1.) Differentiate each of the following functions. DO NOT SIMPLIFY ANSWERS.

a.) $y = \pi + (5x + 1)^{-4}$

b.) $f(x) = \sec x \cdot \tan 3x$

c.) $g(x) = \sin(\cos^3(x^4))$

d.) $y = x^5 + 8^{-x^2}$

e.) $y = \frac{4 - \ln x}{10 + \log_2(3x + 7)}$

f.) $y = x^{\ln x}$
2.) Use \( \lim_{h \to 0} \frac{f(x + h) - f(x)}{h} \) to differentiate the function \( f(x) = \frac{x + 7}{3 - x} \).

3.) Sketch the graph of \( f' \) using the graph of \( f \).
7.) Consider the given diagram. Write $\alpha$ as a function of $x$.

8.) Let $f(x) = x + 5 \arctan(1/x)$. Solve $f'(x) = 0$ for $x$. 
9.) Differentiate the following function and SIMPLIFY your answer as much as possible:

\[ f(x) = (x - 3) \sqrt{6x - x^2} + 9 \arcsin \left( \frac{x - 3}{3} \right) \]

8.) A 15-foot ladder is leaning against a wall. If the base of the ladder is pushed toward the wall at the rate of 2 ft./sec., at what rate is the top of the ladder moving up the wall when the base of the ladder is 6 ft. from the wall?
9.) Use differentials to estimate the value of $\sqrt{96}$.

10.) The radius and height of a cylinder are both equal to $x$ so that the volume of the cylinder is given by $V = \pi x^3$. Assume that $x$ is measured with an absolute percentage error of at most 3%. Use a differential to estimate the maximum absolute percentage error in computing the cylinder’s volume.
The following EXTRA CREDIT PROBLEM is worth  points. This problem is OPTIONAL.

1.) A beetle crawls along a thin rod on the x-axis from \( x = 0 \) in. to \( x = 16 \) in. at the rate of 3 in./min. The temperature of the rod at point \( x \) is \( 40 + 12\sqrt{x} \) degrees Fahrenheit (° F). At what rate (° F per min.) is the temperature of the rod under the beetle changing when the beetle is at \( x = 9 \) in.?