

Name: Key Per. Date:

Algebra 2B/Trig.

Unit 5. Rational Functions

Lesson 2. Transformations of Parent Rational Function

- What is a rational function?

A function that is the quotient (fraction) of two polynomials.

parent rational function: $f(x) = \frac{1}{x}$

- Can the denominator of rational expression equal to 0? Why/Why not?

No, Never.

ex) $\frac{2}{0} = \text{undefined}$; Think $0 \times \square \neq 2$

- What is the value X, the total number of the campers, that cannot be equivalent when you offer 30 scholarship in the last lesson. Why?

30 Think $\frac{\text{[]}}{30-30} = \frac{\text{[]}}{0} = \text{undefined}$

No one's paying.

- Can the numerator of a rational expression equal to 0? Why/Why not?

Yes

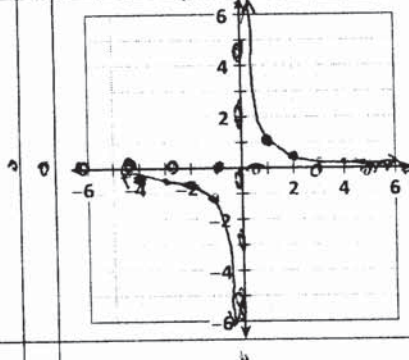
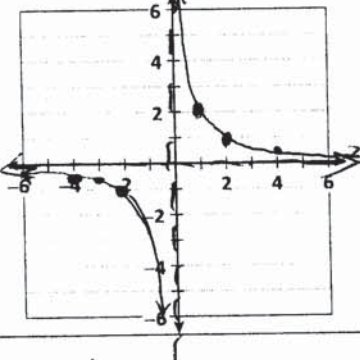
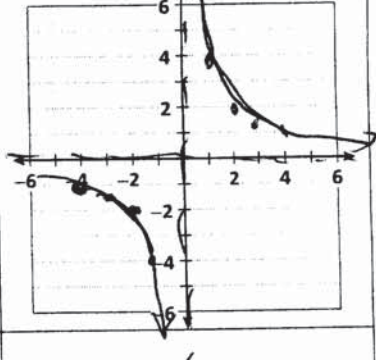
$$\frac{0}{2} = 0$$

Think $2 \times \text{[]} = 0$

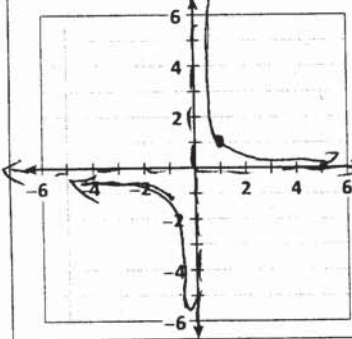
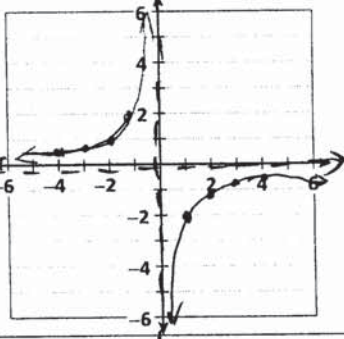
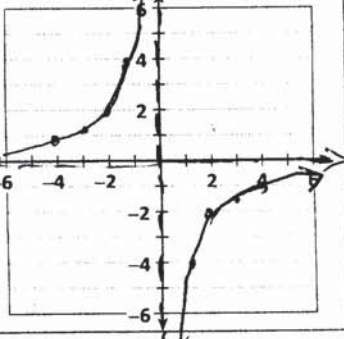
Lesson:

When using a function to model a real life situation like the fee per camper, you only use those values that make sense in the context of the situation. Now, we will look at the rational function in a theoretical view.

