

YOUR NAME: \_\_\_\_\_

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

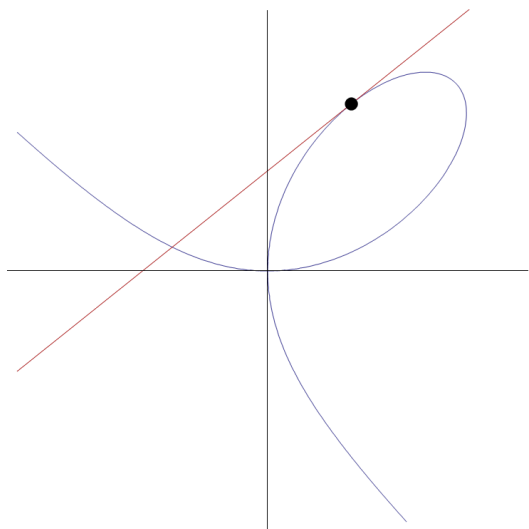
1. Suppose that you know the derivatives of  $\sin x$  and of  $\cos x$ .

(a) Use the quotient rule to find a formula for  $(\tan x)'$ . **Do not omit any steps.**

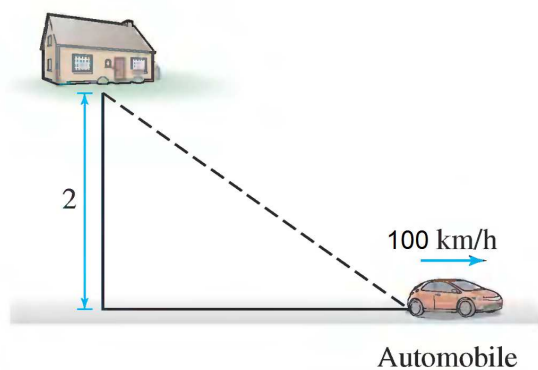
(b) Use the formula for the derivative of the inverse function to find a formula for  $\tan^{-1} x$ .

(c) Use your rules to calculate the derivative of  $f(x) = \tan^{-1} \left( \frac{1+x}{1-x} \right)$  and **simplify**.

2. Find an equation for the tangent to the folium of Descartes  $x^3 + y^3 = 3xy$  at  $(x, y) = \left(\frac{2}{3}, \frac{4}{3}\right)$ .



3. A road perpendicular to a highway leads to a farmhouse located 2 km away. An automobile travels past the farmhouse at a speed of 100 km/h. How fast is the distance between the automobile and the farmhouse increasing when the automobile is 6 km past the intersection of the highway and the road?



4. The resistance of a copper wire at temperature  $T = 20^\circ\text{C}$  is  $R = 35\ \Omega$ . Estimate the resistance at  $22^\circ\text{C}$  Assuming that  $\left.\frac{dR}{dT}\right|_{T=20} = 0.06\ \Omega/^\circ\text{C}$ .

5. Find the absolute extrema of the following function in the indicated interval:

(a)  $f(x) = \cos x + \sin x$  in  $[0, 2\pi]$ .

(b)  $f(x) = xe^{-x}$  in  $[0, 2]$  (You may use  $e \approx 3$ ).