Term Test A

(1) [5 points] Evaluate the limit

$$\lim_{x \to -1} \frac{2x^2 - x - 3}{x + 1}$$

(2) [8 points] Find the equation of the tangent line to the curve

$$y = \sqrt{x^2 + 1} \cdot \tan\left(\frac{x}{2}\right)$$

at the point $(0, 0)$.

(3) [7 points] Find the derivative of

$$f(x) = \arctan\left(x - \sqrt{1 + x^2}\right) \tag{1}$$

(4) [5 points] Find the domain and the derivative of

$$g(z) = \frac{e^z - 1}{2 + \ln z} \tag{2}$$

(5) [7 points] The analysis of tooth shrinkage by C. Loring Brace and colleagues at the University of Michigan's Museum of Anthropology indicates that human tooth size is continuing to decrease and that the evolutionary process did not come to a halt some 30,000 years ago as many scientists contend. In northern Europeans, for example, tooth size reduction now has a rate of 1% per 1,000 years. In about how many years will human teeth be 90% of their present size?

(6) [8 points] Provide the second derivative of the following two functions in their simplest form.

$$f(x) = \frac{x^2}{2}\left(\ln \frac{x}{2}\right) - x \tag{3}$$

$$g(\vartheta) = \vartheta \sin \vartheta$$

(7) [9 points] The temperature of an ingot of silver is 60°C above room temperature right now. Twenty minutes ago, it was 70°C above room temperature. How far above room temperature will the silver be

1. Fifteen minutes from now?
2. Two hours from now?
3. When will the silver be 10°C above room temperature?