

Worksheet 7, Wednesday, July 3, 2019

1. Compute the derivative of $f(x) = \sqrt{x}$ **two** different ways:

- First use the **limit definition of the derivative**.
- Second use the Power Rule.

IMPORTANT: Now memorize $\frac{d}{dx} \sqrt{x} = \frac{1}{2\sqrt{x}}$

2. Compute the derivative of each of the following functions.

(a) $f(x) = \pi^2$

(b) $f(x) = \frac{3}{4}x^8$

(c) $f(x) = x^3 - 4x + 6$

(d) $f(x) = x^7 + 5x^2 - 7x + 9$

(e) $f(x) = \frac{1}{x^3}$

(f) $f(x) = -\frac{12}{x^5}$

(g) $f(x) = 5x^2 - \sqrt{x} + x^{\frac{5}{7}} + \frac{3}{x} - \frac{2}{x^2}$

3. For each of the problems compute the derivative of each of the following functions in **two** ways:

- **FIRST** simplify the function algebra and **THEN** use the Sum and Power Differentiation Rules.
- **FIRST** use the Product or Quotient Differentiation Rules and **THEN** simplify your answers and see if it matches your answer from above

(a) $f(x) = \sqrt{x} \cdot (x - 1)$

(b) $f(x) = \frac{x^2 + 4x + 3}{\sqrt{x}}$

(c) $f(x) = \frac{\sqrt{x} + x}{x^2}$

(d) $f(x) = (x^5 + \sqrt{x}) \left(\frac{1}{x} - 3x^2 \right)$

(e) $f(x) = \frac{\sqrt{x} - \frac{1}{x^8}}{x^7}$

4. Compute the equation of the line that is tangent to the curve $y = (3x^2 + 5)(2 - 4x)$ at the point where $x = 1$.

5. Simplify the expression $3(x + 1)^2(1 - 2x)^4 + (x + 1)^3 4(1 - 2x)^3(-2)$

Hint: Look for Common factors.

6. For later purposes we need to practice solving.

(a) Consider the equation $x^2 + 2xyy' = 3y - 7y'$. Solve for y' .

(b) Consider the equation $3y^2 \frac{dy}{dx} - 5x^3 y = 4x + 7 \frac{dy}{dx}$. Solve for $\frac{dy}{dx}$.

7. Solve the equation $\frac{2x + 1}{\sqrt{x}} - \frac{x\sqrt{x}}{x + 2} = 0$

Hint: First, put the left hand side over a common denominator. Then remember that a fraction is zero when the numerator is zero.

8. Consider the function $f(x) = \frac{7x + 3}{1 - 5x}$. Compute the derivative $f'(x)$ in two different ways:

- First compute the derivative using the **limit definition of the derivative**.

- Second compute the derivative using the **Quotient Rule**.

9. Find **all** x -coordinates at which the graphs of the following functions have horizontal tangent lines. Please **simplify** your derivatives first. Why?

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

(b) $f(x) = x^{\frac{3}{2}} - 4x$

(c) $f(x) = \frac{5 - 2x}{3x + 4}$

(d) $f(x) = \frac{2 - x}{x^2 + 5}$

Turn in your own solutions.
