$\boxed{1}$ **Definition** Let c be a number in the domain D of a function f. Then $f(c)$ is the

- **absolute maximum** value of f on D if $f(c) \geqslant f(x)$ for all x in D.
- **absolute minimum** value of f on D if $f(c) \leqslant f(x)$ for all x in D.

$\boxed{2}$ **Definition** The number $f(c)$ is a

- **local maximum** value of f if $f(c) \geqslant f(x)$ when x is near c.
- **local minimum** value of f if $f(c) \leqslant f(x)$ when x is near c.

$\boxed{3}$ **The Extreme Value Theorem** If f is continuous on a closed interval $[a, b]$, then f attains an absolute maximum value $f(c)$ and an absolute minimum value $f(d)$ at some numbers c and d in $[a, b]$.

Converse

$\boxed{4}$ **Fermat's Theorem** If f has a local maximum or minimum at c, and if $f'(c)$ exists, then $f'(c) = 0$.

Non-example.

Terrace point.

$\boxed{6}$ **Definition** A **critical number** of a function f is a number c in the domain of f such that either $f'(c) = 0$ or $f'(c)$ does not exist.

$\boxed{7}$ If f has a local maximum or minimum at c, then c is a critical number of f.

$x^3 = y$

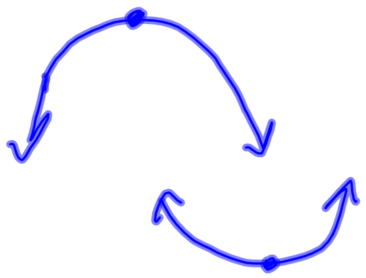
$y' = 3x^2$

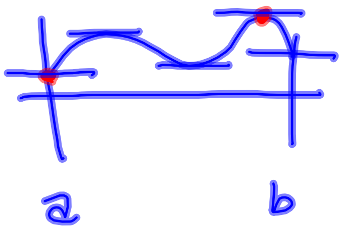
SET $= 0$

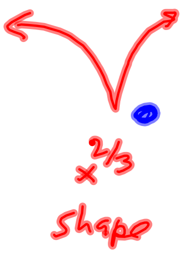
$x = 0$

The Closed Interval Method To find the *absolute* maximum and minimum values of a continuous function f on a closed interval $[a, b]$:

1. Find the values of f at the critical numbers of f in (a, b).
2. Find the values of f at the endpoints of the interval.
3. The largest of the values from Steps 1 and 2 is the absolute maximum value; the smallest of these values is the absolute minimum value.

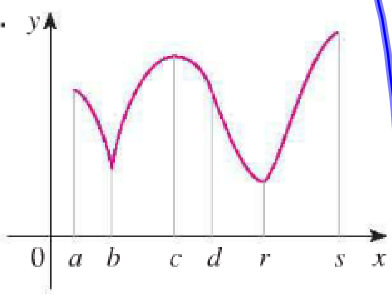



a
b

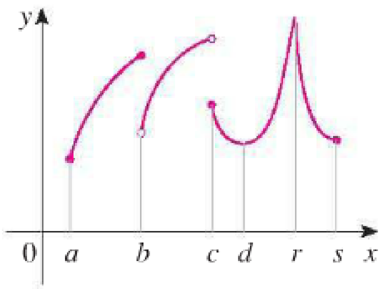

$x^{2/3}$
shape

3–4 For each of the numbers a, b, c, d, r, and s, state whether the function whose graph is shown has an absolute maximum or minimum, a local maximum or minimum, or neither a maximum nor a minimum.

3.



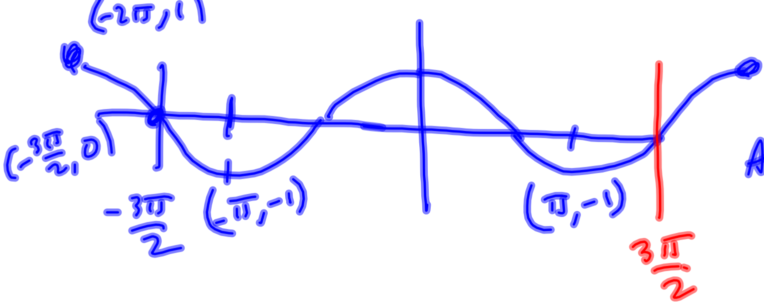
4.



15–28 Sketch the graph of f by hand and use your sketch to find the absolute and local maximum and minimum values of f. (Use the graphs and transformations of Sections 1.2 and 1.3.)

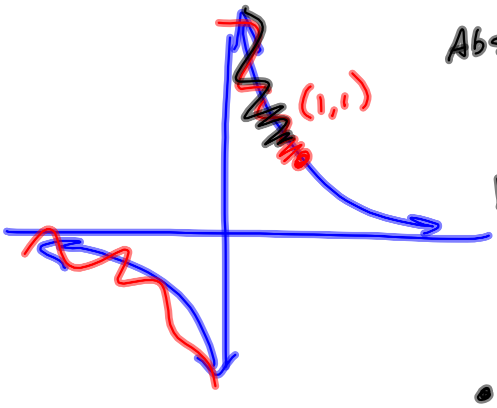
22. $f(t) = \cos t, \quad -3\pi/2 \leqslant t \leqslant 3\pi/2$

Abs & Local min: $(-\pi, -1)$
$(\pi, -1)$



Abs & local max
$(0, 1)$

17. $f(x) = 1/x, \quad x \geqslant 1$



Abs Max on $[1, \infty)$ is $(1, 1)$
No local/abs. min.