

Finding Absolute Maximums and Minimums - Classwork

Suppose you were asked to find the student in this school who, at this point in time, has the most money on him or her. Write below a method that would be efficient and quick.

Our goal will be to find a maximum value of a function and minimum value of a function on a closed interval. Knowing that relative maxima and minima occur only at critical values (where the derivative equals zero or fails to exist), the method for finding absolute maxima and minima on a closed interval $[a, b]$ is as follows:

1. Find the critical value of f in (a, b) . (set both the numerator and denominator of $f' = 0$ and solve).
2. Evaluate f at each critical number in (a, b) .
3. Evaluate f at each endpoint of $[a, b]$ - that is find $f(a)$ and $f(b)$.
4. The smallest of these is the absolute minimum. The largest of these is the absolute maximum.
5. Remember to discern the difference between where the absolute min or max occurs as opposed to what the absolute min or max is. Where is the x -value. What is the y -value.

Examples) Find the absolute minimum and maximum values of the following functions. Justify your answers.

a. $f(x) = 3x^2 - 24x - 1$ $[-1, 5]$

b. $f(x) = 6x^3 - 6x^4 + 5$ $[-1, 2]$

Examples) Find the absolute minimum and maximum values of the following functions. Justify your answers.

a. $f(x) = 3x^2 - 24x - 1$ $[-1, 5]$

$$f'(x) = 6x - 24 = 0$$

$$x = 4$$



rel min $(4, -49)$

$$f(-1) = 26$$

$$f(5) = -46$$

Abs. min at $(4, -49)$

Abs. max is 26 at $x = -1$.

or

Abs max occurs at $(-1, 26)$

b. $f(x) = 6x^3 - 6x^4 + 5$ $[-1, 2]$

$$f'(x) = 18x^2 - 24x = 0$$

$$6x^2(3 - 4x) = 0$$

$$x = 0, x = 3/4$$

$$f(0) = 5$$

$$f(3/4) = 5.633 \text{ abs max}$$

$$f(-1) = -7$$

$$f(2) = -43 \text{ abs min}$$

$f(x)$ has an abs max at $x = 3/4$ of 5.633, and an abs min of -43 at $x = 2$.