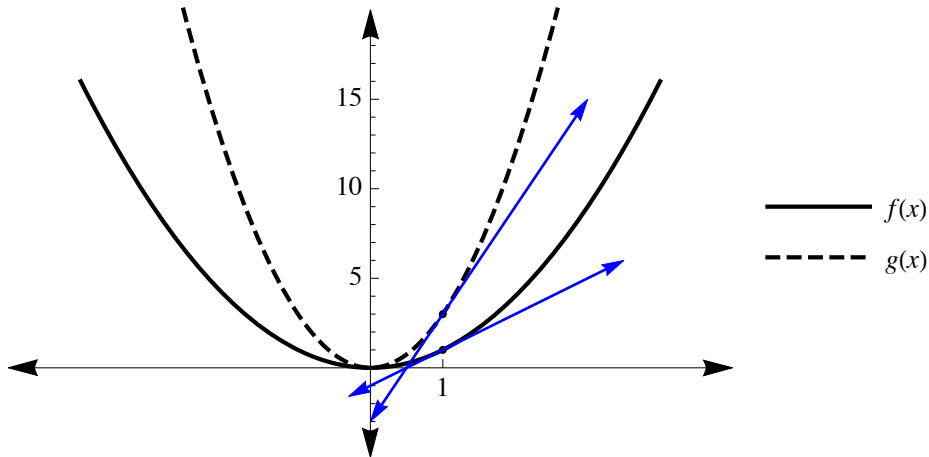


## Slope Function for $f(x) = a x^n$ (Vertical Stretch)

We now know how to write the slope function for  $f(x) = x^n$ . Let's use  $f(x) = x^2$  to explore what happens to the slope of the function if  $f$  undergoes a vertical stretch.

Let's compare and contrast the graphs  $f(x) = x^2$  and  $g(x) = 3 x^2$ .



Clearly, at  $x = 1$ ,  $g(x)$  has a steeper slope than  $f(x)$ . By drawing a series of tangent lines on both curves and finding their slopes, we can see the relationship:

$x$	-4	-3	-2	-1	0	1	2	3	4
$f'(x)$	-8	-6	-4	-2	0	2	4	6	8
$g'(x)$	-24	-18	-12	-6	0	6	12	18	24

For any given  $x$  value the slope of  $g(x)$  is 3 times the slope of  $f(x)$ . Since  $f'(x) = 2x$ ,

$$g'(x) = 3 f'(x) = 3(2x) = 6x$$

In general, if  $f(x) = a x^n$ , where  $a$  is some real-number coefficient, then

$$f'(x) = a \cdot n x^{n-1}$$

### Example

If  $f(x) = 4 x^{25}$  what is  $f'(x)$ ?

### Solution

$$f'(x) = 4 \cdot 25 \cdot x^{25-1} = 100 x^{24}$$