MAKE SURE EACH MEMBER OF YOUR GROUP UNDERSTANDS YOUR RESPONSE TO EACH PROBLEM BEFORE MOVING ON

1.)

Show that the function $f(x) = e^x - 2$ has a root in the interval $(0, 1)$. What theorem are you using?

2.)

a.)

Show that $\frac{\mathrm{d}}{\mathrm{d}x}x^2 = 2x$ using the limit definition of derivative.

b.)

The binomial theorem states that

$$(a+b)^n = a^n + na^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \binom{n}{3}a^{n-3}b^3 + \ldots + \binom{n}{n-2}a^2b^{n-2} + nab^{n-1} + b^n \quad (1)$$

$$= \sum_{k=0}^{n}\binom{n}{k}a^{n-k}b^k \quad (2)$$

where $\binom{n}{k} = \frac{n!}{k!(n-k)!}$.

The power law states that $\frac{\mathrm{d}}{\mathrm{d}x}x^n = nx^n - 1$. Use the binomial theorem in conjunction with the limit definition of derivative to show this.

(HINT: stuck on those pesky binomial coefficients? It turns out they're mostly a red herring here. Rephrase equation (1) to say $(a+b)^n = a^n + na^{n-1}b + b^2g(a,b)$ where $g(a,b)$ is some polynomial in a and b that we can pretty much ignore for the purposes of this problem. Why does that work? Why can we ignore it here??) **IF**

YOUR GROUP HAS COMPLETED BOTH PROBLEMS LET DAVID KNOW!