



Big idea

After you review the algebra of rational expressions, you will then study how to graph rational functions. This will involve the study of the main characteristics of the rational function: the y-intercepts, zeros, holes, vertical asymptotes, horizontal asymptotes and oblique/slant asymptotes. You will learn to solve rational equations and inequalities as well as word problems that are modeled by rational functions. Solving Radicals and Inequalities is also part of this unit.



Feedback & Assessment of Your Success

Date	Pages	Topics	Finished assignment pages?	Summarized notes in a journal?	How many extra practice questions did you try in each topic?	Tentative TEST date:
			Made corrections?	Added your own explanations?		Questions to ask the teacher:
1.5days	2-3	Complicated Fractions (MHF) Journal #1				
2.5days	4-9	Graphing Rationals (MHF) Journal #2-3				
	10-11	Finding Rational Equations (MHF) As well as Review of Inverses Journal finish up to #3				
	12-14	Solve Rational (MHF) & Irrational (AP) Equations As well as Using Graphs to Solve Journal #4				
	15-18	Solve Rational (MHF) & Irrational (AP) Inequalities. As well as Review of other Inequalities Journal #5				
2days	19-24	Solve Rational Word Problems (MHF) Journal #6				

ASSIGNMENT Simplify Complicated Fractions

Simplify

1.
$$\frac{1 + \frac{1}{b}}{a + \frac{a}{b}}$$

2.
$$\frac{\frac{2x^2}{y} - 2y}{\frac{2}{y} + \frac{2}{x}}$$

3.
$$\frac{x^{\frac{1}{2}} + 2x^{\frac{-1}{2}}}{x^2 - 4}$$

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

like difference quotient needed later

5.
$$\frac{(2+h)^4 - 16}{h}$$
 like difference quotient needed later

6.
$$\frac{\frac{3}{\sqrt{x+7}} - \sqrt{x+7}}{x^2 - x - 20}$$

7.
$$\frac{x^{\frac{4}{3}} - x^{\frac{1}{3}} - 6x^{\frac{-2}{3}}}{x^{\frac{9}{4}} - 2x^{\frac{5}{4}} - 8x^{\frac{1}{4}}}$$

