1. What is the relative rate of change of \( y = e^{x^2} \) at \( x = 3 \)?
   \[ \text{Answer: 6} \]

2. The population \( P = C(1.35)^{t/100} \) increases by 35% every 100 days. What is its relative rate of change?
   \[ \text{Answer: } \frac{1}{100} \ln(1.35) = 0.00300 \text{ days}^{-1} \]

3. Solve the initial value problem \( \frac{dy}{dt} = -y \), \( y(5) = 1 \)
   \[ \text{Class Answer: } e^{5-t} \]

4. If the percentage rate of increase of the price of potatoes is the constant 5% per year and potatoes cost \$0.80 per pound at the beginning of 2002, what would they cost at the beginning of the year 2022?
   \[ \text{Answer: } 0.80e^{1} \approx 2.17 \text{ dollars per pound} \]

5. Find \( \frac{d}{dx}(\sqrt{\cos x}) \)
   \[ \text{Answer: } -\frac{1}{2}(\cos x)^{-1/2}\sin x \]

6. What is the derivative of \( y = \sin(x^3 - 4) \)?
   \[ \text{Answer: } 3x^2 \cos(x^3 - 4) \]

7. (a) Express \( w \) in the right triangle of Figure 1 in terms of \( \theta \). (b) What is \( \frac{d\theta}{dt} \) at a moment when \( \theta = \frac{1}{3}\pi \) radians and \( \frac{dw}{dt} = 0.2 \text{ feet per minute?} \)
   \[ \text{FIGURE 1} \]

   \[ \text{Answer: (a) } w = 4 \cos \theta \text{ (feet)} \text{ (b) } 0.1 \text{ radians per minute} \]

8. Find \( dy/dx \) for \( y = (\sin x)/x \).
   \[ \text{Answer: } \frac{x \cos x - \sin x}{x^2} \]

9. What is \( y'(1) \) for \( y = \cos^4 x \)?
   \[ \text{Answer: } -4 \sin(1) \cos^3(1) \]
10. Give an equation of the tangent line to \( y = \sin x \) at \( x = 3 \). Generate the curve and line on your calculator.

   **Answer:** \( y = \sin(3) + \cos(3)(x - 3) \)  

   ![Figure A10](image)

Web 11. The top of a twelve-foot-long ladder is pushed up a vertical wall as its bottom slides on the horizontal ground. How fast are (a) its top and (b) its bottom moving when the angle between the ladder and the ground is 0.4 radians if the angle is increasing 0.05 radians per second? Give exact and approximate decimal values.

   **Answer:** The base is moving toward the wall at the rate of \( 0.6 \sin(0.4) \approx 0.2337 \) feet per second.

12. An acute angle \( x \) in a right triangle is increasing at the rate of 0.1 radian per minute while the leg adjacent to \( x \) has the constant length of 10 feet. How rapidly is the area of the triangle increasing when \( x = 1 \)?

   **Answer:** \( 50 \sec^2(1)(0.1) = \frac{50(0.1)}{\cos^2(1)} = 17.128 \) square feet per minute

13. What is \( y'(1) \) for \( y = 3 \sec x - 5 \cot x \)?

   **Answer:** \( 3 \sec(1) \tan(1) + 5 \csc^2(1) = \frac{3 \tan(1)}{\cos(1)} + \frac{5}{\sin^2(1)} \approx 15.70883872 \)

14. Find \( \frac{d}{dx}[\tan(2x)] \).

   **Answer:** \( 2 \sec^2(2x) \)

15. What is the \( x \)-derivative of \( y = \sin^{-1}(x^2) \)?

   **Answer:** \( \frac{2x}{\sqrt{1 - x^4}} \)

16. Find the \( x \)-derivative of \( y = (\tan^{-1} x)^4 \).

   **Answer:** \( \frac{4(\tan^{-1} x)^3}{1 + x^2} \)