - 1$

Examples: Simplify and state where the domain is undefined.

5) $\frac{7}{2x} - \frac{4x+12}{3x^2}$

6) $\frac{x}{2x-2} - \frac{x}{x^2-1}$

7) $\frac{x+1}{x^2+6x+9} + \frac{6}{x^2-9}$

5) $\frac{3}{x-4} + \frac{2x}{x-4} - \frac{11}{x^2-16}$

You try! Simplify and state any restrictions on the domain.

a) $\frac{x}{x+6} + \frac{-72}{x^2-36}$

b) $\frac{2}{x+6} - \frac{3x-4}{x+6}$

7.5 Notes: Solving Rational Equations

Strategies for solving rational equations:

Reminder: Rational expressions *cannot* equal ___________ on the denominator. Any value of *x* that would give a zero on a denominator is a domain restriction.

Examples: Solve each equation for the variable. Include the restrictions on the domain.

1) $\frac{x}{x+3} = \frac{6}{x-1}$

2) $\frac{x-1}{x+4} = \frac{x+3}{x+9}$

4) $\frac{5}{x} + \frac{7}{4} = \frac{-9}{x}$

5) $\frac{1}{x+3} - \frac{8}{x-3} = \frac{2}{x-3}$

6) $\frac{1}{x+1} - \frac{8}{x-2} = \frac{2}{x^2-x-2}$

7) $\frac{7x^2}{x^2-16} = \frac{3x}{x+4} + \frac{4x}{x-4}$

8) $\frac{2x}{x+3} + \frac{3x}{x-4} = \frac{5x^2-7x+2}{x^2-x-12}$

9) $\frac{x}{x+2} - \frac{8}{x^2-4} = \frac{2}{x-2}$

6.3 Notes: Dividing Polynomials

Long Division

Divide using long division:

$473 \div 12$

What steps did you do?

Divide $f(x) = x^3 + 3x^2 - 7$ *by* $x^2 - x - 2$

1) Divide $f(x) = 3x^4 - 5x^3 + 4x - 6$ by $x^2 - 3x + 5$

2) $(2x^3 + 10x^2 + 6x - 18) \div (2x + 6)$

Write about it: Imagine that you had to get in front of the class and explain how to do long division with polynomials. Write a paragraph describing what you would say to the class to help them understand the process.

Synthetic Division

A shorthand method for dividing a polynomial by $x - a$ is called synthetic division. It is similar to long division, but you use only the coefficients.

3) Divide $(2x^3 + x^2 - 8x + 5)$ by $(x + 3)$

4) Divide $(4x^3 - 3x + 7)$ by $(x - 1)$

Factor Theorem: a polynomial $f(x)$ has a factor $x - a$ if and only if $f(a)=0$
(REMAINDER = 0)

5) Factor $f(x) = 3x^3 - 4x^2 - 28x - 16$ completely given that $x + 2$ is a factor.

**Because you know x+2 is a factor, you know that f(-2) = 0 or that x = -2 is a root. Use synthetic division to find the other factors.*

6) Factor the polynomial completely given that f(x) = $x^3 - 6x^2 + 5x + 12$ and that x - 4 is a factor.

7) Find the other zeros of f given that $f(2) = 0$ and $f(x) = x^3 - x^2 - 22x + 40$

8) Find the other solutions of f given that x = -7 is a root and $f(x) = x^3 + 8x^2 + 5x - 14$

6.4 Notes: Rational Root Theorem

The Fundamental Theorem of Algebra: Any polynomial of degree **n** has at most **n** roots, both real and complex.

1) How many x-intercepts does the following function have? $f(x) = 7x^5 - 4x^2 + 1$

2) With a partner try to solve (find the roots of) the polynomial, $x^3 + 7x^2 + 15x + 9 = 0$.

Can it be factored? Any other ways to solve it?

If we know <u>possible roots</u> we can use synthetic division to tell if they are <u>actual roots</u>! So how do we find a possible root?

The Rational Zeros Theorem: If $f(x)$ is a polynomial with integer coefficients and if $\frac{p}{q}$ is a zero of $f(x)$, then p is a factor of the constant term of $f(x)$ and q is a factor of the leading coefficient of $f(x)$.