8.
$$\frac{(x+1)^{\frac{5}{3}} - 2x(x+1)^{\frac{-1}{3}}}{x^2 + 4}$$

ASSIGNMENT Graphing Rational Functions

1. Match the following equations to the graphs (there is an extra graph)

A) $y = \frac{-2}{-x+2}$

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

C) $y = \frac{1}{x^2}$

D) $y = \frac{1}{x^2-9}$

E) $y = \frac{1}{-3x+5}$

F) $y = \frac{1}{x^2+2}$

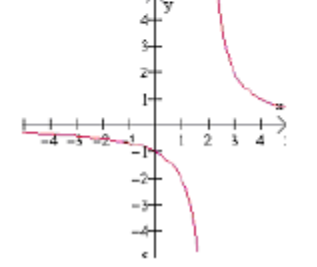
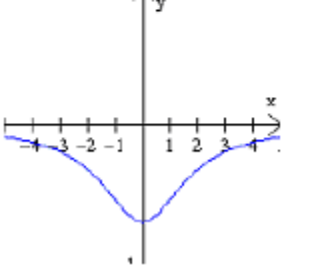
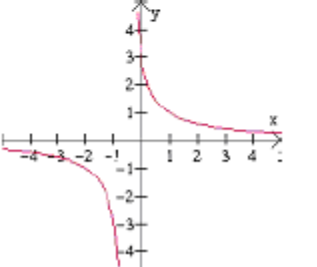
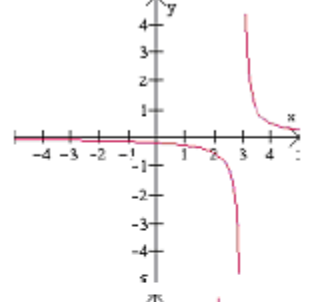
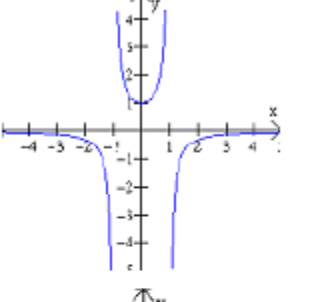
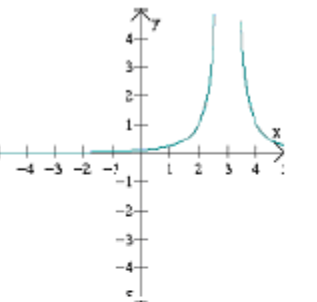
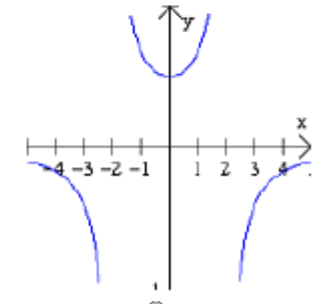
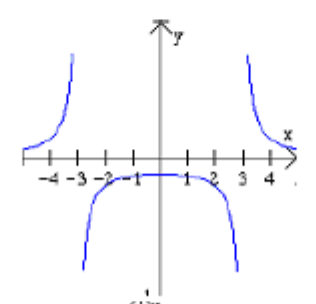
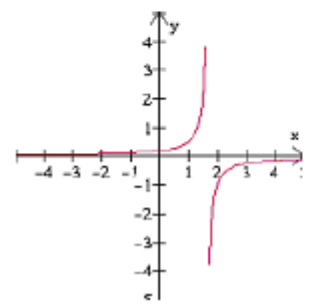
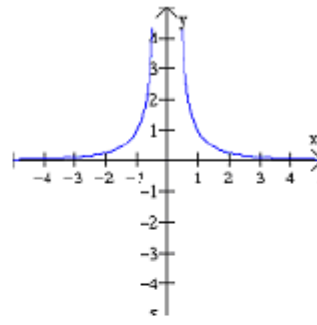
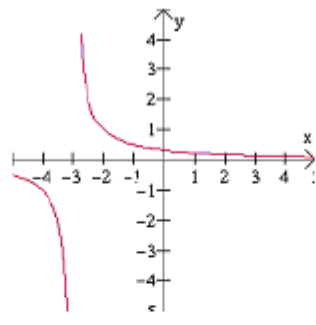
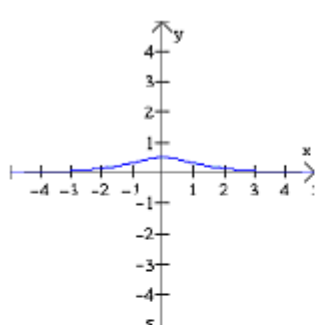
G) $y = \frac{1}{x+3}$

H) $y = \frac{-2}{x^2-4}$

I) $y = \frac{1}{-x^2+1}$

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

K) $y = \frac{1}{(x-3)^2}$

2. Given $f(x) = \frac{2x+3}{2x-3}$, $g(x) = \frac{4}{x}$ find $(f \circ g)(x)$ and state restrictions

For each function, use the algorithm to sketch the following graphs.

3. $b(x) = \frac{x^2 - x - 6}{x^2 - 4}$

4. $k(x) = \frac{2x^2 - 3x - 20}{x - 5}$

5.
$$f(x) = \frac{x^3 - x^2 - 6x}{-3x^2 - 3x + 18}$$

6.
$$f(x) = \frac{16x}{-4x^2 + 4x + 24}$$

7.
$$y = \frac{2}{3-x} - 1$$

8.
$$f(x) = \frac{1}{3x^2 + 3x + 1}$$

9.
$$q(x) = \frac{5-4x}{3x-1}$$

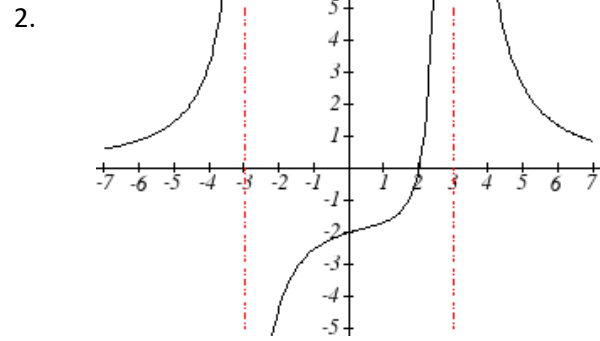
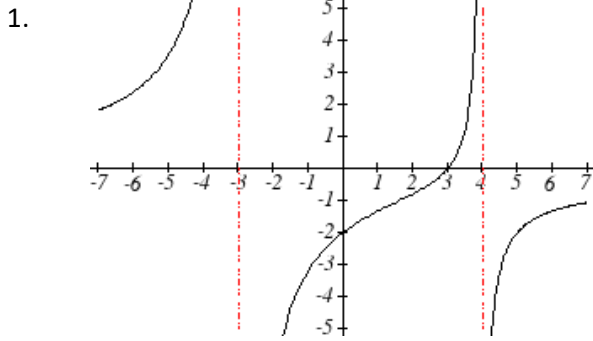
10.
$$r(x) = \frac{5}{(x+1)^2}$$

