

■ 1. Determine whether or not the Mean Value Theorem applies to $f(x) = -\frac{1}{x}$ on the interval $\left[-3, -\frac{1}{2}\right]$. If it applies, find any value(s) of c in the interval such that $f'(c)$ is equivalent to the average rate of change over the interval. If the MVT does not apply, say why.

- A The MVT applies, and $c = -\sqrt{\frac{3}{2}}$
- B The MVT does not apply because f is not continuous at $x = 0$
- C The MVT does not apply because $f\left(-\frac{1}{2}\right) \neq f(-3)$
- D The MVT does not apply because $f'(c)$ does not exist

■ 2. Find all critical numbers of $f(x) = (9 - x^2)^{\frac{3}{5}}$.

- A 0
- B 3
- C -3, 3
- D -3, 0, 3

■ 3. Given $f'(x) = x^2 - 8x - 9$, on what intervals is $f(x)$ increasing?

- A $(-1, 9)$
- B $(-9, 1)$
- C $(-\infty, -9) \cup (1, \infty)$
- D $(-\infty, -1) \cup (9, \infty)$

■ 4. Find the absolute minimum of $f(x) = \frac{10}{x^2 + 1}$ on the interval $[-1, 2]$.

A (2,2)

B (0,10)

C (-1,5)

D $\left(-\frac{1}{2}, 8\right)$

■ 5. At which value(s) of x does $f(x)$ have an inflection point, if $f''(x) = x^2(x - 3)(x - 6)^3$?

A $x = 0$

B $x = 0, 3, 6$

C $x = 3, 6$

D $x = 0, 3$

■ 6. A function $f(x)$ has critical points at $x = 0$ and $x = 2$. Use the Second Derivative Test to classify the critical points, if $f''(x) = -6x + 6$.

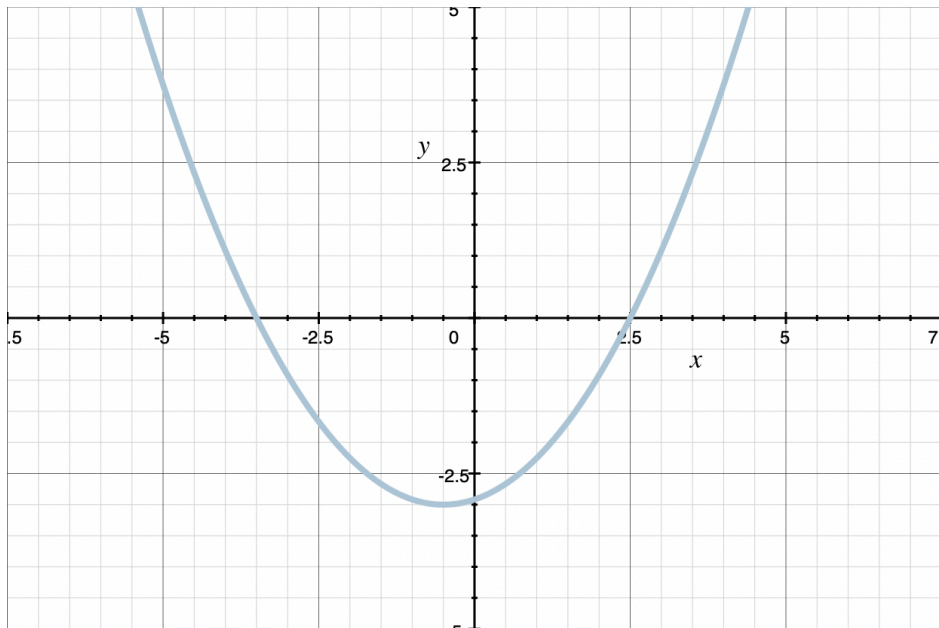
A Relative minimum at $x = 0$; Relative maximum at $x = 2$

