Section 3.1 Derivative of a Function

Derivative

- slope
- m
- $\frac{rise}{run}$
- $\frac{dy}{dx}$
- $\frac{\Delta y}{\Delta x}$
- rate of change
- velocity
- $\frac{y_2 - y_1}{x_2 - x_1}$
- y'
- $\frac{df}{dx}$
- f'

Power Rule

$$\frac{d}{dx}(u^n) = nu^{n-1}\frac{du}{dx}$$

short-cut method
- only works for polynomial functions

Examples:

1. $y = 4x^5 - 3x^2 + 5x - 7$

$y' = 5\cdot 4x^4 - 2\cdot 3x^1 + 1\cdot 5x^0 - 0\cdot 7x^{-1}$

$\boxed{y' = 20x^4 - 6x + 5}$

2. $y = 7x^6 + 2x^4 - 5x^3 + \pi$

$\boxed{y' = 42x^5 + 8x^3 - 15x^2}$

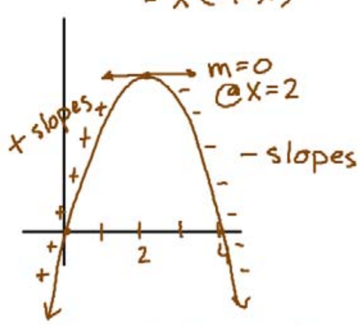
3. $y = \frac{1}{3}x^6 + 4x^3 - ex - 8$

$\boxed{y' = 2x^5 + 12x^2 - e}$

Graphs of functions and their derivatives

4. $y = 4x - x^2$

$= x(4-x)$



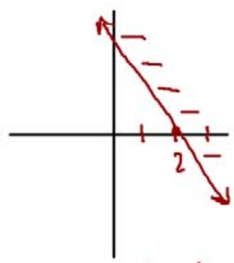
verify algebraically

$y = 4x - x^2$

$y' = 4 - 2x$

$y'' = -2$

$y' =$

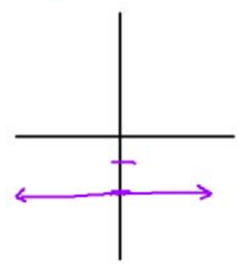


constant
- always negative

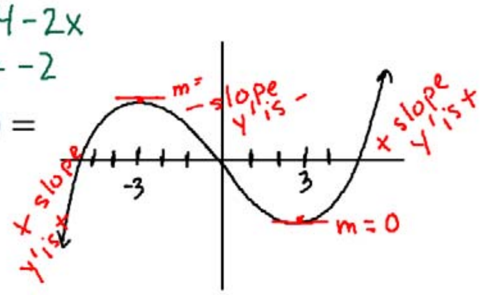
$y' = 4 - 2x$

x	y'
0	4
1	2
2	0
3	-2
4	-4

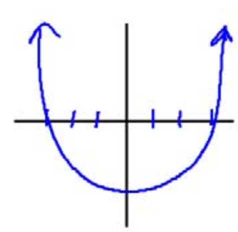
$y'' =$



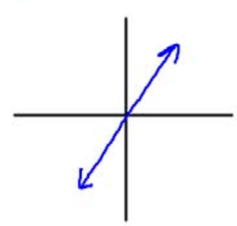
5. $g(x) =$



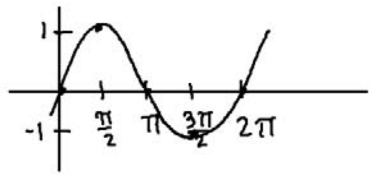
$g'(x) =$



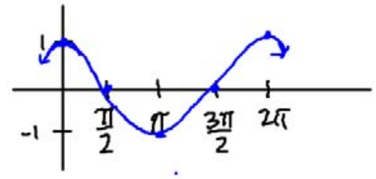
$g''(x) =$



6. $y = \sin x$

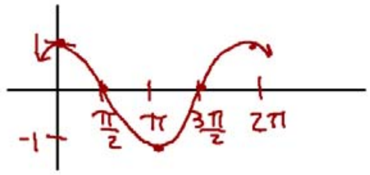


x	y'
0	1
$\frac{\pi}{2}$	0
π	-1
$\frac{3\pi}{2}$	0
2π	1

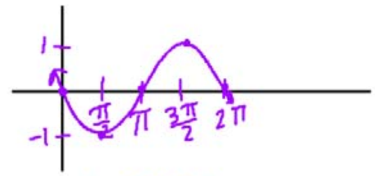


$y = \sin x$
$y' = \cos x$

7. $y = \cos x$

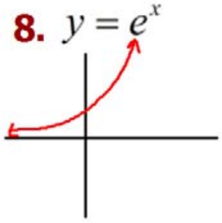


x	y'
0	0
$\frac{\pi}{2}$	-1
π	0
$\frac{3\pi}{2}$	1
2π	0

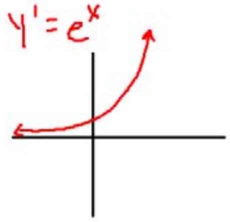


$y = \cos x$
$y' = -\sin x$

8. $y = e^x$



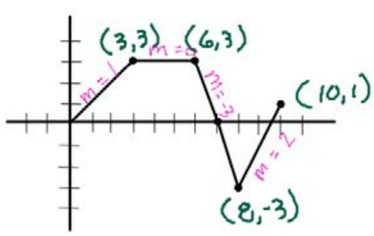
$y' = e^x$



transcendental functions:

If you continue to take the derivative, you eventually get the original function.

9. $f(x) =$



$f'(x) =$