

Chain Rule Worksheet

1. Find the period and the derivative for the following sinusoidal functions.

a. $\cos(x)$

Period:

Derivative:

b. $3 \cos(2x)$

Period:

Derivative:

c. $\cos\left(\frac{x}{2}\right) + 5$

Period:

Derivative:

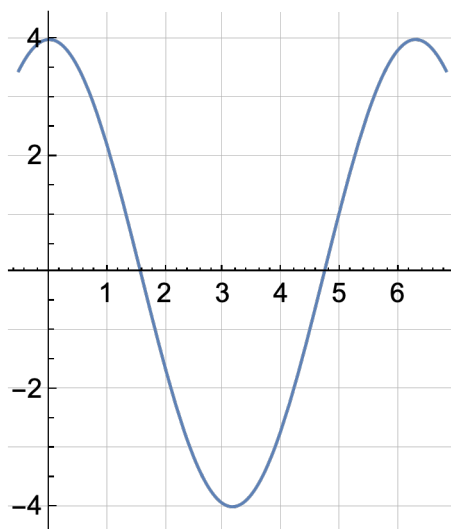
d. $-6 \cos(4x) + 2$

Period:

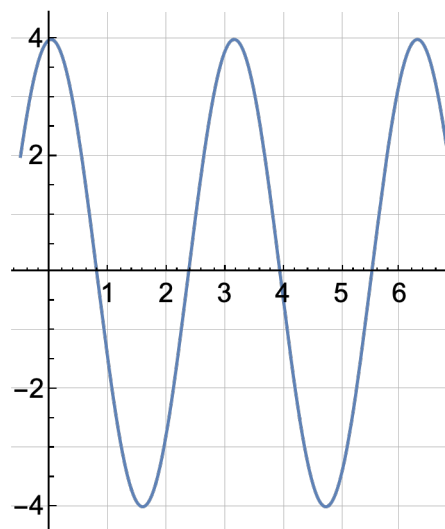
Derivative:

2. Below are the graphs of $f(x) = 4 \cos(x)$ and $g(x) = 4 \cos(2x)$. On those graphs, draw the tangent lines at the indicated x -values and estimate the slopes to get the derivatives.

$y = 4 \cos(x)$



$y = 4 \cos(2x)$



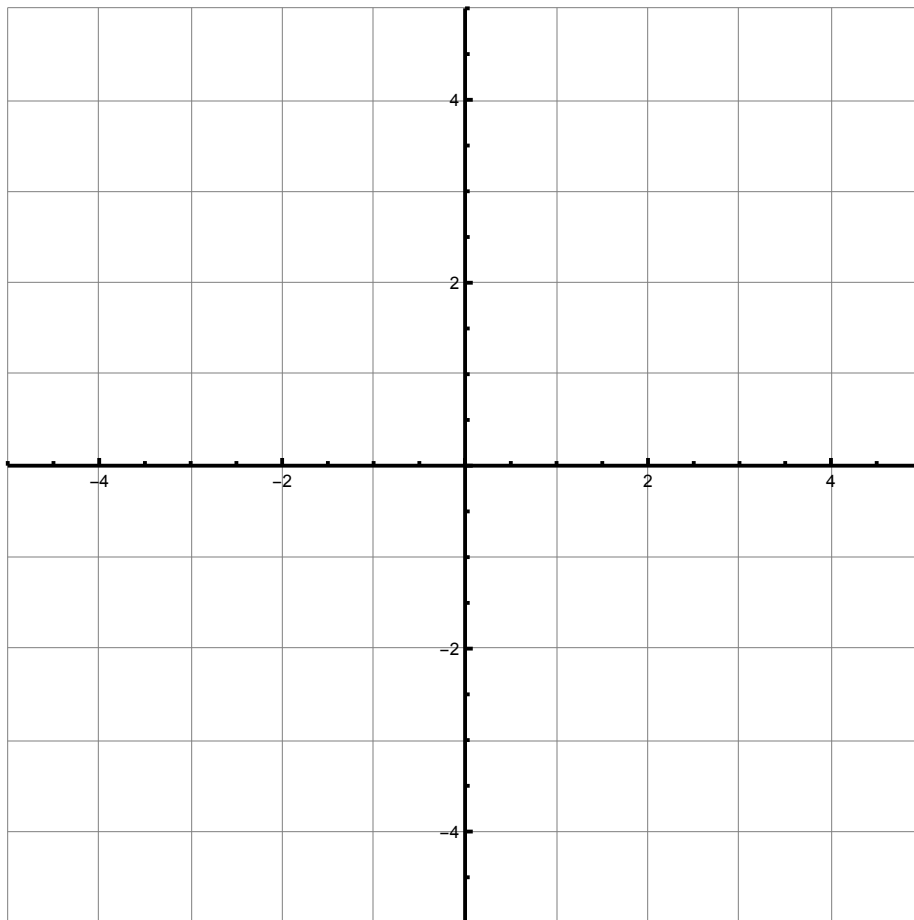
x	$(4 \cos(x))'$ -- as estimated slope	$(4 \cos(2x))'$ -- as estimated slope
0		
$\frac{\pi}{2} \approx 1.6$		
$\pi \approx 3.1$		
$\frac{3\pi}{2} \approx 4.7$		
$2\pi \approx 6.3$		

