Instructions: 1. Closed book, calculators may be used.
2. Show your work and explain your answers and reasoning.
3. Express your answers in simplified form.

1. (25) Evaluate the limits

   a. \( \lim_{x \to 3} \frac{x^2 - 2x - 3}{x^2 - 4x + 3} \)

   b. \( \lim_{x \to 0} \frac{\tan(2x)}{xcos(x)} \)

   c. \( \lim_{x \to 0} \frac{\cos(\pi/3 + x) - \cos(\pi/3)}{x} \)

2. (25) Compute the derivatives of

   a. \( f(x) = 3x^4 + x^5 - 2x^{-4} \)

   b. \( h(x) = \left( \frac{x^2 - 1}{x^2 + 1} \right)' \)

   c. \( g(x) = \tan x + 3x^2 - 5 \)

   d. \( F(x) = \sin(4x^2 + 2) \)

3. (25) Let \( f(x) = x^2 - 6x + 7 \)

   a. Sketch the graph of \( f \).

   b. Find the equation of the line tangent to the graph of \( f \) at the point \((2, f(2))\), and sketch this line on your graph in part \(a\).

   c. Calculate the area of the triangle formed by the \(x\)-axis, the \(y\)-axis, and the line tangent to the graph of \( f \) at the point \((2, f(2))\).

4. (25) Water is being poured into a reservoir in the shape of a cone (point down) 6 feet tall with a radius of 4 feet. If the water level is rising at the rate of 0.5 feet per second, how fast is the water being poured in at the instant the depth is 2 feet?
Answers to Hour Test 1

1. a. 2  
   b. 2  
   c. $-\frac{\sqrt{3}}{2}$ (Definition of derivative of $\cos$ at $\frac{\pi}{3}$)

2. a. $12x^3 + \frac{5}{3}x^2 + 8x^{-5}$  
   b. $\frac{1}{3} \left( \frac{x^2 - 1}{x^2 + 1} \right)^\prime \left( \frac{4x}{(x^2 + 1)^2} \right)$
   
   c. $2 \tan(x) \sec^2(x) + 6x$  
   d. $8x \cos(4x^2 + 2)$

3. a. 
   b. $y = -2x + 3$  
   c. $\frac{9}{4}$

4. $\frac{8\pi}{9}$