11.
$$f(x) = \frac{(x+1)^2(x-3)(x-1)^3}{x^3(x-2)(x+2)^2}$$

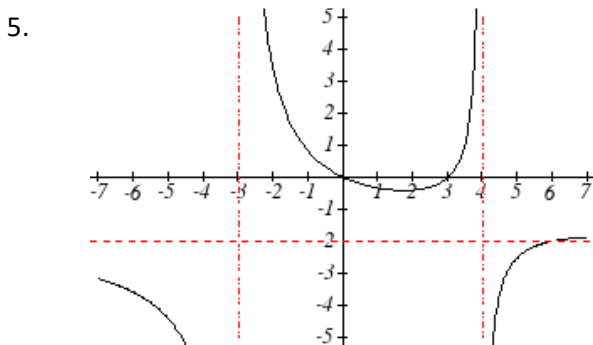
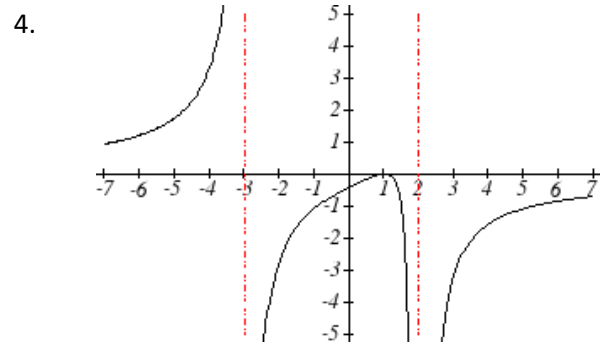
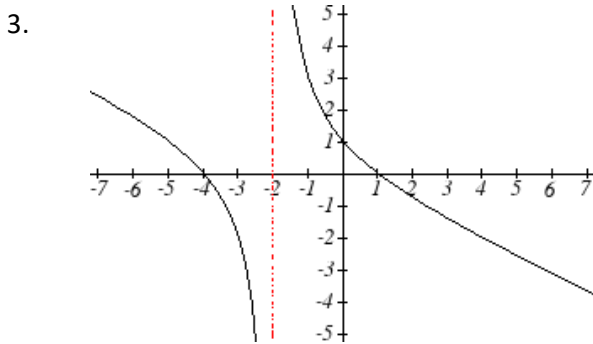
12.
$$f(x) = \frac{-5x^3(x-3)^2(x+3)}{(x-1)^3(x+1)^2(x-4)}$$

ASSIGNMENT Finding Rational Equations. As well as Review of Inverses

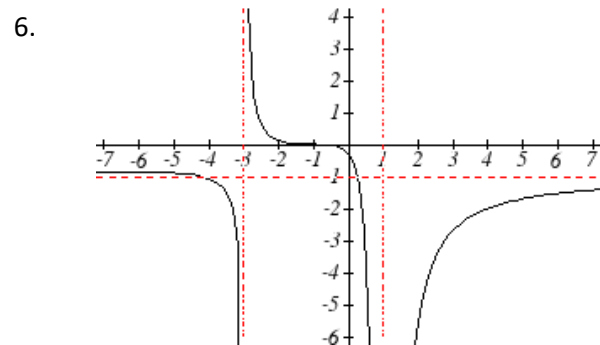
Write an equation for the function graphed



