CALCULUS
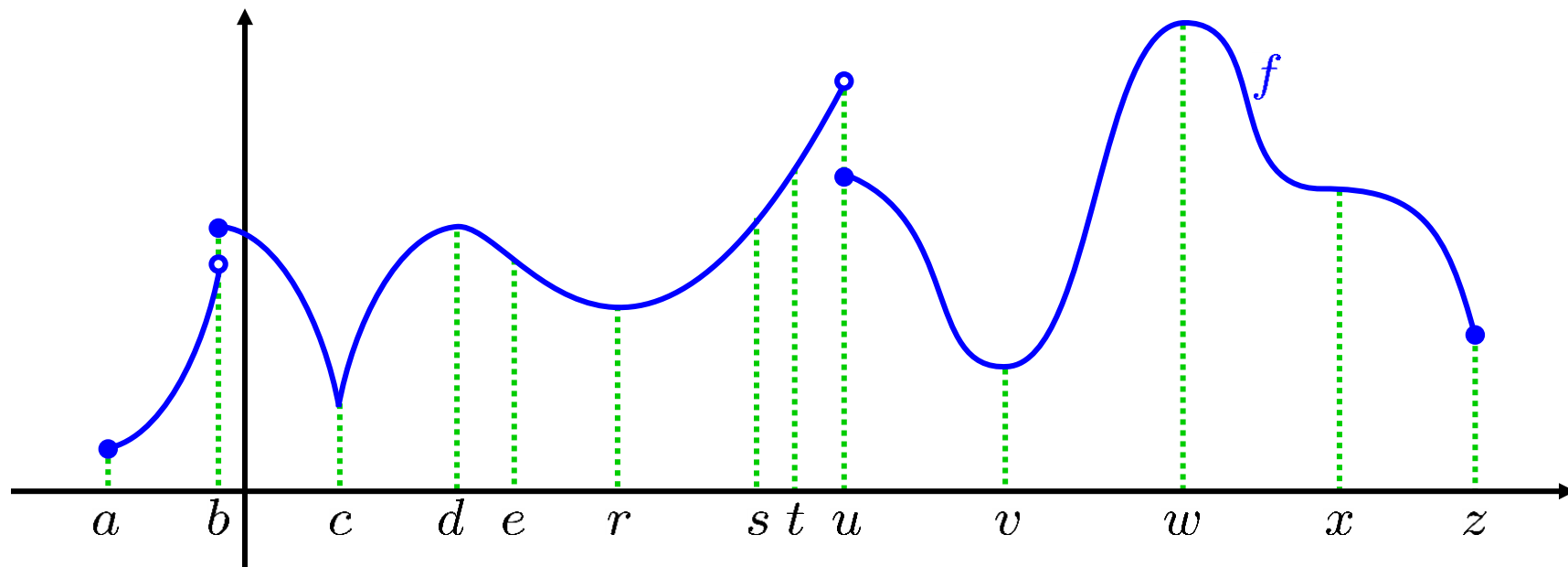## Maxima and minima
OLD

0450-1.a. Sketch the graph of a continuous function whose domain is $[1, \infty)$, and which has exactly one global minimum, and no local minima.

OLD

b. Sketch the graph of a continuous function whose domain is $[1, \infty)$, and which has exactly one local minimum, and no global minima.

0450-2. OLD Let $f : [a, z] \to \mathbb{R}$ be the function whose graph is shown below.

i. For each number $a, b, c, d, e, r, s, t, u, v, w, x, z$, state whether or not f has, at that number,
- a global maximum
- a global minimum
- a local maximum
- a local minimum.

ii. Which of $a, b, c, d, e, r, s, t, u, v, w, x, z$, is a critical number for f?