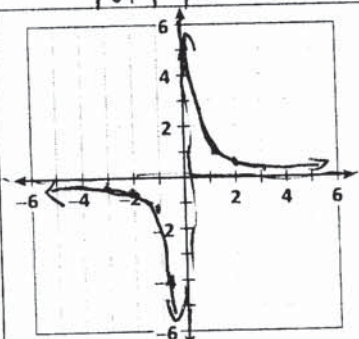
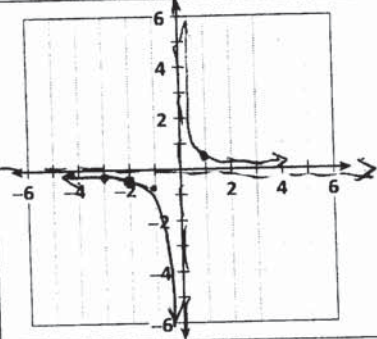
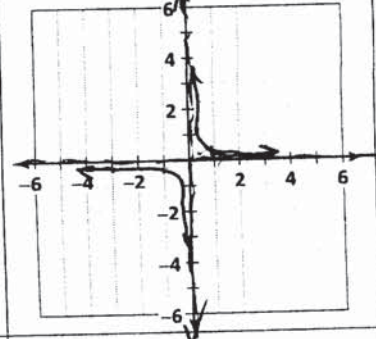
1. Fill out the chart and sketch the graph of the given rational function equations.

X	$F(x) = \frac{1}{x}$	$G(x) = \frac{2}{x}$	$H(x) = \frac{4}{x}$
-4	$-\frac{1}{4} = -0.25$	$\frac{2}{-4} = -\frac{1}{2} = -0.5$	$\frac{4}{-4} = -1$
-3	$-\frac{1}{3} = -0.\bar{3}$	$\frac{2}{-3}$	$\frac{4}{-3} = -1\frac{1}{3}$
-2	$-\frac{1}{2} = -0.5$	$\frac{2}{-2} = -1$	$\frac{4}{-2} = -2$
-1	$-\frac{1}{1} = -1$	$\frac{2}{-1} = -2$	$\frac{4}{-1} = -4$
0	NA / undef.	NA / undef.	NA
1	$\frac{1}{1} = 1$	$\frac{2}{1} = 2$	$\frac{4}{1} = 4$
2	$\frac{1}{2} = 0.5$	$\frac{2}{2} = 1$	$\frac{4}{2} = 2$
3	$\frac{1}{3} = 0.\bar{3}$	$\frac{2}{3}$	$\frac{4}{3} = 1\frac{1}{3}$
4	$\frac{1}{4} = 0.25$	$\frac{2}{4} = \frac{1}{2}$	$\frac{4}{4} = 1$
Vertical asymptote	$x=0$	$x=0$	$x=0$
Horizontal asymptote	$y=0$	$y=0$	$y=0$
X-intercept	NA	NA	NA
Y-intercept	NA	NA	NA
Sketch the Graph			
Transformation from the parent function $F(x) = \frac{1}{x}$	Parent Function	dilation: vertical stretch	dilation: vertical stretch
NOTE:			

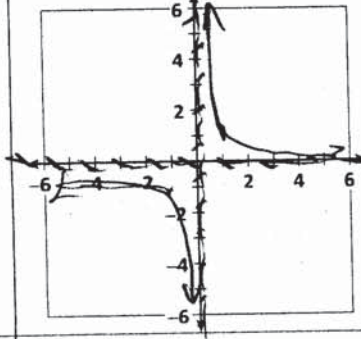
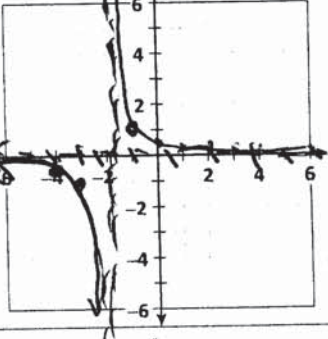
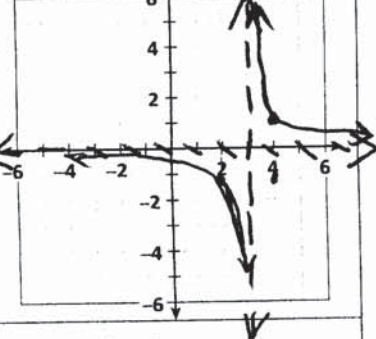
2. Fill out the chart and sketch the graph of the given rational function equations.

