

THE UNIVERSITY OF AKRON
Theoretical and Applied Mathematics



Calculus I: Differentiation Practice
The Chain Rule

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Prerequisite:

Tutorial on the AcroT_EX System of Online Assessment

You must enter your answer in the response boxes using a certain “natural” syntax. This is a brief tutorial on how to enter your answers in the response boxes below.

Instructions: In order to make this a useful academic exercise, you should solve each of the problems on a separate sheet of paper, simplify as needed. Then transfer your answer into the response box. Work neatly and be well-organized. Work as if your paper is to be handed in.

The programming cannot check for a simplified answer, but a simplified answer might be easier to enter into the response box. For example, it is easier to enter ‘ x ’ than the non-simplified expression ‘ $x*(2*x + 4)-2*(x*(x+1))-x$ ’.



Differentiation Formulas

Specific Formulas	General Formulas
1. $\frac{d}{dx} u^n = nu^{n-1} \frac{du}{dx}$ (Power Rule)	1'. $\frac{d}{dx} (cu) = c \frac{du}{dx}$
2. $\frac{d}{dx} \sin(u) = \cos(u) \frac{du}{dx}$	2'. $\frac{d}{dx} (u + v) = \frac{du}{dx} + \frac{dv}{dx}$
3. $\frac{d}{dx} \cos(u) = -\sin(u) \frac{du}{dx}$	3'. $\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}$ (Chain Rule)
4. $\frac{d}{dx} \tan(u) = \sec^2(u) \frac{du}{dx}$	<p>In this table, the letters u and v represent functions of the independent variable, x, and the letter c represents a constant.</p>
5. $\frac{d}{dx} \cot(u) = -\csc^2(u) \frac{du}{dx}$	
6. $\frac{d}{dx} \sec(u) = \sec(u) \tan(u) \frac{du}{dx}$	
7. $\frac{d}{dx} \csc(u) = -\csc(u) \cot(u) \frac{du}{dx}$	



Elementary Exercises. Differentiate each of the following.

$$1. \frac{d}{dx}(3x + 1)^4 =$$

$$2. \frac{d}{dx}(5 - 6x)^3 =$$

$$3. \frac{d}{dx} \frac{2}{(4x + 3)^3} =$$

$$4. \frac{d}{dx} \frac{4}{\sqrt{6x + 17}} =$$

$$5. \frac{d}{dx} \sin(4x^3) =$$

$$6. \frac{d}{dx} \sec(\sqrt{x}) =$$

$$7. \frac{d}{dx}(4x^2 + 2x + 1)^4 =$$

$$8. \frac{d}{dt} \frac{3}{\sqrt{t^3 + 2}} =$$



$$9. \frac{d}{dx} \left(x - \frac{1}{x} \right)^{11} =$$

$$10. \frac{d}{dx} \sqrt{(3x^2 + x)^3} =$$

Repeat this practice set until you get through with *no errors*. Then go on to the next practice set.

Advanced. Differentiate each of the following.

$$1. \frac{d}{dx} \tan(\sin(x)) =$$

$$2. \frac{d}{dx} \sin^4(4x^2) =$$

$$3. \frac{d}{dx} (2x-1)^3 (3x+2)^4 =$$

$$4. \frac{d}{dx} \sin(4x^2) \cos(2x) =$$

$$5. \frac{d}{dx} x^2 \sin(3x^2) =$$



$$6. \frac{d}{dx} \cos\left(\frac{1}{x^2 + 1}\right) =$$


$$7. \frac{d}{dx} \sqrt{\tan(x^2)} =$$

$$8. \frac{d}{dx} \frac{1}{(x^5 - x + 3)^6} =$$

$$9. \frac{d}{dx} 4 \cos^5(x^2) =$$

Repeat this practice set until you get through with *no errors*. When you have finished **both** practice sets without error, try taking a online quiz to test your understanding, go to the [Followup Assessment](#).

Directions:

 Followup Assessment

 AcroT_EX Online Assessment Page