

October 7, 2026

National Chocolate Covered Pretzel Day

Today in History:

East Germany was created (1949)

Arnold Schwarzenegger becomes California governor (2003)

Number of the Day: 1570

1570 = $2 \times 5 \times 157$

1570 is a divisor of $13^{12} - 1$

Fun Fact:

In the movie *The Wizard of Oz*, Toto the dog's salary was \$125 per week, Judy Garland's was \$500 a week.

Quote of the Day:

Can you do Division? Divide a loaf by a knife - what's the answer to *that*?

~Lewis Carroll, *Through the Looking Glass*

Today's Weather:

Partly cloudy, high 77°

Math 121

Quiz #23

Find $f'(x)$ for

$$f(x) = x^2 \sinh(x^2)$$

$$\begin{aligned} f'(x) &= x^2 (\cosh(x^2))(2x) + 2x \sinh(x^2) \\ &= 2x^3 \cosh(x^2) + 2x \sinh(x^2) \end{aligned}$$

mpod #6

$$y = \operatorname{Arcsinh}(\sqrt{x^2+1})$$

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

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

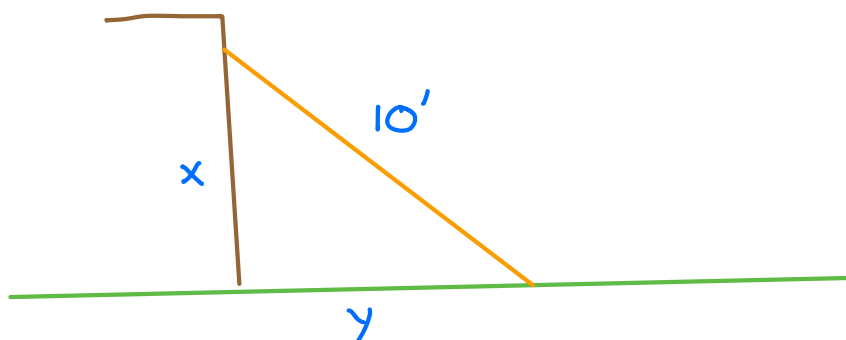
*57

$$y = \frac{\coth t}{1 + \tanh t}$$

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

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?



$$\underline{x^2 + y^2 = 100}$$

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

$$y = 6 \quad \frac{dy}{dt} = 2$$

$$\frac{dx}{dt} = ?$$

$$x^2 + 36 = 100$$

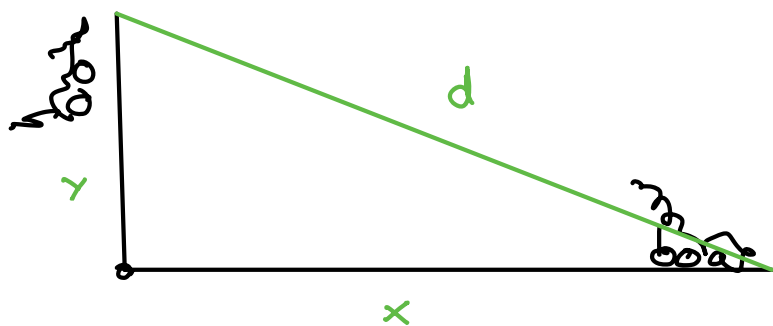
$$x = 8$$

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

$$\frac{dx}{dt} = -\frac{12}{8} = -\frac{3}{2}$$

Top is moving DOWN AT $\frac{3}{2}$ ft/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.



$$x^2 + y^2 = d^2$$

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

$$\frac{dy}{dt} = 10$$

$$\frac{dx}{dt} = 20$$

$$y = 10 \text{ mph} \cdot 3 = 30$$

$$x = 20 \text{ mph} \cdot 2 = 40$$

$$x^2 + y^2 = d^2$$

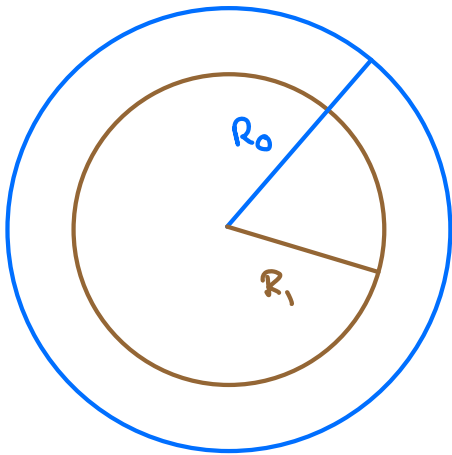
$$30^2 + 40^2 = d^2$$

$$d = 50$$

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

$$\frac{dd}{dt} = 22 \text{ mph} \quad \text{INCR. AT 22.mph}$$

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.



$$A = A_o - A_i$$

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

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

$$R_o = 10$$

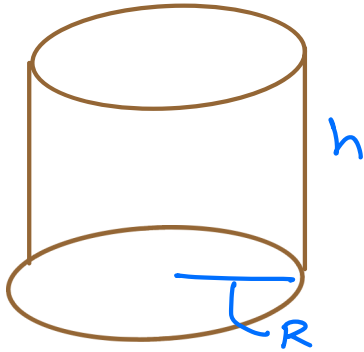
$$R_i = 3$$

$$\frac{dR_o}{dt} = 2$$

$$\frac{dR_i}{dt} = 5$$

$$\begin{aligned} \frac{dA}{dt} &= 2\pi(10)(2) - 2\pi(3)(5) \\ &= 40\pi - 30\pi = 10\pi \text{ ft}^2/\text{SEC} \end{aligned}$$

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 $h = 5$?



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

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

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



$$\frac{dSA}{dt} = 4\pi R \frac{dR}{dt} + 2\pi \left[R \frac{dh}{dt} + h \frac{dR}{dt} \right]$$

$$R = 3 \quad h = 5 \quad \frac{dR}{dt} = 10 \quad \frac{dh}{dt} = 10$$

$$= 4\pi(3)(10) + 2\pi [3(10) + 5(10)]$$

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