X	$F(x) = \frac{1}{x}$	$J(x) = -\frac{2}{x}$	$K(x) = -\frac{4}{x}$
-4	$-\frac{1}{4}$	$-\frac{2}{-4} = \frac{1}{2}$	1
-3	$-\frac{1}{3}$	$\frac{2}{3}$	$1\frac{1}{3}$
-2	$-\frac{1}{2}$	1	2
-1	-1	2	4
0	undefined	undefined	undefined
1	1	-2	-4
2	$\frac{1}{2}$	-1	-2
3	$\frac{1}{3}$	$-\frac{2}{3}$	$-1\frac{1}{3}$
4	$\frac{1}{4}$	$-\frac{1}{2}$	-1
Vertical asymptote	$x=0$	$x=0$	$x=0$
Horizontal asymptote	$y=0$	$y=0$	$y=0$
X-intercept	NA	NA	NA
Y-intercept	NA	NA	NA
Sketch the Graph			
Transformation from the parent function $F(x) = \frac{1}{x}$	Parent Function	* reflection * dilation. vertical stretch.	* Reflection over x-axis * dilation, vertical stretch.
NOTE:			

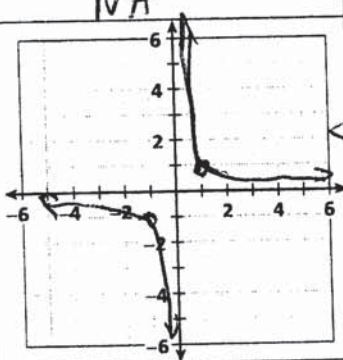
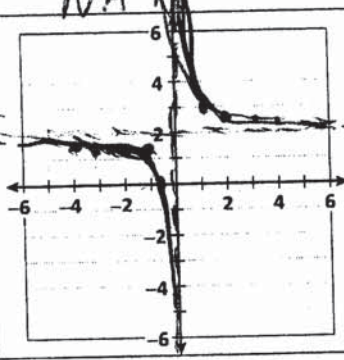
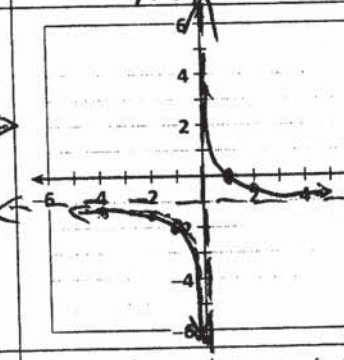
3. Fill out the chart and sketch the graph of the given rational function equations.

X	$F(x) = \frac{1}{x}$	$L(x) = \frac{1}{2x}$	$M(x) = \frac{1}{3x}$
-3	$-\frac{1}{3}$	$\frac{1}{2(-3)} = -\frac{1}{6}$	$\frac{1}{3(-3)} = -\frac{1}{9}$
-2	$-\frac{1}{2}$	$\frac{1}{2(-2)} = -\frac{1}{4}$	$\frac{1}{3(-2)} = -\frac{1}{6}$
-1	-1	$\frac{1}{2(-1)} = -\frac{1}{2}$	$\frac{1}{3(-1)} = -\frac{1}{3}$
0	NA	$\frac{1}{2(0)}$ NA	undefined
1	1	$\frac{1}{2(1)} = \frac{1}{2}$	$\frac{1}{3(1)} = \frac{1}{3}$
2	$\frac{1}{2}$	$\frac{1}{2(2)} = \frac{1}{4}$	$\frac{1}{3(2)} = \frac{1}{6}$
3	$\frac{1}{3}$	$\frac{1}{2(3)} = \frac{1}{6}$	$\frac{1}{3(3)} = \frac{1}{9}$
Vertical Asymptote	$x=0$	$x=0$	$x=0$
Horizontal Asymptote	$y=0$	$y=0$	$y=0$
X-intercept	NA	NA	NA
Y-intercept	NA	NA	NA
Sketch the Graph			
Transformation from the parent function $F(x) = \frac{1}{x}$	Parent Function	dilation (shrinking) vertically	dilation (shrinking) vertically
NOTE			

