Problem 1. Differentiate the given functions.

1. $y = \cos^2 3x$.
2. $r = \sin(\theta + 1)$.
3. $z = \dfrac{\sin 5w}{w^3}$.
4. $y = \sqrt[4]{\sec 3\theta}$.
5. $x = \tan\ \sqrt{t}$.

Problem 2. Find the slope of tangent line to the curve $y = x \sin 2x$ at $x = \pi/4$.

Problem 3. The displacement s of a point on a certain vibrating string is

$$s(t) = \frac{1}{8}\sin(20\pi t)$$

where s is measured in centimeters and t is in seconds. Find the velocity of the point at $t = 0.1$ s.

Problem 4. Find slope of the line normal to the curve $y = 2\cot 2x$ at $x = \pi/8$.

Problem 5. Find the second derivative of $y = x \cot x$.

Answers to problem 1.

1. $dy/dx = -6 \sin 3x\ \cos 3x$.
2. $dr/d\theta = \cos(\theta + 1)$.
3. $dz/dw = \dfrac{5w^3 \cos 5w - 3w^2 \sin 5w}{w^6}$.
4. $dy/d\theta = \dfrac{3 \sec 3\theta\ \tan 3\theta}{4(\sec 3\theta)^{3/4}}$.
5. $dx/dt = \dfrac{\sec^2\ \sqrt{t}}{2\sqrt{t}}$.

Answer to Problem 2. 1.

Answer to Problem 3. $5\pi/2$.

Answer to Problem 4. $1/8$.

Answer to Problem 5. $d^2y/dx^2 = 2(\csc^2 x)(x \cot x - 1)$.