Math 2
Unit 2A Day 1 Notes – Transformations w/ Fred Functions

Name:___Key_____
Date:_____

To the right is a graph of a **"Fred" function**.  We can use Fred functions to explore transformations in the coordinate plane.

**I.**      Let's review briefly.

1.  a. Explain what a function is in your own words.

*set of points where one x-value goes w/ one y-value.*

b.  Using the graph, how do we know that Fred is a function?

*vertical line test*

2.  a. Explain what we mean by the term domain.

*x-values of the function*

b. Using the graph, what is the domain of Fred?

$-1 \le x \le 4$

3.  a. Explain what we mean by the term range.

*y-values of the function*

b. Using the graph, what is the range of Fred?

$-2 \le y \le 1$

4.  Let's explore the points on Fred.
    a.  How many points lie on Fred?                     Can you list them all? *Yes*

    *4 points      (5 point)*

    b.  What are the key points that would help us graph Fred?

    *(-1,1)  (1,-1)  (2,-1)  (4,-2)  (0,0)*

    We are going to call these key points **"characteristic" points.** It is important when graphing a function that you are able to identify these characteristic points.
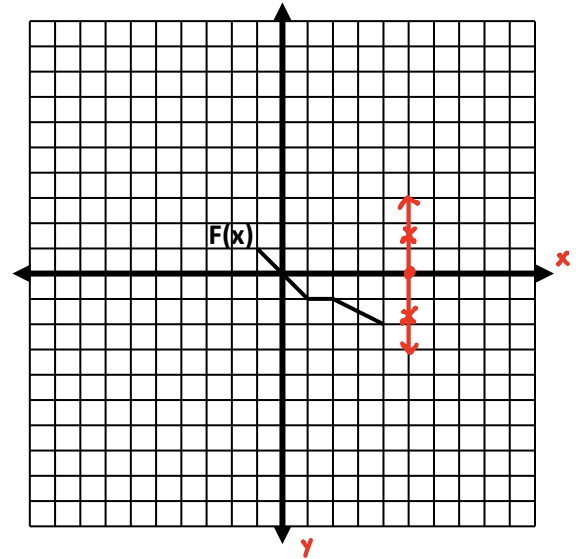
    c.  Use the graph of graph to evaluate the following.

    $F(1) = $ _-1_          $F(-1) = $ _1_          $F(\underline{4}) = -2$          $F(5) = $ _undefined_
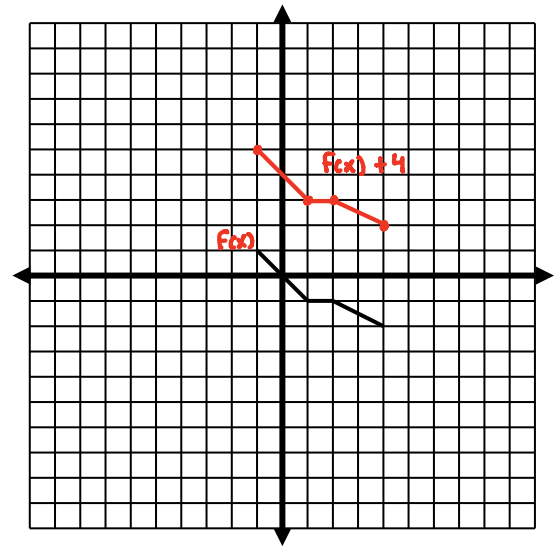
**II.** Remember that F(x) is another name for the y-values.

Therefore the equation of Fred is $y = F(x)$.

| x | F(x) |
|---|------|
| −1 | 1 |
| 1 | −1 |
| 2 | −1 |
| 4 | −2 |

*(graph with handwritten labels: f(x) + 4, f(x))*

1. Why did we choose those x-values to put in the table?

   *x-values from our characteristic points*

   Now let's try graphing Freddie Jr.: $y = F(x) + 4$. Complete the table below for this new function and then graph Freddie Jr. on the coordinate plane above.

