|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Math 260 - Week 2 Lab Name:** | | | |  | | |
| As we have seen, using to find a derivative each time is a long process and often cumbersome. But, there are a few *algorithms* that work perfectly for finding derivatives. They are **the power rule, the product rule, the quotient rule, and the chain rule.**  -------------------------------------------------------------------------------------------------------------------------------------------------------------  **Category 1: Power Rule**  **Directions:** Look at the examples below then answer questions 1 & 2.   1. b.) c.)     d.)       1. Describe in your own words how to find a derivative using the Power Rule. What must be done to c.) and d.) above before using the power rule to differentiate ? | | | | | | | |
|  | | | | | | | |
| 2.) Find the derivative of | | | | | | | |
|  | | | | | | | |
| **Category 2: Product Rule**  **Directions:** Look at the examples below then answer questions 3.        ← **SIMPLIFIED ANSWER**        ↑ **RULE** ↑ **answer** ↑ **SIMPLIFIED**    3.) i.) Describe, in your own words, how to find a derivative using the product rule.  ii.) Find the derivative for f(x) = (2x + 3)(5x2 – 3x + 1)  iii.) Explain what steps were taken to change the answer to the simplified form for b.) | | | | | | | |
|  | | | | | | | |
| **Category 3: Quotient Rule**  **Directions:** Look at the examples below then answer the questions 4.  b.)    **RULE SIMPLIFIED ANSWER**  **RULE SIMPLIFIED ANSWER**  4.) Describe, in your own words, how to find the derivative using the Quotient rule, then find f ’(x) for | | | | | | | |
|  | | | | | | | |
| 5.) Research and explain the **Sum Rule** for derivatives. | | | | | | | |
|  | | | | | | | |
| **Category 4: Chain Rule**  **Directions:** Look at the examples below then answer the question 6 & 7.   1. b.)       c.)    **Rule Simplified Answer**  6.) Describe, in your own words, how to find the derivative using the Chain Rule, then find the  derivative for  . | | | | | | | |
|  | | | | | | | |
| 7.) For example b.) above, explain why the exponent is -1/2 in the first step ? Explain how the  answer to c.) has a 10 in front. | | | | | | | |
|  | | | | | | | |
| .  **Part 2: Higher Order Derivatives**  Higher order derivatives are derivatives of derivatives. The significance of a derivative depends on what x and f(x) represent.  For example, for the graph of f(x), and a point x on the graph f ’(x) is the slope of the curve, and f ’’(x) is the rate at which the slope is changing from point to point, called the curvature.  If s(t) is a displacement or position function, then s ’(t) is the velocity, s ’’(t) is the acceleration, s’’’(t), s(4)(t), s(5)(t), s(6)(t), are the jerk, jounce/snap, crackle and pop.  8.) Check the box below each valid form of notation for a higher order derivative.  y’’’ y’’’’ y(6) f ’’(x) | | | | | | | |
|  | | | | | | | |
| 9.) Examine the higher derivatives a, b, c below, then answer questions i and ii.   1. b.) c.)     i. For example a.) what value does every higher derivative have starting with the fourth derivative ? | | | | | | | |
|  | | | | | | | |
| ii. Does the same value occur for example b.) or c.) ? Explain why or why not ? | | | | | | | |
|  | | | | | | | |
| 9.) Find the 3rd derivative for , show all work. | | | | | | | |
|  | | | | | | | |
| 10.) As a dare devil is shot from a cannon. His wallet drops from his pocket when he is 70 feet from the ground. The position function of the wallet is given by s(t) = -26t2 + 73t + 70, t in seconds. Use your calculator, round all answers to the 100ths   1. How long will it take the wallet to hit the ground ? | | | | | | | |
|  | | | | | | | |
| b.) What is the instantaneous velocity of the wallet when t = 2.2 seconds ? | | | | | | | |
|  | | | | | | | |
| c.) What is the velocity of the wallet as it hits the ground ? | | | | | | | |
|  | | | | | | | |
| d.) What is the velocity of the wallet after it lands in the mud on the ground ? | | | | | | | |
|  | | | | | | | |
| |  | | --- | | 11.) To find the derivative of a piecewise function, you must differentiate each piece. If  asked to find the derivative at a particular value of x, the correct derivative must be  chosen according to the domain of each piece of f(x).  Find f ’(x) and f ’(-3), f ’(2), and f ’(3), f ’(10). | | | | | | | | |
| |  | | --- | |  | | |  | | | | | |
|  | | | | | |
|  | | | | | |
|  | | | | | |
|  | | | | | | | |
|  |  | |  | |  |  | |
|  |  | |  | |  |  | |
|  |  | |  | |  |  | |
|  |  | |  | |  |  | |
| |  | | --- | | 12.) The energy output E of an electric device is a function of time given by the formula  E = t(1 + 3t)2. Power, P is the first derivative of E. Find the Power (in Watts) generated by the  device at 3 seconds. | | | | | | | | |
|  | | | | | | | |
| 13.) Find the derivative of **f(r)** with respect to **r** given S and n are constant. | | | | | | | |
|  | | | | | | | |
| 14.) Find the rate of change of f(x) at x = 0: | | | | | | | |
|  | | | | | | | |