Alessia Laise 10/7/09

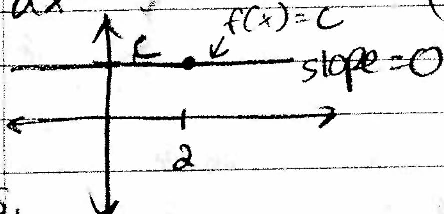
Outline
Stuff you already Know!
(Derivatives)

- Quiz Tomorrow on Derivatives (Covers the previous week + today)

Differentiation Formulas

understand the geometric and limit for why these derivatives are what they are

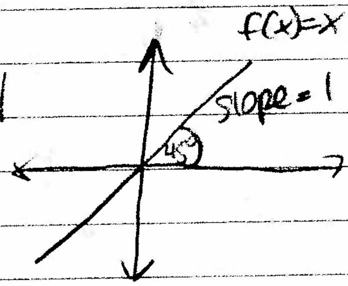
① $\frac{d}{dx}(c) = 0$



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

$\lim_{h\to 0} \frac{c-c}{h} = \lim_{h\to 0} 0 = 0$)

② $\frac{d}{dx}(x) = 1$



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

$\lim_{h\to 0} \frac{\cancel{x}+h-\cancel{x}}{h} = \frac{h}{h} = 1$)

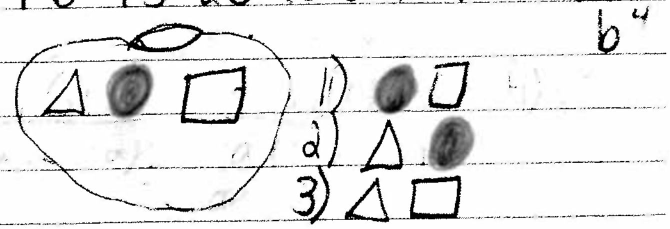
exercise Show $f'(x) = 2$ if $f(x) = 2x-3$ geometrically and using the definition of the derivative

③ $\frac{d}{dz}\left(z^n\right) = nz^{n-1}$

sidebar:

1	0	$(a+b)^0 = 1$
1 1	1	$(a+b)^1 = a+$
1 2 1	2	$(a+b)^2 = a^2+2ab+b$
1 3 3 1	3	
1 4 6 4 1	4	$(a+b)^4 =$
1 5 10 10 5 1		$a^4b^0+4a^3b^1$
1 6 15 20 15 6 1		$4a^2b^2+4ab^3+$ b^4

exercise
Show $\frac{d}{dx}\, nx^{n-1}$ use it with $(x+h)^n$



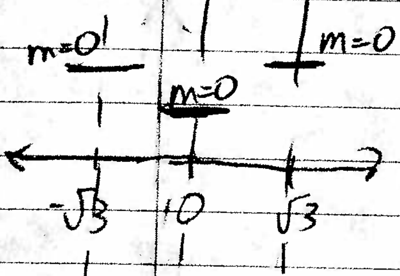
constant

(4) $\frac{d}{dy}\left(cf(y)\right) = c\frac{d}{dy}\left(f(y)\right)$ ex) $f(x)=2x^4$
$f'(x)=8x^3$

(5) $\frac{d}{dx}\left(f(x)\pm g(x)\right) = f'(x) \pm g'(x)$

using 1-5   ex) $f(x)=17x^2-2x^7+3x-12$
$34x-14x^6+3$

ex) $y=x^4-6x^2+4$ Find the points on this curve wit[h] horizontal tangent lines



$y'=4x^3-12x$
$0=4x^3-12x$
$4x(x^2-3)$
$x=0$ | $x=\pm\sqrt{3}$

So this curve has horizontal tangents at $x=0, \pm\sqrt{3}$

(6) $\frac{d}{dx}\left(f(x)\cdot g(x)\right) = f(x)g'(x) + f'(x)g(x)$

(7) $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{f'(x)g(x)-f(x)g'(x)}{(g(x))^2}$

ex) $\frac{x^4+3x-1}{2x^5-2x^2} = f(x)$ $F'(x) = \frac{(4x^3+2)(2x^5-2x^2)-(x^4+3x-1)(10x^4-4}{(2x^5-2x^2)^2}$

Let It Like This!

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

ex) $g(z)=z^{\pi}$ $g'(z) = \pi z^{\pi-1}$

$\left(\cancel{\text{ex) } h(x)=7^x \quad h'(x)=x7^{x-1}}\right)$ warning Don't confuse the power function with the exponential function

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(33) $y = x + \sqrt{x}$ $(1,2)$

tangent line $x + (x)^{1/2}$

$1 + \frac{1}{2}x^{-1/2} = \frac{2\sqrt{x}1}{2\sqrt{x}} + \frac{1}{2\sqrt{x}}$ $\frac{2\sqrt{x}+1}{2\sqrt{x}} = \frac{2\sqrt{1}+1}{2\sqrt{1}} = \frac{2+1}{2} = \frac{3}{2}$

$m = \frac{3}{2}$ $y = mx + b$ $2 = \frac{3}{2}(1) + b$

$\frac{(2)2}{2} - \frac{3}{2} = b$ $\frac{4-3}{2} = b = \frac{1}{2}$ $\boxed{y = \frac{3}{2}x + \frac{1}{2}}$

normal line $m = \frac{-2}{3}$ $y = mx + b$ $2 = \frac{-2}{3}(1) + b$

$\frac{(3)2}{3} + \frac{2}{3} = b$ $\frac{6+2}{3} = \frac{8}{3} = b$

$\boxed{y = \frac{-2}{3}x + \frac{8}{3}}$