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

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?
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 \( y = -5f(4x) - 3 \)?