3) Make a list of all possible rational zeros of $f(x)$ given below.

Steps for finding possible roots:
1. Write down all the factors of the constant term (p)

$f(x) = 2x^4 + x^3 - 19x^2 - 9x + 9$

2. Write down all the factors of the leading coefficient (q)
3. Write down all the possible value of $\frac{p}{q}$. Remember to include both positive and negative factors.
4. Remove any duplicate values.

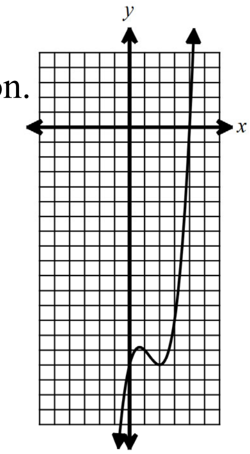
4) Make a list of all possible roots for the function, $f(x) = x^3 + x^2 - 8x - 12$.

Now use synthetic division to see which possible roots are actual solutions to *f(x)*. If it is a solution the remainder needs to be equal to _________.

5) Which of the following are <u>not possible solutions</u> to the function below. Choose all that apply! $f(x) = 2x^4 + 5x^3 - 5x^2 - 5x + 3$

A. 2 B. $-\frac{3}{2}$ C. 1 D. $\frac{1}{2}$ E. $-\frac{2}{3}$ F. 3 G. $\frac{1}{3}$

6) The equation $x^3 - 4x^2 + 4x - 16 = 0$ is graphed to the right.
Use the graph to help solve the equation and find all the roots of the function.



7) a. Find all possible roots of the function, $g(x) = 2x^4 - 3x^3 + 7x^2 + 12x$.

b. Use the possible roots and synthetic division to find the solutions.

7.6 Notes: Inverse Variation and the Reciprocal Function

Inverse Variation:
Inverse variation is a relation between two variables such that as one variable increases, the other decreases proportionally. $(xy = k)$

Ex 1) In an inverse variation, $x = 6$ and $y = \frac{1}{2}$. What is the value of y, when $x = 15$.

Ex 2) If x and y vary inversely and $x = 4$ when $y = 32$. What is the value of x when $y = 16$.

Ex 3) Determine if the following table of values represent inverse variation?

a)

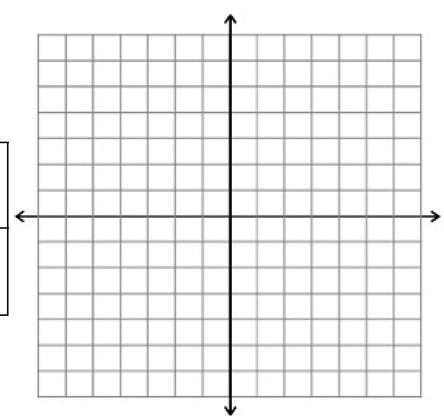
x	1	2	3	4	6	12
y	12	6	4	3	2	1

b)

x	1	2	3	4	5	6
y	20	17	14	11	8	5

Parent Function for Rational Functions: $f(x) = \frac{1}{x}$
Graph by using a table of values.

x	-3	-2	-1	$-\frac{1}{2}$	$-\frac{1}{3}$	$-\frac{1}{4}$	0	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	1	2	3
y													



Key Features
Domain: Range:

Vertical Asymptote (VA): Horizontal Asymptote (HA):

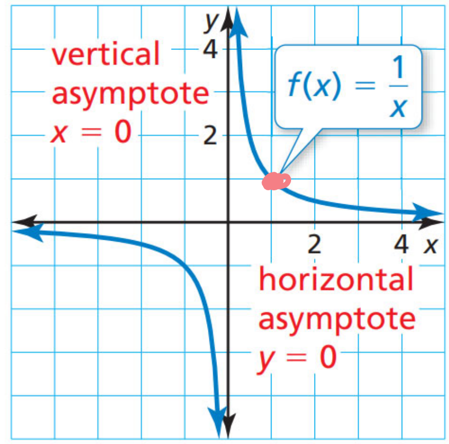
End Behavior: as $x \to \infty, f(x) \to$ ______
as $x \to -\infty, f(x) \to$ ______

Graphing the Simple Rational function:

$$\boldsymbol{y = \frac{a}{x}}$$

The graph of the parent function $f(x) = \frac{1}{x}$ is a hyperbola, which consists of two symmetrical parts called branches. The domain and range are all nonzero real numbers.

