Adaptation of 2003 Calculus AB Form B question 5 for Geometry (1)

1. Find the slope of \(f(x)\) if \(0 \leq x \leq 2\).

2. Segments \(\overline{OA}\) and \(\overline{AB}\) are not perpendicular; however, segments \(\overline{BC}\) and \(\overline{CE}\) are perpendicular. Justify that this is a true statement.

3. Find the length of the segment \(\overline{OA}\).

4. Graph \(h(x) = f(x) + 1\). Label the points on the new graph as \(O', A', B', C', D', E'\). Title the graph as “Graph of \(h\).”
5. What is the slope of $h(x)$ if $0 \leq x \leq 2$? Explain your reasoning.

6. What statement can you make about the slopes and the lengths of the segments $\overline{OA}$ and $\overline{O'A'}$, $\overline{AB}$ and $\overline{A'B'}$, $\overline{BC}$ and $\overline{B'C'}$, $\overline{CE}$ and $\overline{C'E'}$, as well as $\overline{ED}$ and $\overline{E'D'}$?

7. $h(x)$ represents a translation of $f$ up one unit. Write the equation of a new function $g(x)$ that will translate $f$ down 2 units.

8. Explain why the statements that were made in question 6 will also be true for the corresponding segments of the new function $g$. Generalize your statement for any function $m(x) = f(x) + k$.

9. Write an equation for a new function $p(x)$ in terms of $f(x)$ that will translate $f$ two units to the right.

10. Write a conjecture about the slopes and the lengths of segments of corresponding segments that have been translated vertically or horizontally.

11. Segment $\overline{AB}$ is a reflection of segment $\overline{OA}$ about which vertical line?

12. Find the slope of $\overline{AB}$ and compare it to the slope of $\overline{OA}$ that you calculated in question 1.
13. Compare the slopes of segment $\overline{BC}$ and $\overline{CE}$. These two segments are also reflections of each other about the vertical line $x = 5$.

14. Use your results from questions 12 and 13 to make a conjecture about the slopes of segments that are reflections about a vertical line.

15. Draw a new function $k(x)$ that is reflection of $f(x)$ about the $y$-axis. Write an equation in terms of $f(x)$ for $k(x)$.

16. Using the grid provided in question 15, draw a new function $m(x)$ that is reflected about the $x$-axis. Write an equation in terms of $f(x)$ for $m(x)$.
17. If a bug crawls along the function $f$ beginning at point O and stopping at point D, how far does it travel?

18. If the same bug crawls along any one of the functions, $h, g, p, k,$ or $m$ what statement can you make about the distance that the bug will travel? Explain your reasoning.

19. Generalize a statement about the slopes and lengths of line segments under a reflection about a vertical line.

20. Generalize a statement about the slopes and lengths of line segments under a reflection about a horizontal line.