1st Derivative Test:
Let \( f(x) \) be a continuous function on \( \mathbb{R} \) and let \( c \) be a critical number (i.e. \( f'(c) \) DNE or \( f'(c) = 0 \)).

Then:
- If \( f''(c) < 0 \), then \( f(c) \) is a relative maximum.
- If \( f''(c) > 0 \), then \( f(c) \) is a relative minimum.

\[ f''(x) \text{ tells the concavity.} \]
\[ f''(x) > 0 \text{ on } I \Rightarrow f(x) \text{ is concave up} \]
\[ f''(x) < 0 \text{ on } I \Rightarrow f(x) \text{ is concave down} \]
Then: if \( f'(c) = 0 \) and \( f''(c) > 0 \), then \( f(c) \) is rel min. 
and \( f''(c) < 0 \) then \( f(c) \) is rel max.

If: \( f(x) = \cos^2 x - 2 \sin x \quad 0 \leq x \leq 2\pi \)
\[ f'(x) = -2 \cos x \sin x - 2 \cos x \]
\[ = -\sin 2x - 2 \cos x \]
\[ f''(x) = -2 \sin 2x + 2 \sin x \]

Now set \( f'(x) = 0 \) to find crit. \#s
\[-2 \cos x \sin x - 2 \cos x = 0\]
\[\Rightarrow -2 \cos x (\sin x + 1) = 0\]
so \( \cos x = 0 \quad x = \pi/2, 3\pi/2 \)
or \( \sin x = -1 \quad x = 3\pi/2 \).