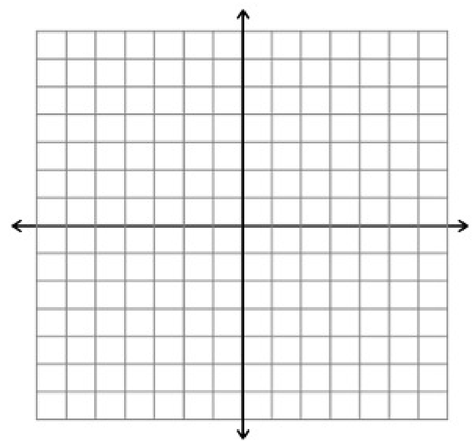
Any function of the form $f(x) = \frac{1}{x}$ (a ≠ 0) has the same asymptotes, domain, and range as the function $f(x) = \frac{1}{x}$.



Examples: Graph the following and state the transformation from the parent function $f(x) = \frac{1}{x}$, the domain, range (in set notation), and the vertical and horizontal asymptotes.

1) $y = \frac{4}{x}$

Transformations:



D:

R:

VA:

HA:

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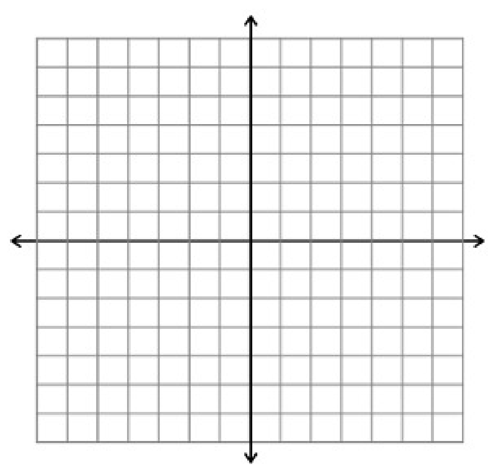
2) $y = \frac{-3}{x}$

Transformations:



D:

R:

VA:

HA:

Translations of Simple Rational Functions

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

Example 3: Translate the graph of $f(x) = \frac{1}{x}$ to the left 5 units and up one unit. Write the equation of the function after the translation.

Example 4: Identify the transformations from the parent function $f(x) = \frac{1}{x}$

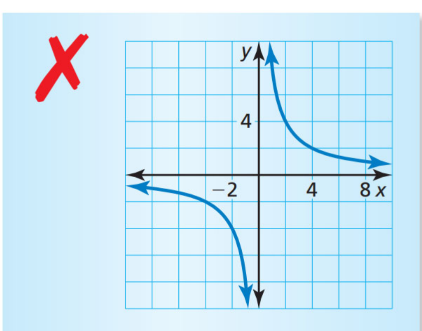
a. $f(x) = \frac{1}{x-6} + 2$

b. $f(x) = \frac{-1}{x+2} - 4$

c. $f(x) = \frac{5}{x} + 1$

d. $f(x) = \frac{-2}{x-3}$

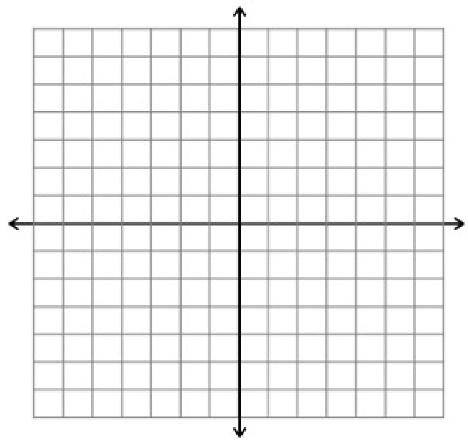
Example 5: Describe and correct the error in graphing the function $f(x) = \frac{-8}{x}$



7.7: Graphing Rational Functions in the Form $y = \frac{a}{x-h} + k$

Examples: Graph the following and state the transformation from the parent function $f(x) = \frac{1}{x}$, the domain, range (in set notation), and the vertical and horizontal asymptotes.