   $y = F(x) + 4$

   *• outside the parentheses*
   *→ • translate the function*
   *   up or DOWN*
   *   (+)    (−)*
   *• changes the y-value*

| x | y |
|---|---|
| −1 | 5 |
| 1 | 3 |
| 2 | 3 |
| 4 | 2 |

2. What type of transformation maps Fred, F(x), to Freddie Jr., F(x) + 4? (Be specific.)

   *translated the function 4 units up*

3. How did this transformation affect the x-values? *(Hint: Compare the characteristic points of Fred and Freddie Jr.)*

   *x-values did not change*

4. How did this transformation affect the y-values? *(Hint: Compare the characteristic points of Fred and Freddie Jr.)*

   *y-values increased by 4*

5. In $y = F(x) + 4$, how did the "+4" affect the graph of Fred? Did it affect the domain or the range?
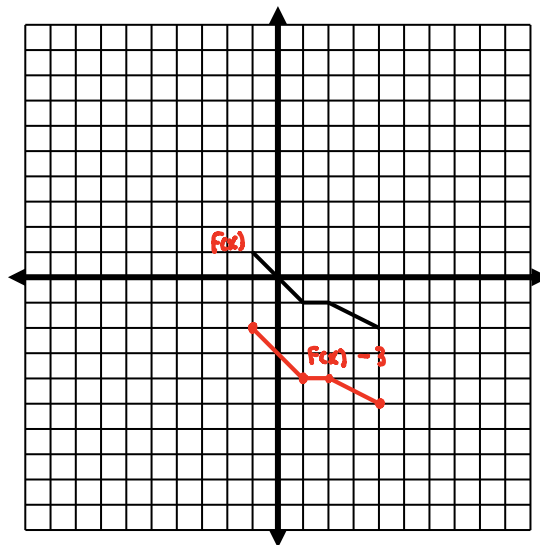
   *moved the graph 4 units up.     Range*

**III.**     Suppose Freddie Jr's equation is:  $y = F(x) - 3$.  Complete the table below for this new function and then graph Freddie Jr. on the coordinate plane above.

*· outside parentheses*
*· translates the graph*
*UP or DOWN*
*(+)    (-)*
*· changes the y-value*

$y = F(x) - 3$

| x | y |
|----|----|
| −1 | −2 |
| 1 | −4 |
| 2 | −4 |
| 4 | −5 |

*F(x)*

*F(x) − 3*

1.  What type of transformation maps Fred, F(x), to Freddie Jr., F(x) – 3?   Be specific.

*translate down 3 units*

2.  How did this transformation affect the x-values?   *(Hint:  Compare the characteristic points of Fred and Freddie Jr.)*

*x-values did not change*

3.  How did this transformation affect the y-values?   *(Hint:  Compare the characteristic points of Fred and Freddie Jr.)*

*y-values decreased by 3*

4.  In  $y = F(x) - 3$, how did the "– 3" affect the graph of Fred?  Did it affect the domain or the range?

*moved the graph down 3 units    Range*

**IV.**     Checkpoint:  Using the understanding you have gained so far, describe the affect to Fred for the following functions.

| Equation | Effect to Fred's graph |
|----------|------------------------|
| Example:  y=F(x) + 18 | Translate up 18 units |
| 1.   y = F(x) – 100 | *Translate down 100 units* |
| 2.   y = F(x) + 73 | *Translate up 73 units* |
| 3.   y = F(x) + 32 | *Translate up 32 units* |
| 4.   y = F(x) – 521 | *Translate down 521 units* |

**V.** Suppose Freddie Jr's equation is: $y = F(x + 4)$. *[handwritten: ↗ inside parentheses · translate the graph LEFT or RIGHT (+) (−) · changes the x-values]*

1. Complete the table.

| x | x + 4 | y |
|---|---|---|
| −5 | −1 | 1 |
| −3 | 1 | −1 |
| −2 | 2 | −1 |
| 0 | 4 | −2 |

*(Hint: Since, x + 4 = −1, subtract 4 from both sides of the equation, and x = −5. Use a similar method to find the missing x values.)*
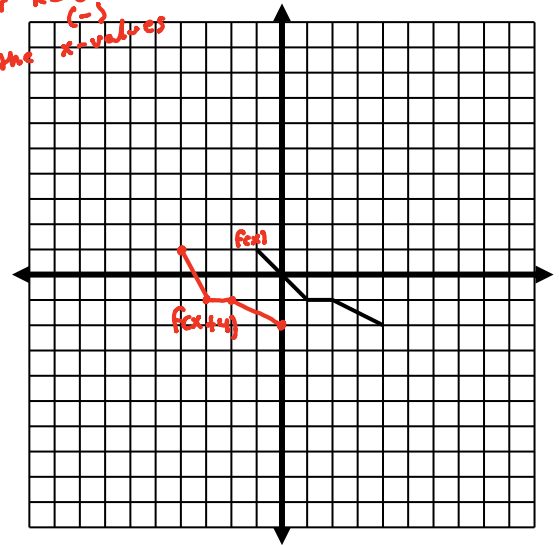


