MODULE 9 – RATIONAL FUNCTIONS

Module 9: Lessons 1 & 2 – Add/Subtract/Multiply Divide Rational Expressions

Add/Subtract Fractions Evaluate.

1. $\frac{1}{2}+\frac{2}{5}$	2. $\frac{3}{7}-\frac{1}{4}$	3. $\frac{6}{5}+\frac{7}{2}-\frac{3}{4}$	4. $\frac{1}{4}+\frac{2}{x}$

Multiply/Divide Fractions Evaluate each.

5. $\frac{3}{8}\cdot\frac{2}{7}$	6. $\frac{15}{4}\cdot\frac{14}{9}$	7. $\frac{x^2}{3}\cdot\frac{21}{x}$
8. $\frac{5}{2}\div\frac{1}{2}$	9. $\frac{10}{3}\div\frac{14}{21}$	10. $\frac{x^3}{15}\div\frac{x}{5}$

Multiply/Divide Rational Expressions

*Simplify each Rational Expression. Discuss the idea of quantities vs. terms.

11. $\frac{x+7}{x}\cdot\frac{x-7}{(x-7)(x+7)}$	12. $\frac{(x+6)(x-2)}{(x+1)}\div\frac{(x-7)(x-2)}{(x-7)}$	13. $\frac{x+8}{x^2-6x-27}\cdot\frac{x^2+8x+15}{2x+16}$

Add/Subtract Fractions

*Simplify each Rational Expression. Identify restrictions for x.

14. $\frac{3}{x+1}+\frac{7}{x-2}$	15. $\frac{x}{x+1}-\frac{7}{x-2}$

Working with Opposite Expressions.

*Simplify each Rational Expression.

16. $\frac{1}{(x-7)} \cdot \frac{(7-x)}{8}$	17. $\frac{18x^6}{x-5} \div \frac{12x}{5-x}$
18. $\frac{5}{2x-9} + \frac{3x}{9-2x}$	19. $\frac{c+3}{3c-2} + \frac{2c+1}{2-3c} + \frac{3c-1}{-2+3c}$

Working with other Occurrences with Rational Expressions.

*Simplify each Rational Expression. (Talk about how to check answers with a calculator.) Identify restrictions for x.

20. $\frac{1}{3} + \frac{x}{12}$	21. $\frac{3}{x+2} + 2$	22. $\frac{3x}{x^2+3x-10} - \frac{6}{x^2+3x-10}$
23. $\frac{x-1}{x^2-1} - \frac{2x}{x^2-2x+1}$	24. $\frac{\frac{x^2+12x+35}{x^2-3x-40}}{\frac{x^2+9x+14}{x^2-64}}$	

Module 9: Lessons 6 – Solving Rational Equations

Intro: Cross-Multiply each of the following to solve for x.
*** Solve for x.**

25. $\frac{x}{9}=\frac{5}{3}$	26. $\frac{7}{4}=\frac{1}{x}$	27. $5=\frac{3x+1}{2}$

Reattempt each problem by multiplying both sides of equation by denominator values until denominators are gone.

28. $\frac{7}{4}=\frac{1}{x}$	29. $5=\frac{3x+1}{2}$

Cross-Multiplication is …

30. Solve for x. $\frac{x}{3}+\frac{2x}{5}=10$	
a. Combine fractions on each side of equation and then cross-multiply.	b. Multiply both sides of the equation by the denominator values.

Focus: Multiply both sides of the equation by the denominator values.
Identify any solution restrictions before beginning.
Solve for x.

31. $\frac{a}{7}-\frac{a-5}{2}=3$	**32.** $\frac{2}{3c}=\frac{5+c}{4c}-\frac{5}{12}$
33. $\frac{2}{x+3}+\frac{3}{x+4}=\frac{7}{x^2+7x+12}$	**34.** $\frac{x-1}{x+1}-\frac{6}{x-3}=3$

