Due: August 13, 2024

1. Given the function $y = 3x + 5$

   a) Find the difference quotient as a function of $x + \Delta x$.

   b) Find the derivative dy/dx.

   c) Find $f'(1)$ and $f'(3)$.

2. Given the function $y = 5x^2 - 4x$

   a) Find the difference quotient as a function of $x + \Delta x$.

   b) Find the derivative dy/dx.

   c) Find $f'(2)$ and $f'(3)$.

3. Compute the derivatives for the following functions by use of the power rule:

   a) $f(x) = -6x^3 + 12x^2 - 4x + 7$

   b) $f(x) = (1/10)x^{10} + (1/9)x^9 - (1/8)x^8$

   c) $f(x) = (3x + 5)^2$ (expand first)

   d) $f(x) = 100x^2 + (1/100)x$

4. Compute the derivatives y' two ways: product rule and expanding first:

   a) $y = (x^2 + 1)(x^3 + 1)$

   b) $y = (x - 1)(x^5 + x^4 + x^3 + x^2 + x + 1)$

   c) $y = (x^3 + 1)(x^2 + 1)(x + 1)$

5. Compute the following derivatives by using the quotient rule:

   a) $y = \dfrac{5x + 6}{x^2 + 1}$

   b) $y = \dfrac{x^3 - x}{x^5 - x^3 + 1}$

6. Compute the following derivatives by using the quotient rule and the product rule:

   a) $y = \dfrac{(x^3 - 2x^2 + 7x + 1)(x^2 - x + 3)}{x^3 + 1}$

b) $y = \dfrac{(x^2 + 1)(x^4 + 1)}{(x^3 + 1)(x^5 + 1)}$

7. Differentiate the following:

a) e^{5x}

b) $e^{\sqrt[3]{x}}$

c) $(e^e)^x$

d) 7^x

e) $2^{(x^2 + 6x - 5)}$

f) $\ln(x^4 - x^2 + 1)$

g) $\ln(e^x)$

h) $\ln(2x)$