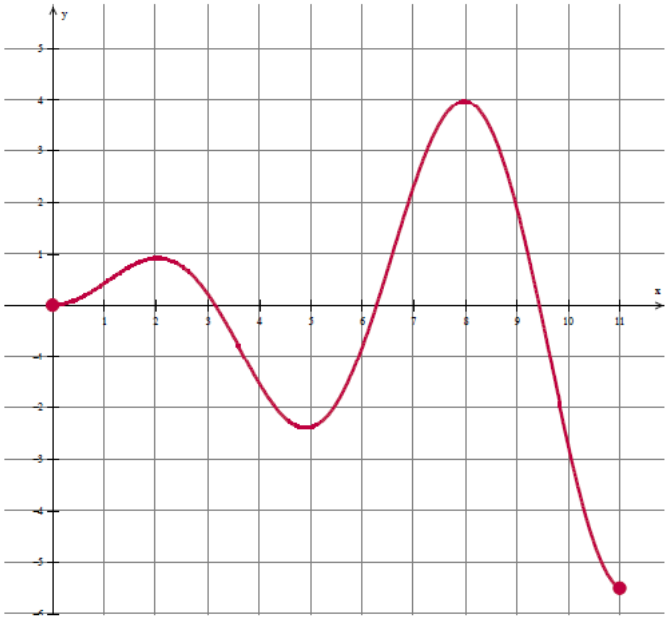
Absolute Maximum and Absolute Minimum

Set 4



The *relative maxima* (if any) occur at $x=$

The *relative minima* (if any) occur at $x=$

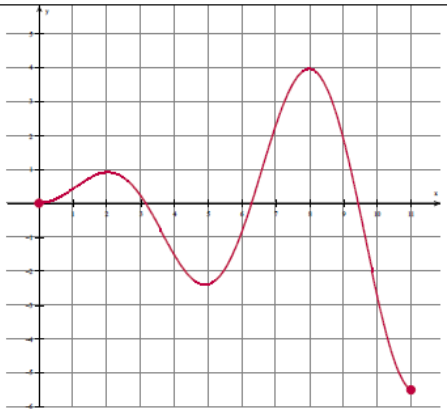
However, there are likely going to be times when we don't care about all the places where the function is at a peak, or a nadir. We care what the *highest* value or *lowest* value is. We call the *highest* value of a graph the *absolute maximum* and the lowest value the *absolute minimum*.

An example might be: What's the highest value a stock reached in the last 10 years? What's the lowest value? On a graph, these points would represent the absolute maximum and absolute minimum.

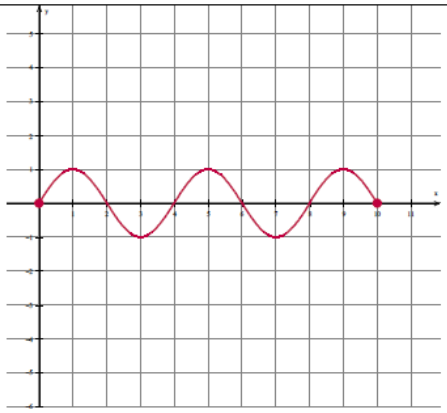
Look at the following 5 graphs and identify the x-value(s) **where** the *absolute maximum* and *absolute minimum* occur. Then answer the questions: "**what** is the absolute maximum?" and "**what** is the absolute minimum?" Notice that **where** refers to the x coordinate, and **what** refers to the y coordinate.

Absolute Maximum and Absolute Minimum

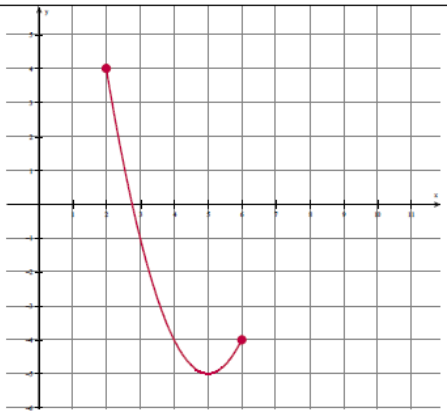
Set 4



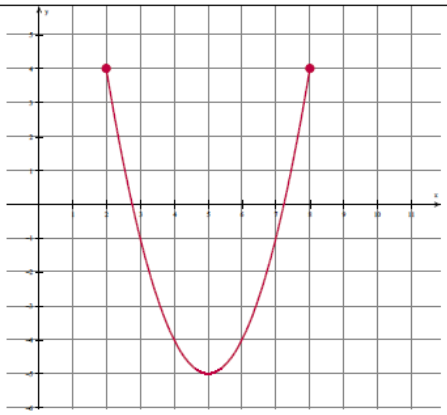
Where is/are absolute max(s)?
Where is/are absolute min(s)?
What is the absolute max?
What is the absolute min?



