New Vocabulary

- rational function

- excluded value

- asymptote

These are sample questions for today;

8. State the excluded value of the function $y = \dfrac{4}{x+4}$.

9. Identify the asymptotes of $y = \dfrac{6}{x} - 5$.

KeyConcept Rational Functions

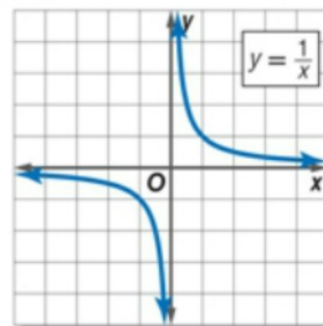| Words		Graph
A rational function can be described by an equation of the form $y = \dfrac{p}{q}$, where p and q are polynomials and $q \neq 0$.		$y = \dfrac{1}{x}$
Parent function: $f(x) = \dfrac{1}{x}$		
Type of graph: hyperbola		
Domain: $\{x \mid x \neq 0\}$		
Range: $\{y \mid y \neq 0\}$		

Remember; graphs are showing all the answers to a given value.

KeyConcept Rational Functions

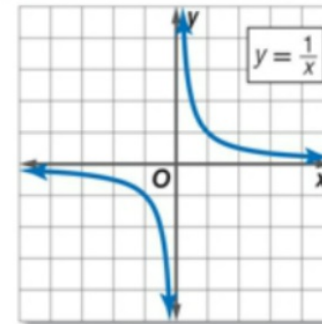| Words	Graph
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First, let's practice "excluded values."

Remember; you can't divide by zero.

Example 1 State the excluded value for each function.

1. $y = \frac{5}{x}$ **x = 0**

2. $y = \frac{1}{x+3}$ **x = −3**

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

4. $y = \frac{x}{2x-8}$ **x = 4**

KeyConcept Rational Functions

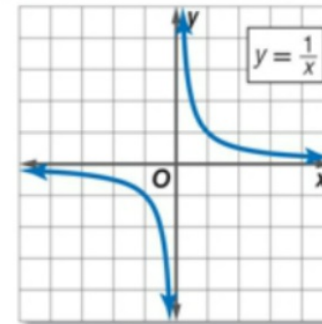| Words		Graph
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	Parent function: $f(x) = \frac{1}{x}$	$y = \frac{1}{x}$
	Type of graph: hyperbola	
	Domain: $\{x \mid x \neq 0\}$	
	Range: $\{y \mid y \neq 0\}$	

Now let's talk about these graph in everyday life...since we are talking about an *amount,* what values to we NOT use?

Example 2

5. PARTY PLANNING The cost of decorations for a party is $32. This is split among a group of friends. The amount each person pays y is given by $y = \frac{32}{x}$, where x is the number of people. Graph the function. **See margin.**
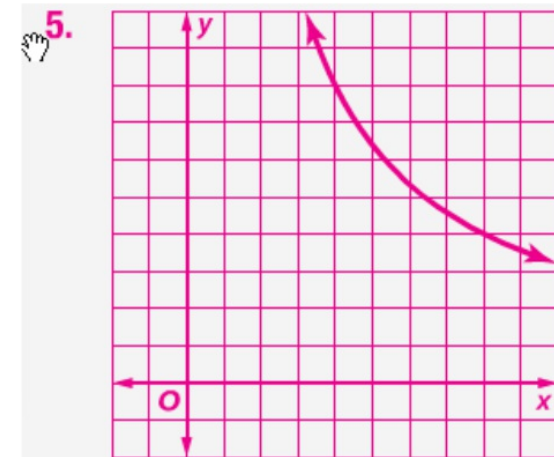
5.