2. On the coordinate plane above, graph the 4 ordered pairs (x, y). The first point is (−5, 1).

3. What type of transformation maps Fred, F(x), to Freddie Jr., F(x + 4)? (Be specific.)
   *[handwritten: translate left 4 units]*

4. How did this transformation affect the x-values? *(Hint: Compare the characteristic points of Fred and Freddie Jr.)*
   *[handwritten: x-values decreased by 4]*

5. How did this transformation affect the y-values? *(Hint: Compare the characteristic points of Fred and Freddie Jr.)*
   *[handwritten: y-values did not change]*

6. In $y = F(x + 4)$, how did the "+4" affect the graph of Fred? Did it affect the domain or the range?
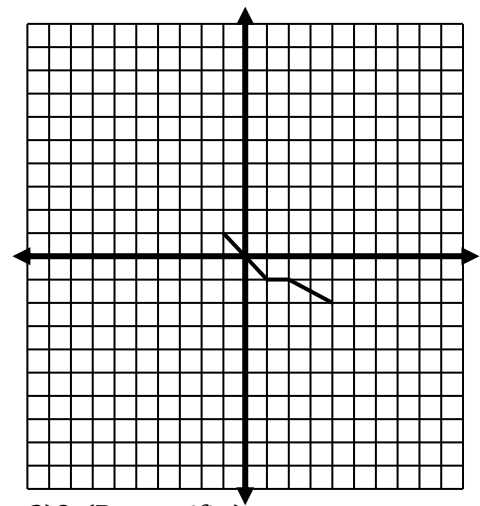   *[handwritten: moved the graph left 4 units    Domain]*

**VI.** Suppose Freddie Jr's equation is: $y = F(x − 3)$. Complete the table below for this new function and then graph Freddie Jr. on the coordinate plane above.
*[handwritten: → right]*

1. Complete the table.

$y = F(x − 3)$

| x | x − 3 | y |
|---|---|---|
| 2 | −1 | 1 |
| 4 | 1+3 | −1 |
| 5 | 2+3 | −1 |
| 7 | 4+3 | −2 |

*[handwritten: x − 3 = −1,  +3  +3,  x = 2]*



2. On the coordinate plane above, graph the 4 ordered pairs (x, y). [*Hint: The 1st point should be (2, 1).*]

3. What type of transformation maps Fred, F(x), to Freddie Jr., F(x − 3)? (Be specific.)
   *[handwritten: translates right 3 units]*

4. How did this transformation affect the x-values?
   *(Hint: Compare the characteristic points of Fred and Freddie Jr.)*
   *[handwritten: x-values increased by 3]*

5. How did this transformation affect the y-values?
   *(Hint: Compare the characteristic points of Fred and Freddie Jr.)*
   *[handwritten: y-values did not change]*

6. In $y = F(x − 3)$, how did the " −3" affect the graph of Fred? Did it affect the domain or the range?
   *[handwritten: moved the graph right 3 units    Domain]*

**VII.** Checkpoint: Using the understanding you have gained so far, describe the effect to Fred for the following functions.

*inside parentheses → left or right*

| Equation | Effect to Fred's graph |
|---|---|
| Example:  y=F(x + 18) | Translate left 18 units |
| 1.  y = F(x – 10) | Translate right 10 units |
| 2.  y = F(x) + 7  *↗ up* | Translate up 7 units |
| 3.  y = F(x + 48) | Translate left 48 units |
| 4.  y = F(x) – 22 | Translate down 22 units |
| 5.  y = F(x + 30) + 18  *left  up* | Translate left 30 + up 18 units |

*outside parentheses → up or down*


**VIII.** Checkpoint: Using the understanding you have gained so far, write the equation that would have the following effect on Fred's graph.

