Worksheet: Extrema, MVT | AP Calculus AB | ap-calc.github.io

Name: ___________________________________

1) Decide whether Rolle's Theorem can be applied to $f(x) = x^3 - 2x^2$ on the interval [0, 2]. If Rolle's Theorem can be applied, find all values of c in the interval such that $f'(c) = 0$. If Rolle's Theorem cannot be applied, state why.

a) Rolle's cannot be applied: f(x) is not differentiable on (0, 2)
b) Rolle's cannot be applied: $f(0) \neq f(2)$
c) Rolle's cannot be applied; f(x) is not continuous on [0, 2]
d) Rolle's can be applied; c = 0, $\frac{4}{3}$
e) None of these

2) Find all of the open intervals on which f(x) is increasing or decreasing: $f(x) = \frac{1}{x^2}$

a) increasing $(-\infty, 0)$; decreasing $(0, \infty)$
b) decreasing $(-\infty, 0)$; increasing $(0, \infty)$
c) strictly increasing
d) strictly decreasing
e) None of these

3) Determine whether the Mean Value Theorem applies to $f(x) = 3x - x^2$ on the interval [2, 3]. If the "MVT" does apply, find all values of c in [2, 3] such that $f'(c) = \frac{f(b) - f(a)}{b - a}$. If it does not apply, state why.

a) MVT applies; c = $\frac{2}{3}$
b) MVT applies; c = $\frac{5}{2}$
c) MVT does not apply; f(2) = f(3)
d) MVT does not apply; f(x) is not differentiable on [2, 3]
e) None of these

4) Identify the open intervals where the function $f(x) = x\sqrt{20 - x^2}$ is increasing or decreasing.

a) Decreasing: $\left(-\infty, \sqrt{10}\right)$; Increasing: $\left(\sqrt{10}, \infty\right)$
b) Increasing: $\left(-\sqrt{10}, \sqrt{10}\right)$; Decreasing: $\left(-\sqrt{20}, -\sqrt{10}\right) \cup \left(\sqrt{10}, \sqrt{20}\right)$
c) Increasing: $\left(-\infty, \sqrt{20}\right)$; Decreasing: $\left(\sqrt{20}, \infty\right)$
d) Increasing: $\left(-\sqrt{20}, -\sqrt{10}\right) \cup \left(\sqrt{10}, \sqrt{20}\right)$; Decreasing: $\left(-\sqrt{10}, \sqrt{10}\right)$
e) None of the above

5) Find the ordered pairs of all extrema on the interval $[0, 2\pi]$ for $y = x + \sin x$.

a) $(-1,\ -1 + \frac{3\pi}{2})$

b) $(-1,\ 0)$

c) $(\pi,\ \pi)$

d) $(\frac{3\pi}{2}, 0)$

e) None of these

6) Decide whether Rolle's Theorem can be applied to $f(x) = x^{2/3}$ on the interval $[-1, 1]$. If Rolle's Theorem can be applied, find all values of c in the interval such that $f'(c) = 0$. If Rolle's Theorem cannot be applied, state why.

a) Rolle's cannot be applied: f(x) is not differentiable on (-1, 1).
b) Rolle's cannot be applied: $f(-1) \neq f(1)$
c) Rolle's cannot be applied; f(x) is not continuous on [-1, 1].
d) Rolle's can be applied; c = 0
e) None of these

7) TRUE or FALSE: ___________________________
If the graph of a polynomial function has three intercepts, then it must have at least two points at which the tangent line is horizontal.

8) TRUE or FALSE: ___________________________
The Mean Value Theorem can be applied to $f(x) = \frac{1}{x^2}$ on the interval [-1, 1]

9) Find the extrema of $f(x) = 3x^4 - 4x^3$ on the interval [-1, 2]
a) Maximum at x = 0, minimum at x = 1
b) Maximum at x = 1, minimum at x = 0
c) Maximum at x = 2, minimum at x = 1
d) Maximum at x = -1, minimum at x = 2
e) None of these

10) Find the values of x that give relative extrema for the function $f(x) = 3x^5 - 5x^3$.

a) relative maximum: x = 0; relative minimum $x = \sqrt{\frac{5}{3}}$

b) relative maximum: $x = \pm 1$; relative minimum x = 0

c) relative maximum: x = 0; relative minimum $x = \pm 1$

d) relative maximum: x = -1; relative minimum x = 1

e) None of these