with a hole at $x=1$



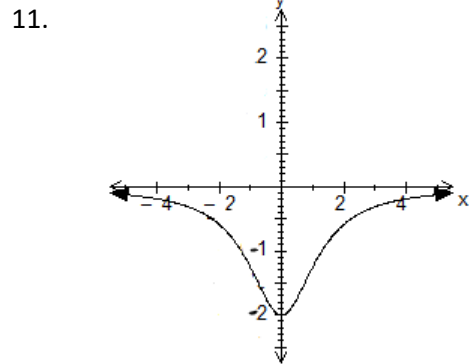
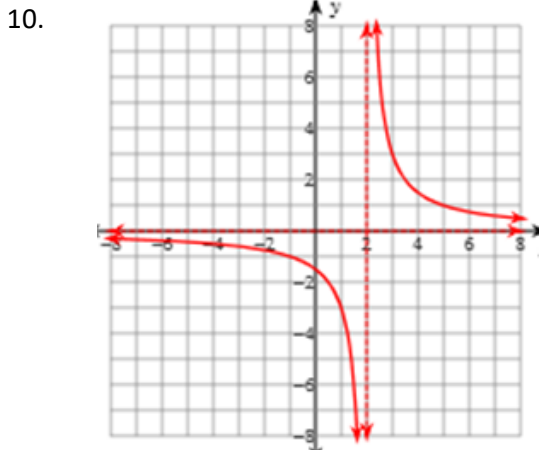
with a hole at $x=3$



Write an equation for a rational function with the given characteristics.

7. Vertical asymptotes at $x = -4$ and $x = -5$ x intercepts at $(4,0)$ and $(-6,0)$ Horizontal asymptote at $y = 7$
8. Vertical asymptote at $x = -1$ Root of multiplicity 2 at $x = 2$ y intercept at $(0,2)$ with horizontal asymptote
9. Vertical asymptotes at $x = 5$ and $x = -5$ x intercepts at $(2,0)$ with a bounce and $(-1,0)$ where graph bends; y intercept at $(0,4)$;
 $\lim_{x \rightarrow 5^{\pm}} f(x) = \infty$; $\lim_{x \rightarrow -5^{\pm}} f(x) = -\infty$
 with an oblique asymptote

Sketch the inverse of each graph after you restrict domain so that the function is one-to-one



Find the inverse of each equation

12. $f(x) = \frac{2}{3-x} - 1$

13. $q(x) = \frac{5-4x}{3x-1}$

**ASSIGNMENT Solve Rational (MHF) & Irrational (AP) Equations
As well as Using Graphs to Solve**

Solve the equation algebraically. Check for extraneous solutions.

1.
$$\frac{1}{x-2} + 2 = \frac{3x}{x+2}$$

2.
$$\frac{2}{x^2-9} + \frac{x}{x^2-x-12} = \frac{3}{x+3}$$

Solve the equation. Check for extraneous solutions.

3.
$$6 - \sqrt{x^2 - 12} = x$$

4.
$$\sqrt{x+4} + \sqrt{x-4} = 4$$

Find the solutions of each of the following by drawing a graph of each side over-top of each other and looking for the values of x in the POI or solution intervals.

5.
$$\frac{1}{x^2+1} = \frac{1}{x+1}$$

6.
$$|2x-5| < 7$$

7.
$$\sqrt[3]{x^2(x-1)(x+2)^3} \leq 0$$

8.
$$f(x) \begin{cases} |x+5|-2 & x \leq -4 \\ -(x+2)^2+4 & x \in (-4, -1) \\ -x-1 & x \in [-1, 1) \\ \sqrt{x-1}+3 & x \geq 1 \end{cases}$$

find when $-1 < f(x) \leq 3$

Solve

9.
$$\frac{3}{x} + \frac{2x}{x+1} = 2$$

10.
$$\frac{x+6}{x^2-4} = \frac{2}{x-2} + \frac{x}{x+2}$$

11.
$$\frac{3x+2}{x-1} + \frac{2x-4}{x+2} = 5$$

12.
$$3 = \frac{6x-1}{2x+7} + \frac{22}{x+5}$$

**ASSIGNMENT Solve Rational (MHF) & Irrational (AP) Inequalities
As well as Review of other Inequalities**

Solve algebraically.

1.
$$\frac{1}{x+2} \leq \frac{3}{x}$$

2.
$$x + \frac{x}{x-2} \geq \frac{2}{x-2}$$

3.
$$\sqrt{3x+10} - 4 \geq x$$

4.
$$\sqrt{3x^2 - 4x + 9} > 3$$

Solve.