Module 9: Lessons 3 & 4 – Graphing Reciprocal and Rational Functions

Investigating the function $f(x) = \frac{1}{x}$

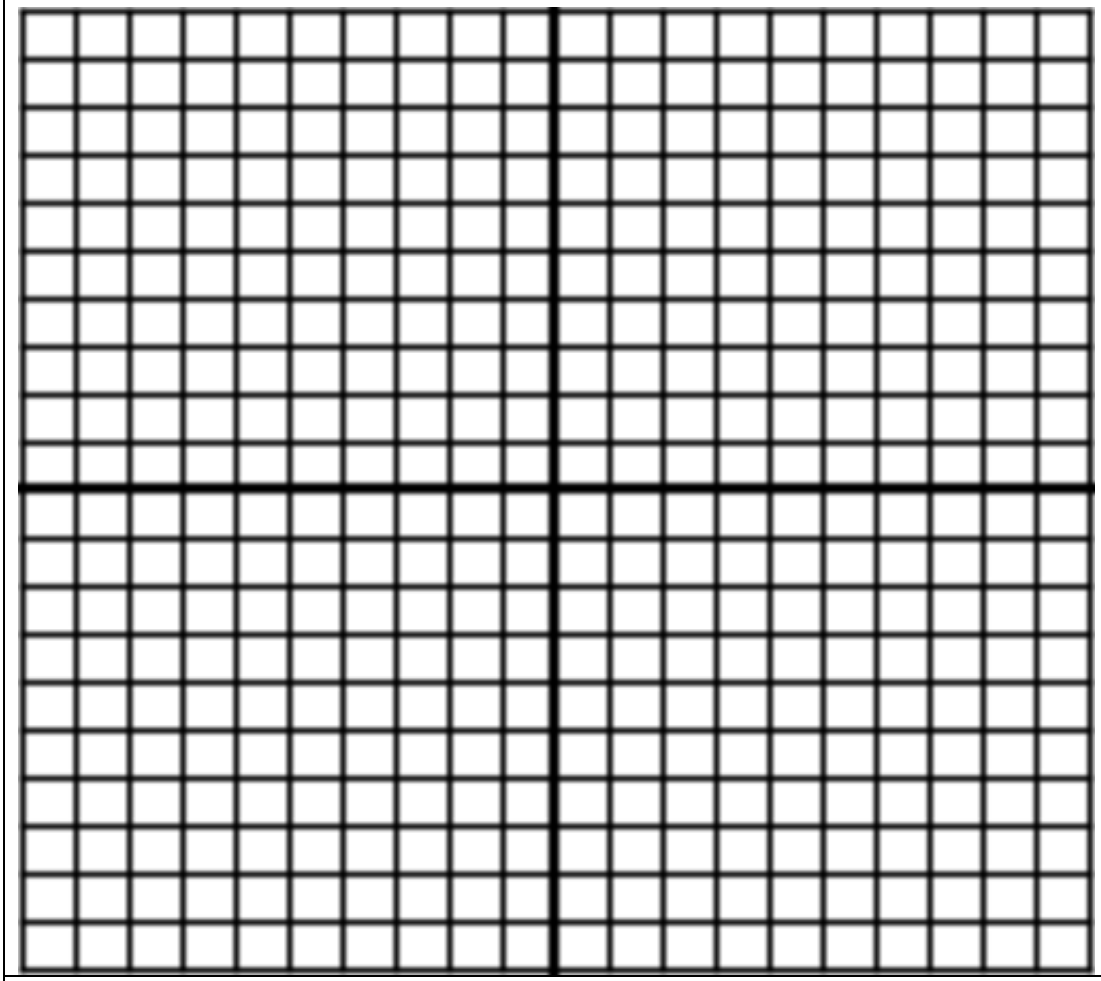
1. Use your calculator to graph the function $f(x) = \frac{1}{x}$

a. Use Zoom 6 to see what the function looks like.

b. Use Table to accurately sketch the function in the cell below.

c. What are the coordinates of the two easiest points to remember from this table?

2.



3. Remember the term asymptote from the unit on exponents and logarithms. Remember that an asymptote is an imaginary line that a function approaches but never quite reaches.

The function $f(x) = \frac{1}{x}$ has two asymptotes. Describe each of these.

