October 8, 2025

National Pierogi Day

Today in History:

Great Chicago Fire begins (1871)

Fist patent filed for the microwave. (1945)

Number of the Day: 206

206 = 2 x 103

206 = $1^3 + 2^3 + 2^3 + 4^3 + 5^3$.

Fun Fact:

In Marion Ohio, it is against the law to eat a doughnut and walk backwards on a city street.

Quote of the Day:

"There's one way to find out if a man is honest – ask him. If he says "yes," he is a crook."

- Groucho Marx

Today's Weather:

Partly cloudy skies, high 62^o

Math 121

Quiz #23

Find $f'(x)$ for

$$f(x) = \sin(\sinh x) + \tanh(\tan x)$$

$f'(x) = \cos(\sinh x) \cdot \cosh x + \operatorname{sech}^2(\tan x) \cdot \sec^2 x$

MPOD 23

#6 $y = \operatorname{arcsinh}\left(\sqrt{x^2+1}\right)$

$$\frac{dy}{dx} = \frac{1}{\sqrt{\left(\sqrt{x^2+1}\right)^2+1}} \cdot \frac{1}{2}(x^2+1)^{-\frac{1}{2}}(2x)$$

$$= \frac{1}{\sqrt{x^2+2}} \cdot \frac{x}{\sqrt{x^2+1}}$$

#5 $y = \sinh(\cosh^3 x)$

$$\frac{dy}{dx} = \cosh(\cosh^3 x) \cdot 3\cosh^2 x \sinh x$$

Pg 196

#9 $y = e^{(\ln x)^2}$

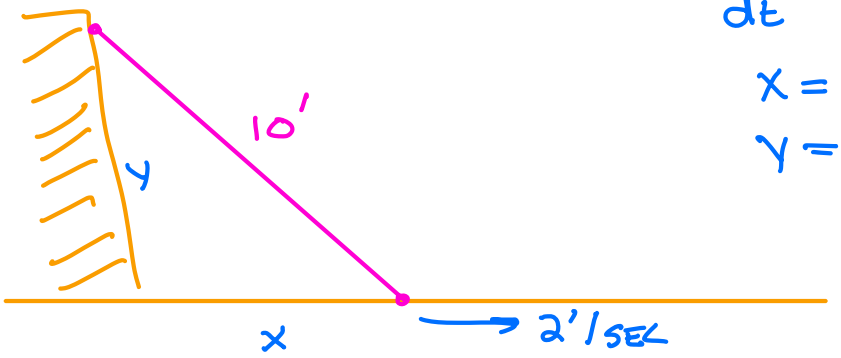
$$\frac{dy}{dx} = e^{(\ln x)^2} \, 2(\ln x) \cdot \frac{1}{x}$$

#57 $y = \dfrac{\coth t}{1 + \tanh t}$

$$\frac{dy}{dx} = \frac{(1+\tanh t)(-\operatorname{csch}^2 t) - (\coth t)\operatorname{sech}^2 t}{(1+\tanh t)^2}$$

RELATED RATES (WORD PROBLEMS)

A ten foot ladder leans against a building. The bottom of the ladder slides away from the building at 2 feet per second. How fast is the top of the ladder moving when the bottom is six feet from the building?



$\frac{dx}{dt} = 2'/\text{SEC}$

$x = 6$

$y = 8$

$x^2 + y^2 = 100$

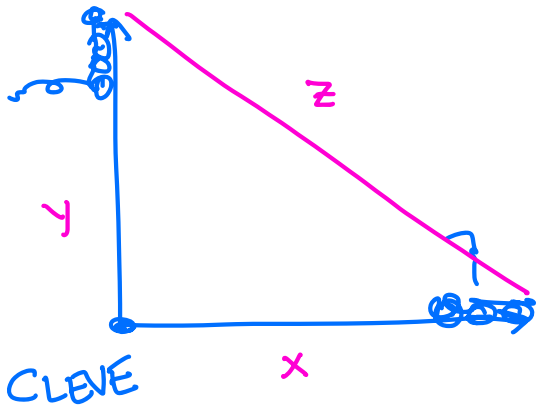
$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$(6)(2) + 8\frac{dy}{dt} = 0$

$\frac{dy}{dt} = -\frac{12}{8} = -\frac{3}{2}'/\text{SEC}$

SLIDING DOWN AT $\frac{3}{2}'/\text{SEC}$.

