

Absolute Extreme Points

Definition 4.3.1 (Absolute Extrema)

A function f has an **absolute maximum** at input c if _____
_____. Similarly, f has an **absolute minimum**
at c if _____.

In practice, there is very little distinction between what we did in 4.2 and what we do here in 4.3; the key difference is determining whether or not the particular max/min is *the greatest* or *the least* output value.

Examples

Example 4.3.2. Consider the function $f(x) = 6x^4 - 6x^3 - 5x^2 + 5x - 1$

(a) Locate any extreme values of the function on the interval $-2 \leq x \leq 2$.

(b) Classify the extreme values you found in part (a)

Example 4.3.3. Consider the function $g(t) = -0.37t^3 + 5.34t^2 - 9.66t + 96.93$

(a) Locate any extreme values of the function on the interval $0 \leq x \leq 11$.

(b) Classify the extreme values you found in part (a)

Example 4.3.4. Consider the function $h(p) = (e^{2-p})(3^p - p^2)$

(a) Locate any extreme values of the function on the interval $-1 \leq x \leq 4$.

(b) Classify the extreme values you found in part (a)

Example 4.3.5. Consider the function $y(x) = 0.75x^4 - 3.86x^2 + 10.18x + 22.186$

(a) Locate any extreme values of the function on the interval $(-\infty, \infty)$

(b) Classify the extreme values you found in part (a)

Example 4.3.6. Find and classify the absolute and relative maxima/minima for the function $f(x) = 3x^4 - 16x^3 + 18x^2$ on $[-1, 4]$. If necessary, round to the nearest hundredth.

Example 4.3.7. Find the absolute and relative extrema for the function $f(x) = x^3 - 3x^2 + 1$ on $-\frac{1}{2} \leq x \leq 4$. If necessary, round to the nearest hundredth.

Example 4.3.8. Find and classify all extrema of the function $f(x) = 12 + 4x - x^2$ on $[0, 5]$. If necessary, round to the nearest hundredth.

Example 4.3.9. Find and classify all extrema of the function $f(t) = (t^2 - 4)^3$ on $[-2, 3]$. If necessary, round to the nearest hundredth.

Example 4.3.10. Find the relative and absolute maxima and minima of the function $g(x) = \frac{x}{x^2 - x + 1}$ on $[0, 3]$. If necessary, round to the nearest hundredth.

Example 4.3.11. The sales of a new Starbucks drink are approximated by the function $S(x) = -.002x^4 + .093x^3 - 1.38x^2 + 6.573x + 5.393$ thousand dollars, x months after its introduction. Round your answers to the nearest hundredth.

- (a) The absolute **maximum** of drink sales between month 1 and month 15 was _____
and occurred _____ months after release.
- (b) The absolute **minimum** of drink sales between month 1 and month 15 was _____
and occurred _____ months after release.
- (c) Calculate the percent rate of change 4 months after introduction, to the nearest hundredth as a percent.

Example 4.3.12. The quantity of a drug in the bloodstream t hours after a tablet is swallowed is given by $q(t) = 20(e^{-t} - e^{-3t})$ μg .

- (a) How much of the drug is in the bloodstream at time $t = 0$?
- (b) Over the first twelve hours, at what time is the amount of drug in the bloodstream at its highest? What is the maximum amount?