

Algebra

Activity 5a - Transformations of Functions and their Graphs

In order to do this activity, you will need a device to draw graphs, such as the graphing tool on [desmos.com](https://www.desmos.com)

1. Translations

- Group 1: Graph $y = x^2$, $y = x^2 + 4$, $y = x^2 - 2$ and $y = (x - 1)^2$
- Group 2: Graph $y = \sqrt{x}$, $y = \sqrt{x+3}$ and $y = \sqrt{x} - 1$
- Group 3: Graph $y = \ln x$, $y = \ln(x - 4)$ and $y = \ln(x + 3)$
- For the function $y = (x + C)^2 + D$, what effect will adding D to a function value have on a graph? What effect will adding C to the input value (x) before applying the function have on the graph?
- If you know what the graph of $y = \sin x$ looks like, can you describe what the graph of $y = (\sin x) + 4$ and $y = \sin(x - \frac{\pi}{4})$ look like?

2. Reflections

- Group 1: Graph $y = \sqrt{x}$, $y = \sqrt{-x}$, $y = -\sqrt{x}$ and $y = -\sqrt{-x}$
- Group 2: Graph $y = \ln x$, $y = \ln(-x)$, $y = -\ln x$ and $y = -\ln(-x)$
- Group 3: Graph $y = e^x$, $y = e^{-x}$, $y = -e^x$ and $y = -e^{-x}$
- What effect will placing a negative sign in front of the function value do to the graph? What effect will placing a negative sign on the input value before applying the function have on the graph?
- Why do the graphs of $y = x^2$ and $y = (-x)^2$ look the same? Give two reasons, one by simplifying the second equation algebraically, the second by interpreting the effect of the negative sign on the graph.
- If you know what the graph of $y = \sin x$ looks like, can you describe what the graph of $y = -\sin x$ and $y = \sin(-x)$ look like?

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3. Magnifications

- Group 1: Graph $y = \sqrt{1 - x^2}$, $y = 4\sqrt{1 - x^2}$ and $y = \sqrt{1 - (3x)^2}$
- Group 2: Graph $y = \arcsin x$, $y = 2 \arcsin x$ and $y = \arcsin(2x)$
- Group 3: Graph $y = \arctan x$, $y = 2 \arctan x$ and $y = \arctan(3x)$
- For the function $y = A \arcsin(Bx)$, what effect will multiplying A to a function value have on a graph? What effect will multiplying B to the input value (x) before applying the function have on the graph?
- If you know what the graph of $y = \sin x$ looks like, can you describe what the graph of $y = A \sin x$ and $y = \sin(Bx)$ look like?

4. Summary

Given the graph of a function $y = f(x)$ and the transformed graph $y = \pm A \cdot f(\pm Bx + C) + D$:

- Which things in the transformation effect the graph horizontally (left and right) and which effect the graph vertically (top and bottom)?
- How does a multiplier effect the graph? a minus sign? a number added?
- If you know the graph of $y = f(x)$, how can you find the graph of $y = -5f(4x) - 3$?