At noon a train leaves Cleveland and heads due north at 10 mph. Another train leaves Cleveland at 1:00 p.m. going due east at 20 mph. How fast is the distance between them changing at 3:00 p.m.



$x = 20 \cdot 2 = 40$

$y = 10 \cdot 3 = 30$

$40^2 + 30^2 = z^2$

$z = 50$

$$x^2 + y^2 = z^2$$

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 2z\frac{dz}{dt}$$

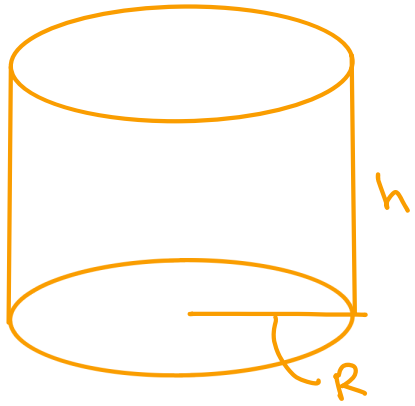
$x = 40 \qquad y = 30 \qquad z = 50$

$\frac{dx}{dt} = 20 \qquad \frac{dy}{dt} = 10$

$$(40)(20) + (30)(10) = 50\frac{dz}{dt}$$

$$\frac{dz}{dt} = \frac{1100}{50} = 22 \text{ mph}$$

A circular cylinder has a radius r and a height h feet. If the height and radius both increase at the constant rate of 10 feet per minute, at what rate is the surface area increasing when $r = 3$ and $h = 5$?



$$SA = A_{TOP} + A_{BOTTOM} + A_{SIDE}$$

$$= \pi R^2 + \pi R^2 + 2\pi R h$$

$$SA = 2\pi R^2 + 2\pi R h$$

$$\frac{dSA}{dt} = 2\pi\, 2R \frac{dR}{dt} + 2\pi \left(R \frac{dh}{dt} + h \frac{dR}{dt} \right)$$

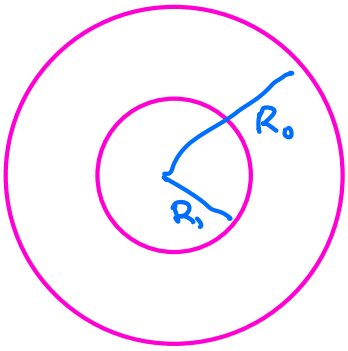
$R = 3$ $\quad h = 5$

$\frac{dR}{dt} = 10$ $\quad \frac{dh}{dt} = 10$

$$\frac{dSA}{dt} = 4\pi(3)(10) + 2\pi(3(10) + 5(10))$$

$$= 280\pi \text{ ft}^2/\text{min}$$

Two concentric circles are expanding. At a certain instant the outer radius is 10 ft and it is expanding at a rate of 2 ft/sec, while the inner radius is 3 ft and it is expanding at the rate of 5 ft/sec. Find the rate of change of the area between the circles at that instant.



$$A_{BET} = A_{OUT} - A_{IN}$$

$$A = \pi R_o^2 - \pi R_i^2$$

$$\frac{dA}{dt} = 2\pi R_o \frac{dR_o}{dt} - 2\pi R_i \frac{dR_i}{dt}$$

$R_o = 10$ $\quad R_i = 3$

$\frac{dR_o}{dt} = 2$ $\quad \frac{dR_i}{dt} = 5$

$$\frac{dA}{dt} = 2\pi(10)(2) - 2\pi(3)(5)$$

$$= 40\pi - 30\pi = 10\pi \text{ ft}^2/\text{SEC}$$

Sand being dumped from a funnel forms a conical pile whose height is always one-third the diameter of the base. If the sand is being dumped at a rate of 2 cubic meters per minute, how fast is the pile rising when it is 1 meter deep?