# Bellwork 11/15

$$f(x) = \frac{\sin(x)}{x^2 + x + 1}$$

Determine the local extrema of $f$ on $x \in [-2, 2]$ with the first derivative test.

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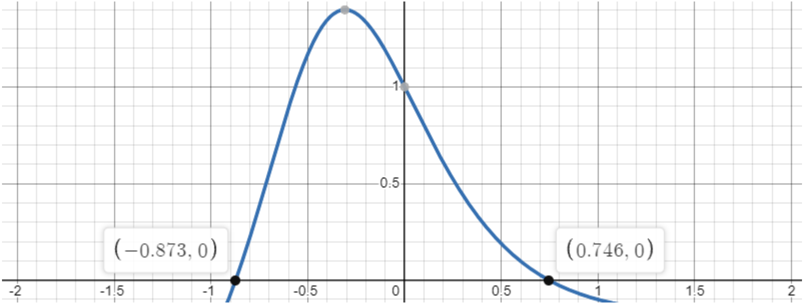
# Bellwork 11/15 - Solution

Graph of $f'(x)$:




Because $f'(x)$ changes signs at $x = -0.873, 0.746$, local extrema are $f(-0.873)$ and $f(0.746)$.

$$f(-0.873) = -0.862; \; f(0.746) = 0.295$$

$$\boxed{\text{Local Maximum: } 0.295\text{; Local Minimum: } -0.862}$$

# Exercise 1

$$g(x) = x^2 e^x$$

Find the relative extrema of $g$ using the second derivative test.

# Exercise 1 - Solution, Part 1

Find the critical points:

$$g'(x) = 2xe^x + x^2e^x = 0$$

$$e^x > 0 \text{ for all } x \implies (2x + x^2)\frac{\cancel{e^x}}{\cancel{e^x}} = \frac{0}{e^x} \implies x = -2,\, 0$$

Plug those $x$-values into the second derivative function:

$$g''(x) = e^x x^2 + 4xe^x + 2e^x = e^x(x^2 + 4x + 2)$$

$$g''(-2) = e^{-2}(4 - 8 + 2) = e^{-2}(-2);\ g''(0) = 2$$

# Exercise 1 - Solution, Part 2

Because $g''(-2) < 0$ and $g''(0) > 0$, $g(-2)$ is the relative maximum while $g(0)$ represents the relative minimum of $g$.

$$\boxed{\text{Local Maximum: } 4e^{-2}\text{; Local Minimum: } 0}$$