## Warmup!

1) If y = sin(5x), find y' $= \cos(5x) \cdot 5$

✓ y' = 5cos(5x)

$y = \cos(x^2)$

$y' = -\sin(x^2) \cdot 2x$

2) Suppose $y = \sqrt{\cos(x^2)}$ , find dy/dx

$y = [\cos(x^2)]^{\frac{1}{2}}$

$y' = \frac{1}{2}[\cos(x^2)]^{-\frac{1}{2}} [-\sin(x^2)] \cdot 2x$

✓

$$\frac{dy}{dx} = \frac{-x\sin(x^2)}{\sqrt{\cos(x^2)}}$$

# 2.4b Chain Rule with Trig!

## ESSENTIAL LEARNING TARGETS

At the end of this lesson, you will be able to:

- Apply the chain rule to differentiate composite functions

You try!

If $f(x) = \sqrt[3]{\tan(6x^4 + 3x - 2)}$ , find $f'(x)$

Find dy/dx for each of the following:

a) $y = (2x + 3)^3$

b) $y = (2x^2 + 3)^3$ $y' = 3(2x^2+3)^2 (4x)$

c) $y = (2x^3 + 3)^3$

d) $y = \sqrt{2x + 3}$ $= 12x(2x^2+3)^2$

e) $y = (x + 1)^3$

f) $y = (x + 1)^{-3}$

g) $y = \sin(5x)$

h) $y = \sin(x^2)$

i) $y = \sin(x^3 + 1)$

j) $y = \sin(\cos x)$

k) $y = \sin(\tan x)$

l) $y = \sin(\sin x)$

m) $y = \tan(x^2)$

n) $y = \tan(\sin x)$

o) $y = \cot(\sin x)$

p) $y = \csc(\cos x)$

$y' = -\csc(\cos x)\cot(\cos x) \cdot (-\sin x)$

q) $y = \cos^2 x$

r) $y = \cos^3 x$

s) $y = \sin^2 x$

t) $y = \sin^9 x$

u) $y = \sin^9(2x)$

v) $y = \sin^9(x^2)$

w) $y = \sin^9(\cos x) = [\sin(\cos x)]^9$

$y' = 9[\sin(\cos x)]^8 \cdot \cos(\cos x) \cdot (-\sin x)$

x) $y = \sin^{37}(\tan \pi/6) = [\sin(\tan \frac{\pi}{6})]^{37}$

$y' = 0$

# Check your answers!

a) $y' = 6(2x + 3)^2$

b) $y' = 12x(2x^2 + 3)^2$

c) $y' = 18x^2(2x^3 + 3)^2$

d) $y' = 1 / \sqrt{2x + 3}$

e) $y' = 3(x + 1)^2$

f) $y' = -3(x + 1)^{-4}$

g) $y' = 5\cos(5x)$

h) $y' = 2x\cos(x^2)$

i) $y' = 3x^2\cos(x^3 + 1)$

j) $y' = -\sin x \cdot \cos(\cos x)$

k) $y' = \sec^2 x \cdot \cos(\tan x)$

l) $y' = \cos x \cdot \cos(\sin x)$

m) $y' = 2x\sec^2(x^2)$

n) $y' = \cos x \cdot \sec^2(\sin x)$

o) $y' = -\cos x \cdot \csc^2(\sin(x))$

p) $y' = \sin x \cdot \csc(\cos x).\cot(\cos x)$

q) $y' = -2\cos x\sin x$

r) $y' = -3\cos^2 x\sin x$

s) $y' = 2\sin x\cos x$

t) $y' = 9\sin^8 x\cos x$

u) $y' = 18\sin^8(2x)\cos(2x)$

v) $y' = 18x\sin^8(x^2)\cos(x^2)$

w) $y' = -9\sin^8(\cos x) \cdot \sin x$

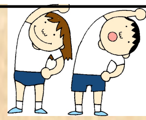
x) $y' = 0$

# 2007 Form B #3

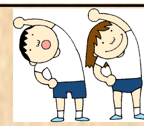
The wind chill is the temperature, in degrees Fahrenheit (°F), a human feels based on the air temperature, in degrees Fahrenheit, and the wind velocity $v$, in miles per hour (mph). If the air temperature is 32°F, then the wind chill is given by $W(v) = 55.6 - 22.1v^{0.16}$ and is valid for $5 \le v \le 60$.

(a) Find $W'(20)$. Using correct units, explain the meaning of $W'(20)$ in terms of the wind chill.

(b) Find the average rate of change of $W$ over the interval $5 \le v \le 60$. Find the value of $v$ at which the instantaneous rate of change of $W$ is equal to the average rate of change of $W$ over the interval $5 \le v \le 60$



# Review!!



1) Find $\frac{d(\sec(\tan x^3))}{dx}$

2) Given $y = ax^2 + bx + c$ passes through (-2, 8) and is tangent to the line $9x + y = 8$ at the point (1, -1), find a, b and c.

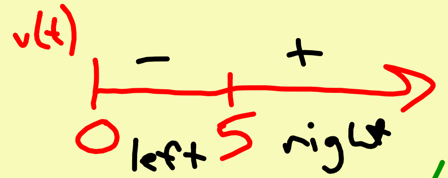
Position: $x(t) = t^2 - 10t + 3,\ t \geq 0$ (x in ft, t in sec)

Velocity: $v(t) = 2t - 10$

At rest? $2t - 10 = 0$

$t = 5$ sec b/c $v(5) = 0$

Chg direction?



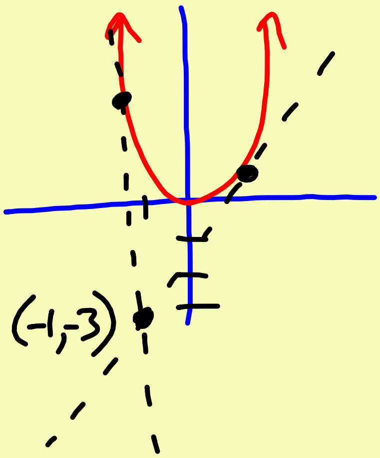

chgs dir @ $t = 5$ b/c $v(t)$ chgs sign

Moving left? $(0, 5)$ b/c $v(t) < 0$

" right? $(5, \infty)$ b/c $v(t) > 0$

Speed @ $t = 2$? $v(2) = -6$ so speed $= 6\ \frac{ft}{sec}$

Acceleration function? $a(t) = v'(t) = 2$




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

$y + 3 = \underline{2x}(x+1)$

$y = 2x(x+1) - 3 = x^2$

## What have we learned?

- Can I apply the chain rule in a variety of problems and situations involving polynomial, radical, rational and trigonometric funtions?