1. (12 points) Match the graphs of the functions in Figure 1 to the graphs of their derivatives in Figure 2. No explanation is necessary.

![Figure 1: Functions](image1)

![Figure 2: Derivatives](image2)

2. (20 points)
   
   (a) Let \( y = \tan^3 x + \tan (3x) \). Find \( y'(\pi/4) \).
   
   (b) Find all values of \( \theta \) in the interval \([0, 2\pi]\) that satisfy \( 2 \cos^2 \theta = 1 + \cos \theta \).
3. (30 points) Let \( f(x) = \sqrt{x - 4} \).

(a) Find the domain and range of \( f \). Express your answer in interval notation.
(b) Use the definition of derivative to find \( f' \).
(c) Find the point(s) on the curve \( y = f(x) \) where the tangent line is parallel to the line \( x - 5y + 15 = 0 \).
(d) Find the value(s) of \( c \) on the interval \([4, 29]\) that satisfy the conclusion of the Mean Value Theorem for the function \( f \).

4. (12 points)

\[ f(t) = 12t \csc(3t) \quad \text{and} \quad g(t) = \begin{cases} f(t) & t \neq 0 \\ 0 & t = 0 \end{cases} \]

(a) Find \( \lim_{t \to 0} f(t) \).
(b) Is \( g \) continuous at \( t = 0 \)? Justify your answer using the definition of continuity.

5. (14 points) Use implicit differentiation to find the tangent slope of \( \sin \left( \frac{x}{y} \right) = \frac{1}{y} + 1 \) at \((0, -1)\).

6. (30 points) Let \( g(x) = \frac{\sqrt{x} - 1}{\sqrt{x^2}} \).

(a) Find \( g' \).
(b) Find an equation of the line tangent to \( y = g(x) \) at \( x = 1 \).
(c) Find the critical numbers of \( g \).
(d) What is the linearization of \( g \) at \( a = 1 \)?
(e) Use the linearization to estimate the value of \((0.97)^{1/3} - (0.97)^{-2/3}\).
(f) Is \( g \) even, odd, or neither?

7. (14 points) A 15-ft ladder is leaning against a wall when its base starts to slide away. By the time the base of the ladder is 12 ft from the wall, the base is moving at the rate of 2 ft/sec. How fast is the angle between the ladder and the ground changing then?

8. (18 points) No explanation is necessary for the following problems.

(a) Sketch the graph of a single function \( f \) that satisfies all of the following conditions.
\( f \) is continuous and odd
\( \lim_{x \to \infty} f(x) = -4 \)
\( f'(-2) \) is undefined
\( \lim_{h \to 0} \frac{f(h) - f(0)}{h} = -4 \)

(b) Sketch the graph of a single function \( g \) that satisfies all of the following conditions.
\( g \) is even
\( \lim_{x \to 1^+} g(x) = \infty \)
\( g' < 0 \) on \((0, 1)\)
\( \lim_{x \to 2} g(x) = -3 \)
\( g(2) = 1 \)