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0450-3. Let $f : [-4, 4] \to \mathbb{R}$ be the function whose graph is displayed below.
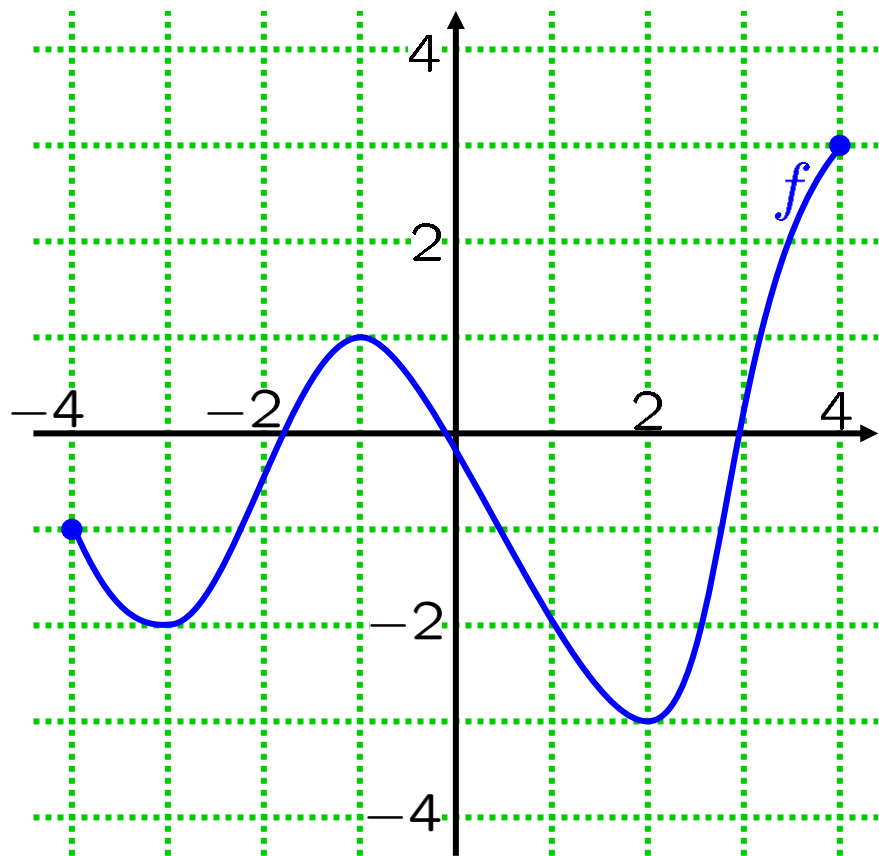
a. At what numbers x does $f(x)$ have a local minimum?

b. What are the corresponding local minimum values?

c. At what numbers x does $f(x)$ have a local maximum?

d. What are the corresponding local maximum values?

f

4

Let $f : [-4, 4] \to \mathbb{R}$ be the function whose graph is displayed below.

f
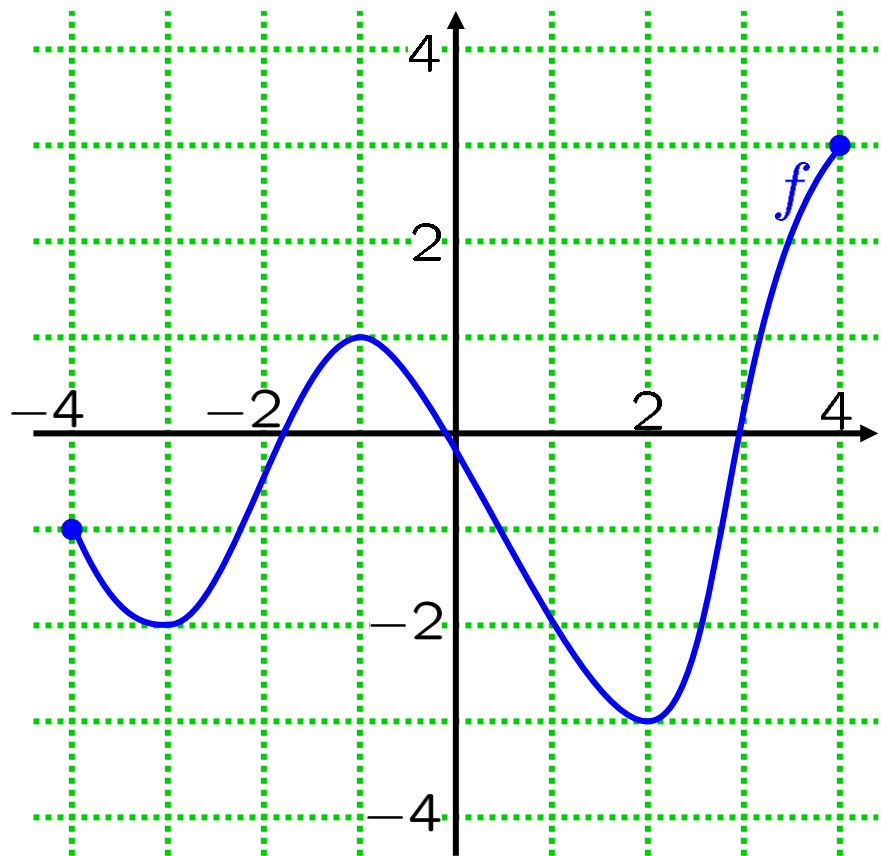
a. At what numbers x does $f(x)$ have a global minimum?

b. What is the corresponding global minimum value?

c. At what numbers x does $f(x)$ have a global maximum?

d. What is the corresponding global maximum value?

