

# 4.1 Winner, Winner

## A Develop Understanding Task

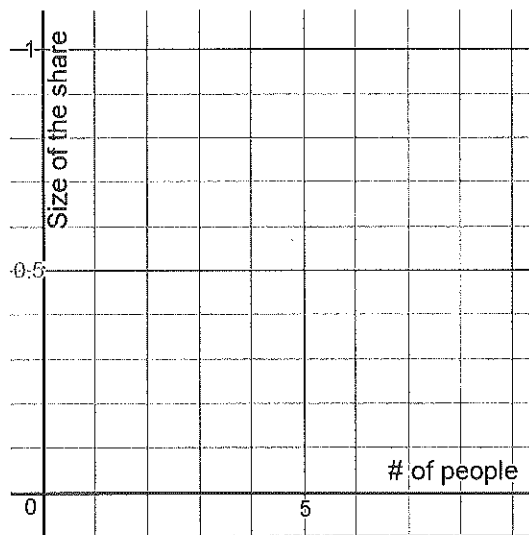
One of the most interesting functions in mathematics is  $f(x) = \frac{1}{x}$  because it brings up some mathematical mind benders. In this task, we will use story context and representations like tables and graphs to understand this important function.



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Let's begin by thinking about the interval  $[1, \infty)$ .

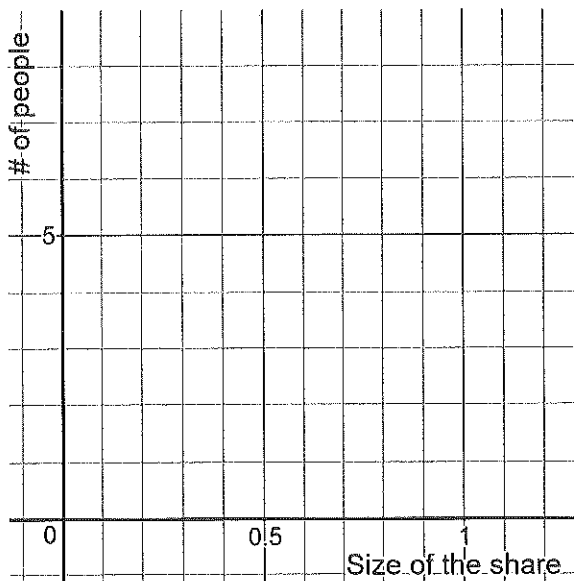
1. Imagine that you won the lottery and were given one big pot of money. Of course, you would want to share the money with friends and family. If you split the money evenly between yourself and one friend, what would be each person's share of the prize money?
2. If three people shared the prize money, what would be each person's share?
3. Model the situation with a table, equation, and graph.



4. Just in case you didn't think about the really big numbers in your model, how much of the pot would each person get if 1000 people get a share? If 100,000 people get a share? If 100,000,000 people get a share?
5. Use mathematical notation to describe the behavior of this function as  $x \rightarrow \infty$ .

Next, let's look at the interval  $(0, 1]$  and consider a new way to think about splitting the prize money.

6. Imagine that you want each person's share to be  $\frac{1}{2}$  of the prize. How many people could share the prize?
7. If you want each person's share to be  $\frac{1}{3}$  of the prize, how many people could share the prize?
8. Model this situation with a table, graph and equation.



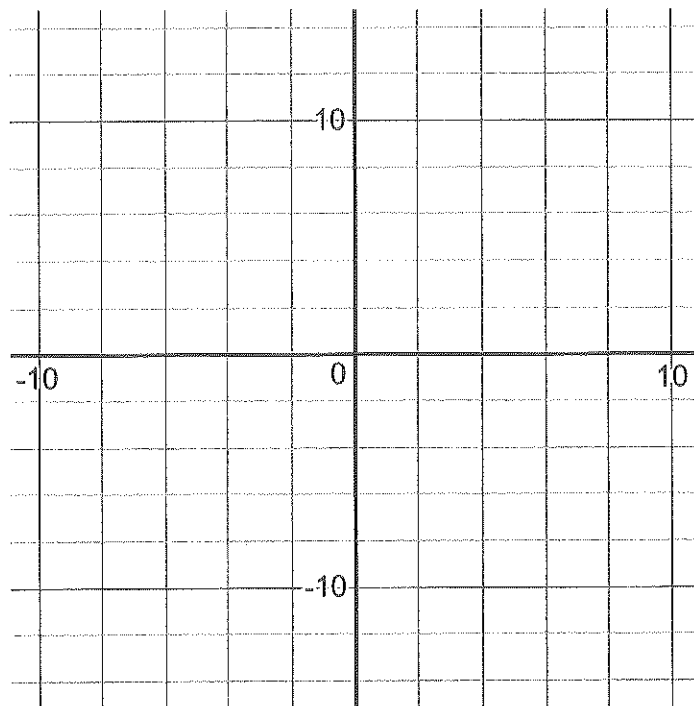
9. What do you notice when you compare the two models that you have written?

