1) Differentiate the following functions.
   a) \( f(x) = x\sqrt{x^2 - 3} \)
   b) \( g(x) = \frac{x^3 + 2}{x^2 + 1} \)
   c) \( h(x) = (3x^2 - 1)\left(x^2 - \frac{1}{x}\right) \)
   d) \( r(x) = \frac{x^3 + 2x^2 + x - 1}{\sqrt{x}} \)

2) Differentiate the following functions:
   a) \( h(x) = \frac{x^2 - x + 1}{(x-1)^{2/3}} \)
   b) \( k(x) = \begin{cases} \frac{x^2 - 1}{x + 2}, & x > -1 \\ x + 2, & x \leq -1 \end{cases} \)
   c) \( n(x) = \sin^2(\cos(4x)) \)

3) Find...
   \[ \lim_{h \to 0} \frac{\frac{5}{\sqrt{x + h}} - \frac{5}{\sqrt{x}}}{h} \]

4) Given \( f(x) = 3x^2\sqrt{4 - x^2} \)
   a) Find \( \frac{df}{dx} \)
   b) Where are the horizontal and vertical tangents?

5) For the following equation:
   \( 5x^2y - y^3 = 1 + x^2 \)
   a) Find \( \frac{dy}{dx} \)
   b) Find the equation of the tangent line to the curve at the point (1,2).

6) Find the derivatives of the following functions:
   a) \( f(x) = \frac{x}{x + 3} \)
   b) \( g(x) = \sin(3x) \)

7) For what values of \( x \) does the function \( g(x) = x + 2\sin(x) \) have horizontal tangent lines?

8) Suppose \( f(x) = ax^2 + bx + c \) and that the tangent lines at \( x = 1 \) and \( x = -1 \) have slopes \(-8 \) and \(-1\) respectively, and that the point (2,15) is a point on the graph. What are the values of \( a, b, \) and \( c \)?

9) Find the values of \( a \) so that the tangent line to \( y = x^2 - 2\sqrt{x} + 1 \) is perpendicular to the line \( ay + 2x = 2 \) at \( x = 4 \).

10) Find the \( x \) values where the curve represented by the following equation has horizontal tangent lines.
    \( x^2 + xy + y^2 = 6 \)

11) Take the derivatives of the following functions [using logarithmic differentiation):
    a) \( f(x) = 5\tan^2(x) \)
    b) \( g(x) = x^{\sin(x)} \)
    c) \( h(x) = \frac{e^{3x+1}(x^2+3)^3}{\sqrt{2x-1}} \)