Let $y = \sin(x) \cos(x)$ on $[0, \pi]$.

a) Plot the values of $y$ at the boundaries.

b) Find $y'$; simplify.

c) Find where $y' = 0$; plot.

d) Find $y''$; simplify.

e) Find where $y'' = 0$; plot.

f) Find where $y$ is concave up; concave down.

g) ON THE BACK OF THE PAPER:
Make a graph and plot the points from a)-f)
It should take up about a third of the paper.

h) Connect dots on the graph.

$$y' = \cos(x) \cos(x) + \sin(x)(-\sin(\sin(x))$$

$$= \cos^2(x) - \sin^2(x)$$

c) $y' = 0$ when $x = \pi/4, 3\pi/4$

d) $y'' = 2 \cos(x)(-\sin(x)) - 2 \sin(x)(\cos(x) - \cos(x) \sin(x))$

$$= 4 \cos(x) \sin(x)$$

e) $y'' = 0$ when $x = 0, \pi, \pi/2$

f) 

<table>
<thead>
<tr>
<th>$x$</th>
<th>$\sin(x) \cos(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0$</td>
<td>$0$</td>
</tr>
<tr>
<td>$\pi/4$</td>
<td>$\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$</td>
</tr>
<tr>
<td>$\pi$</td>
<td>$-1$</td>
</tr>
<tr>
<td>$3\pi/4$</td>
<td>$\frac{1}{2} \cdot \frac{1}{2} = -\frac{1}{2}$</td>
</tr>
</tbody>
</table>

f) 

$$\int_{\pi/2}^{\pi} \sin(x) \cos(x) dx = \left[ 0 \right]$$

$$\int_{0}^{\pi/2} \cos(x) \sin(x) dx = \left[ 0 \right]$$
Let \( y = \cos^2(x) - \sin^2(x) \) on \([0, \pi]\).

a) Plot the values of \( y \) at the boundaries.
b) Find \( y' \); simplify.
c) Find where \( y' = 0 \); plot.
d) Find \( y'' \); simplify.
e) Find where \( y'' = 0 \); plot.
f) Find where \( y \) is concave up; concave down.
g) ON THE BACK OF THE PAPER:
Make a graph and plot the points from a)-f)
It should take up about a third of the paper.
h) Connect dots on the graph.

\[ x | \cos^2(x) - \sin^2(x) \]
\[
\begin{array}{c|c|c}
0 & 1 & \text{bound} \\
\pi & 1 & \text{bound} \\
\frac{\pi}{2} & -1 & \text{cp} \\
\frac{\pi}{4} & \left(\frac{1}{2}\right)^2 - \left(\frac{\sqrt{2}}{2}\right)^2 = 0 & \text{po} \\
\frac{3\pi}{4} & \left(-\frac{\sqrt{2}}{2}\right)^2 - \left(-\frac{1}{2}\right)^2 = 0 & \text{po} \\
\end{array}
\]
Let \( y = \sin(x) + \cos(x) \) on \([0, \pi]\).

a) Plot the values of \( y \) at the boundaries.

b) Find \( y' \); simplify.

c) Find where \( y' = 0 \); plot.

d) Find \( y'' \); simplify.

e) Find where \( y'' = 0 \); plot.

f) Find where \( y \) is concave up; concave down.

g) ON THE BACK OF THE PAPER:
Make a graph and plot the points from a)-f)
It should take up about a third of the paper.

h) Connect dots on the graph.

\[ y' = \sqrt{2} \sin(x) - \cos(x) \]

\[ y' = 0 \text{ at } x = \pi/4 \]

\[ y'' = -\sin(x) - \cos(x) \]

\[ y'' = 0 \text{ when } x = 3\pi/4 \]

\[ f(x) = \begin{cases} - & x < 3\pi/4 \\ + & x > 3\pi/4 \end{cases} \]

\[ x \left[ \sin(x) + \cos(x) \right] \]

\[ f(0) \cup C \text{ at } (0, 3\pi/4, \pi) \]

\[ f(\pi) \cup C \text{ at } (0, 2\pi/4) \]
Let \( y = \sin^2(x) - \cos^2(x) \) on \([0, \pi]\).

a) Plot the values of \( y \) at the boundaries.

b) Find \( y' \); simplify.

c) Find where \( y' = 0 \); plot.

d) Find \( y'' \); simplify.

e) Find where \( y'' = 0 \); plot.

f) Find where \( y \) is concave up; concave down.

g) ON THE BACK OF THE PAPER:

Make a graph and plot the points from a)-f).

It should take up about a third of the paper.

h) Connect dots on the graph.

5) \( y' = 2 \sin(x) \cos(x) - 2 \cos(x) (-\sin(x)) \)
\[ = \frac{1 + \sin(x) \cos(x)}{1} \]

5a) \( y' = 0 \) when \( \sin(x) = 0 \) \( x = 0, \pi \)

\( \text{When } \cos(x) = 0 \) \( x = \frac{\pi}{2}, \frac{3\pi}{2} \)

5b) \( y'' = 4 \left[ \cos^2(x) + \sin^2(x) \right] \)
\[ = \frac{1 + \cos^2(x) - \sin^2(x)}{1} \]

5c) \( y'' = 0 \) when \( \cos(x) = \pm \sin(x) \)
\( x = 0, \pi/4, 3\pi/4 \)

The graph shows a sine wave with key points at \( 0, \pi/4, \pi/4, \pi, 3\pi/4 \).