A simple egg salad can be made from a pair of hard boiled eggs, a tablespoon of mayonnaise, a tablespoon of pickle relish, a quarter of a teaspoon of European paprika (find a friend from Hungary or Serbia), and a dash of salt.

1. Compute \( \frac{dy}{dx} \) for the following expressions (5 points each) Do not simplify your results!

(a) 
\[ y = (x + 2)(x - 1)(x - 3) \]

(b) 
\[ y = \sqrt{\sin(x) \cos(x)} \]

(c) 
\[ y = \cos(e^x) \]

(d) 
\[ x^{\frac{3}{2}} + y^{\frac{3}{2}} = 5 \]

(e) 
\[ y = x \arcsin(x) \]

(f) 
\[ y = x^x \]

2. (5 points) Compute the equation of line tangent to the curve \( f(x) = \sqrt{x} \) at \( x = 9 \).

3. (5 points) Compute the equation of the line tangent to the circle \( x^2 + y^2 = 25 \) at the point \( (3, 4) \).

4. (10 points) A large coffee cone 10 centimeters in radius and 15 centimeters tall drips coffee at a rate of 2 cubic centimeters per second. How fast is the height of the coffee dropping when the height is 3 centimeters?
The volume of a cone is \( V = \frac{\pi}{3}r^2h \) where \( r \) denotes the radius and \( h \) denotes the height.

5. (10 points) Two cars diverge from an intersection in the middle of Kansas. The car headed east travels at 35 miles per hour; the car headed south travels at 40 miles per hour. How fast is the distance between them increasing after 20 minutes (1/3 of an hour)?

6. (10 points) Determine the maximal and minimal values for the function \( f(\theta) = \cos(\theta) + \sin(\theta) \) over the interval \([0, 2\pi]\). For which angles \( \theta \) do these optima occur?

7. (10 points) Determine the \( x \)-coordinates and the optimal values (maximum and minimum) for the function \( f(x) = 3x^2 + 2x - 5 \) on the interval \([-1, 3]\).

8. (10 points) Sketch the graph of the function
\[
f(x) = \frac{(x + 1)}{(x - 2)}.
\]

9. (10 points) Sketch the graph of the function
\[
f(x) = (x + 2)(x + 1)(x - 2).
\]