

## 4.5 – Absolute (Global) Extreme Values

### Absolute (Global) Extreme Values

An absolute maximum is the largest value of a function over an interval. An absolute minimum is the smallest value of a function over an interval.

Some functions have naturally-occurring absolute extreme values within their domains, while other functions must have domain restrictions established to obtain absolute extreme values.

It is possible for a function to have multiple absolute extreme values within an interval. It is also possible for a function to have no absolute maximum and/or no absolute minimum on an interval.

### Extreme Value Theorem

If  $f$  is continuous on a closed interval  $[a, b]$ , then  $f$  attains both an absolute maximum and absolute minimum on  $[a, b]$ .

### Finding Absolute Extreme Values on an Interval

- Find all critical numbers for  $f$  that lie in the given interval.
- Evaluate  $f$  at all critical numbers and endpoints.
- Identify the largest value(s) as absolute maximum value(s) and the smallest value(s) as absolute minimum value(s).

Find all absolute extreme values for each function over the given interval.

1.  $y = x^4 - 8x^2, [-1, 3]$

2.  $f(x) = xe^{-x}, -2 \leq x \leq 2$

3.  $r(\theta) = \sin^2(2\theta), \frac{\pi}{6} \leq \theta \leq \frac{\pi}{3}$