Read Me First: *Show all essential work very neatly. Use correct notation when presenting your computations and arguments. Write using complete sentences. Be careful. Remember this: "=" denotes "equals" , "⇒" denotes "implies" , and "⇔" denotes "is equivalent to". Do not "box" your answers. Communicate. Show me all the magic on the page.*

1. (10 pts.) (a) Using implicit differentiation, compute dy/dx and d^2y/dx^2 when $x^3 + y^2 = 9$. **Label your expressions correctly or else.**

(b) Obtain an equation for the line tangent to the graph of $x^3 + y^2 = 9$ at the point $(-1,-(10)^{1/2})$.

2. (5 pts.) A 5-ft. ladder is leaning against the wall. If the top of the ladder slips down the wall at a rate of 4 ft./sec., how fast will the foot be moving away from the wall when the top is 3 ft. above the ground?

3. (5 pts.) Use logarithmic differentiation to find dy/dx when $y = x^{\sec(x)}$. **Label your expressions correctly or else.**

4. (15 pts.) Differentiate the following functions. Do not attempt to simplify the algebra.

(a) $f(x) = \exp(3x^3 - 7x) - 2\cdot\ln(5x^3 - 14)$

$f'(x) =$

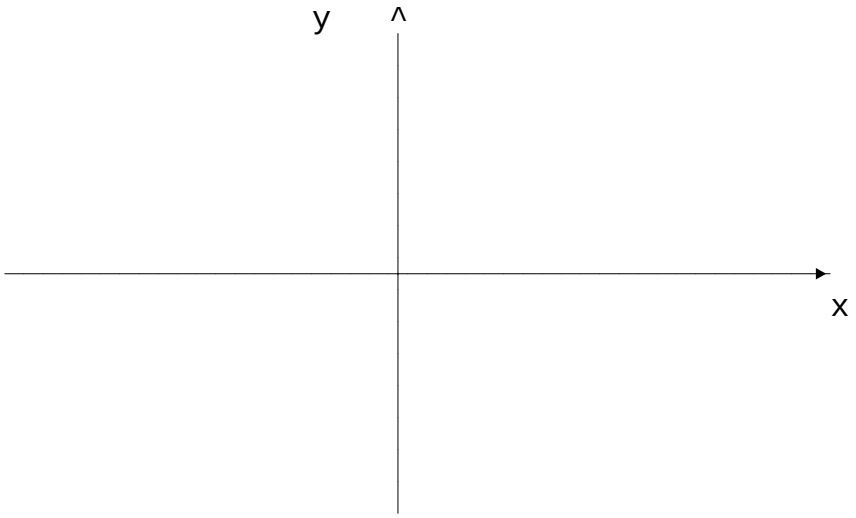
(b) $g(x) = 10^x + x^{10} + 10^{10} + \log_{10}(x) + \ln(10)$

$g'(x) =$

(c) $h(x) = \sec^{-1}(7x) + e^x\cdot\tan^{-1}(x) - 4\cdot\cos^{-1}(x^2)$

$h'(x) =$

5. (5 pts.) Carefully sketch the graph of $y = \tan^{-1}(x)$. Label very carefully.

