Just Move It

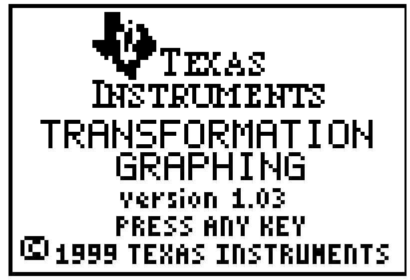
Name ________________________

Class ________________________

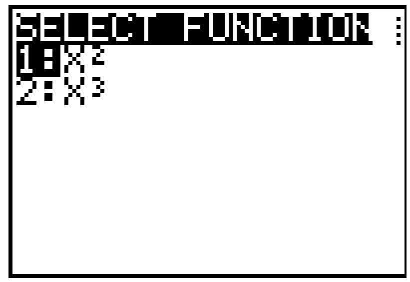
The graph of a function can be moved up, down, left, or right by adding to or subtracting from the output or the input.

In this activity, the movements of the parent functions $f(x) = x^2$ and $f(x) = x^3$ will be explored.

You will be using the Transformation Graphing App. Press [APPS] and select **Transfrm**. Press any key to start.



Press [PRGM] and select **MOVEIT**. On the Home screen, two options will appear. Option 1 will graph the parent function $f(x) = x^2$ and option 2 will graph $f(x) = x^3$.



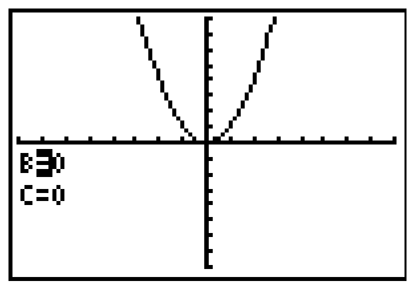
Press [2nd] [QUIT] to exit a graph. Press [ENTER] immediately to run the program again.

For each problem in this activity, look at the transformation of both types of functions.

Problem 1 – $f(x) \rightarrow f(x-b)$

Use the left and right arrow keys to change the value of **B only**. Leave C = 0.

You will need to first determine the value of B in each question.



Transforming $f(x) \rightarrow f(x - b)$

b can be negative or positive.

For example,

- if $b = 1$, the transformation is written $f(x - 1)$
- if $b = -1$, the transformation is written $f(x + 1)$

1. The graph of $f(x - 2)$ is just like the graph of $f(x)$, but the graph has been shifted…

   ☐ 2 units up ☐ 2 units left
   ☐ 2 units down ☐ 2 units right

2. Prediction of how $f(x + 5)$ compares to $f(x)$: The graph will shift…

   ☐ 5 units up ☐ 5 units left
   ☐ 5 units down ☐ 5 units right

3. How accurate was your prediction regarding the graph of $f(x-5)$?

4. In general, the transformation of ***f*(*x*)→*f*(*x*–*b*)** shifts the graph…

☐ *b* units horizontally ☐ *b* units vertically

5. This is because the _______ are affected.

☐ *x*-values/inputs ☐ *y*–values/outputs

Problem 2 – $f(x) \to f(x)+c$

Use the left and right arrow keys to change the value of **C only**. Leave C = 0.

You will need to first determine the value of C in each question.

Transforming $f(x) \to f(x) + c$

c can be negative or positive

For example,

- if $c = 1$, the transformation is written $f(x) + 1$
- if $c = –1$, the transformation is written $f(x) – 1$

6. The graph of $f(x)+4$ is just like $f(x)$, but the graph has been shifted…

☐ 4 units up ☐ 4 units left

☐ 4 units down ☐ 4 units right

7. The graph of $f(x)-3$ is just like $f(x)$, but the graph has been shifted…

☐ up 3 unit ☐ left 3 unit

☐ down 3 unit ☐ right 3 unit

8. In general, the transformation of **f(x)→f(x) + c** shifts the graph...

☐ *c* units horizontally ☐ *c* units vertically

9. This is because the _______ are affected.

☐ *x*-values/inputs ☐ *y*-values/outputs

Problem 3 – $f(x) = (x - b)^2 + c$

10. Consider the graph of $f(x – 7) + 6$ as compared to the graph of $f(x)$. This graph will be shifted...

☐ 7 units left, 6 units up ☐ 7 units left, 6 units down

☐ 7 units right, 6 units down ☐ 7 units right, 6 units up

11. How accurate was your prediction for the graph of $f(x – 7) + 6$?

12. In general, the graph of ***f*(*x* – *b*) + *c***, as compared to the parent function graph *f*(*x*), is shifted ____________ when *b* and *c* are positive.

