Calculus Review Questions.

1. Find *dy/dx* given $x^2y - xy^2 + x = 0$

2. Given $x^3y + xy^3 = 2$ find dy/dx at the point (1,1).

3. Find the equation of the tangent and normal lines to $y = x^3 - 2x^2 + 4$ at the point (2,4).

4. Show in the space below that $f(x) = 4x^3 + x - 3 = 0$ has exactly one real solution (you only need to show the existence of one real solution – you do not have to find the value). Hint: sketch a graph of the function at look at the slope. Use a fact about the slope to demonstrate the result.

5 a) Use the fact that $y = e^{\ln y}$ to rewrite 2^x in exponential form.
b) Use your answer to (a) to differentiate 2^x.

6 a) Use the chain rule to write *dz/dt* where $z = f(x(t),y(t))$
b) Use the expression from part (a) to find *dz/dt* given $z = \ln(x^2+y^2)$; $x(t) = e^{-t}$ and $y(t) = e^t$

7. Find the relative extrema (max and min) for the function $f(x) = -7x^2 + 126x - 23$.

a) Write the First Order Condition
b) Write the solution(s) to the First Order Condition
c) Use the second order conditions to classify the critical values as relative maxima, relative minima or neither.

8. Solve each of the following equations for x in terms of y:
a) $\ln x = \ln 3 + \ln y$
b) $\ln x = 3y$

9. Find the derivatives of
a) e^{3x+1}
b) x^2e^x
c) $\ln(x-10)$

10. For each of the following find $\partial f/\partial x$ and $\partial f/\partial x$
a) $f(x,y) = x^2 + 3xy + y^2$
b) $f(x,y) = \ln x + 2\ln y$
c) $f(x,y) = e^{xy}$

11. Solve the following constrained optimization problem:

max $\ln x + 2\ln y$ subject to $x + y = 60$