3. Consider $y = e^{\sin(x)} + 1$ at $x = 0$.

3.1. Compute the derivative $y'(x)$.

3.2. Find an equation for the tangent line to $y = e^{\sin(x)} + 1$ at $x = 0$.

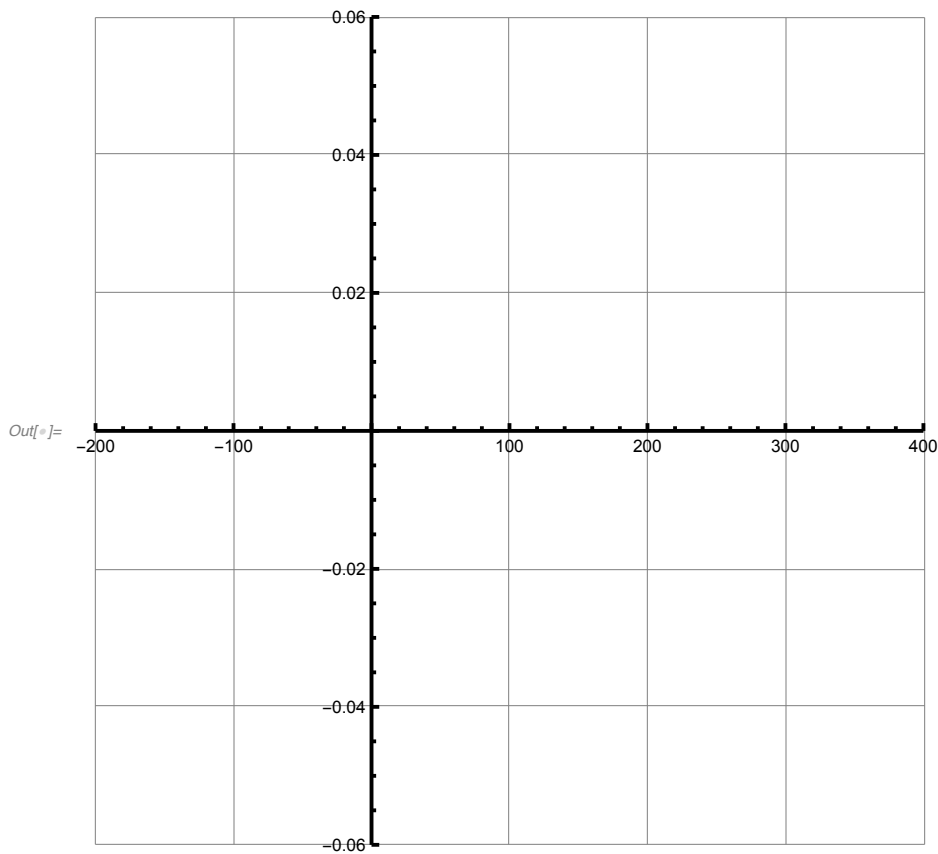
3.3. In Desmos or on a graphing calculator plot both $y = e^{\sin(x)} + 1$ and the tangent line you found. Sketch the results below.



4. The function $f(x) = 3 \cos\left(\frac{2\pi}{365}(x - 171)\right) + 12$ gives a good approximation for the hours of daylight for the x day of the year.

4.1. Today is day 76 of this year. According to this model, how many hours of daylight should we expect?

4.2. Find $f'(x)$, and plot it.



4.3. You should get that $f'(76) = 0.0515351$. What does the sign and size indicate about today's daylight?

5. Consider the graph $y = \sqrt{x^4 - 3x^2 + 5}$.

5.1. What is $\frac{dy}{dx}$?

5.2. Using the derivative, find all the x -values where the graph has horizontal tangents.

5.3. Graph this function in Desmos or on a graphing calculator. Sketch the results below and indicate on the graph the points with horizontal tangents. Does it agree with your calculations?

