

1. Let

$$y = \frac{x^4}{4} - \frac{7x^3}{3} + \frac{15x^2}{2} - 9x$$

- (a) Find dy/dx . (b) Find and classify all critical points. (c) Sketch the graph.
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2. Let $f(x) = \sin(x)$. Find and classify all critical points of $f(x)$ for x in $[0, 2\pi]$.

3. True or false. Justify your answer.

- (a) The function $z(x) = \sqrt{x}$ has a local maximum on $[0, \infty)$. What about a local minimum?
- (b) If a function is continuous on a closed interval, then it has an absolute maximum on that interval.
- (c) Let $f(x)$ be a function such that $f'(2) = 0$. Then $f(x)$ has a local maximum or a local minimum at $x = 2$.
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4. Let $f(x)$ be a differentiable function.

- (a) Suppose $f(x)$ has a local maximum at $x = c$. What is the sign of $f(x) - f(c)$ when x is near c and $x > c$?

(b) Consider the limit

$$\lim_{x \rightarrow c^+} \frac{f(x) - f(c)}{x - c}$$

and use it to show that $f'(c) \leq 0$.

- (c) Repeat parts (a) and (b) assuming $x < c$ (use the limit from the left) and conclude that $f'(c) \geq 0$.

(d) Prove that $f'(c) = 0$.