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## College Algebra / Module 12 - Transformations

Topic 1: Translating the graph of a parabola: Two steps

Problem 1: The graph of  $y = x^2$  is translated 2 units to the right and 3 units down. Write the equation of the new parabola and sketch its graph.

Problem 2: Sketch the graph of  $y = x^2$  shifted 1 unit left and 4 units up. Provide the equation of the transformed parabola.

Topic 2: Translating the graph of an absolute value function: One step

Problem 1: The graph of  $y = |x|$  is translated 5 units up. Write the equation of the new function and sketch its graph.

Problem 2: Sketch the graph of  $y = |x|$  shifted 3 units to the left. Provide the equation of the transformed absolute value function.

Topic 3: Translating the graph of an absolute value function: Two steps

Problem 1: The graph of  $y = |x|$  is translated 2 units right and 1 unit down. Write the equation of the new function and sketch its graph.

Problem 2: Sketch the graph of  $y = |x|$  shifted 4 units left and 2 units up. Provide the equation of the transformed function.

Topic 4: How the leading coefficient affects the graph of an absolute value function

Problem 1: Compare the graphs of  $y = 2|x|$  and  $y = (1/2)|x|$  to  $y = |x|$ . Describe how the leading coefficient affects the shape of the graph.

Problem 2: Explain the effect of the leading coefficient in  $y = -3|x|$  compared to  $y = |x|$ . Sketch both graphs to illustrate the differences.

Topic 5: Translating the graph of a function: Two steps

Problem 1: The graph of  $f(x) = x^3$  is translated 3 units to the left and 2 units up. Write the equation of the transformed function and sketch its graph.

Problem 2: Sketch the graph of  $f(x) = \sqrt{x}$  shifted 1 unit right and 3 units down. Provide the equation of the transformed function.

Topic 6: Transforming the graph of a function by reflecting over an axis

Problem 1: Reflect the graph of  $f(x) = x^2$  over the x-axis. Write the equation of the new function and sketch its graph.

Problem 2: Reflect the graph of  $f(x) = x^3$  over the y-axis. Provide the equation of the transformed function and sketch its graph.

Topic 7: Transforming the graph of a quadratic, cubic, square root, or absolute value function

Problem 1: Transform the graph of  $f(x) = \sqrt{x}$  by reflecting over the x-axis and shifting 2 units up. Write the equation and sketch the transformed graph.

Problem 2: For  $f(x) = x^2$ , apply a vertical stretch by a factor of 3 and a shift 1 unit left. Provide the equation and sketch the resulting graph.

Topic 8: How the leading coefficient affects the shape of a parabola

Problem 1: Compare the graphs of  $y = 3x^2$ ,  $y = (1/3)x^2$ , and  $y = x^2$ . Describe how the leading coefficient affects the width of the parabola.

Problem 2: Explain the effect of the leading coefficient in  $y = -2x^2$  compared to  $y = x^2$ . Sketch both parabolas to show the differences in shape.

Topic 9: Determining whether two functions are inverses of each other

Problem 1: Determine if  $f(x) = 2x + 3$  and  $g(x) = (x - 3)/2$  are inverses of each other. Compute  $(f \circ g)(x)$  and  $(g \circ f)(x)$  to verify.

Problem 2: Check if  $f(x) = x^3$  and  $g(x) = \sqrt[3]{x}$  are inverses. Show the composition of both  $(f \circ g)(x)$  and  $(g \circ f)(x)$  and confirm the result.