Concepts & Skills to Know for Calculus I Test 2

1. The Derivative is:
   a) The rate of change of the function f(x) at a given value of x (or t, if it is a function of time)
   b) Also called the instantaneous rate of change.
   c) $f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$
   d) It is also the slope of the tangent line at a given point.
   **e) <u>It is not the average rate of change</u>**
2. The speed of an object is $|v(t)|$. It is always positive.
3. Know how to calculate the derivative of a variety of functions. You may use the attached sheet which is a differentiation table. It will be attached to test 1. **Print a copy and take it with you if you are testing with ProctorU**
4. When calculating the derivative of a power of x, you should write x in the numerator before applying the formula for the derivative. $\frac{d}{dx}\left(\frac{1}{x^3}\right) = \frac{d}{dx}x^{-3} = -3x^{-4} = \frac{-3}{x^4}$
5. Know how to use the product, quotient, and chain rule.
6. When you take a derivative of a composite function, be sure that you have considered every function involved and use the chain rule. You must include the derivative of every function and use the Chain Rule! $y = (x^3 + \ln x + sin^2 x)^5$

$$y' = 5(x^3 + \ln x + sin^2 x)^4 \frac{d}{dx}(x^3 + \ln x + sin^2 x)$$

$$y' = 5(x^3 + \ln x + sin^2 x)^4 (3x^2 + \frac{1}{x} + 2\sin x \cos x)$$

7. If $s(t)$ *is an object's position,* $s'(t)$ *is the velocity* $v(t)$*, and the acceleration is* $a(t) = v'(t) = s"(t)$.
8. An object is moving forward (or upward) when v > 0, and is moving backward (or downward) when v < 0.
9. Understand implicit differentiation.
10. Understand how to calculate related rates.
11. Be able to interpret the derivative/slope of a graph at a point (+, -, 0)

# Differentiation Rules

$$\frac{d}{dx}x^n = nx^{n-1}$$

$$\frac{d}{dx}\ln x = \frac{1}{x}$$

$$\frac{d}{dx}\sin x = \cos x$$

$$\frac{d}{dx}\cos x = -\sin x$$

$$\frac{d}{dx}\tan x = \sec^2 x$$

$$\frac{d}{dx}\csc x = -\csc x \cot x$$

$$\frac{d}{dx}\sec x = \sec x \tan x$$

$$\frac{d}{dx}\cot x = -\csc^2 x$$

$$\frac{d}{dx}e^x = e^x$$

$$\frac{d}{dx}a^x = (\ln a)a^x$$

$$\frac{d}{dx}\sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\cos^{-1} x = \frac{-1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\tan^{-1} x = \frac{1}{1+x^2}$$

$$\frac{d}{dx}\cot^{-1} x = \frac{-1}{1+x^2}$$

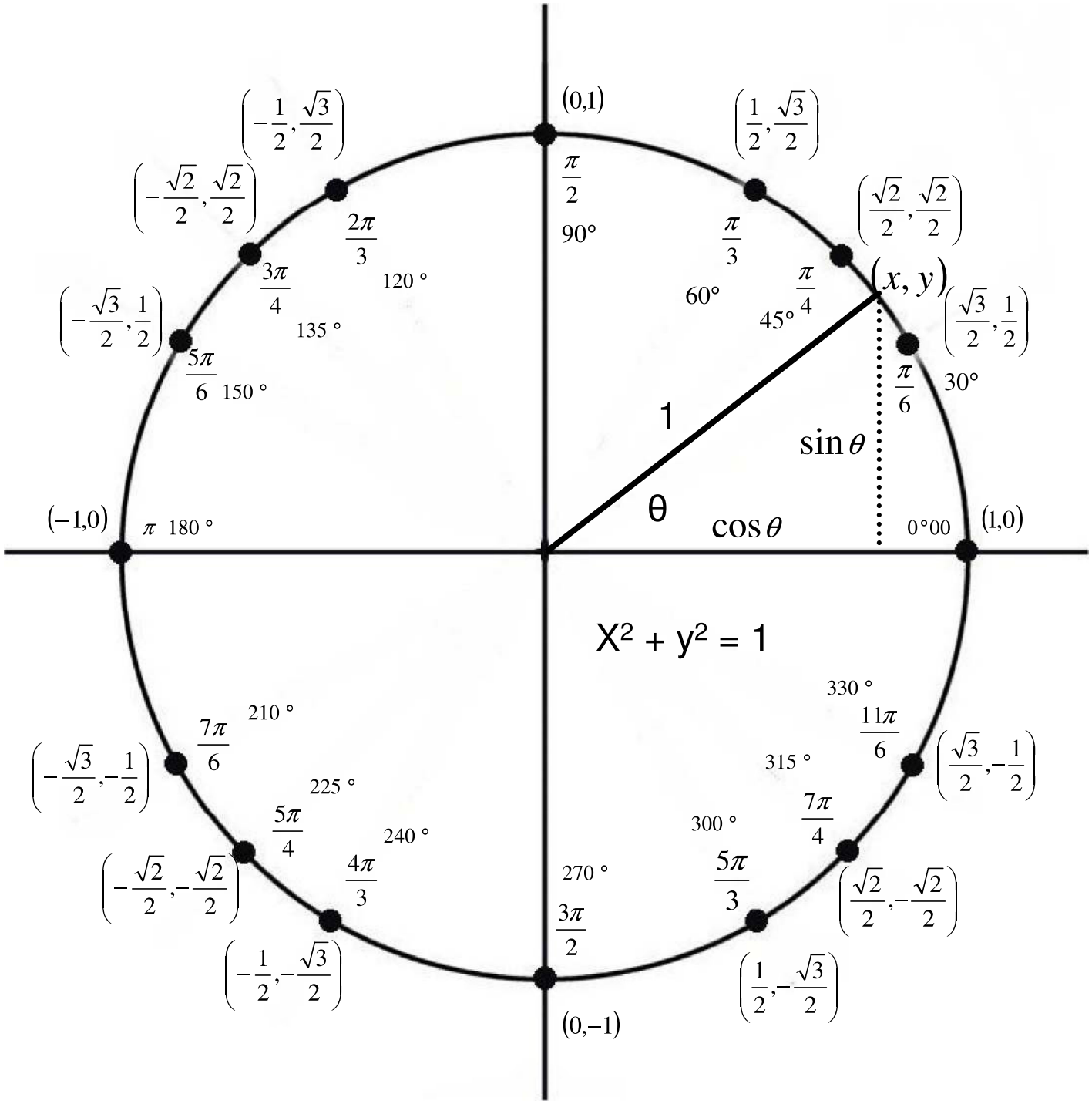
$$\frac{d}{dx}\sec^{-1} x = \frac{1}{x\sqrt{x^2-1}}$$

$$\frac{d}{dx}\csc^{-1} x = \frac{-1}{x\sqrt{x^2-1}}$$

Note: **Remember the Chain Rule! If the variable in the function is not just plain x but is u(x), you must multiply the results by** $\frac{du}{dx}$.

Product Rule: $(uv)' = uv' + vu'$

Quotient Rule: $\left(\frac{u}{v}\right)' = \frac{vu' - uv'}{v^2}$




# The Unit Circle