B Relative minimum at $x = 2$; Relative maximum at $x = 0$

C Relative minima at $x = 0$ and $x = 2$

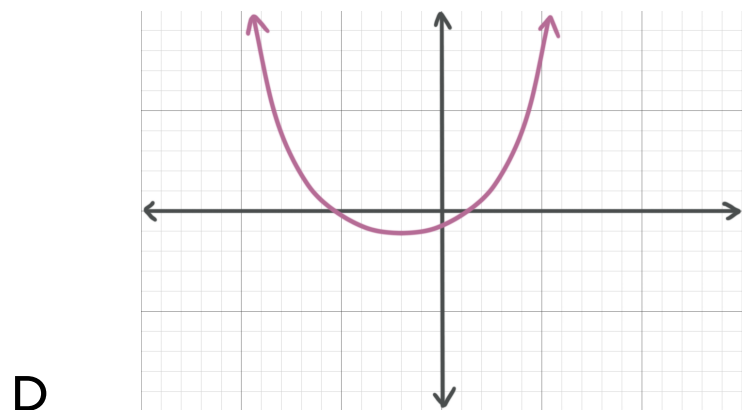
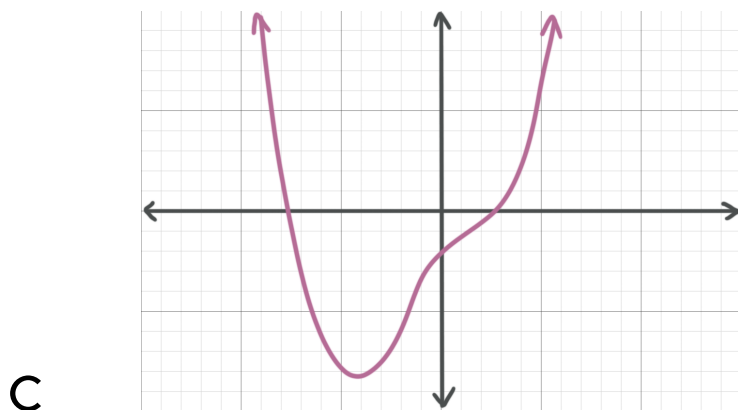
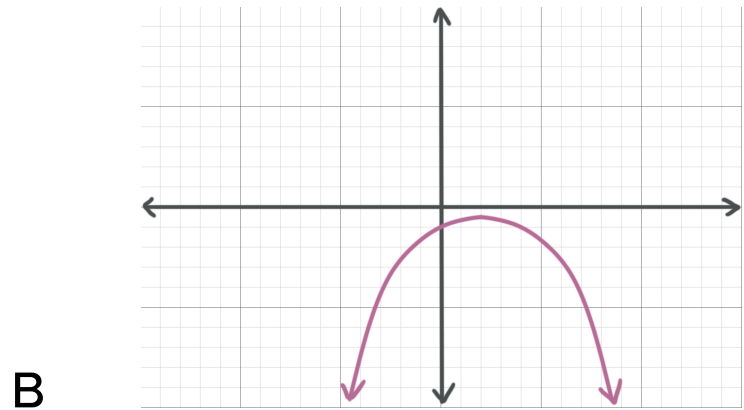
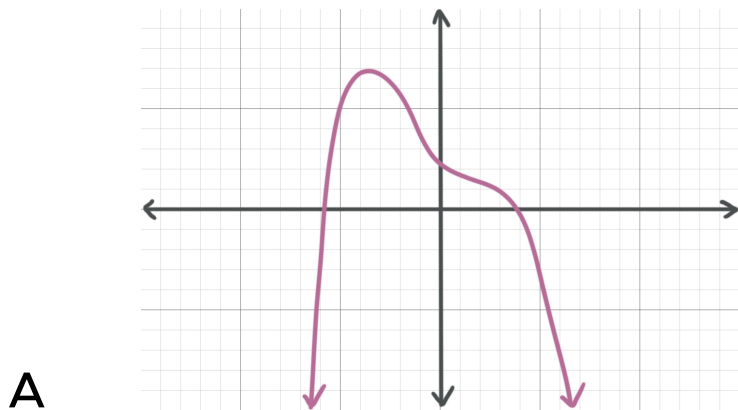
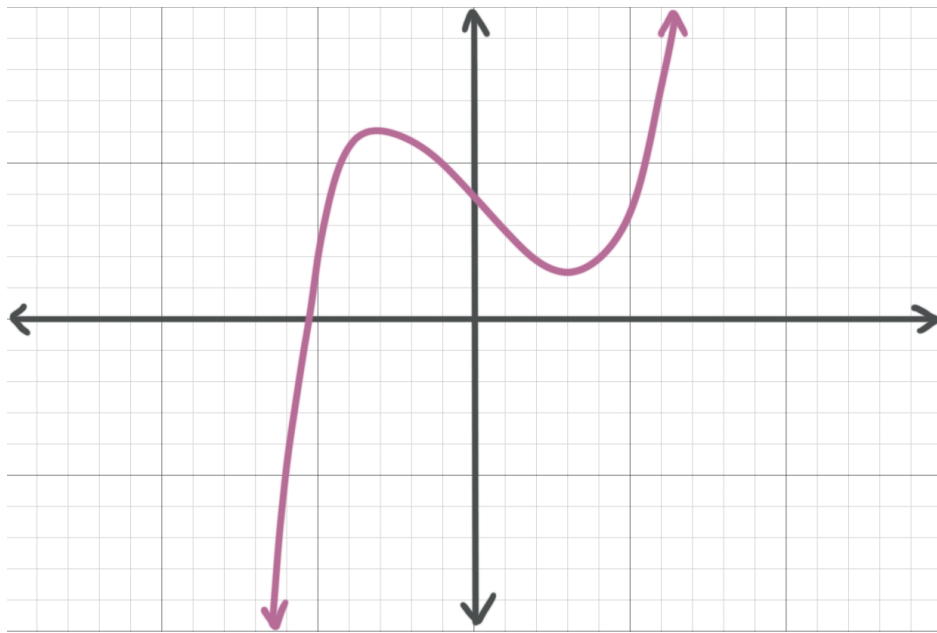
D Relative maxima at $x = 0$ and $x = 2$

■ 7. The graph of $f'(x)$ is shown below. Which of the following is not true about $f(x)$.



- A $f(x)$ has a critical point at $x = -\frac{7}{2}$
- B $f(x)$ is increasing on $\left(-\frac{1}{2}, \infty\right)$
- C $f(x)$ has an inflection point at $x = -\frac{1}{2}$
- D $f(x)$ is decreasing on $\left(-\frac{7}{2}, \frac{5}{2}\right)$

■ 8. Given the graph of $f'(x)$, which is a possible graph of $f(x)$?



■ 9. How many horizontal tangents does the curve $y^2 + 3 = x^2 - e^y$ have?

A One

B Two

C Three

D None

- 10. Find the value(s) of c that satisfy the Mean Value Theorem for the function $h(x) = -\sqrt{25 - 5x}$ on the interval $[0,5]$.
- 11. For each question below about the function $f(x) = \frac{x^2 - 2x + 4}{x - 2}$, justify your answer.
- Determine the first derivative.
 - On what intervals is $f(x)$ increasing and decreasing?
 - Find and classify all relative extrema.
 - Determine the second derivative.
 - On what intervals is the function concave up/down?
 - Determine the location of any inflection points.
- 12. A rectangular box is made from a sheet of tin that is 4 in. by 4 in. Congruent squares are cut from the corners and the sides are folded up to form the box. What height of the box will produce the maximum volume?