

Homework Problem Set I
CH 347
23 August 2006
Instructor: John Shriver

Due: Friday, 25 August 2006.

1. Prove that the product 1.atm represents an energy by converting it to SI units and knowing that a J is $1 \text{ kg m}^2/\text{s}^2$.

2. Prove that

$$\log(10^x) = x \quad \text{and} \quad x = 10^{\log(x)}$$

and similarly

$$\ln(e^x) = x \quad \text{and} \quad x = e^{\ln(x)}$$

3. Demonstrate the validity of Eqn. 8 in the Mathematics Review Supplementary

Material by calculating $\left(1 + \frac{1}{n}\right)^n$ for increasing values of n and show that the limit approaches e .

4. The maximum (or minimum) of a function occurs where the first derivative becomes equal to zero. Why? Justify your answer with a sketch.

5. Use calculus to show that the maximum of $\sin(x)$ occurs at $\pi/2$ radians on the interval from 0 to π . Sketch the function and its derivative and discuss your result relative to the two plots.

6. Plot the indefinite integral of $\sin(x)$ over the same interval as in the preceding question. Calculate the definite integral of $\sin(x)$ from 0 to $\pi/2$. Compare this to the plot of the indefinite integral.