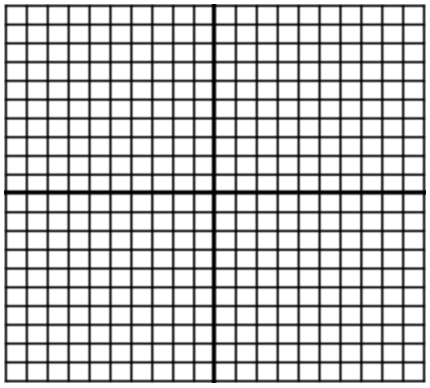
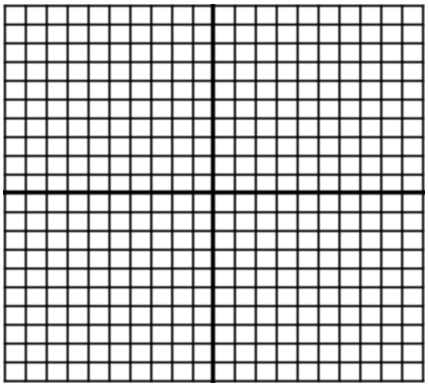
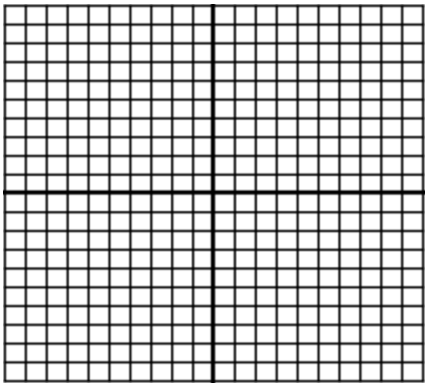
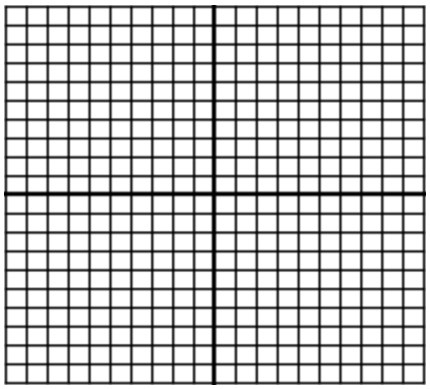
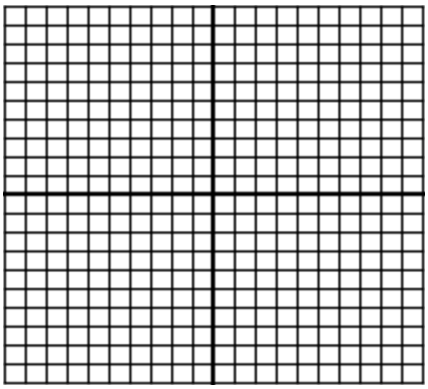
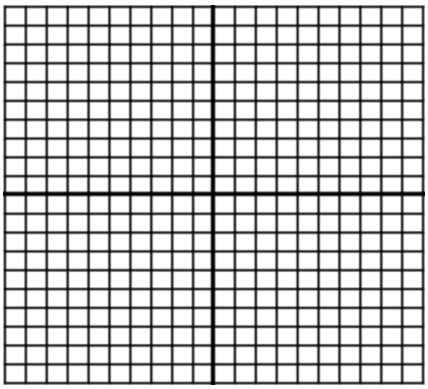
Identify the Domain and Range of this function.

4. Transformations of $f(x) = \frac{1}{x}$

Use your understanding of transformations to describe each transformation from the parent function $f(x) = \frac{1}{x}$.

a. $y = \frac{1}{x} + 3$	b. $y = \frac{1}{x-2}$	c. $y = -\frac{1}{x}$
d. $y = \frac{1}{x+4} - 1$	e. $y = \frac{1}{-x}$	f. $y = \frac{-1}{x-5}$

5. Draw a rough sketch of each of the following. Identify the Domain and Range of each.

a. $y = \frac{1}{x} + 3$ 	b. $y = \frac{1}{x-2}$ 	c. $y = -\frac{1}{x}$ 
d. $y = \frac{1}{x+4} - 1$ 	e. $y = \frac{1}{-x}$ 	f. $y = \frac{-1}{x-5}$ 

* For the given function determine the horizontal asymptote, discontinuities, domain, holes, and vertical asymptotes. Then accurately graph the function. Choose a scale that allows you to use most of the space on the grid.

