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

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

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

   (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) $f(x) = \dfrac{3}{(2x-7)^4} - \dfrac{1}{(2x-7)^5} + 9$

3. (24 points) Give full answers to the following limit questions, splitting into sides, if necessary.

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

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

(c) $\lim_{x \to 3} \left(\dfrac{2}{(x-3)^2} - \dfrac{3}{x-3} + 4 \right)$

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

$$x^2 + xy - y^2 = 1 \text{ at the point} (2, 3).$$

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

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

   (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.