4. Fill out the chart and sketch the graph of the given rational function equations.

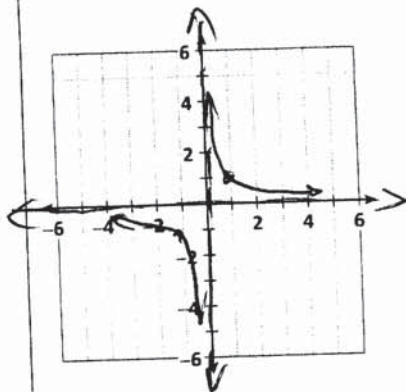
X	$F(x) = \frac{1}{x}$	$N(x) = \frac{1}{x+2}$	$P(x) = \frac{1}{x-3}$
-4	$-\frac{1}{4}$	$\frac{1}{-4+2} = \frac{1}{-2} = -\frac{1}{2}$	$\frac{1}{-4-3} = -\frac{1}{7}$
-3	$-\frac{1}{3}$	$\frac{1}{-3+2} = \frac{1}{-1} = -1$	$\frac{1}{-3-3} = -\frac{1}{6}$
-2	$-\frac{1}{2}$	$\frac{1}{-2+2}$ undefined	$\frac{1}{-2-3} = -\frac{1}{5}$
-1	-1	$\frac{1}{-1+2} = \frac{1}{1} = 1$	$\frac{1}{-1-3} = -\frac{1}{4}$
0	undefined	$\frac{1}{0+2} = \frac{1}{2}$	$\frac{1}{0-3} = -\frac{1}{3}$
1	$\frac{1}{1}$	$\frac{1}{1+2} = \frac{1}{3}$	$\frac{1}{1-3} = -\frac{1}{2}$
2	$\frac{1}{2}$	$\frac{1}{2+2} = \frac{1}{4}$	$\frac{1}{2-3} = -1$
3	$\frac{1}{3}$	$\frac{1}{3+2} = \frac{1}{5}$	undefined
4	$\frac{1}{4}$	$\frac{1}{4+2} = \frac{1}{6}$	$\frac{1}{4-3} = 1$
Vertical asymptote	$x=0$	$x=-2$	
Horizontal asymptote	$y=0$	$y=0$	
X-intercept	NA	NA	
Y-intercept	NA	NA	
Sketch the Graph			
Transformation from the parent function $F(x) = \frac{1}{x}$	Parent Function	Translation: horizontal 2 unit left.	Translation: horizontal 3 units to right.
NOTE			

5. Fill out the chart and sketch the graph of the given rational function equations.

X	$F(x) = \frac{1}{x}$	$R(x) = \frac{1}{x} + 2$	$S(x) = \frac{1}{x} - 1$
-4	$-\frac{1}{4} = -0.25$	1.75	-1.25
-3	$-\frac{1}{3} = -0.33$	1.66	$-1.\overline{33}$
-2	$-\frac{1}{2} = -0.5$	1.5	-1.5
-1	-1	1	-2
0	NA	NA	undefined
1	1	3	$\frac{1}{1} - 1 = 0$
2	$\frac{1}{2}$	2.5	$-\frac{1}{2}$
3	$\frac{1}{3}$	2.3	$-\frac{2}{3}$
4	$\frac{1}{4}$	2.25	$-\frac{3}{4}$
Vertical asymptote	$x=0$	$x=0$	$x=0$
Horizontal asymptote	$y=0$	$y=2$	$y=-1$
X-intercept	NA	$-\frac{1}{2}$	1
Y-intercept	NA	NA	NA
Sketch the Graph			
Transformation from the parent function $F(x) = \frac{1}{x}$	Parent Function	Vertical translation 2 units up	Vertical translation 1 unit down
NOTE:		$x\text{-int: } -\frac{1}{2}$ $0 = \frac{1}{x} + 2$ $-2 = \frac{1}{x}$ $-2x = 1$ $x = -\frac{1}{2}$	$x\text{-int: } 1$ $0 = \frac{1}{x} - 1$ $1 = \frac{1}{x}$ $x = 1$

Homework 5-2

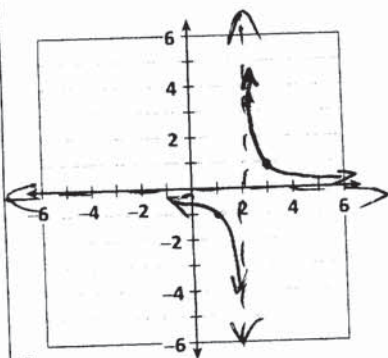
1) $f(x) = \frac{1}{x}$



a) Asymptotes:
Vertical: $X = 0$ Horizontal: $Y = 0$

b) Intercepts:
X-intercept: NA y-intercept: NA

3) Sketch and describe $H(x) = \frac{1}{x-2}$



a) Describe the Transformation from the parent function $f(x) = \frac{1}{x}$
horizontal translation 2 units to the right

