WARM UP EXERCSE

A cable company has found that the total number N (in thousands) of subscribers t months after the installation of the system is given by

$N(t) = 200t / (t + 5)$

Find N (15) and N ‘ (15). Write an interpretation of these results.

1

§11.4 Chain Rule: Power Form

The student will learn about:

- **the easy version of the chain rule,**
- **combining different rules of derivation**
- **application**

2

Some examples

$$\frac{d}{dx}\left(5x^3\right)^2 = \frac{d}{dx}\left(25x^6\right) =$$

$$\frac{d}{dx}\left(5x^3\right)^2 = \frac{d}{dx}\left(\left(5x^3\right)\left(5x^3\right)\right) =$$

$$\frac{d}{dx}\left(5x^3\right)^3 = \frac{d}{dx}\left(\left(5x^3\right)^2\left(5x^3\right)\right) =$$

3

Some examples

$$\frac{d}{dx}\left(u(x)\right)^2 = \frac{d}{dx}\left(\left(u(x)\right)\left(u(x)\right)\right) =$$

$$\frac{d}{dx}\left(u(x)\right)^3 = \frac{d}{dx}\left(\left(u(x)\right)^2\left(u(x)\right)\right) =$$

4

Chain Rule: Power Rule.

Theorem 1. (General Power Rule or easy Chain Rule) If u (x) is a differential function, n is any real number, and

$$f(x) = [u(x)]^n$$

then $f'(x) = n[u(x)]^{n-1} u'(x)$

$$= n u^{n-1} u'$$

or $\frac{d}{dx} u^n = n u^{n-1} \frac{du}{dx}$

Find the derivative of $y = (x^3 + 2)^5$.

Example 2

Find the derivative of $y = \sqrt{x^3 + 3}$

Example 3: Combining Rules of Differentiation

Find $f'(x)$ if $f(x) = \dfrac{x^4}{(3x-8)^2}$.

7

Example 4

Let $f(x) = x^2(1-x)^4$; at $x = 2$.

Find $f'(x)$ and find the equation of the line tangent to the graph of f at the indicated value of x.

8

Application

The number $f(p)$ of stereo speakers people are willing to buy per week at a price of $\$p$ is given by

$f(p) = 1{,}000-60(p+25)^{1/2}$

for $20 \le p \le 100$.

1. Let $f(p) = 1{,}000-60(p+25)^{1/2}$ what is $f(75)$?

2. What does it mean?

9

Application

The number $f(p)$ of stereo speakers people are willing to buy per week at a price of $\$p$ is given by

$f(p) = 1{,}000-60(p+25)^{1/2}$

for $20 \le p \le 100$.

1. Find $f'(p)$

2. Find $f'(75)$.

10

Summary.

If

$$y = f(x) = [u(x)]^n$$

then

$$\boxed{\frac{d}{dx} u^n = n u^{n-1} \frac{du}{dx}}$$

11