

## Slope Function for $f(x) = a(x - h)^n + k$ (The General Power Rule)

We can put all three of these rules together into a single, general rule:

If

$$f(x) = a(x - h)^n + k$$

then

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

### Example

If  $f(x) = 3(x - 4)^8 - 10$  what is  $f'(x)$ ?

### Solution

$$f'(x) = 3 \cdot 8(x - 4)^{8-1} = 24(x - 4)^7$$

### Generalization

Though we won't prove it here, the General Power Rule works when the exponent,  $n$ , is not just a positive integer but *any* real number!

This means that we can take a function such as

$$f(x) = 4(x - 8)^{5/2}$$

and still find its slope function:

$$f'(x) = \frac{5}{2} \cdot 4(x - 8)^{5/2-2/2} = 10(x - 8)^{3/2}$$

### Example

If  $f(x) = 2.4(x - 4)^{3.5} - 4$  what is  $f'(x)$ ?

### Solution

$$f'(x) = (2.4)(3.5)(x - 4)^{3.5-1} = 8.4(x - 4)^{2.5}$$