The Power Rule:

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$f(x) = x$

$$f'(x) = \lim_{h \to 0} \frac{(x+h) - x}{h}$$

$$= \lim_{h \to 0} \frac{h}{h} = 1$$

$f(x) = x$
$f'(x) = 1$

$f(x) = x^2 \rightarrow f'(x) = 2x$

$f(x) = x^3$

$$f'(x) = \lim_{h \to 0} \frac{\overset{a^3}{(x+h)^3} - \overset{b^3}{x^3}}{h}$$

$$= \lim_{h \to 0} \frac{(\overset{a}{\cancel{x}+h} \overset{-b}{-\cancel{x}})(\overset{a^2}{(x+h)^2} + \overset{a\ b}{(x+h)(x)} + \overset{b^2}{x^2})}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}((x+h)^2 + (x+h)(x) + x^2)}{\cancel{h}}$$

$$= (x+0)^2 + (x+0)(x) + x^2$$

$$= x^2 + x^2 + x^2 = 3x^2$$

$f(x)$	$f'(x)$
x	x^0
x	x^1
x	x^2
x^4	$4x^3$
x^7	$7x^6$
$2x^4$	$8x^3$

$f(x) = \sqrt{x} = x^{1/2}$

$f'(x) = \frac{1}{2}x^{-1/2}$

$f(x) = \sqrt[7]{x^5}$

$= x^{5/7}$

$f'(x) = \frac{5}{7}x^{-2/7}$

$= \frac{5}{7\sqrt[7]{x^2}}$

In general: The Power Rule is:

If $f(x) = x^n$

then $f'(x) = nx^{n-1}$

The Constant Rule:

If 'c' is some constant, then

if $g(x) = c \cdot f(x)$ (eg. $2(x^2+1)$)

then $g'(x) = c \cdot f'(x)$

$f(x) = 3 \cdot x^5$

$f'(x) = 3 \cdot (5x^4) = 15x^4$

Sum and Difference Rules:

If f and g are differentiable then so are $f+g$ and $f-g$.

That is:

$(f+g)' = f' + g'$

ex: $\underbrace{(3x^2}_{f} + \underbrace{7x)}_{g} \Rightarrow \underbrace{6x}_{f'} + \underbrace{7}_{g'}$

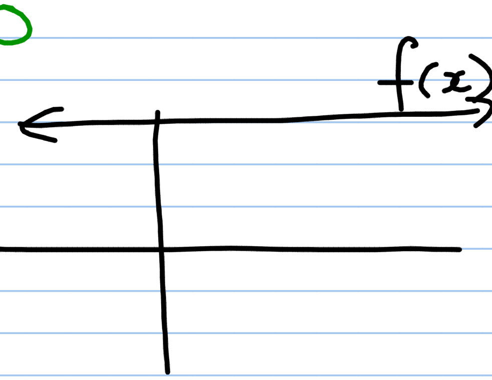
$(f-g)' = f' - g'$

$3x^2 - 7x \Rightarrow 6x - 7$

what if: $f(x) = 3$ what is $f'(x)$?

$$\lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h\to 0} \frac{3-3}{h} = 0$$



OR $f(x) = 3x^0$

$f'(x) = 0$

The derivative of a constant is **ZERO**

Eg: $f(x) = 4x^7 - \sqrt{x} + 8$

$x^{1/2}$

$f'(x) = 28x^6 - \frac{1}{2}x^{-1/2} + 0$

(2.1) + 2.2 & 2.3