Where is/are absolute max(s)?
Where is/are absolute min(s)?
What is the absolute max?
What is the absolute min?



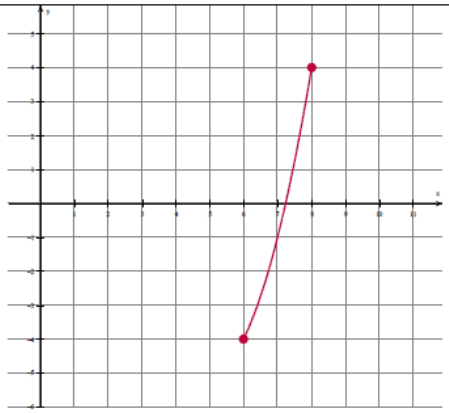
Where is/are absolute max(s)?
Where is/are absolute min(s)?
What is the absolute max?
What is the absolute min?



Where is/are absolute max(s)?
Where is/are absolute min(s)?
What is the absolute max?
What is the absolute min?

Absolute Maximum and Absolute Minimum

Set 4



Where is/are absolute max(s)?
Where is/are absolute min(s)?
What is the absolute max?
What is the absolute min?

Notice for all these graphs, the x-coordinates of all the absolute maximums and minimums are at only a few select places:

1)

2)

So if we are asked to find the **absolute** maximum or **absolute** minimum, we don't have too much work to do. We only have to look at those places!

Let's try it out with a simple example.

Example: Find the absolute maximum and absolute minimum of $y = x^2 - 2x + 1$ on the interval $[-2, 3]$.

Solution. Well, we know that the absolute maximum and absolute minimum can only occur at *the endpoints* of the interval or at the top and bottom of humps in the interval.

Humps (a.k.a. relative maxima and minima)

Let's check out if there are any humps in the interval by doing a sign analysis on the interval $[-2, 3]$:

The top and bottom of the humps occur at x=

The height of the top and bottom of these humps are at y=

Now let's check the endpoints:

The endpoints occur at x=

The height of the endpoints are at y=

Conclusion

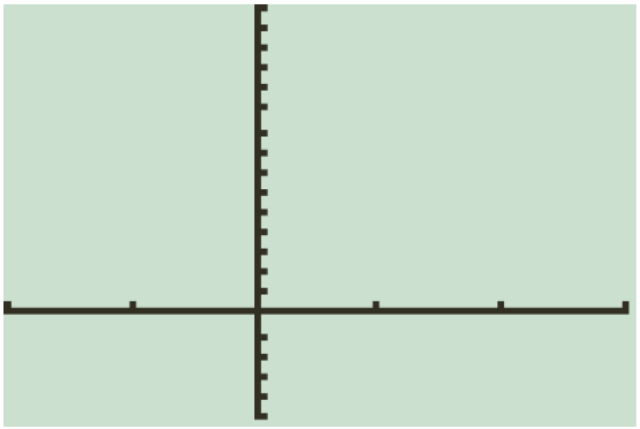
The absolute maximum is _____ and occurs at x=_____.

Absolute Maximum and Absolute Minimum

Set 4

The absolute minimum is _____ and occurs at x=_____.

Now graph the function on your calculator with a window of: $[-2,3]\times[-5,15]$. Sketch what you see below:



Draw a giant TRIANGLE at the location of the absolute maximum.

Draw a giant CIRCLE at the location of the absolute minimum.

Do these values match what you found above?

Problems for you to try

1. Find the absolute maximum and minimum values of $f(x)=4x^2-12x+10$ on the interval $[1,2]$

2. Find the absolute maximum and minimum values of $f(x)=2x^3+3x^2-12x$ on the interval $[-3,2]$

3. Find the absolute maximum and absolute minimum of $y=xe^{-x}$ on the interval $[-1,5]$.