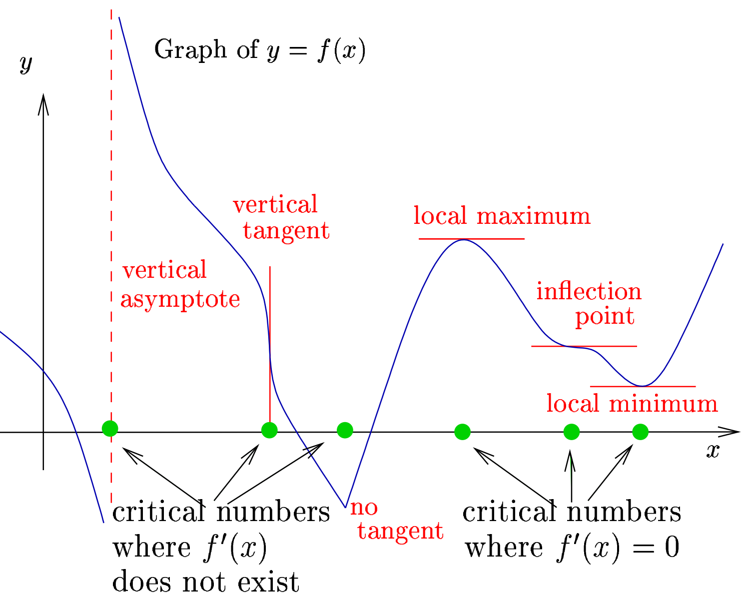


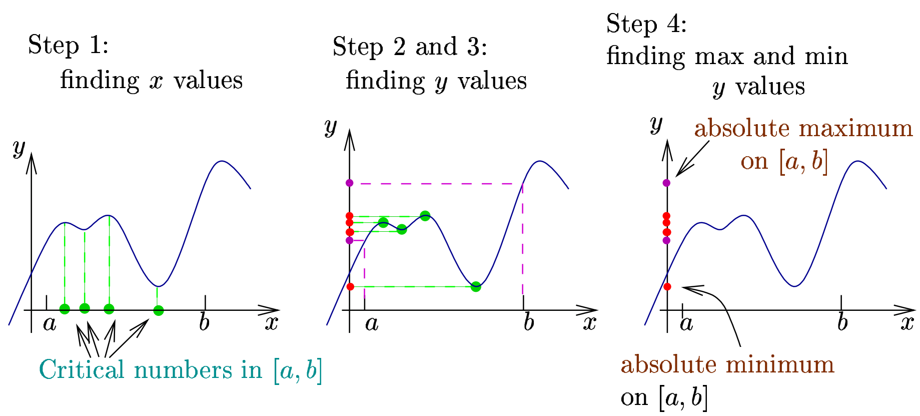
Optimization Definitions:

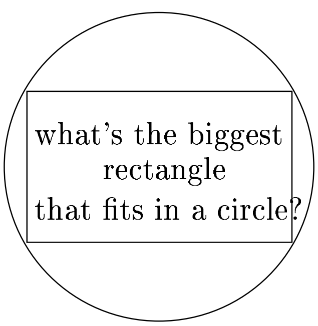
- $f(x)$ has an **absolute maximum** at $x = c$ if $f(c) \geq f(x)$ for all x in the domain of $f(x)$. In this case $y = f(c)$ is the **absolute maximum value** of f.
- $f(x)$ has an **absolute minimum** at $x = c$ if $f(c) \leq f(x)$ for all x in the domain of $f(x)$. In this case $y = f(c)$ is the **absolute minimum value** of f.
- $f(x)$ has an **absolute maximum** in $[a, b]$ at $x = c$ if $f(c) \geq f(x)$ for all $x \in [a, b]$. Then $y = f(c)$ is the **absolute maximum value of f on** $[a, b]$.
- $f(x)$ has an **absolute minimum** in $[a, b]$ at $x = c$ if $f(c) \leq f(x)$ for all $x \in [a, b]$. Then $y = f(c)$ is the **absolute minimum value of f on** $[a, b]$.
- $f(x)$ has a **local maximum** in $[a, b]$ at $x = c$ if $f(c) \geq f(x)$ for all x close to c.
- $f(x)$ has a **local minimum** in $[a, b]$ at $x = c$ if $f(c) \leq f(x)$ for all x close to c.
- $f(x)$ has a **critical value** at $x = c$ if $f'(c) = 0$ or if $f'(c)$ does not exist.

Strategy for finding max and min of $f(x)$ on $[a, b]$:

1. Locate the critical numbers of $f(x)$ in $[a, b]$
2. Find $f(x)$ at the critical numbers
3. Find $f(a)$ and $f(b)$

4A. The absolute maximum of $f(x)$ in $[a, b]$ is the largest of the values in steps 1 and 2.
4B. The absolute minimum of $f(x)$ in $[a, b]$ is the smallest of the values in steps 1 and 2.

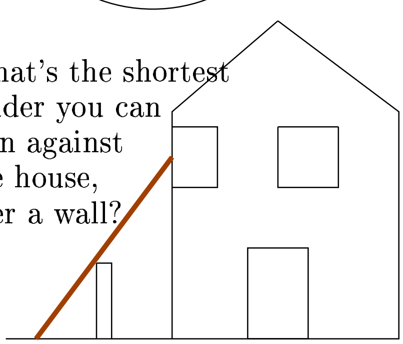




Strategy for optimization word problems:

1. **Read** the question.
2. Draw a **diagram** showing all quantities involved.
3. Work out what quantity has to be maximized. Give this a name, e.g., call this Q.
4. Work out what this quantity depends on, and name these, e.g., say Q depends on an x and y, so $Q = Q(x, y)$.
5. Work out what the constraints to the problem are, e.g., say $y = f(x)$
6. Write Q as a function of one variable, e.g., by substitution $Q = Q(x, f(x))$
7. Check whether x must be an interval $[a, b]$.
8. Apply the strategy for finding max or min values of a function on an interval, as above.
9. The numbers you get from step 7 should be interpreted in terms of the original problem.

What's the shortest ladder you can lean against the house, over a wall?



What's the largest area you can enclose by a 28 yard long fence?