☐ *b* units left and *c* units up ☐ *b* units right and *c* units up

☐ *b* units left and *c* units down ☐ *b* units right and *c* units down

13. Explain how the graph shifts when (1) *b* and *c* are negative, (2) *b* is positive and *c* is negative, and (3) *b* is negative and *c* is positive.

Problem 4 – *f*(*x*)→*af*(*x*)

Transforming *f*(*x*)→*af*(*x*)

a can be negative or positive

Press [Y=] and enter $\mathbf{AX^2}$ next to Y1 and $\mathbf{AX^3}$ next to Y2. Press [ENTER] on the = sign to choose the function you want to graph. Press [GRAPH] to explore the transformations.

14. The graph of 0.5*f*(*x*) as compared to the parent function, *f*(*x*) appears...

☐ wider ☐ narrower

Compare *y*-values for given *x*-values for the functions $f(x)=x^2$ and $f(x)=0.5x^2$. When $x = 2$, the corresponding values for the functions are 4 and 2 respectively. In other words, the *y*-values are "pushed lower" as a result of multiplying by 0.5. This is known as **vertical compression**.

15. The graph of 2*f*(*x*) as compared to *f*(*x*) is...

☐ wider/stretched vertically ☐ wider/compressed vertically

☐ narrower/stretched vertically ☐ narrower/compressed vertically

16. When $0 < |a| < 1$, the graph of $\boldsymbol{a \cdot f(x)}$ is…

☐ wider/stretched vertically ☐ wider/compressed vertically

☐ narrower/stretched vertically ☐ narrower/compressed vertically

17. When $|a| > 1$, the graph of $\boldsymbol{a \cdot f(x)}$ is…

☐ wider/stretched vertically ☐ wider/compressed vertically

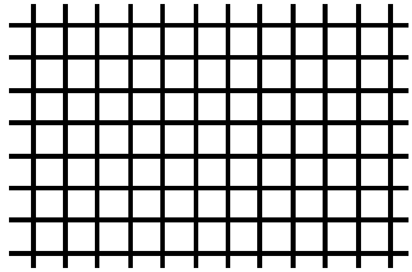
☐ narrower/stretched vertically ☐ narrower/compressed vertically

Change the coefficient of the quadratic and cubic functions to –0.5 and then to –2.

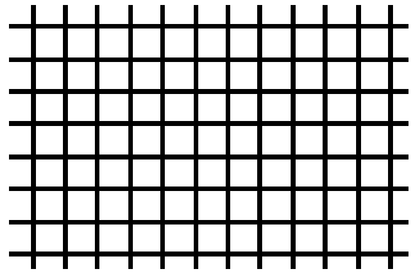
18. Describe the graph of $a \cdot f(x)$ when *a* is negative as compared to when *a* is positive.

Additional Exploration and Practice

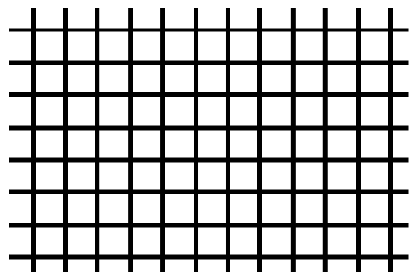
1. Compare the graph of $f(x)=|x-6|$ to the graph of $f(x)=|x|$. What is the effect of the –6 *inside* the absolute value symbol?



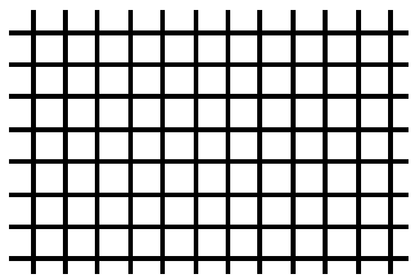
2. Compare the graph of $f(x)=|x|-6$ to the graph of $f(x)=|x|$. What is the effect of the –6 *outside* the absolute value symbol?



3. Compare the graph of $f(x)=-|x|$ to the graph of $f(x)=|x|$. What is the effect of the negative sign *in front of* the absolute value symbol?



4. Compare the graph of $f(x)=5\sin x$ to the graph of $f(x)=\sin x$. What is the effect of the 5 *in front of* sin? What part of the wave is impacted by this value?



5. What happens to the graph when you change the equation by putting a negative sign in front of the 5 in $f(x)=5\sin x$?