Term Test A version 1

(1)[9 points] An aluminum beam was brought from the outside cold into a machine shop where the temperature was held at 65°F. After 10 minutes, the beam warmed to 35°F and after another 10 minutes it was 50°F. Use Newton's law of cooling to estimate the beam's initial temperature.

(2)[7 points] Find the domain and the derivative of

$$f(x) = \frac{\ln x}{3 + \ln x}$$

Make sure to simplify the derivative as much as possible.

(3)[8 points] Find the equation of the tangent line to the curve

$$y = \frac{1}{5\sin x + 2\cos x}$$

at the point $(0, 0.5)$.

(4)[8 points] Provide the second derivative of the following two functions in their simplest form.

$$f(x) = 5x - \frac{3}{x-2}$$

$$g(x) = \frac{x^2 \ln x}{2} - \frac{3x^2}{4}$$

(5)[5 points] Evaluate the limit

$$\lim_{x \to 5} \left(\frac{1}{x-5} - \frac{10}{x^2 - 25} \right)$$

(6)[5 points] Find the derivative of

$$g(t) = 4e^{t\cos t}$$

(7)[7 points] The half-life of Polonium-210 is 139 days, but your sample will not be useful to you after 95% of the radioactive nuclei present on the day the sample arrives has disintegrated. For about how many days after the sample arrives will you be able to use the polonium?