Rational Functions

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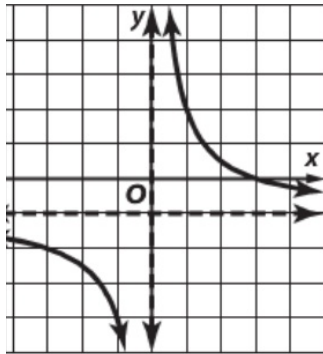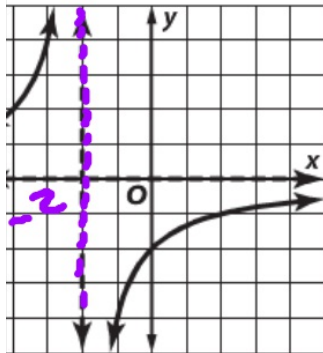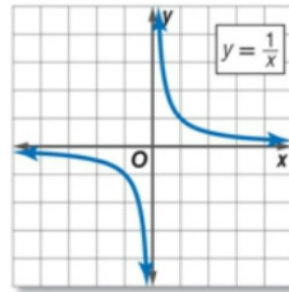
$y = \frac{1}{x}$

$= -2; y = 0$

NOW, let's put both concepts together...
excluded values are asymptotes!

Identify the asymptotes of each function. Then graph the function.

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

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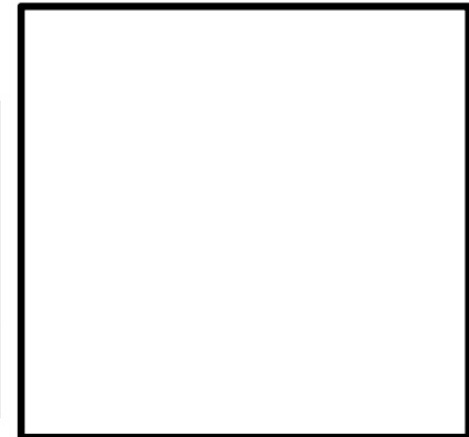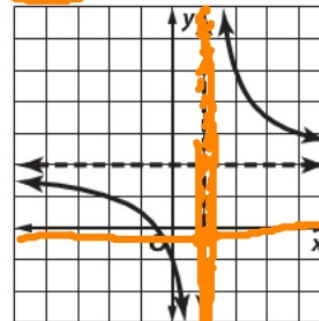
8. $y = \frac{1}{x - 2}$

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

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

$x = 0$

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

$x = -2$

10. $x = 1$; $y = 2$

Example 1

State the excluded value for each function. **14. $x = -2$**

12. $y = \dfrac{-1}{x}$ **$x = 0$**   13. $y = \dfrac{8}{x-8}$ 14. $y = \dfrac{x}{x+2}$ 15. $y = \dfrac{4}{x+6}$

18. $x = 2$

16. $y = \dfrac{x+1}{x-3}$ **$x = 3$**   17. $y = \dfrac{2x+5}{x+5}$ 18. $y = \dfrac{7}{5x-10}$ 19. $y = \dfrac{x}{2x+14}$

Example 2

20. **ANTELOPES** A pronghorn antelope can run 40 miles without stopping. The average speed is given by $y = \dfrac{40}{x}$, where x is the time it takes to run the distance.

   a. Graph $y = \dfrac{40}{x}$. **See Ch. 11 Answer Appendix.**

   b. Describe the asymptotes. **$x = 0$ and $y = 0$**

21. **CYCLING** A cyclist rides 10 miles each morning. Her average speed y is given by $y = \dfrac{10}{x}$, where x is the time it takes her to ride 10 miles. Graph the function.

Example 3 Identify the asymptotes of each function. Then graph the function.

