- **Lesson 29 and 31- Differentials and Product Rule**

  -Relationship between the function, first derivative, and second derivative

  - ➔ If the function is increasing the derivative is positive
  - ➔ If the function is decreasing the derivative is negative
  - ➔ If the function is concave up the derivative is increasing and the second derivative is positive
  - ➔ If the function is concave down the derivative is decreasing and the second derivative is negative

  - Product Rule

  $$\frac{d}{dx}(f(x) \cdot g(x)) = (f'(x) \cdot g(x)) + (g'(x) \cdot f(x))$$

  -<u>Example:</u> $f(x)= 3xy^3+2x+4y+x^2y$ find the derivative

  Answer: $f'(x)= 9xy^2+3y^3+2+4+2xy+x^2$

- **Lesson 32- Indefinite Integrals**

  -Indefinite integrals give you a family of functions starting with the derivative of that family of functions

  -<u>Example:</u> $\int 4x^3\, dx = x^4 + c$

  To check your answer take the derivative of your answer so

  $f(x)= x^4 + c$

  $f'(x)= 4x^3$

  Since the derivative matches the inside of the integral we know that our answer is correct

- **Lesson 33- Graphing Polynomial Functions**

  -Let's say we have a function $f(x)= (x-a)n\ (x+b)m\ (x-c)p$, n,m, and p are all exponents

  - ➔ if n is even then at the zero x= a the line will bounce
  - ➔ if it is n is odd then the line will pass through

  - The end behavior of the function is determined by the total of the exponents and the sign of the leading coefficient

  - ➔ If the total of the exponents is even then the end behavior will look that of a parabola
    - ◆ If the leading coefficient is negative the end behavior will be that of an upside down parabola
    - ◆ If the leading coefficient is positive that end behavior will be that of a positive parabola
  - ➔ If the total of the exponents is odd then the end behavior will be increasing on one end and decreasing on the other so like ↑↓ or ↓↑

- If the leading coefficient is negative the end behavior will be ↑↓
- If the leading coefficient is positive the end behavior will be ↓↑

-<u>Example:</u> Graph $f(x)= -3(x-2)^3(x+3)^2(x-4)$

Zero's: 2, -3, 4
Passes Through: 2, 4
Bumps Off: -3
End Behavior: ↓↓