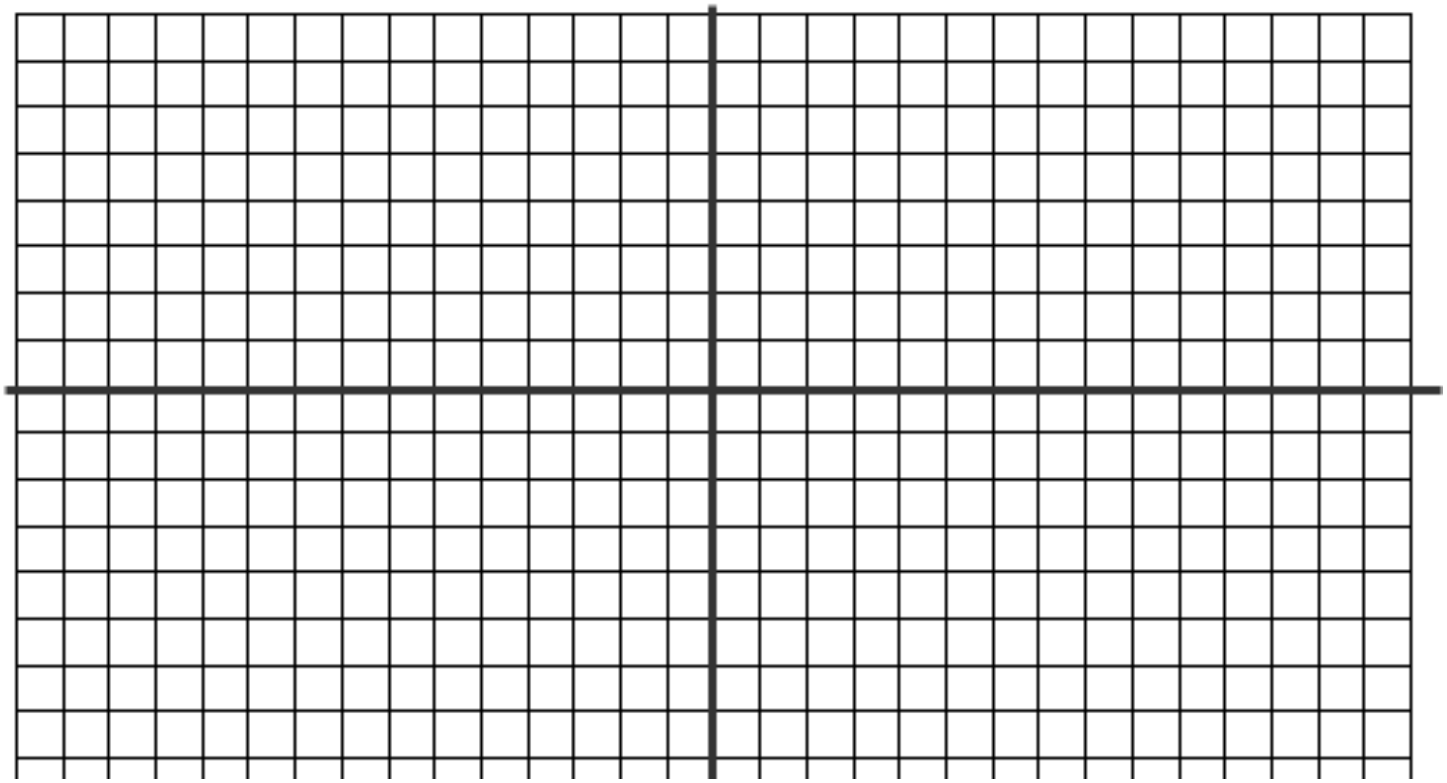
Scenarios for determining horizontal asymptotes:

a. If the degree of the numerator is less than the degree in the denominator, then the horizontal asymptote is represented by the line y = 0.

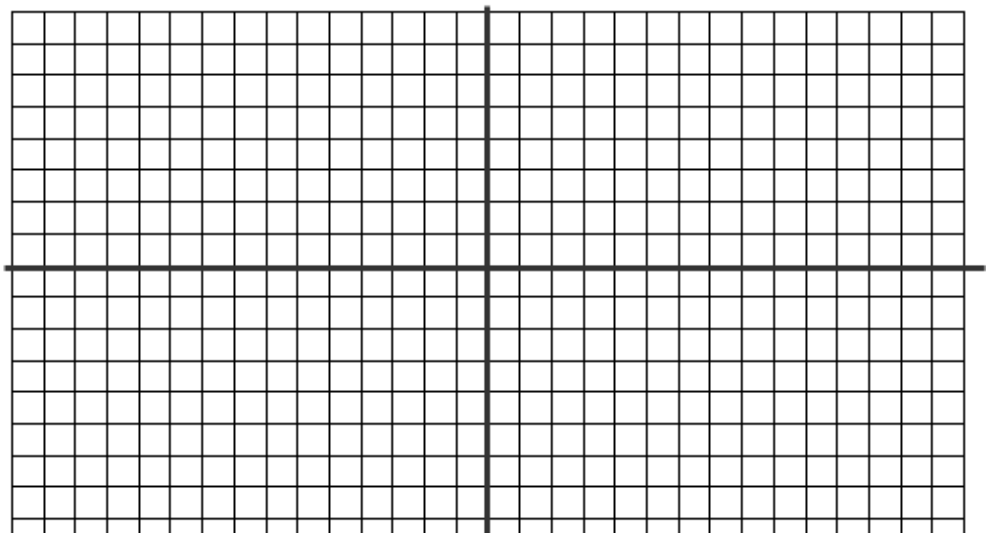
b. If the degree of the numerator is equal to the degree in the denominator, then the horizontal asymptote is represented by then line $y = \frac{leading\ coefficient\ of\ the\ numerator}{leading\ coefficient\ or\ the\ denominator}$.

