1) (20 pts) Compute and simplify:
\[ \int e^{2x} \, dx = \]
\[ \int \sec(x)(\sec(x) + \tan(x)) \, dx = \]
\[ \int \frac{1}{1+16t^2} \, dt = \]
\[ \int \frac{t}{1+16t^2} \, dt = \]

2) (10 pts) Suppose a particle has velocity \( v(t) = 3t + 2 \) at time \( t \). Suppose it begins at position \( s(0) = 5 \). Find its position after 3 seconds.

3) (15 pts) Compute \( y' \):
   a) \( y = (2x)^2 \)
   b) \( y = \log_3(2x) \)
   c) \( y = \sin^{-1}(x + 1) \)

4) (10 pts) Find the slope of the tangent line to the curve, \( x = \sec(t) \), \( y = \tan(t) \) at the point where \( t = \pi/3 \). For maximum credit, use the chain rule as done in class.

5) (10 pts) Assume oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2 ft/s. How fast is the area of the spill increasing when the radius of the spill is 60 ft?

6) (10 pts) CHOOSE ONE (you may continue on the back or on extra paper):
   A) State and prove Rolle’s Theorem.
   B) State and prove the Product Rule.

7) (10 pts) Answer TRUE or FALSE:
\( f(x) = \ln |x| \) is an increasing function.

A continuous function defined on \((-\infty, +\infty)\) must have a minimum value.

A rational function is continuous except where the denominator is zero.

If \( f \) is differentiable on the open interval \((a, b)\) then it is continuous on the closed interval \([a, b]\).

The function \( \cot(x) \) is continuous on the interval \((-\pi/4, \pi/4)\).

8) [5pts] Compute \( \lim_{x \to +\infty} (1 + 2/x)^{2x} = \) (and show all work, as always)

9) [10pts] Suppose a particle has position \( s(t) = t^3/3 - 2t^2 + 5 \) [so, \( v(t) = t^2 - 4t \) and \( a(t) = 2t - 4 \)] for \( t \geq 0 \). When is the particle speeding up? Slowing down? Explain briefly.

**Remarks and Answers:** The average was about 65 / 100, based on 7 grades above 40. The scores were slightly below 50% on problem 9, and only about 57% on the TF, but none of the problems were disasters. You can use the scale on the syllabus for this exam. I have not set a scale for the semester yet.

1a) \( e^{2x}/2 + C \)

1b) \( \tan(x) + \sec(x) + C \)

1c) \( \tan^{-1}(4x)/4 + C \)

1d) \( \ln(1 + 16t^2)/32 + C \)

2) \( 27/2 + 6 + 5 \)

3a) \( (2x)[\ln(2x) + 1] \)

3b) \( 1/(x\ln(3)) \)

3c) \( [1 - (x + 1)^2]^{-1/2} \)
4) $\csc(\pi/3) = 2/\sqrt{3}$

5) $240\pi$

6) see text

7) FFTFF

8) $e^4$

9) It speeds up when $t \in (0, 2)$ or $t \in (4, +\infty)$. 