# Good afternoon

Have your notes out when the bell rings, we will go over (the last!) derivative rules to memorize and practice with those :)

The last ~15 mins will be for working on the AP packet or doing a retake if you wish

Remember to stay for Thursday DS if you are needing extra help or for retakes! It's reserved for you

# Your history with functions

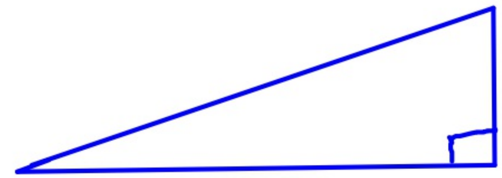
- Constant
- Linear
- Absolute Value
- Quadratic
- Cubic, Quartic, Polynomial
- Rational
- Exponential
- Logarithmic
- Trigonometric
- Inverse Trigonometric

Can you take its derivative?

# Derivatives of Inverse Trigs

What is even arcsin(x)

$\sin^{-1}(x)$



$\cancel{\sin^{-1}x = \frac{1}{\sin x} = \csc x}$

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

$\frac{d}{dx}\,{}^2$

$\sin^{-1}(x) = y$ what is this?

$\Updownarrow$

$\sin(y) = x$

angle

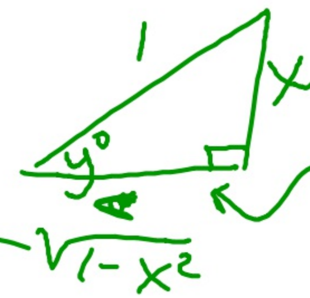
ratio

$\frac{d}{dx}\sin(y) = \frac{d}{dx}x$

use derivative on both sides

$\cos(y)\cdot\frac{dy}{dx} = 1$

Chain Rule




$a^2 + x^2 = 1^2$

$a^2 = 1 - x^2$

$a = \sqrt{1-x^2}$

$\frac{dy}{dx} = \frac{1}{\cos(y)}$

$$\boxed{\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}}}$$

(Add to booklet)

$$\frac{d}{dx}\left(\sin^{-1} x\right) = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\left(\cos^{-1} x\right) = -\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\left(\tan^{-1} x\right) = \frac{1}{1+x^2}$$

$$\frac{d}{dx}\left(\cot^{-1} x\right) = -\frac{1}{1+x^2}$$

$$\frac{d}{dx}\left(\sec^{-1} x\right) = \frac{1}{|x|\sqrt{x^2-1}}$$

$$\frac{d}{dx}\left(\csc^{-1} x\right) = -\frac{1}{|x|\sqrt{x^2-1}}$$

Good afternoon: warm ups

Find f '(6) if f(x) = arctan($\frac{1}{2}x$)

$$\tan^{-1}(\ ) = \frac{1}{1+\ ^2}\cdot$$

$$f' = \frac{1}{1+(\frac{1}{2}x)^2}\cdot\frac{1}{2} \Rightarrow \frac{1}{2(1+\frac{1}{4}x^2)} = \frac{1}{20}$$

6

Find the equation of the line tangent to y=csc$^{-1}$(2x) at the point (1, 0.524)

$$y - y_1 = m(x - x_1)$$

$$y = -\frac{1}{|2x|\sqrt{(2x)^2-1}}\cdot 2$$

$$\csc^{-1}(x) \quad \frac{-1}{|x|\sqrt{x^2-1}}$$

$$y' = -\frac{2}{|2x|\sqrt{4x^2-1}}$$

$$y'(1) = -\frac{\cancel{2}}{\cancel{2}\sqrt{3}} = \frac{-1}{\sqrt{3}}$$

Let's say you take a derivative....and

$$f'(x) = \frac{\left(\frac{3}{x} - \ln x\right)}{x^2} \cdot \frac{x}{x}$$

$$\frac{3 - x\ln x}{x^3}$$

Some Algebra Techniques

*NOTES*

Show that the derivative of $y = 4x\sqrt{6x-1}$ is $\dfrac{36x-4}{\sqrt{6x-1}}$

$y = \underbrace{4x}_{f} \cdot \underbrace{(6x-1)^{1/2}}_{g}$

$f: 4x \qquad g: (6x-1)^{1/2}$

$f': 4 \qquad g': \cancel{\tfrac{1}{2}}(6x-1)^{-1/2} \cdot \cancel{6}\,3$

$3(6x-1)^{-1/2}$

$y' = 4(6x-1)^{1/2} + 12x(6x-1)^{-1/2}$

$(6x-1)^{-1/2}\left[4(6x-1)^{1} + 12x\right]$

$(6x-1)^{-1/2}\left[24x - 4 + 12x\right]$

$$\frac{36x-4}{\sqrt{6x-1}}$$

$4x^3 - 2x^2$

$2x^2(2x^1 - 1)$

Take the derivative of $y=2e^{-4\ln x^3}$

$a \cdot \ln b \rightleftarrows \ln b^a$

$y = 2e^{\ln(x^3)^{-4}}$

$y = 2\boxed{\cancel{e}^{\ln x^{-12}}}$

$y = 2x^{-12}$

$y' = -24x^{-13}$

$y' = \dfrac{-24}{x^{13}}$

Find q'(π/21)  where q(t) = -csc(7t)

$$q(t) = -\csc(7t)$$

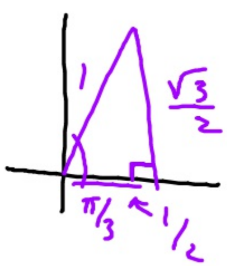
$$q'(t) = - -\csc(7t)\cot(7t)\cdot 7$$

$$q'(t) = 7\csc(7t)\cot(7t)$$

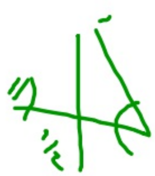
$$q'(\pi/21) = 7\csc\left(7\cdot\frac{\pi}{21}\right)\cot\left(7\cdot\frac{\pi}{21}\right)$$

$$q'(\pi/21) = 7\csc\left(\frac{\pi}{3}\right)\cot(\pi/3)$$

$$= 7\left[\frac{1}{\sin(\pi/3)}\right]\left[\frac{1}{\tan(\pi/3)}\right]$$




$$7\left(\frac{2}{\sqrt{3}}\right)\cdot\left(\frac{\frac{1}{\cancel{2}}}{\frac{\sqrt{3}}{\cancel{2}}}\right)$$




$$7\left(\frac{2}{\sqrt{3}}\right)\left(\frac{1}{\sqrt{3}}\right)$$

$$= \frac{7\cdot 2\cdot 1}{3} = 14/3$$

Find the derivative of $\ln\left(\frac{1}{4-x}\right)$

Show that the derivative of $y = \log_2 \sqrt[3]{x}$ is $\dfrac{1}{x \ln 8}$

Find the second derivative of ~~derivative~~ of $y = \cancel{\log_3 3^{4x^2}}$

$y = 4x^2$

$y' = 8x$

$y'' = 8$

Take a 1 minute stretch and relax break

(then clear your desks :))

The Tangent Line Game :)

Each pair gets a pack of 30 cards, 10 sets of 3

One describes a function, another a derivative,

and another a particular tangent line

(If you get a 'raw' pack, please get

and return scissors + recycle scraps)

Pair F with F ' and a tangent line