Name: _____ _____ **/ 25**

Please circle your instructor's name: Leah Berman Jill Faudree James Gossell

There are 25 points possible on this quiz. Any outside materials (textbook, course notes, calculator) are not allowed. **For full credit, show all work in a way someone else can follow it.**

1. (12 points) Compute the derivatives of the following functions:

   (a) $f(x) = 3\sec(x) - \sin(x) + \tan(\pi/4)$

   (b) $g(x) = \left(x^4 - 6x + x^{-\frac{1}{3}}\right)^5$

   (c) $y = \tan\left(\dfrac{x^4 - 7}{x}\right)$

   (d) $r(\theta) = \theta^3 \cot(2\theta)$

2. (9 points) A giant pendulum is pulled back and released so that it begins swinging back and forth. Its horizontal position is given by

$$x(t) = a\cos\left(\frac{t}{2}\right)$$

where a is a constant representing the initial horizontal position, t measures time in seconds, and x measures the position to the right of equilibrium in feet. (See the diagram below.)

(a) Find $\dfrac{dx}{dt}$, the derivative of the horizontal position function.

(b) Using your answer in part (a), find the **initial horizontal velocity** of the pendulum. Interpret your answer and explain if this makes sense in the context of the problem.

(c) After π seconds, the pendulum is moving to the left at a rate of 14 feet per second. Using this information, solve for the **initial position** a.

3. (4 points) Suppose $f(x)$ and $g(x)$ are differentiable functions, and $h(x) = f\left(\sqrt{g(x)}\right)$. Given that $f(3) = 3$, $f'(3) = 6$, $g(3) = 9$, and $g'(3) = 12$, **find $\mathbf{h'(3)}$** and show your work.