1. (16 points) Find $\frac{dy}{dx}$. You do NOT need to simplify on this page.

(a) $y = \sec(\cos(\pi x))$

(b) $y = \frac{\sin(5x)}{(4x + 5)^3}$

(c) $y = \tan(x^3) \tan(x^5) \tan(x^7)$

(d) $y = \sin^4(\sqrt{x} \tan(x))$
2. (16 points) In each case, differentiate, then find all \( x \) such that \( f'(x) = 0 \).

(a) \( f(x) = (3x - 4)^2 \sqrt{5x - 1} \)

(b) \( f(x) = \frac{3}{(2x - 7)^4} - \frac{1}{(2x - 7)^5} + 9 \)
3. (24 points) Give full answers to the following limit questions, splitting into sides, if necessary.

(a) \( \lim_{x \to \pi/4} \frac{3 + \cos x}{1 - \tan x} \)

(b) \( \lim_{x \to 0} \frac{3x^2 \sin x + 4 \sin x}{x} \)

(c) \( \lim_{x \to 3} \left( \frac{2}{(x - 3)^2} - \frac{3}{x - 3} + 4 \right) \)
4. (10 points) The position of a certain object traveling in a straight line is given by \( s(t) = \sin^2(t) \).

(a) Find \( a(t) \), the acceleration of the object.

(b) For what value(s) of \( t \) in the interval \([0, \pi]\) is the acceleration of the object equal to 0?

5. (10 points) A spool of cable is mounted on a truck bed three feet off the ground. The end of the cable is fixed to a hook in the ground, and the truck drives (straight) away from the hook at 3 ft/sec, keeping the cable taut. At what rate is the cable reeling off the spool when the truck is 10 feet from the hook? (Exact answer, may contain a radical.)
6. (14 points) Find the equation of the line tangent to the curve

\[ x^2 + xy - y^2 = 1 \] at the point \((2, 3)\).

7. (10 points) Let \( g(x) = \frac{1}{x} \).

   (a) Use the linearization \( L(x) \) of \( g \) at \( a = 5 \) to give a decimal approximation for \( \frac{1}{5.02} \).

   (b) Should your answer be an overestimate of the actual value, or an underestimate? Explain. You may use an appropriate graph to help illustrate your explanation.