0450-5.
OLD
  Sketch a graph of a function
      whose domain is $[-3, 2]$ and which has
                        no global maxima,
                        two local maxima,
                   and two global minima.
    Note: By the Extreme Value Theorem,
              it cannot be continuous on $[-3, 2]$.

0450-6.
OLD
  Sketch a graph of a function whose domain
      is $[1, 4]$, which is continuous on $[1, 4]$
      and which has
                    two global maxima,
                    no local maxima
              and one local minimum.

0450-7. Define $f : [-2, 2] \to \mathbb{R}$ by $f(x) = x^2$.

a. Sketch the graph of f.

b. Does f have a global maximum? If so, at what number(s)?

c. Does f have a global minimum? If so, at what number(s)?

d. Does f have a local maximum? If so, at what number(s)?

e. Does f have a local minimum? If so, at what number(s)?

f. What are the critical numbers of f?

0450-8. Define $f : (-2, 2) \to \mathbb{R}$ by $f(x) = x^2$.

a. Sketch the graph of f.

b. Does f have a global maximum? If so, at what number(s)?

c. Does f have a global minimum? If so, at what number(s)?

d. Does f have a local maximum? If so, at what number(s)?

e. Does f have a local minimum? If so, at what number(s)?

f. What are the critical numbers of f?

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0450-9. Define $f : [-2, 2] \to \mathbb{R}$ by $f(x) = x^3$.

a. Sketch the graph of f.

b. Does f have a global maximum? If so, at what number(s)?

c. Does f have a global minimum? If so, at what number(s)?

d. Does f have a local maximum? If so, at what number(s)?

e. Does f have a local minimum? If so, at what number(s)?

f. What are the critical numbers of f?

Define $f : (-2, 2) \to \mathbb{R}$ by $f(x) = x^3$.

a. Sketch the graph of f.

b. Does f have a global maximum?
   If so, at what number(s)?

c. Does f have a global minimum?
   If so, at what number(s)?

d. Does f have a local maximum?
   If so, at what number(s)?

e. Does f have a local minimum?
   If so, at what number(s)?

f. What are the critical numbers of f?

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0450-11. Define $f : (-2, 2) \to \mathbb{R}$ by
$$f(x) = 1 + (x + 1)^3.$$

a. Sketch the graph of f.

b. Does f have a global maximum? If so, at what number(s)?

c. Does f have a global minimum? If so, at what number(s)?

d. Does f have a local maximum? If so, at what number(s)?

e. Does f have a local minimum? If so, at what number(s)?

f. What are the critical numbers of f?

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Define $f : [-2, 2] \to \mathbb{R}$ by

$$f(x) = 1 + (x + 1)^3.$$

a. Sketch the graph of f.

b. Does f have a global maximum?
If so, at what number(s)?

c. Does f have a global minimum?
If so, at what number(s)?

d. Does f have a local maximum?
If so, at what number(s)?

e. Does f have a local minimum?
If so, at what number(s)?

f. What are the critical numbers of f?

0450-13. Find the critical numbers of
$$f(x) = 2x^3 + 9x^2 - 60x + 24.$$

0450-14. Find the critical numbers of
$$f(x) = |x^2 - 8x + 15|.$$

0450-15. Find the critical numbers of
$$f(x) = |x^2 + 2x + 1|.$$

0450-16. Find the critical numbers of
$$f(x) = \sin x.$$

0450-17. Find the critical numbers of
$$f(x) = |\sin x|.$$

0450-18. OLD Find the global maximum and minimum values of
$$f(x) = 2x^3 + 9x^2 - 60x + 24$$
on $-6 \le x \le 3$.

0450-19. OLD Find the global maximum and minimum values of
$$g(t) = \frac{2t}{t^2 + 4}$$
on $-1 \le t \le 3$.

0450-20. OLD Find the global maximum and minimum values of
$$H(s) = se^{-s^2/2}$$
on $-4 \le s \le 8$.