22. $y = \frac{5}{x}$

23 $y = \frac{-3}{x}$

24. $y = \frac{2}{x} + 3$

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

26. $y = \frac{1}{x+3}$
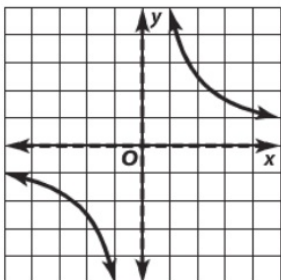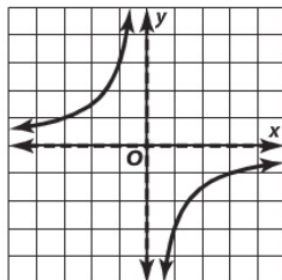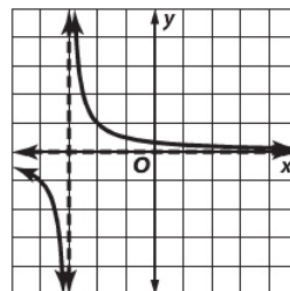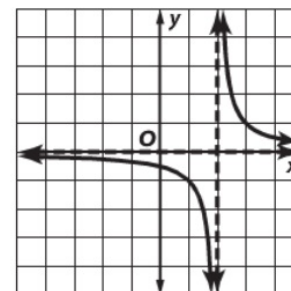
27. $y = \frac{1}{x-2}$
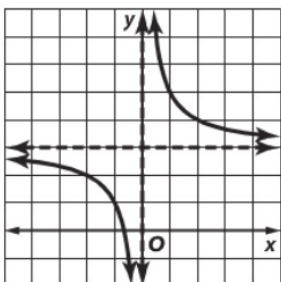
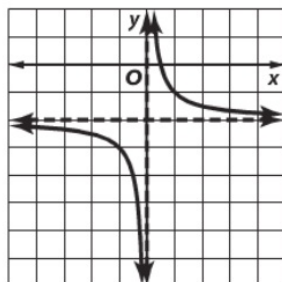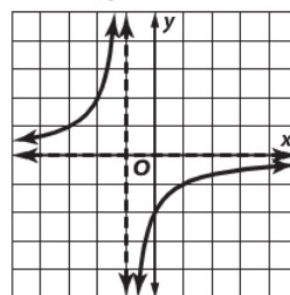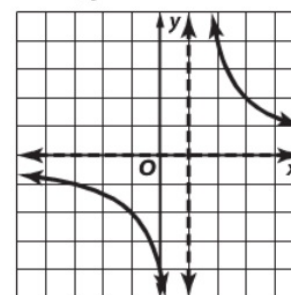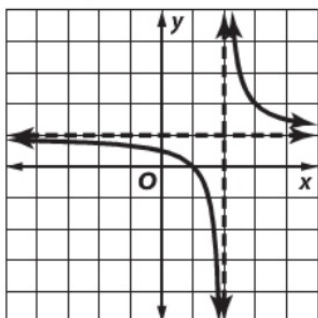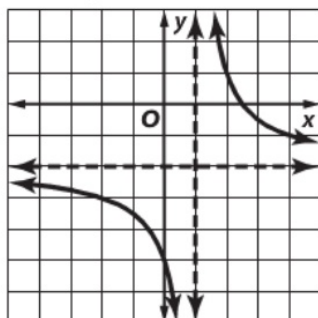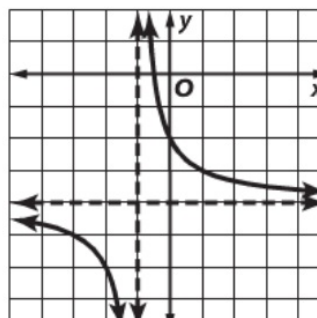**28.** $y = \frac{-2}{x+1}$

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

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

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

32. $y = \frac{2}{x+1} - 4$

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

22. $x = 0; y = 0$

23. $x = 0; y = 0$

26. $x = -3; y = 0$

27. $x = 2; y = 0$

24. $x = 0; y = 3$

25. $x = 0; y = -2$

28. $x = -1; y = 0$

29. $x = 1; y = 0$

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33. $y = \dfrac{-1}{x + 4} + 3$

30. $x = 2; y = 1$

31. $x = 1; y = -2$

32. $x = -1; y = -4$

33. $x = -4; y = 3$