5. $3x - 2 > 5x + 4$

6. $|3x - 4| \geq 11$

7. $x^4 - 3x^3 - 20x^2 + 84x - 80 \leq 0$

8. $|2x - 4| - 6 \leq \frac{12}{x}$

Solve.

9.
$$\frac{2+x}{1-x} \leq 3$$

10.
$$\frac{x}{x-2} + 1 \leq 4$$

11.
$$\frac{x}{x-1} - \frac{2}{1-x^2} > \frac{8}{x+1}$$

12.
$$\frac{-5}{3x-1} + \frac{3}{x+1} \geq 0$$

Solve

$$13. \quad 0 \geq \frac{-5x^2(3-x)^2(x+3)}{(1-x)^3(x-2)^5(4-x)}$$

$$14. \quad \frac{(8-4x)^2(9-x^2)}{(6-x)^3(x-1)(-4x-16)} \geq 0$$

$$15. \quad \sqrt{x} + \sqrt{x-7} = \frac{21}{\sqrt{x-7}}$$

$$16. \quad \left| \frac{x+2}{x-1} \right| + 12 \leq 14$$

ASSIGNMENT Solve Rational Word Problems

1. The aerodynamic covering on a bicycle increases a cyclist's average speed by 10mph. The time for a 75 mile trip is reduced by 2 hours. What is the average speed for the trip with the aerodynamic covering?
2. Each week, Mr. Smith flew his Cessna 390 km from Vancouver to Kelowna. The air speed of his plane is 165 km/h. On the flight out, there is a constant tail wind, and on the way back a constant head wind of the same speed. Find the speed of the wind if the round trip takes him 5 hours.

3. One pipe can fill a pool 1.5 times faster than a second pipe. If both pipes are open, the pool can be filled in 6 hours. If only the slower pipe is open, how long would it take to fill the pool?
4. Alex, by himself, can paint a 4 room apartment in 12 hours. If Sophie helps him, then it takes 8 hours. How long would it take Sophie to paint the 4 room apartment by herself?
5. A 100 - cup beverage dispenser contains 50 cups of a 25% Kool - Aid solution. You add x cups of a 75% Kool - Aid solution to the tank.
- How many cups should you add to make the concentration be 60%?
 - If you did the above correctly, you'd notice the amount of cups would not fit into dispenser, so how much of the 25% should you remove and replace to get 60% of 50 cups?
6. Your overall mark for this course is _____, and so far there have been _____ units with _____ units to go. Your goal mark before the exam is _____. What is mark on average you should get on the rest of the units to achieve your goal mark?

7. Give possible dimensions for a cylinder that is to have a surface area of 1200 cm^2 and a volume of 3 litres. (1 L = 1000 cm^3)

Use technology to help you find solutions

8. A box with a square base and a volume of 1000 cubic inches is to be constructed. The material for the top and bottom of the box costs \$3 per 100 square inches, and the material for the sides costs \$1.25 per 100 square inches. If the side of the base must be at least 10 inches long, what is the length of the base for the cost of the box to be \$20?

Use technology to help you find solutions

9. Mario drove from Edmonton to Grande Prairie and back, a distance of about 360 km each way. Mario's average speed was 30 km/h greater on his return trip than on his trip out. His total driving time was 10 h. Determine Mario's average speed on each leg of his journey.
10. Jerome rows his boat 24 km downstream and back to where he began. When the average speed of the current is 2 km/h, Jerome can complete the journey in 9 h. What is Jerome's average rowing speed in still water?

11. Kyra mows a lawn in 40 min. When Mark and Kyra work together, they can mow the lawn in 24 min. How long would it take Mark to mow the lawn on his own?
12. Antifreeze is added to water to make a solution that is used in automobiles. How much antifreeze must be added to 12 L of water to make a solution that contains 40% antifreeze?

13. Bronwyn rides her electric bicycle 10 km/h faster than Aaron. Bronwyn can travel 60 km in the same time that it takes Aaron to travel 40 km. Determine Bronwyn's average speed and Aaron's average speed.
14. Lyle can fill the bathtub using the cold water tap in 8 min. When both the hot and cold water taps are fully open, he can fill the bathtub in 6 min. How long would it take Lyle to fill the bathtub using only the hot water tap?