Problem 1. Differentiate the following functions:

1. $y = x^2\sqrt{x^2-1}$.
2. $y = 2(x^6+1)^{10}$.
3. $y = x\sqrt{x}$.
4. $y = \dfrac{x^3+2x}{x^2-8}$.
5. $P = \dfrac{t-2}{t^2+4}$.
6. $y = \dfrac{(4+x^4)^5}{5}$.
7. $y = \dfrac{2}{\sqrt{x^3-3x}}$.

Problem 2. Find dy/dx implicitly.

1. $x^4y^4 - 3y^2 + 5x = 6$.
2. $x + x^2y^2 - y = 1$.

Problem 3. Find the equations of tangent and normal lines to each of the following curves at the given point.

1. $x^2 + 4y^2 = 5$ at $(1,-1)$.
2. $y^2 - x^2 = 5$ at $(2,-3)$.
3. $y^2 + 12x = 0$ at $(-3,6)$.

Answers to problem 1. (1) $\dfrac{dy}{dx} = \dfrac{3x^3-2x}{\sqrt{x^2-1}}$. (2) $\dfrac{dy}{dx} = 120x^5(x^6+1)^9)$. (3) $\dfrac{dy}{dx} = \dfrac{3}{2}\sqrt{x}$.

(4) $\dfrac{dy}{dx} = \dfrac{x^4-26x^2-16}{(x^2-8)^2}$. (5) $\dfrac{dP}{dt} = \dfrac{-t^2+4t+4}{(t^2+4)^2}$. (6) $\dfrac{dy}{dx} = 4x^3(x^4+4)^4$.

(7) $\dfrac{dy}{dx} = -3(x^2-1)(x^3-3x)^{-3/2}$.

Answers to problem 2. (1) $\dfrac{dy}{dx} = \dfrac{-(4x^3y^4+5)}{4x^4y^3-6y}$. (2) $\dfrac{dy}{dx} = \dfrac{-(2xy^2+1)}{2x^2y-1}$.

Answers to problem 3.

1. Equation of tangent is $x - 4y - 5 = 0$. Equation of normal is $4x + y - 3 = 0$.
2. Equation of tangent is $2x + 3y + 5 = 0$. Equation of normal is $3x - 2y - 12 = 0$.
3. Equation of tangent is $x + y - 3 = 0$. Equation of normal is $x - y + 9 = 0$.