c. If the degree of the numerator is greater than the degree in the denominator, then there is no horizontal asymptote.

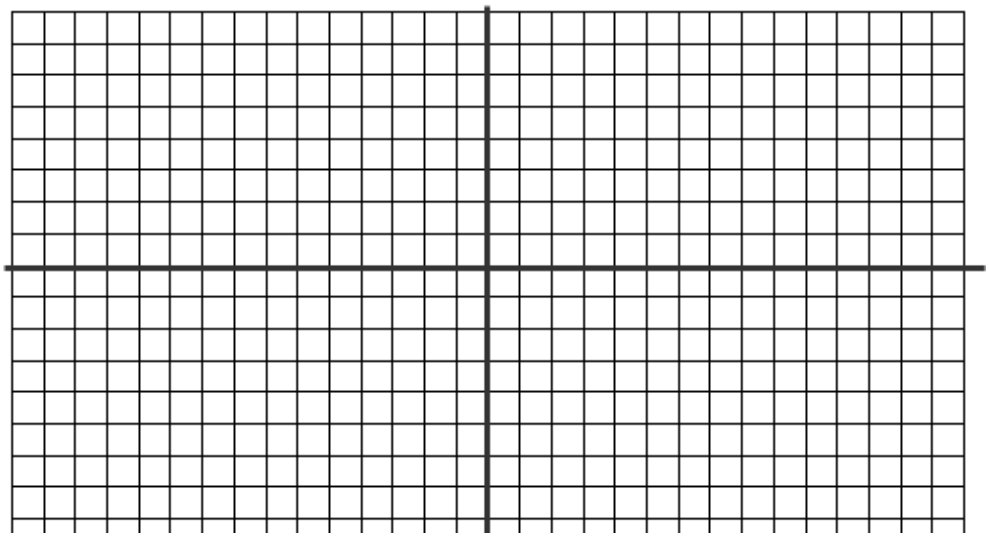
6. $f(x) = \frac{x^2+2x-3}{x^2+x-2}$	Notes:



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



8. $f(x) = \frac{x^2-x-2}{x-2}$



Module 9: Lessons 5 – Variation

	Direct	Inverse
Statement	y varies directly as x.	y varies inversely as x.
Similarity Statement		
Equation		
Examples		

*Solve each variation problem.

1. y varies directly as x. If y = 21 when x = 7, find y when x = 10. Then find x when y = 2.	2. y varies inversely as x. If y = .5 when x = 8, find y when x = 10. Then find x when y = 5.
3. y varies directly as x. If y = 16 when x = 2, find y when x = 10. Then find x when y = 2.	4. y varies directly as p and inversely as q. If y = 3 when p = 5 and q = 7 , find y when p = 3 and q = 9. Then find q when y = 13 and p = 5.
5. y varies directly as x. If y = 16 when x = 2, find y when x = 10. Then find x when y = 2.	6. y varies inversely as x. If y = 14 when x = 8, find y when x = 10 and then 8. Then find x when y = 5 and then 22.

3. **Hooke's Law** - Hooke's law of elasticity is an approximation that states that the extension of a spring is in direct proportion with the load added to it as long as this load does not exceed the elastic limit.

The distance that a spring stretches (S) varies directly as the amount of weight (W) that supports the spring. Use S and W instead of x and y to answer the following questions.

A particular spring stretches 2 inches when 34 lbs of weight are hung from the spring.

a. Find the constant of variation.
b. Write the variation equation.
c. If 20 lbs are hung from the spring, how far will it stretch?
d. If the spring stretches 3.6 inches, how much weight is the spring supporting?