Now, let's put it all together to graph the entire function,  $f(x) = \frac{1}{x}$ .

10. Create a table for  $f(x) = \frac{1}{x}$  that includes negative input values.

11. How do the values of  $f(x)$  in the interval from  $(-\infty, 0)$  compare to the values of  $f(x)$  from  $(0, \infty)$ ? Use this comparison to predict the graph of  $f(x) = \frac{1}{x}$ .

12. Graph  $f(x) = \frac{1}{x}$ .



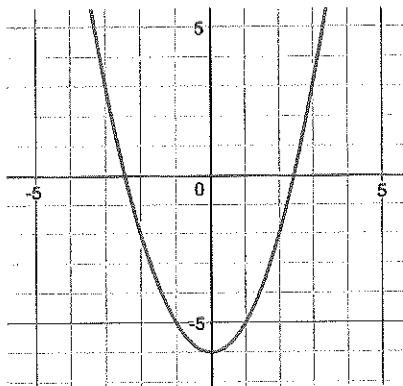
13. Describe the features of  $f(x) = \frac{1}{x}$ , including domain, range, intervals of increase or decrease,  $x$ - and  $y$ - intercepts, end behavior, and any maximum(s) or minimum(s).

**READY, SET, GO!** Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

**READY**  
 Topic: Recalling transformations on quadratic functions

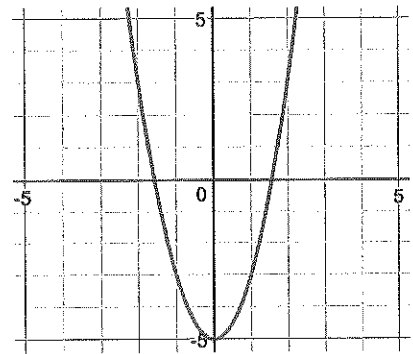
**Describe the transformation of each function. Then write the equation in vertex form.**

1. Description:



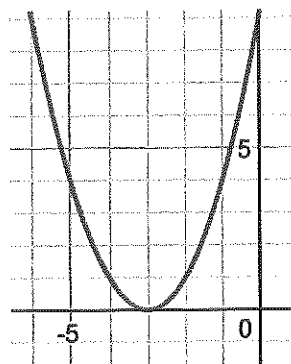
Equation:

2. Description:



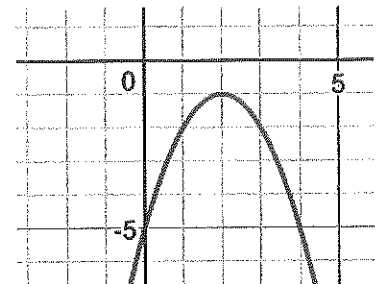
Equation:

3. Description:



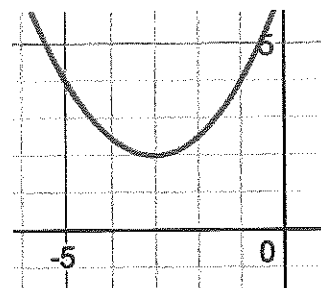
Equation:

4. Description:



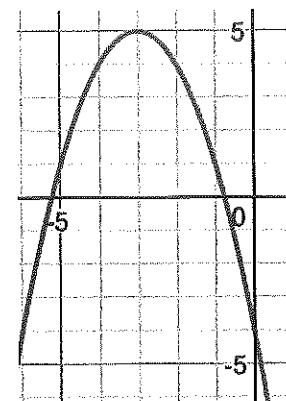
Equation:

5. Description:



Equation:

6. Description:



Equation:

