1. The MVT on $[a, b]$ requires **which** hypotheses?

   ☐ $f$ differentiable on $(a, b)$

   ☐ $f$ continuous on $[a, b]$

   ☐ $f(a) = f(b)$

   ☐ $f$ is a polynomial

   *Tick every correct option.*

2. A critical point is an interior $x$ in the domain of $f$ where...

   ☐ $f(x) = 0$ or $f(x)$ does not exist

   ☐ $f'(x) = 0$ or $f'(x)$ does not exist

   ☐ $f''(x) = 0$ only

   ☐ $f(x)$ is largest on the interval

3. Which condition guarantees that a differentiable function is increasing on an interval?

   ☐ $f''(x) > 0$ there

   ☐ $f(x) > 0$ there

   ☐ $f(x) < 0$ there

   ☐ $f'(x) > 0$ there

4. If $f$ is continuous at $c$ and $f'$ changes from positive to negative across $c$, then $f$ has a...

   ☐ inflection point

   ☐ vertical asymptote

   ☐ local minimum

   ☐ local maximum

5. To find absolute extrema on $[a, b]$, evaluate $f$ at **which** points?

   ☐ every integer in $[a, b]$

   ☐ the endpoint $b$

   ☐ all critical points in $[a, b]$

   ☐ the endpoint $a$

   *Tick every correct option.*

6. If $f'(c) = 0$ and $f''(c) > 0$, then $c$ is a...



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   ☐ relative maximum

   ☐ relative minimum

   ☐ inflection point

7. Where the graph of $f$ has a horizontal tangent, the graph of $f'$...

   ☐ is undefined

   ☐ is at a maximum

   ☐ equals zero

   ☐ is negative

8. On an interval where the graph of $f'$ is positive, $f$ is increasing.

   ☐ True ☐ False

9. The goal of the setup is to write the objective in terms of a _____ variable.

   _____

10. On a smooth implicit curve with $dy/dx = -F_x/F_y$, a vertical tangent occurs when $F_x$ is nonzero and the _____ is zero.

    _____

1. **$f$ differentiable on $(a, b)$; $f$ continuous on $[a, b]$**

   Continuous on the closed interval and differentiable on the open one. ($f(a) = f(b)$ is the extra Rolle condition.)

2. **$f'(x) = 0$ or $f'(x)$ does not exist**

   The input must belong to the domain of $f$, and $f' = 0$ or $f'$ is undefined there.

3. **$f'(x) > 0$ there**

   Positive first derivative means increasing.

4. **local maximum**

   Up then down = the top of a hill = local max.

5. **the endpoint $b$; all critical points in $[a, b]$; the endpoint $a$**

   Critical points plus both endpoints – that is the full candidate list.

6. **relative minimum**

   Concave up at a flat spot = minimum.

7. **equals zero**

   Horizontal tangent $\Rightarrow$ slope $0 \Rightarrow f' = 0$.

8. **True**

   $f' > 0$ throughout an interval guarantees $f$ is increasing there. The converse need not be strict at every point.

9. **single**

   One variable $\Rightarrow$ an ordinary extremum problem.

10. **denominator**

    With $F_x$ nonzero, $F_y = 0$ gives a vertical tangent on a smooth implicit curve. A zero denominator alone does not settle singular cases.



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