

Differentiate and simplify where appropriate:

1. (5pts) $\frac{d}{dx} \ln(x^2 - 3x + 1) =$

2. (5pts) $\frac{d}{d\theta} 5^{\sin \theta} =$

3. (6pts) $\frac{d}{dx} x^2 \arcsin x =$

4. (9pts) $\frac{d}{dx} \ln \frac{(x+1)^2}{(3x-2)^4} =$

5. (9pts) $\frac{d}{dt} \arctan \left(\frac{t^2 - 1}{t} \right) =$

6. (12pts) Use implicit differentiation to find the equation of the tangent line to the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ at the point $(-2, \frac{3\sqrt{3}}{2})$. Draw the picture of the ellipse and the tangent line.

7. (10pts) Use implicit differentiation to find y' .

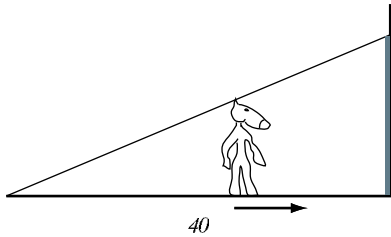
$$xe^y = \frac{x}{y}$$

8. (8pts) Use logarithmic differentiation to find the derivative of $y = x^{\cos x}$.

9. (10pts) Let $f(x) = x^3 + 2x^2 + 5x$, and let g be the inverse of f . Use the theorem on derivatives of inverses to find $g'(8)$.

10. (10pts) Find all points on the graph of $3x^2 + 4y^2 + 3xy = 24$ where the tangent line is horizontal.

11. (16pts) Somewhere on campus, a spotlight is shining on a wall 40ft away. Seven-foot tall Dunker is walking from the spotlight toward the wall at rate 4 ft/second. How fast is the height of Dunker's shadow on the wall changing when Dunker is 30ft away from the spotlight? What are the units?



Bonus. (10pts) Let $f(\theta) = \sec \theta$, and let g be the inverse of f . Use the theorem on derivatives of inverses to find the general expression for $g'(x)$. (A triangle with θ and x will help you.)