*inside parentheses → left or right*

| Equation | Effect to Fred's graph |
|---|---|
| Example:          y=F(x + 8) | Translate left 8 units |
| 1.          y = f(x) + 29 | Translate up 29 units |
| 2.          y = f(x – 7) | Translate right 7 |
| 3.          y = f(x + 45) | Translate left 45 |
| 4.          y = f(x + 5) + 14 | Translate left 5 and up 14  *1st        2nd* |
| 5.          y = f(x – 6) – 2 | Translate down 2 and right 6  *2nd        1st* |

*outside parentheses → up or down*

**IX.** Now let's look at a new function.
Its notation is **H(x)**, and we will call it **Harry**.
Use Harry to demonstrate what you have learned
so far about the transformations of functions.
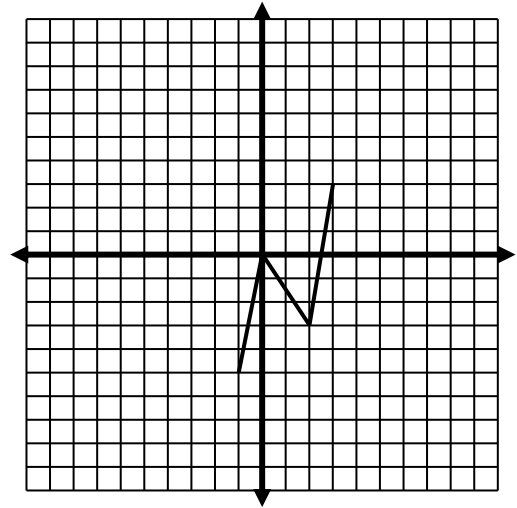
1. What are Harry's characteristic points?

$(-1, -5)$ $(0, 0)$ $(2, -3)$ $(3, 3)$

2. Describe the effect on Harry's graph for each
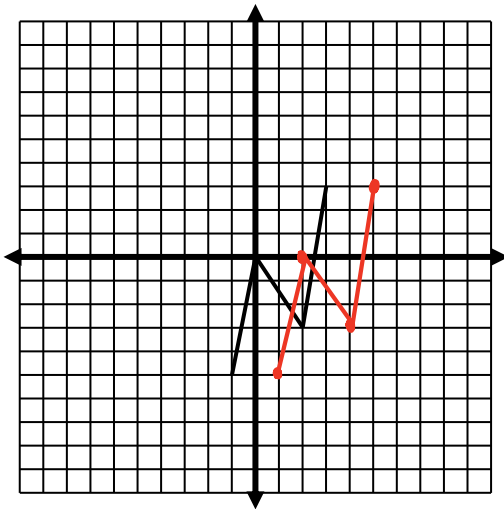   of the following.
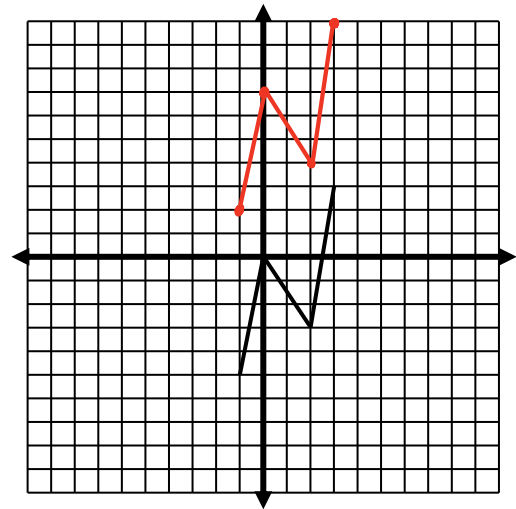   a. H(x − 2)    right 2 units
   b. H(x) + 7    up 7 units
   c. H(x+2) − 3    left 2 units + down 3 units

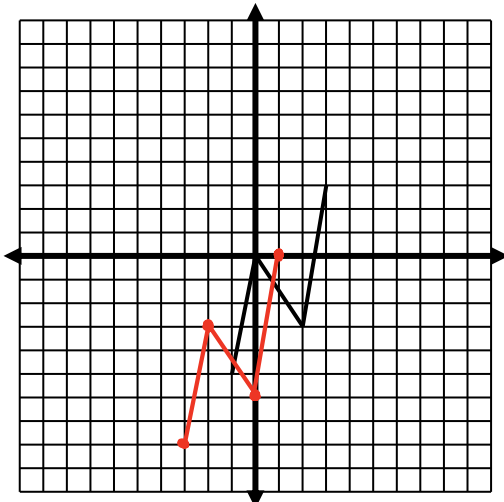3. Use your answers to questions 1 and 2 to help you sketch each graph *without using a table*.

   a. y = H(x − 2)          b. y = H(x) + 7

c. y = H(x+2) − 3

Translation Sum Up:

F(x + #) → translate LEFT (+)

F(x − #) → translate RIGHT (−)

_____

F(x) + # → translate UP (+)

F(x) − # → translate DOWN (−)