1. (12 points) At which value(s) of \( x \) is this function not differentiable? Give short reasons for each value you state.

2. (12 points) Find \( y' \) if \( y = \frac{2^x}{1 - x^2} \).
3. (12 points) Find $y''$ if $y = x^5 + \frac{2}{e^{2x}}$. 

4. (12 points) Find the line tangent to the hyperbola $x^2 + 2xy - y^2 + x = 2$ at the point $(1, 2)$. 
5. (12 points) Find \(\frac{d}{dx}[(\cos x)^x]\).

6. (12 points) At what point does the curve \(y = [\ln(x + 3)]^2\) have a horizontal tangent?
7. (14 points) A cup of tea sits in a room kept at 20°C and cools from 80°C to 60°C in half an hour. What will be the temperature of the tea after another half hour? Simplify your answer for full credit.
8. (14 points) Gravel is dumped onto a conical pile at a rate of 36 ft$^3$ per second. The gravel always shifts so that the base diameter of the pile equals its height. At what rate is the height of the pile increasing when it is 6 ft high? (The volume of a cone with base radius $r$ and height $h$ is $\frac{1}{3}\pi r^2 h$.)