

# AP Precalculus - M3Y & M3Z

## Transformations and composition of functions - Homework 1

1. For each of the following functions, apply the transformations in the order listed and afterwards write the formula of the function, like in the example:

Example:

$$p(x) = x^3 + x^2 - 1$$

1. Reflection over the x-axis  $\rightarrow p_1(x) = -p(x) = -x^3 - x^2 + 1$
2. Vertical translation 3 units up  $\rightarrow p_2(x) = p_1(x) + 3 = -x^3 - x^2 + 4$
3. Horizontal dilation by a factor of  $\frac{1}{5} \rightarrow p_3(x) = p_2(5x) = -125x^3 - 25x^2 + 4$
4. Horizontal translation 1 unit to the left  $\rightarrow p_4(x) = p_3(x+1) = -125(x+1)^3 - 25(x+1)^2 + 4$
5. Reflection over the y-axis  $\rightarrow p_5(x) = p_4(-x) = -125(-x+1)^3 - 25(-x+1)^2 + 4$
6. Vertical dilation by a factor of 2  $\rightarrow p_6(x) = 2p_5(x) = -250(-x+1)^3 - 50(-x+1)^2 + 8$

(i)  $f(x) = x^2 - 2x - 5$

1. Vertical translation 6 units down
2. Horizontal dilation by a factor of 2
3. Horizontal translation 2 units to the left
4. Reflection over the x-axis
5. Vertical dilation by a factor of  $\frac{1}{3}$

(ii)  $g(x) = \frac{3x+1}{5x-2}$

1. Vertical dilation by a factor of 5
2. Reflection over the x-axis
3. Horizontal dilation by a factor of  $\frac{1}{2}$
4. Reflection over the y-axis
5. Horizontal translation 3 units to the right
6. Horizontal dilation by a factor of 3

(iii)  $h(x) = \sqrt{x+2} - x^2$

1. Reflection over the y-axis
2. Vertical dilation by a factor of 4
3. Reflection over the x-axis
4. Vertical translation 5 units down
5. Reflection over the y-axis
6. Vertical dilation by a factor of  $\frac{1}{4}$
7. Horizontal translation 8 units to the left

2. Let  $f(x) = x^2 + 2x + 1$ ,  $g(x) = \frac{x+2}{x-2}$ ,  $h(x) = \sqrt{x-1}$ ,  $p(x) = \frac{1}{x^2 - 3x - 18}$

(i) Find the domain of the functions  $f(x)$ ,  $g(x)$ ,  $h(x)$  and  $p(x)$

(ii) Find the domains of the following functions:

1.  $(f \circ g)(x)$

2.  $(h \circ f)(x)$

3.  $(p \circ g)(x)$

4.  $(h \circ g)(x)$

5.  $(f \circ f)(x)$

6.  $(h \circ h)(x)$

(iii) Find the formulas for the functions from part (ii)