Differentiate the following using the appropriate differentiation rule.

**Power Rule**

1. \( y = ax^2 \)

2. \( y = x^{13} \)

3. \( y = x^{2a} \)

4. \( y = \sqrt[8]{x^4} \)

**Sum Rule**

5. \( y = ax^2 + bx + c \)

6. \( y = 2ax^n + q \)

**Chain Rule**

7. \( y = (x^2 + 1)^{-1} \)

8. \( y = (a + bx^2)^{3/2} \)

9. \( y = (2x + 1)^2 \)
Product and Quotient Rules

10. \( y = (x + 3)(x + 5) \)  

11. \( y = \frac{x + 3}{x + 5} \)

12. \( \phi = \phi_0 e^{-\lambda t} \left( \frac{d\phi}{dz} = ? \right) \)

13. \( E = a 10^{-1.5m} \left( \frac{dE}{dm} = ? \right) \)

14. \( y = a - ae^{-\frac{y}{b}} \left( \frac{dy}{dx} = ? \right) \)

Footnote: quite often derivatives are expressed using the notation \( y' \) and \( \dot{y} \). This is just shorthand for \( \frac{dy}{dx} \) and \( \frac{dy}{dt} \), respectively, the spatial and temporal derivatives. Similarly, \( \frac{d^2 y}{dx^2} \) and \( \frac{d^2 y}{dx^2} \) are written as \( y'' \) and \( \ddot{y} \), respectively. With the second derivative you are just differentiating the result you obtained following the first differentiation. Thus \( \frac{d^2 x^n}{dx^2} \) is just \( \frac{d}{dx} \left[ \frac{dx^n}{dx} \right] \).

You should also be familiar with derivatives of common trigonometric functions (see Table 8.2)

Start working problems 8.13 and 8.14 and bring questions to class.

Review as you read through chapter 8 and turn in next time