HOMEWORK TAKE-UP

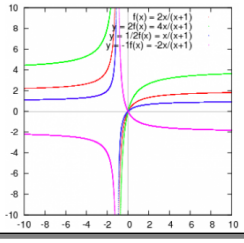
Pg. 215 #3 a,b,c,g,h,i
#10 i,iv,v
#16 iv

UNIT #4: Inverses and Transformations of Functions

Combinations of Transformations

Learning Goal:

I will learn how to sketch graphs and write equations of transformations of functions.



Lesson: Combinations of Transformations

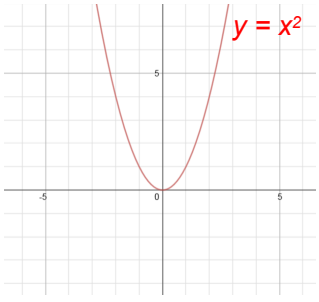
Combinations of transformations are done in this order:

1. Expansions and compressions
2. Reflections
3. Translations (shift left/right or up/down)

Expansions, compressions and reflections can be thought of as multiplications, while translations are like additions or subtractions.
Order of operations dictates that multiplication must be done before addition.

Example 1:

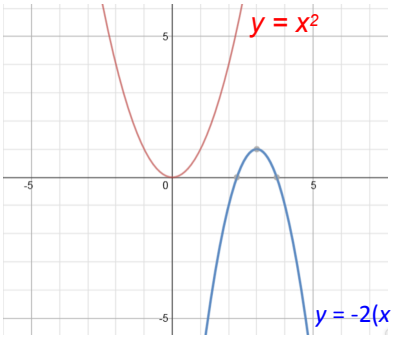
Sketch the graph of $y = -2f(x-3)+1$ when $f(x) = x^2$



Solution

The transformations for $y = -2(x - 3)^2 + 1$ are:

- Stretched vertically by a factor of 2
- Reflected in the x - axis
- Shifted up 1 unit up
- Shifted right 3 units



Example 2:

Given $y = f(x)$, explain how to obtain the graph $y = f(3x - 6) + 8$

Solution:

The function must be in the form $y = af(k(x - h)) + q$ in order to apply the transformations.

To do this, factor the coefficient of the x-term to identify the characteristics of the function more easily.

Rewrite as $y = f(3(x - 2)) + 8$

The transformations are:

- Compressed **horizontally** by a factor of 1/3
- Shifted 2 units to the right
- Shifted up 8 units

Example 3:

Given $f(x) = \sqrt{x}$, sketch the graph of $y = 2f(-x-3) + 4$.

Solution:

The graph of $y = 2f(-x-3) + 4$ is $y = 2\sqrt{-x-3} + 4$

First, factor the coefficient of x: $y = 2\sqrt{-(x+3)} + 4$

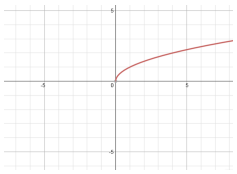
Now you can see the following **transformations**:

- Stretched vertically by factor of 2
- Reflection in the y-axis
- Shift 3 units to the left
- Shift 4 units up

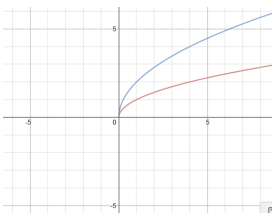
Sketching the Graph

Example 3 continued:

To sketch the graph, start with the base graph $y = \sqrt{x}$

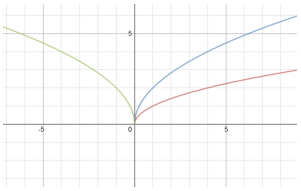


Now draw the graph of $y = 2\sqrt{x}$. *(Every y-value should be multiplied by 2 since it's a vertical stretch of 2)*

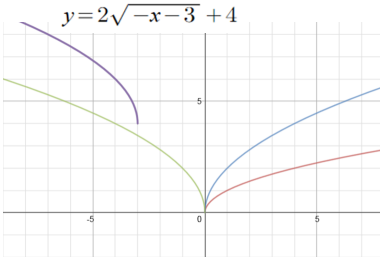


Example 3 continued:

Now sketch the graph $y = 2\sqrt{-x}$ *(this is a reflection in the y-axis)*



Apply the horizontal shift 3 units to the left and vertical shift 4 units upwards.



SUMMARY:

Horizontal stretch or compression by factor of $1/k$. Negative represents reflection in y-axis.

Horizontal shift left or right

$$y = af(k(x - h)) + q$$

Vertical stretch or compression by factor of a. Negative represents reflection in x-axis.

Vertical shift up or down

UNIT 4: Inverses and Transformation of Functions

Combinations of Transformations

Learning Goal:

I will learn how to sketch graphs and write equations of transformations of functions.

Success Criteria:

To be successful, I must be able to...

- Interpret the transformations of a function from an equation or a graph
- Write an equation of the transformation of a function and sketch the graph

Practice Work

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