Teacher Notes

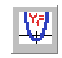
Activity 14

Discovering the Derivative of the Sine and Cosine Functions

Objective

- Students will discover the derivative of *sin(x)* and *cos(x)* by analyzing a scatterplot of *x*-values and the function's numerical derivatives at these *x*-values.

Applicable TI InterActive! Functions

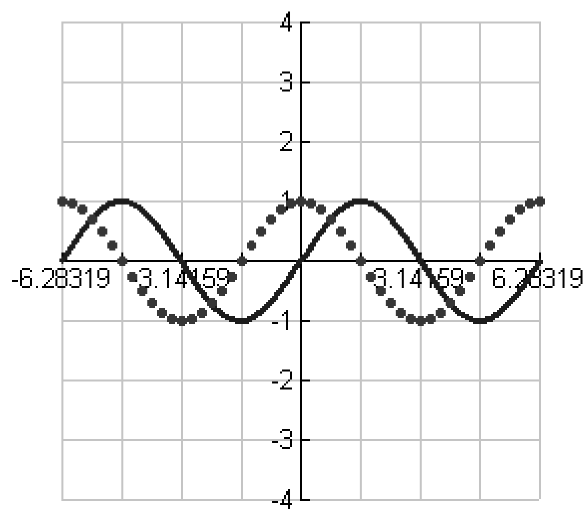
♦ Define	*variable*:= *value*
♦ Store	{*list*} ⟶ *list_name*
♦ NDeriv	nDeriv(*function*, *variable*)
♦ Graph	

Problem

The slope of the tangent to a curve at a point is defined to be the derivative. By calculating the derivative of a curve at many points a new function can be obtained. By finding the equation that will fit the points, the derivative of $f(x) = \sin(x)$ and $g(x) = \cos(x)$ can be discovered.

Exploration

Steps 1 through 10 are details for the students to set up the problem. When students have completed step 10, their graph should look appear as shown.



Analysis

1. $y2(x) = \cos(x)$

2. Yes, $y2$ matches $y3$.

4. $f'(x) = \cos(x)$

5. Students answers may vary.

6. The graph of $f(x)$ and the scatterplot of numerical derivatives have changed. Since $y2 = \cos(x)$, the graph of $f(x)$ is the same as the graph of $y2$.

7. $y2(x) = -\sin(x)$

8. $f'(x) = -\sin(x)$

Additional Exercises

2. $y2(x) = 2\cos(2x)$

3. When $g(x) = \sin(2x)$, $g'(x) = 2\cos(2x)$.

5. $y2(x) = 3\cos(3x)$

6. When $g(x) = \sin(3x)$, $g'(x) = 3\cos(3x)$.

8. $y2(x) = 5\cos(5x)$

9. When $g(x) = \sin(5x)$, $g'(x) = 5\cos(5x)$.

11. $y2(x) = -2\sin(2x)$

12. When $g(x) = \cos(2x)$, $g'(x) = -2\sin(2x)$.

14. $y2(x) = -3\sin(3x)$

15. When $g(x) = \cos(3x)$, $g'(x) = -3\sin(3x)$.

17. $y2(x) = -5\sin(5x)$

18. When $g(x) = \cos(5x)$, $g'(x) = -5\sin(x)$.

19. If $f(x) = \sin(n * x)$, $f'(x) = n\cos(nx)$.

20. If $f(x) = \cos(n * x)$, $f'(x) = -n\sin(nx)$.