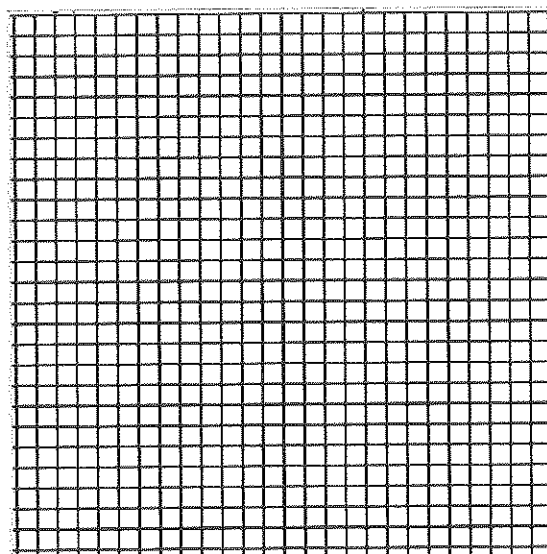
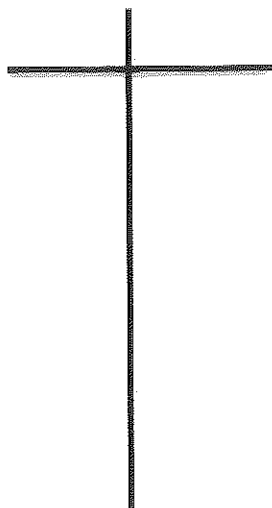
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SET

Topic: Exploring a rational function

Chile is celebrating her Quinceañera. Hannah knows the perfect gift to buy Chile, but it costs \$360. Hannah can't afford to pay for this on her own so thinks about asking some friends to join in and share the cost.

7. How much would each person spend if there were two people dividing the cost of the gift?  
How much would each person spend if there were five people dividing the cost?  
Ten people?                      One hundred?
8. The function that models this situation is  $f(x) = \frac{360}{x}$ . Define the meaning of the numerator and the denominator within the context of the story.
9. Create a table and a graph to show how the amount each person would contribute to the gift would change, depending on the number of people contributing.



10. Hannah created a fundraising site on the internet. Within 5 days, enough people had registered so that each friend, including Hannah, only needed to donate \$0.50.
  - a. How many people had registered in 5 days?
  - b. By the day of the event, enough people had registered that each friend, including Hannah, only donated 10¢. How many friends had registered?

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GO

Topic: Reviewing the horizontal asymptote in an exponential function

All exponential functions have a horizontal asymptote. All of the graphs below show exponential functions.

Match the function rule with the correct graph. Then write the equation of the horizontal asymptote.

11.  $f(x) = 2^x$

12.  $g(x) = 2^x - 3$

13.  $h(x) = 2^{x-3}$

Equation of horizontal asymptote:

Equation of horizontal asymptote:

Equation of horizontal asymptote:

14.  $m(x) = -(2^x) - 3$

15.  $q(x) = 2^{(-x)} + 3$

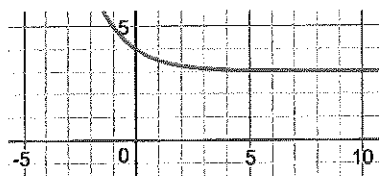
16.  $r(x) = -2^{(-x)}$

Equation of horizontal asymptote:

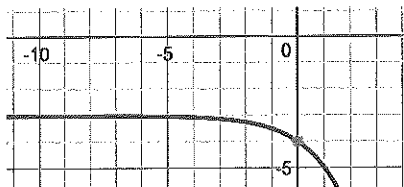
Equation of horizontal asymptote:

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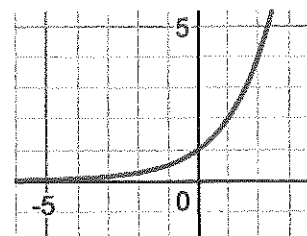
a.



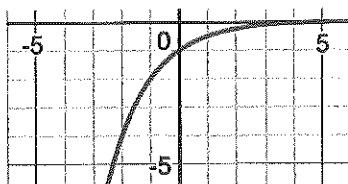
b.



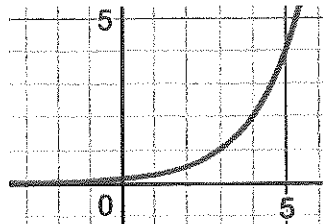
c.



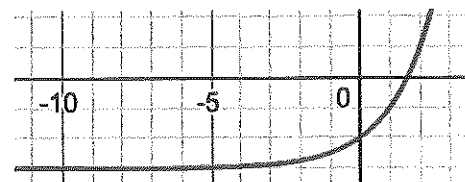
d.



e.



f.



17. Use  $f(x) = ab^{(x-h)} + k$  to explain which values affect the position of the horizontal asymptote in an exponential function. Be precise.

18. Why does an exponential function have a horizontal asymptote?

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