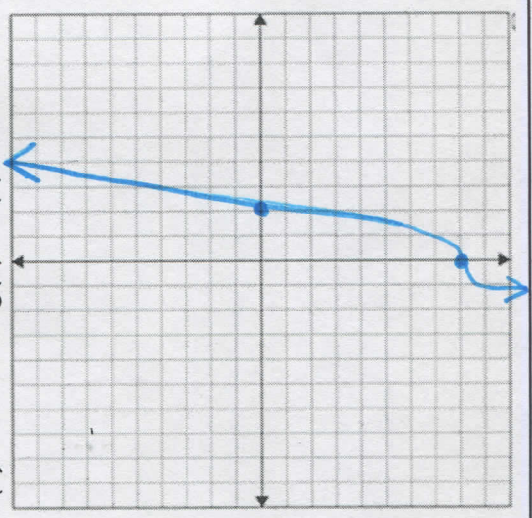


Transformations of $f(x)$		
Transformation	$f(x)$ Notation	Examples
Vertical translation	$f(x) + k$	$g(x) = x^3 + 3$ 3 units up $g(x) = x^3 - 4$ 4 units down
Horizontal translation	$f(x - h)$	$g(x) = (x - 2)^3$ 2 units right $g(x) = (x + 1)^3$ 1 unit left
Vertical stretch/compression	$af(x)$	$g(x) = 6x^3$ stretch by 6 $g(x) = \frac{1}{2}x^3$ compression by $\frac{1}{2}$
Horizontal stretch/compression	$f\left(\frac{1}{b}x\right)$	$g(x) = \left(\frac{1}{5}x\right)^3$ stretch by 5 $g(x) = (3x)^3$ compression by $\frac{1}{3}$
Reflection	$-f(x)$ $f(-x)$	$g(x) = -x^3$ across x-axis $g(x) = (-x)^3$ across y-axis

**TASK 1:** Write the rule for the function, describe the transformation in words, & sketch its graph.

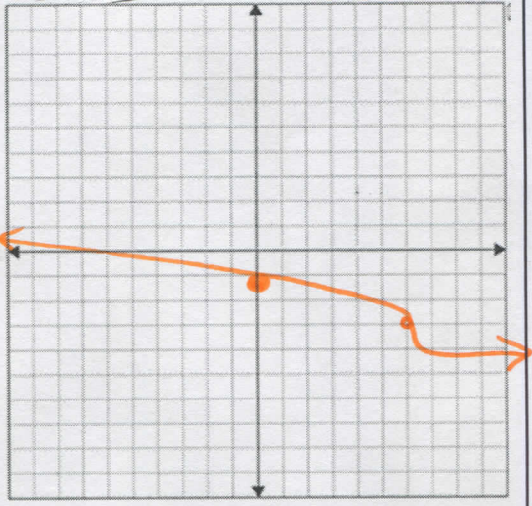
a)  $f(x) = x^3 - 6$     $g(x) = f(x) - 2$



$$g(x) = x^3 - 6 - 2$$

$$= x^3 - 8$$

b)  $f(x) = x^3 - 6$     $h(x) = f(x + 3)$



$$h(x) = (x+3)^3 - 6$$

TASK 2: Write a function  $g(x)$  that performs each transformation onto  $f(x) = x^3 + 5x^2 - 8x + 1$ .

a) Reflect  $f(x)$  across the x-axis.

$$g(x) = -f(x)$$

$$g(x) = -(x^3 + 5x^2 - 8x + 1)$$

$$g(x) = -x^3 - 5x^2 + 8x - 1$$

b) Reflect  $f(x)$  across the y-axis.

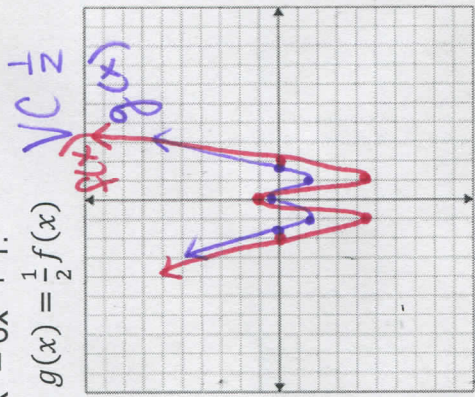
$$g(x) = f(-x)$$

$$g(x) = (-x)^3 + 5(-x)^2 - 8(-x) + 1$$

$$g(x) = -x^3 + 5x^2 + 8x + 1$$

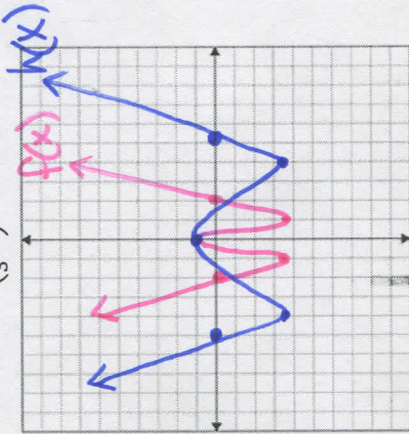
TASK 3: Graph  $f$  and  $g$  on the same coordinate plane (label appropriately). Describe  $g$  as a transformation of  $f$ . Let  $f(x) = 2x^4 - 6x^2 + 1$ .

a)  $g(x) = \frac{1}{2}f(x)$



b)  $h(x) = f\left(\frac{1}{3}x\right)$

HS 3



TASK 4: Write a rule & a new function for all transformations, in order, onto  $f(x) = 6x^3 - 3$ .

a) Reflect across the y-axis & shift down 2 units.

$$m(x) = f(-x) - 2$$

$$m(x) = -6x^3 - 3 \Rightarrow m(x) = -6x^3 - 5$$

b) Compress vertically by a factor of  $\frac{1}{3}$  and shift 2 units right.

$$n(x) = \frac{1}{3}f(x-2)$$

$$n(x) = 6(x-2)^2 - 3 = \frac{1}{3}[6(x-2)^3 - 3] = 2(x-2)^3 - 1$$

c) Compress vertically by a factor of  $\frac{1}{2}$  and move the x-intercept 3 units right.

$$c(x) = \frac{1}{2}f(x-3)$$

$$c(x) = 8(x-3)^2 - 2 = \frac{1}{2}[8(x-3)^3 - 2] = 4(x-3)^3 - 1$$

Still need help with: