Unit 2, Lesson 4

The Chain Rule

Objectives:

The lesson focuses on using the chain rule to differentiate three types of functions: a function raised to a power, exponential functions, and logarithmic functions. Students will be able to:

- Break down a composition of two functions into basic functions
- Apply the chain rule to find derivatives of a function raised to a power, exponential functions, and logarithmic functions

SEPTEMBER 2016

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT/SUN
26	27	28	29	30	
Quiz IV					
U2L4		U2L5			

OCTOBER 2016

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT/SUN
3	4	5	6	7	8/9
Quiz V		Test II Group A	Test II Groups A and B	Test II Group B	PCA U3L1 (10/9)
Review For Test II		Review For Test II			

Choose the 3 conditions that must be satisfied for a function to be continuous at a point:

A. $\lim_{x \to a} f(x) \neq f(a)$

B. $\lim_{x \to a} f(x) = f(a)$

C. $\lim_{x \to a} f(x)$ exists.

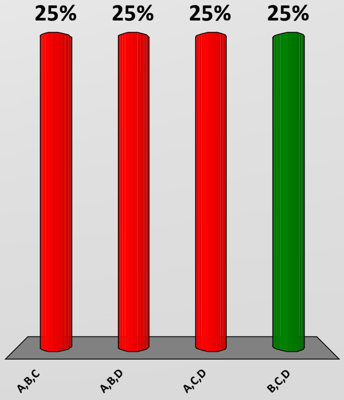
D. $f(a)$ is defined.

A. A,B,C

B. A,B,D

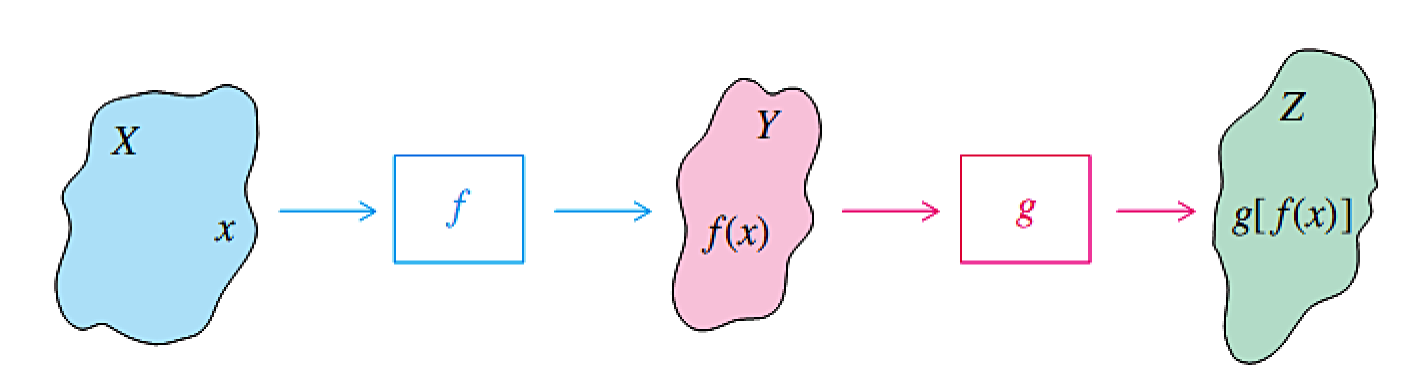
C. A,C,D

D. B,C,D



Composite Function

Let f and g be functions. The **composite function**, or **composition**, of g and f is the function whose values are given by $g[f(x)]$ for all x in the domain of f such that $f(x)$ is in the domain of g. (Read $g[f(x)]$ as "g of f of x".)



Chain Rule

If y is a function of u, say $y = f(u)$, and if u is a function of x, say $u = g(x)$, then $y = f(u) = f[g(x)]$, and

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}.$$

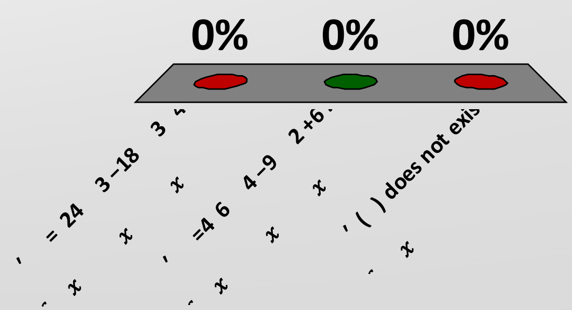
If $f(x) = (3x^2 - 7)^{2/3}$, then find $f'(x)$.

Let $f(x) = (6x^4 - 9x^2 + 6)^4$. Find $f'(x)$.

A. $f'(x) = (24x^3 - 18x)^3(4x)^3$

B. $f'(x) = 4(6x^4 - 9x^2 + 6)^3(24x^3 - 18x)$

C. $f'(x)$ does not exist



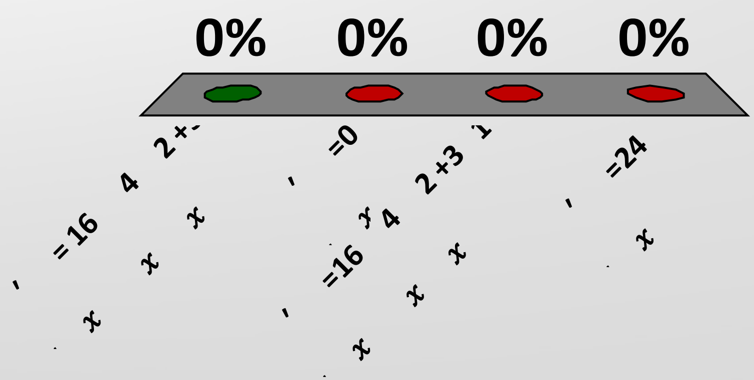
Let $g(x) = 4\sqrt{4x^2 + 3}$. Find $g'(x)$.

A. $g'(x) = \frac{16x}{\sqrt{4x^2+3}}$

B. $g'(x) = 0$

C. $g'(x) = 16x(4x^2 + 3)^{\frac{1}{2}}$

D. $g'(x) = 24x$



Consider the following table of values of the functions f and g and their derivatives at various points.

x	1	2	3	4
$f(x)$	1	3	4	2
$f'(x)$	-2	-4	-6	-9
$g(x)$	3	4	2	1
$g'(x)$	1/9	7/9	5/9	2/9

Use the table to find $D_x(f[g(x)])$ at $x = 3$.

Derivative of e^x

$$\frac{d}{dx}(e^x) = e^x$$

Derivative of a^x

For any positive constant $a \neq 1$,

$$\frac{d}{dx}(a^x) = (\ln a)a^x.$$

Derivative of $a^{g(x)}$ and $e^{g(x)}$

$$\frac{d}{dx}(a^{g(x)}) = (\ln a)a^{g(x)}g'(x)$$

and

$$\frac{d}{dx}(e^{g(x)}) = e^{g(x)}g'(x)$$

Let $f(x) = e^{-8x}$. Find $f'(x)$.

Let $f(x) = e^{x^3}$. Find $f'(x)$.

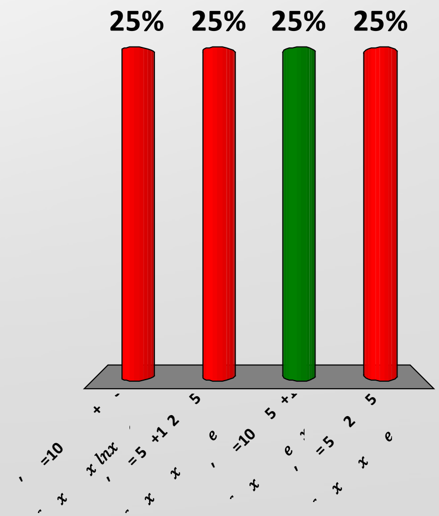
Let $f(x) = 2e^{5x+1}$. Find $f'(x)$.

A. $f'(x) = 10x(lnx) + e^{5}$

B. $f'(x) = (5x+1)(2)e^{5x}$

C. $f'(x) = 10(e^{5x+1})$

D. $f'(x) = (5x)(2)e^{5x}$



Derivative of $\ln x$

$$\frac{d}{dx}[\ln x] = \frac{1}{x}$$

Derivative of $\log_a x$

$$\frac{d}{dx}[\log_a x] = \frac{1}{(\ln a)x}$$

(The derivative of a logarithmic function is the reciprocal of the product of the variable and the natural logarithm of the base.)

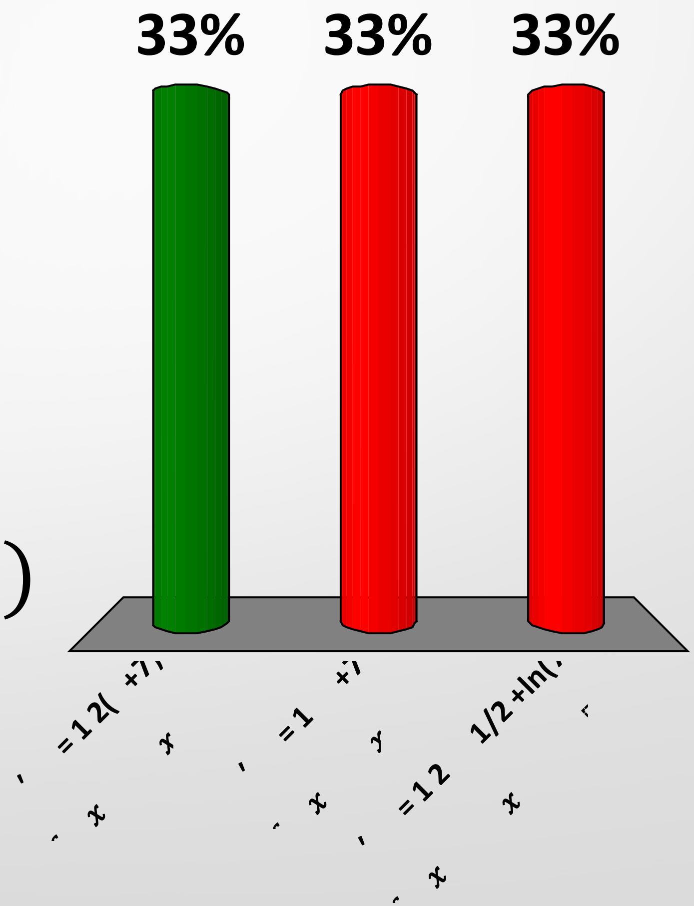
Let $f(x) = \ln(4 - 3x)$. Find $f'(x)$.

Let $f(x) = ln\sqrt{x+7}$. Find $f'(x)$.

A. $f'(x) = \frac{1}{2(x+7)}$

B. $f'(x) = \frac{1}{\sqrt{x+7}}$

C. $f'(x) = \frac{1}{2}x^{1/2} + \ln(7)$



QUESTION:

- *A friend concludes that because* $y = \ln(6x)$ *and* $y = \ln(x)$ *both have the same derivative, namely* $\frac{dy}{dx} = \frac{1}{x}$, *then these two functions must be the same.*

- *Is your friend correct? Why or why not?*

QUESTION:

- If $f(t)$ give the number of units of a certain product sold by a company after t days and $g(x)$ gives the revenue (in dollars) from the sale of x units of the company's products, what does $(g \circ f)'(t)$ describe?