The function \( f(x) = x^4 - x^2 + 3 \) is graphed below on the interval \([-3/2, 3/2] \):

1. At what \( x \) value(s) (you can approximate!) does \( f(x) \) have an absolute maximum?

2. Find the absolute maximum value of \( f(x) \) on \([-3/2, 3/2] \).

3. At what \( x \) value(s) does \( f(x) \) have an absolute minimum?

4. Find the absolute minimum value of \( f(x) \) on \([-3/2, 3/2] \).
The function \( f(x) = 3 \sin x \) is graphed below on the interval \([-\pi, \pi] \):

1. At what \( x \) value(s) does \( f(x) \) have an absolute maximum?

2. Find the absolute maximum value of \( f(x) \) on \([-\pi, \pi]\).

3. At what \( x \) value(s) does \( f(x) \) have an absolute minimum?

4. Find the absolute minimum value of \( f(x) \) on \([-\pi, \pi]\).
The function $f(x) = 3 \sin x$ is graphed below on the interval $[-\pi/4, \pi/4]$:

1. At what $x$ value(s) does $f(x)$ have an absolute maximum?

2. Find the absolute maximum value of $f(x)$ on $[-\pi/4, \pi/4]$.

3. At what $x$ value(s) does $f(x)$ have an absolute minimum?

4. Find the absolute minimum value of $f(x)$ on $[-\pi/4, \pi/4]$. 
The function \( f(x) = \cos x \) is graphed below, \(-\frac{\pi}{2} \leq x \leq \frac{3\pi}{2}\).

1. Find the \( x \) coordinate of a local maximum value of \( f(x) \).

2. Evaluate \( f'(x) \) at the \( x \) coordinate you found in the previous question.

3. Find the \( x \) coordinate of a local minimum value of \( f(x) \).

4. Evaluate \( f'(x) \) at the \( x \) coordinate you found in the previous question.

5. What is interesting about your answers to questions 2 and 4?
Do you think that every local maximum or minimum occurs at a point $x$ so that $f'(x) = 0$? To help answer the question, think about the function $f(x) = |x|$, graphed below, $-1 \leq x \leq 1$.

1. Find the $x$ coordinate of a local minimum value of $f(x)$.

2. What is the derivative of $|x|$ at $x = 0$?
Graphing Worksheet 1

We have seen that \( f(x) \) can have a local extreme at \( x = c \) if \( f'(c) = 0 \), or if \( f'(c) \) DNE. Can there be any other types of local extremes?

To help you think about the question, try to draw the graph of a function \( f(x) \) satisfying the following conditions:

(a) \( f(x) \) has a local minimum at \( x = 1 \)
(b) \( f'(1) \) exists
(c) \( f'(1) \neq 0 \)

From these two graphs, we see that there are at least two types of points where \( f(x) \) can have a local maximum or local minimum. What are they?

- \( f'(x) = \)
- \( f'(x) \)
Do you think that \( f'(a) = 0 \) always means that \( f(x) \) has a local maximum or minimum value at \( x = a \)? To help you answer the question, consider the graph of \( f(x) = x^3 + 1, \ -2 \leq x \leq 2 \): 

1. Does \( f(x) \) have any local extrema between \( x = -2 \) and \( x = 2 \).
2. Find \( f'(x) \) and evaluate \( f'(0) \).

Notice that we have found a point \( x = 0 \) so that \( f'(0) = 0 \), but 0 is not a local extreme.