

AP CALCULUS BC
Unit 5 Outline – Analytical Applications of Differentiation

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/3	EXTREME VALUES – ABSOLUTE AND LOCAL EXTREMES	Ex. 1 Find all critical values for each function: (a) $y = x^3 - 3x + 2$ (b) $y = x^{\frac{2}{3}}$ (c) $y = \sin x$ on $[0, 2\pi]$ Ex. 2 Determine if the EVT applies. If so, find the extrema of $f(x) = 3x^4 - 12x^3$ on the interval $[-1, 2]$. Ex. 3 Determine if the EVT applies. If so, find the extrema of $f(x) = \sin x + \cos x$ on the interval $[0, 2\pi]$.
AP MULTIPLE CHOICE The function g is given by $g(x) = 4x^3 + 3x^2 - 6x + 1$. What is the absolute minimum value of g on the closed interval $[-2, 1]$? (A) -7 (B) $-\frac{3}{4}$ (C) 0 (D) 2 (E) 6		
Let f be the function defined by $f(x) = \frac{\ln x}{x}$. What is the absolute maximum value of f? (A) 1 (B) $\frac{1}{e}$ (C) 0 (D) $-e$ (E) f does not have an absolute maximum value.		
HOMEWORK		Worksheet 31

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/4	MEAN VALUE THEOREM	Ex. 1 Determine if the MVT applies to $f(x) = x^3 - x$ on $[0, 2]$. If so, find the value(s) guaranteed by the theorem. Ex. 2 For the following functions, determine if the MVT applies. If so, find the value of c guaranteed by the theorem. If not, specifically state why the theorem does not apply. (a) $f(x) = \frac{x+5}{x-1}$ on $[-3, 3]$ (b) $g(x) = x^{2/3}$ on $[-3, 3]$

AP MULTIPLE CHOICE

Let f be the function given by $f(x) = x^3 + 5x$. For what value of x in the closed interval $[1, 3]$ does the instantaneous rate of change of f equal the average rate of change of f on that interval?

- (A) $\sqrt{\frac{7}{3}}$ (B) $\sqrt{\frac{13}{3}}$ (C) $\sqrt{5}$ (D) $\sqrt{6}$ (E) $\sqrt{\frac{19}{3}}$

x	3	4	5	6	7
$f(x)$	20	17	12	16	20

The function f is continuous and differentiable on the closed interval $[3, 7]$. The table above gives selected values of f on this interval. Which of the following statements must be true?

- I. The minimum value of f on $[3, 7]$ is 12.
- II. There exists c , for $3 < c < 7$, such that $f'(c) = 0$.
- III. $f'(x) > 0$ for $5 < x < 7$.
- (A) I only
 (B) II only
 (C) III only
 (D) I and III only
 (E) I, II, and III

HOMEWORK	Worksheet 32
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DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/7	INCREASING AND DECREASING BEHAVIOR FIRST DERIVATIVE TEST	Ex. 1 For $f(x) = \frac{2}{5}x^5 - \frac{7}{4}x^4 - \frac{4}{3}x^3 + 9$ (a) Find the open intervals on which $f(x)$ is increasing and/or decreasing. Justify. (b) Determine the x-values of any local maxima or local minima of $f(x)$. Justify. Ex. 2 Find the exact values of any relative extrema of the function $f(x) = \frac{1}{2}x - \sin x$ on the interval $[0, 2\pi]$.

AP MULTIPLE CHOICE

The function f given by $f(x) = 9x^{2/3} + 3x - 6$ has a relative minimum at $x =$

- (A) -8 (B) $-\sqrt[3]{2}$ (C) -1 (D) $-\frac{1}{8}$ (E) 0

The function f has a first derivative given by $f'(x) = x(x-3)^2(x+1)$. At what values of x does f have a relative maximum?

- (A) -1 only (B) 0 only (C) -1 and 0 only (D) -1 and 3 only (E) -1 , 0 , and 3



The first derivative of the function f is given by $f'(x) = \sin(x^2)$. At which of the following values of x does f have a local minimum?

- (A) 2.507 (B) 2.171 (C) 1.772 (D) 1.253 (E) 0

HOMEWORK

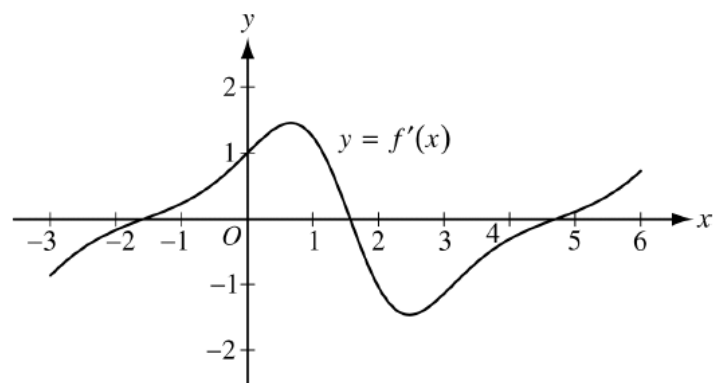
Worksheet 33

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/8	CONCAVITY POINTS OF INFLECTION	Notes Handout
AP MULTIPLE CHOICE For what values of x does the graph of $y = 3x^5 + 10x^4$ have a point of inflection? (A) $x = -\frac{8}{3}$ only (B) $x = -2$ only (C) $x = 0$ only (D) $x = 0$ and $x = -\frac{8}{3}$ (E) $x = 0$ and $x = -2$		
HOMEWORK		Worksheet 34

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/9	SECOND DERIVATIVE TEST FOR EXTREMA	Notes – Handout Quiz – Extreme Values, Inc/Dec, First Derivative Test
HOMEWORK		Worksheet 34 (cont.)

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/10	GRAPHICAL ANALYSIS	Notes - Handout

AP MULTIPLE CHOICE



The figure above shows the graph of f' , the derivative of the function f , on the interval $[-3, 6]$. If the derivative of the function h is given by $h'(x) = 2f'(x)$, how many points of inflection does the graph of h have on the interval $[-3, 6]$?

- (A) One (B) Two (C) Three (D) Four (E) Five

The derivative of a function f is increasing for $x < 0$ and decreasing for $x > 0$. Which of the following could be the graph of f ?

- (A)
- (B)
- (C)
- (D)
- (E)

HOMEWORK	Worksheet 35
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DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/11	OPTIMIZATION	Handout
AP MULTIPLE CHOICE A rectangular area is to be enclosed by a wall on one side and fencing on the other three sides. If 18 meters of fencing are used, what is the maximum area that can be enclosed? (A) $\frac{9}{2} \text{ m}^2$ (B) $\frac{81}{4} \text{ m}^2$ (C) 27 m^2 (D) 40 m^2 (E) $\frac{81}{2} \text{ m}^2$		
HOMEWORK		Worksheet 36

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/14	OPTIMIZATION AND REVIEW	Extreme Values Increasing/Decreasing Behavior Max/Min Concavity Points of Inflection Graphs of f' Optimization
HOMEWORK		Worksheet 37

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/15	UNIT 5 - FRQ	FREE RESPONSE QUESTIONS
HOMEWORK		Worksheet 38

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/17	UNIT 5 EXAM	Extreme Values; Increasing/Decreasing Behavior Max/Min; Concavity Points of Inflection; Graphs of f' Optimization
HOMEWORK		None