

(1) [5 points] Differentiate

$$y = \frac{x}{1 - \ln(x - 1)}$$

(2) [5 points] Use logarithmic differentiation to find the derivative:

$$y = \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2}$$

(3) [5 points] Gravel is being dumped from a conveyor belt at a rate of $10 \text{ m}^3/\text{min}$ to form a pile in the shape of a cone. The cone-shaped pile of gravel grows in such a way that the height is always equal to the diameter of the base. How fast is the height of the pile increasing when the pile is 2 m tall? State units with your answer. (Recall that the volume of a cone of base radius r and height h is $V = \pi r^2 h/3$.)