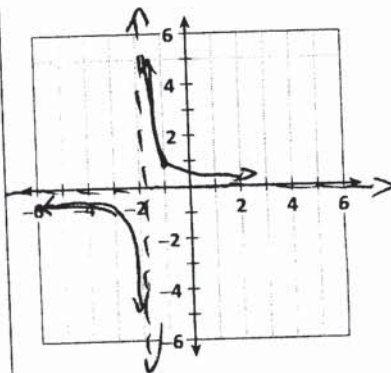
b) Asymptotes:
Vertical: $X = 2$ Horizontal: $Y = 0$

c) X-intercept: NA y-intercept: $-\frac{1}{2}$

$$y \quad \frac{1}{0-2} = -\frac{1}{2}$$

Lesson 2 Transformation of Rational Functions

2) Sketch and describe $G(x) = \frac{1}{x+2}$

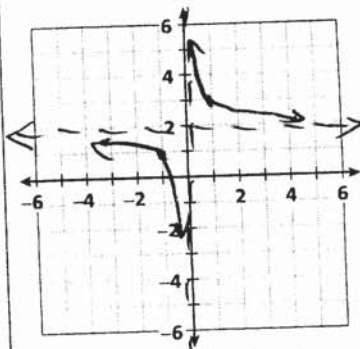


a) Describe the Transformation from the parent function $f(x) = \frac{1}{x}$
horizontal translation 2 units to the left

b) Asymptotes:
Vertical: $X = -2$ Horizontal: $Y = 0$

c) X-intercept: NA y-intercept: $\frac{1}{2} \Rightarrow \frac{1}{0+2} = \frac{1}{2}$

4) Sketch and describe $J(x) = \frac{1}{x} + 2$



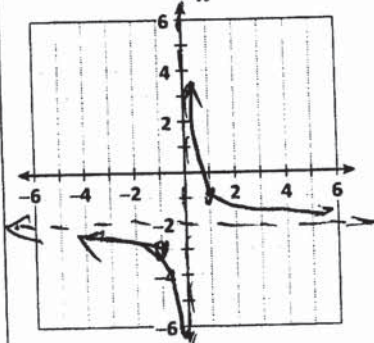
a) Describe the Transformation from the parent function $f(x) = \frac{1}{x}$
vertical translation up 2 units

b) Asymptotes:
Vertical: $X = 0$ Horizontal: $Y = 2$

c) X-intercept: $-\frac{1}{2}$ y-intercept: NA

$$\begin{aligned} 0 &= \frac{1}{x} + 2 \\ -2 &= \frac{1}{x} \\ -2x &= 1 \\ x &= -\frac{1}{2} \end{aligned}$$

5) $K(x) = \frac{1}{x} - 2$



- a) Describe the Transformation from the parent function $f(x) = \frac{1}{x}$

vertical translation
2 units down

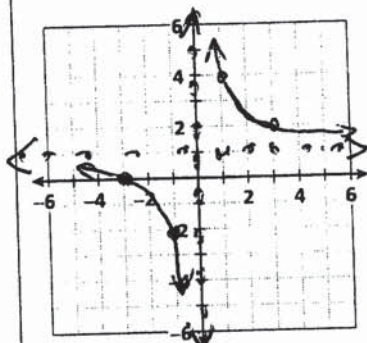
- b) Asymptotes:

Vertical: $X = 0$ Horizontal: $Y = -2$

- c) X-intercept: $\left(\frac{1}{2}\right)$ y-intercept: NA

$0 = \frac{1}{x} - 2$
 $2 = \frac{1}{x}$ $2x = 1$ $x = \frac{1}{2}$

7) $M(x) = \frac{3}{x} + 1$



- a) Describe the Transformation from the parent function $f(x) = \frac{1}{x}$

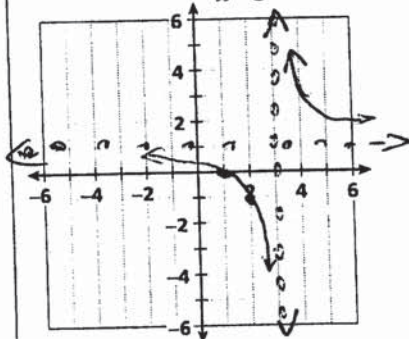
dilation: vertical stretch
translation: vertically 1 unit up

