1) Find the derivatives of the following functions:

1. \( y = \frac{x \sin x}{\cos x} \);
2. \( g(\theta) = \frac{\tan \theta - 1}{\sec \theta} \);
3. \( h(t) = \tan(\sin t + \cos t) \);
4. \( f(t) = \sqrt{1 + \tan t} \)

2) Find all the points on the graph of \( f(x) = 2 \sin x + (\sin x)^2 \), where the tangent line is horizontal.

3) Find \( \frac{dy}{dx} \) and \( \frac{d^2y}{dx^2} \) by implicit differentiation:

1. \( 4 \cos x \sin y = 1 \);
2. \( x^2 - xy^2 = 5y \)

4) Find

1. \( D^{100} \sin 2x \);
2. \( D^n \left( \frac{1}{x} \right) \)

5) A particle moves along a straight line with the displacement function \( s(t) = 20 \sin(5t + 3) \)

1. find the velocity and acceleration of the particle;
2. find the acceleration after 1 second;
3. when is the speed maximal?

6) A ladder 10 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a speed 2 ft/sec, how fast is the angle between the top of the ladder and the wall changing when the angle is \( \pi/4 \) rad?

7) Use linear approximation to estimate \((2.01)^6\).