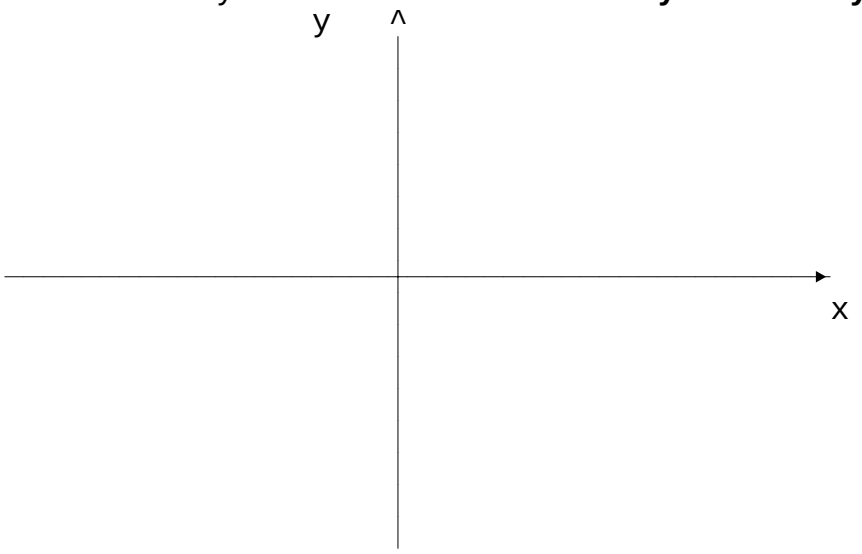


6. (5 pts.) Solve for x without using a calculator. Use the natural logarithm when logarithms are needed.

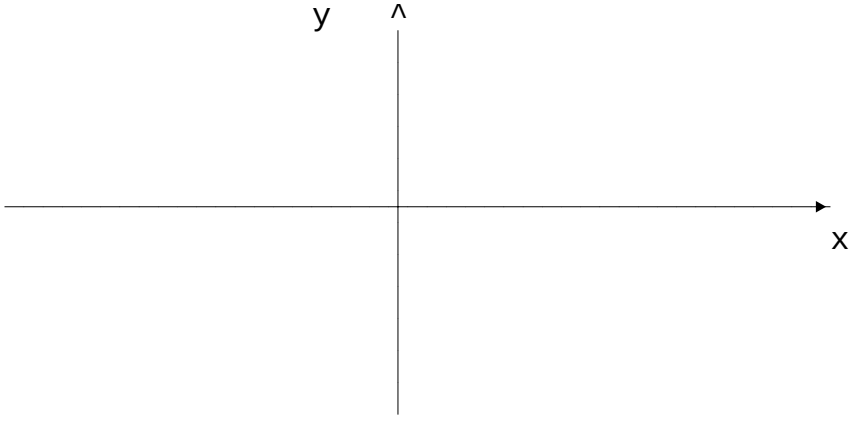
$e^{2x} - e^{x} = 12$

7. (5 pts.) Using a complete sentence and appropriate notation, provide the precise mathematical definitions for the following term: // The differential, dy, of a function f(x) //

8. (5 pts.) Carefully sketch both $f(x) = \ln(x)$ and $g(x) = e^{x}$ on the coordinate system below. **Label very carefully.**



9. (5 pts.) Carefully sketch the graph of $y = \sin^{-1}(x)$. Label very carefully.



10. (10 pts.) Evaluate each of the following limits. If a limit fails to exist, say how as specifically as possible.

(a) $\lim_{t \to \infty} 7t \cdot \sin(3\pi \cdot t^{-1}) =$

(b) $\lim_{x \to 0} \dfrac{4 - 4 \cdot \cos(10x)}{e^{2x} + e^{-2x} - 2} =$

11. (5 pts.) The radius of a sphere is measured to be 15 feet with a possible error of ±0.5 feet. Use differentials to estimate the relative error in the computed volume.

12. (5 pts.) Find the exact value of $\tan[2 \cdot \tan^{-1}(4/5)]$. [**Warning**: You will have to use several identities to handle this.]

13. (5 pts.) Let $f(x) = \tan^{-1}(x^3) + (7\pi/4)\cdot x$. (a) Show f is invertible. (b) Then solve the equation $f^{-1}(x) = -1$.

14. (5 pts.) Use differentials and a linear approximation formula to estimate $(9)^{1/3}$. [Hint: Use $x_0 = 8$ and $f(x) = x^{1/3}$.]

15. (5 pts.) Solve for x without using a calculator.

$$\ln(64x) - 3\cdot\ln(x^2) = \ln(2)$$

16. (5 pts.) Carefully sketch the graph of $y = \cos^{-1}(x)$. Label very carefully.