PART 3

1. Solve for x. $\log_x 16 = 4$ $\log_3 \frac{1}{27} = x$ $\ln x = 0$ $\log_x 8 = 3$ $\ln\sqrt{e} = x$

   Rewrite these expressions in logarithmic form: $7^2 = 49$ $e^{2.303} = 10$

2. Given that $\ln 2 \approx 0.69$ and $\ln 3 \approx 1.10$, use the algebraic rules for logarithms to estimate the following numbers. Show your work even if you can do it mentally: $\ln 6$ $\ln 9$ $\ln\frac{1}{2}$

   Given that $\log_4 5 \approx 1.2$ and $\log_4 6 \approx 1.3$, calculate the following: $\log_4 25$ $\log_4 30$

3. Use algebraic rules for logarithms to rewrite $\ln\left(\frac{a^3}{b^2c^4}\right)$ into an expression of logarithms with linear arguments.

4. $f(x) = \ln(2x-5)$. What is the domain of f ?

   $g(x) = \ln(4-x^2)$. What is the domain of g ? Evaluate $\lim_{x\to 2^-} g(x)$

5. A bank offers a savings account that pays an annual interest rate of 5%, compounded continuously.
   (a) Write an expression that would calculate the amount of money in the account if the principal P is invested for t years.
   (b) Use this expression to calculate, to the nearest dollar, the value of the account if \$10 is invested for twenty years.
   (c) What is the value of an investment of \$500 for 3 years at a rate of 4% assuming continuous compounding? You may leave the answer is exponential form.

6. Suppose \$5,000 is invested at an interest rate of 10% compounded continuously.
   (a) Find the equation that would calculate the amount of money in the bank after t years.
   (b) How much money would there be after 10 years?
   (c) How long will it take to have \$10,000 in the bank?

7. Differentiate. DO NOT SIMPLIFY.

$f(x)=e^x+\ln x+2^x+\log_2 x$ $\quad y=\dfrac{e^{-x}}{1+e^{2x}}$ $\quad g(x)=x^2e^x$ $\quad h(x)=\ln(e^x+x^3-e)$

$h(x)=\log_{10}3^x$ $\quad F(x)=\ln^2(3x^4)$ $\quad f(x)=e^{2x}-e^{-x}$ $\quad y=\ln(4-x^2)$ $\quad f(x)=\ln(e^x-\ln x)$

$f(x)=e^x+\ln x+\log_5 x+3^x$ $\quad y=x^2\ln(x^3+1)$ $\quad h(x)=\dfrac{1+\ln x}{e^{2x}}$

Find $\dfrac{dy}{dx}$ for $e^y=\ln(x+y)$

8. Find the equation of the line tangent to $x^3-3xy^2+y^3=1$ at the point (2, -1).

9. Find $\frac{dy}{dx}$ and the equation of the line tangent to $x^2+xy^2-y=3$ at the point (1, 2).

10. A plane, flying at an altitude of 1 mile and a speed of 500 mi/hr, passes over a radar station (and continues on). Find the rate at which the distance from the plane to the station is increasing when the plane is 2 miles away from the station. Include units of measure in your answer.

11. Two similar products are competing for customers. The sales of product x and product y are related according to the following formula: $\sqrt{x}+\sqrt{y}=100$. When sales of product x are 4900 units, those sales are growing at a rate of 500 per year. At what rate are sales of product y declining at that time?

12. A boat is pulled into a dock by a rope attached to the bow of the boat and passing through a pulley on the dock that is 1 meter higher than the bow of the boat. If the rope is being pulled in at a rate of 1 meter/sec., how fast is the boat approaching the dock when it is 5 meters from the dock?