3-70. DERIVATIVES OF SINE AND COSINE GRAPHICALLY

It appears that the derivatives of sine and cosine are related. What about the second derivatives?

You will be given a resource page with five sets of axes, vertically aligned. The x-axis is scaled from $[-2\pi, 2\pi]$ by $\frac{\pi}{2}$, and the y-axis is scaled from $[-2, 2]$ by 1.

a. Sketch as accurately as you can $f(x) = \sin x$ on the top set of axes. Draw bold dots on all maximum and minimum points.

b. On the second set of axes, sketch $f\,'(x)$ (found in 3-69) as accurately as you can.

c. Compare the graph of $f(x)$ with $f\,'(x)$. What does $f(x)$ look like when $f\,'(x) = 0$?

   Your teacher will show you how to use Desmos to find the slopes of tangent lines along the curve. These slopes of $f(x)$ can be plotted to result in the same $f\,'(x)$ graph that you created on your resource page. For this demonstration, visit: **http://tinyurl.com/FXsine**

d. Repeat the Desmos process for $f''(x)$, $f'''(x)$, and $f^{iv}(x)$, the second, third and fourth derivatives of $f(x)$.

   To create $f''(x)$, visit: **http://tinyurl.com/FXtrig2**

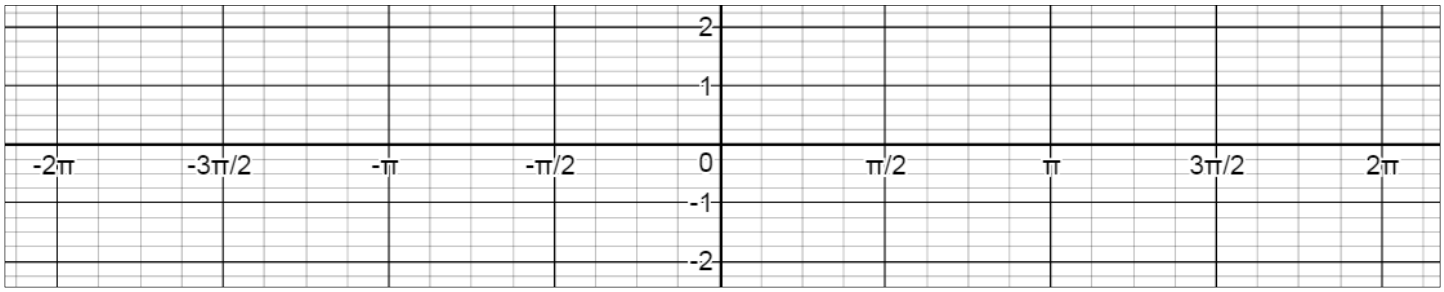
   To create $f'''(x)$, visit: **http://tinyurl.com/FXtrig3**

   To create $f^{iv}(x)$, visit: **http://tinyurl.com/FXtrig4**

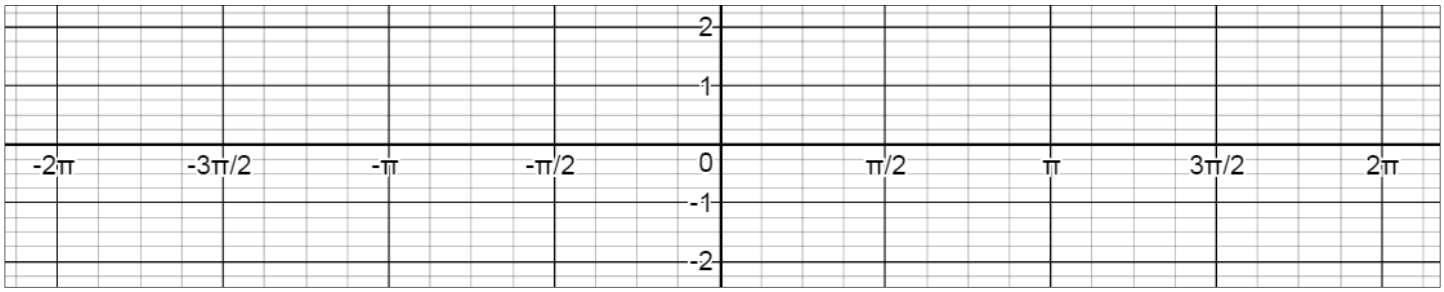
e. What do you notice about $f^{iv}(x)$?

f. Predict $f^{20}(x)$ and $f^{101}(x)$.

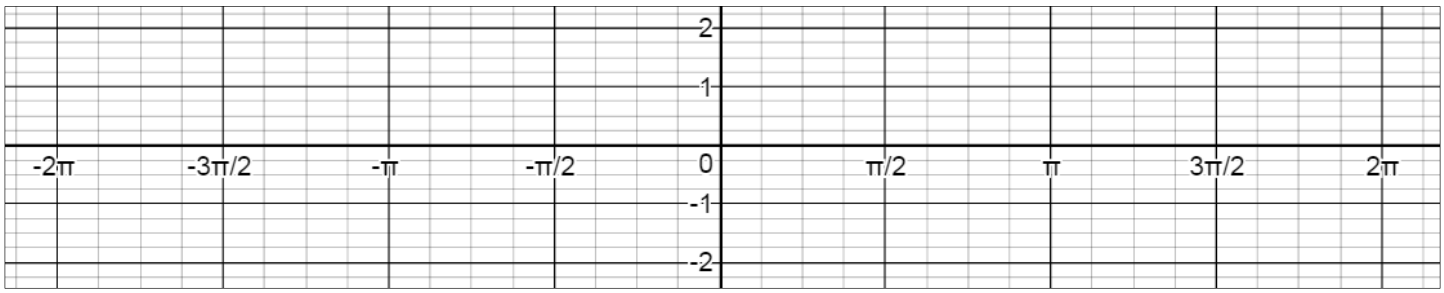
$f(x)$



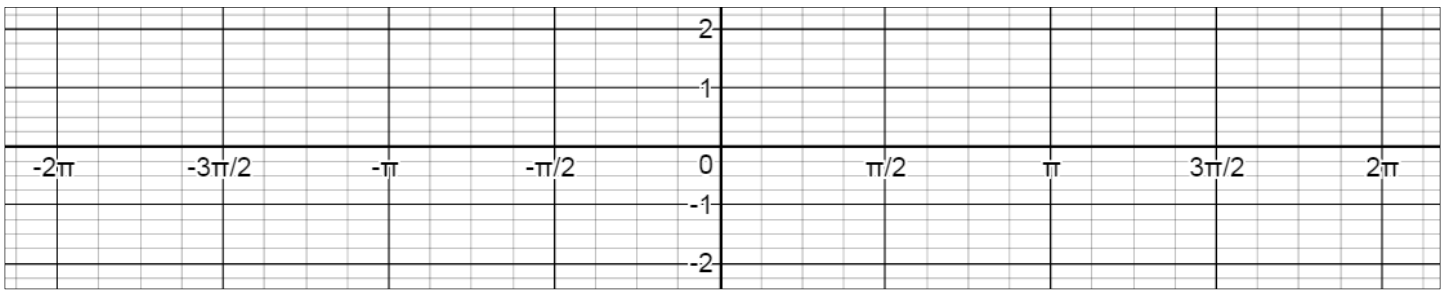
$f'(x)$



$f''(x)$



$f'''(x)$



$f^{iv}(x)$