- b) Asymptotes:

Vertical: $X = 0$ Horizontal: $Y = 1$

- c) X-intercept: -3 y-intercept: NA

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



- a) Describe the Transformation from the parent function $f(x) = \frac{1}{x}$

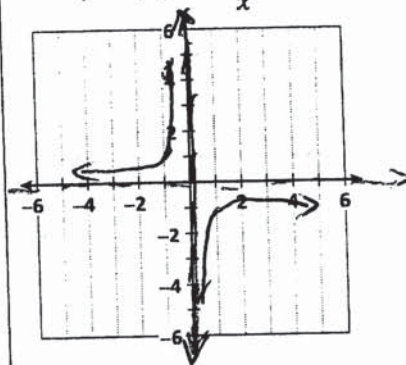
Dilation: vertical stretch
Translation: horizontal 3 units to the right
vertical 1 unit up

- b) Asymptotes:

Vertical: $X = 3$ Horizontal: $Y = 1$

- c) X-intercept: (1) y-intercept: $\left(\frac{1}{3}\right)$
 $y = \frac{2}{0-3} + 1$ $y = -\frac{2}{3} + 1$ $y = \frac{1}{3}$

8) $N(x) = -\frac{1}{x}$



- a) Describe the Transformation from the parent function $f(x) = \frac{1}{x}$

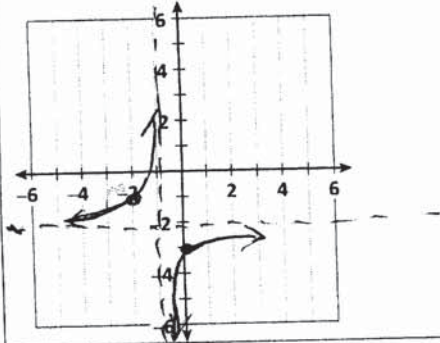
Reflection over the
X-axis

- b) Asymptotes:

Vertical: $X = 0$ Horizontal: $Y = 0$

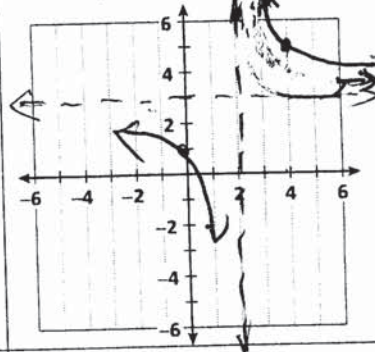
- c) X-intercept: NA y-intercept: NA

9) Sketch $P(x) = -\frac{1}{x+1} - 2$



10)

Sketch $R(x) = 3 + \frac{4}{x-2}$



11) Write a function that is $f(x) = \frac{1}{x}$ translated 3 units down and 5 units to the right.

$$f(x) = \frac{1}{x-5} - 3$$

12) Describe the graph of $s(x) = \frac{1}{4x}$
As a transformation of the parent function $F(x) = \frac{1}{x}$

vertical shrinking

13) The parent function $f(x) = \frac{1}{x}$ is translated 4 units up and 7 units to the right. Without graphing identify the asymptotes.

asymptotes $\rightarrow$ horizontal $y = 4$
 $\rightarrow$ vertical $x = 7$

14) What is the vertical asymptote of $T(x) = \frac{2}{x+1} - 5$

$$x = -1$$

Warm up for the next lesson - Factoring

15) Factor $x^2 - 4$

$$(x-2)(x+2)$$

16) Factor $x^2 + 7x + 12$

$$(x+3)(x+4)$$

17) Factor $x^3 - x^2 - 2x$

$$x(x^2 - x - 2)$$

$$x(x-2)(x+1)$$

18) Factor $8x^3 + 125$

$$(2x+5)(4x^2 - 10x + 25)$$

Remember SOA

19) Factor $27x^3 - 64$

$$(3x)^3 - (4)^3$$

$$(3x-4)(9x^2 + 12x + 16)$$

20) Factor Completely $3x^2 - 9x$

$$3x(x-3)$$

*2 Extra Credit Homework Point: Write a real life situation/scenario that can be written as a rational function (0.5pt), Write the rational function equation (0.5pt), Fill out the data on a T-Chart (0.5pt), Graph the function equation (0.5pt).