1) $y = \frac{4}{x-3} + 2$



Transformations:

D:

R:

VA:

HA:

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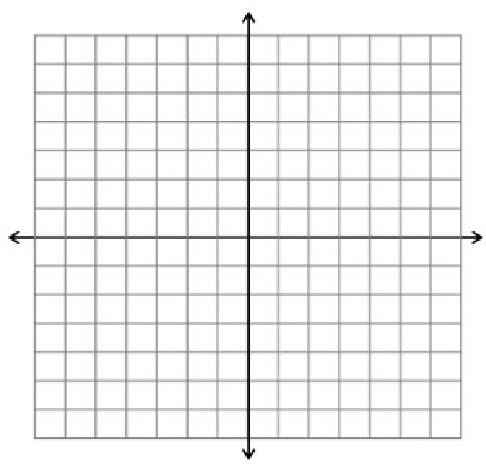
2) $y = \frac{-6}{x+1} - 3$



Transformations:

D:

R:

VA:

HA:

Changing Rational Expressions of the form $y = \frac{ax+b}{cx+d}$ to Graphing Form $y = \frac{a}{x-h} + k$

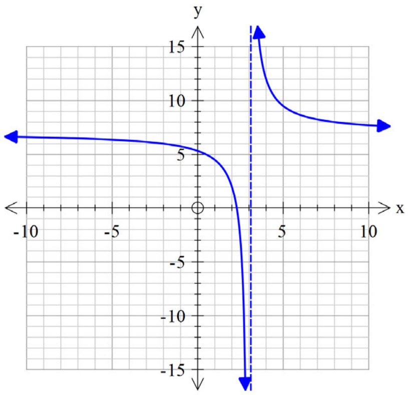
Example 4: How could you change $f(x) = \frac{5x-7}{x-4}$ to graphing form?

Write the following rational expression in graphing form: $f(x) = \frac{5x-7}{x-4}$. Then identify the HA and VA.

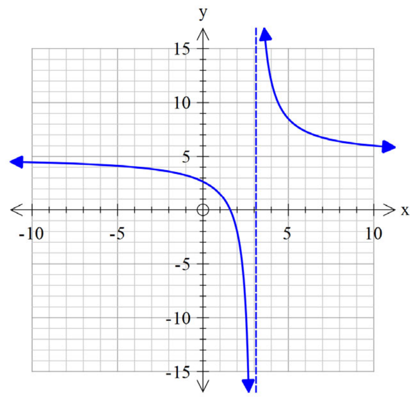
Example 5: Write the following rational expression in graphing form: $f(x) = \frac{-2x+1}{x+5}$. Then identify the HA and VA.

Example 6: Which is the graph of $f(x) = \frac{5x-8}{x-3}$?

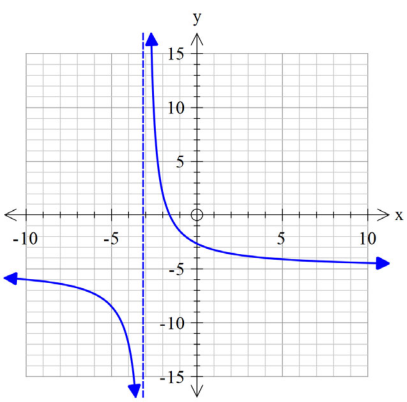
A)



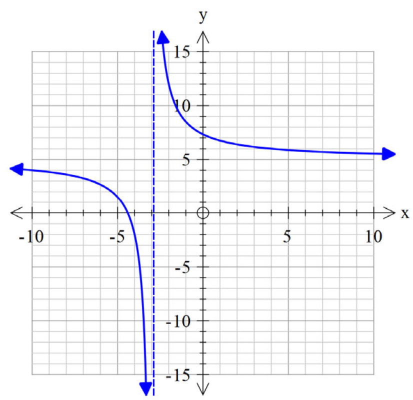
B)



C)



D)



Example 7: Find the end behavior of $y = \frac{3x+5}{x+4}$.