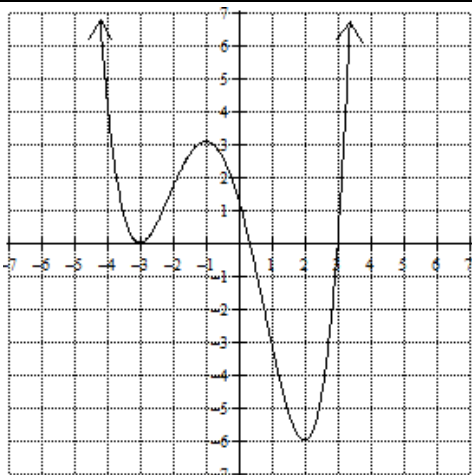


AP Calculus  
 Unit 5 – Applications of the Derivative – Part 2

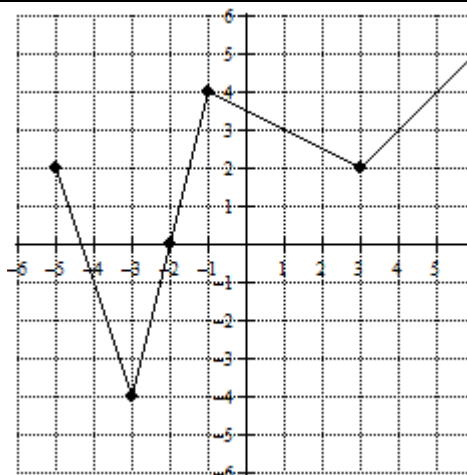
**Day 1 Notes: The Extreme Value Theorem**

**Definitions of Relative and Absolute Extrema of a Function**

Pictured below are the graphs of  $f$  and  $g$ . Answer the questions about these two functions.



Graph of  $f(x)$



Graph of  $g(x)$

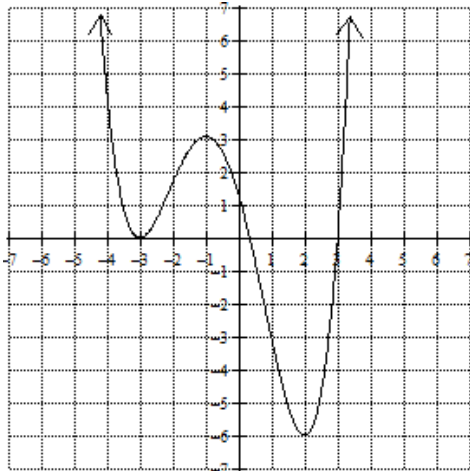
Identify the coordinates of the relative extrema of  $f$ .

Identify the coordinates of the relative extrema of  $g$ .

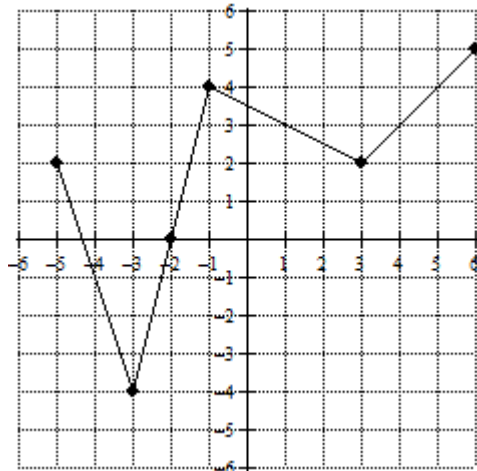
On the domain of  $f$ , what are the coordinates of the absolute extrema of  $f$ ?

On the domain of  $g$ , what are the coordinates of the absolute extrema of  $g$ ?

On the domain of the given function, did the absolute extrema occur at the function's relative extrema?



Graph of  $f(x)$



Graph of  $g(x)$

On the interval  $-2 \leq x \leq 3$ , what are the absolute extrema of  $f$ ?

On the interval  $-4 \leq x \leq 5$ , what are the absolute extrema of  $g$ ?

On the interval  $-4 \leq x \leq 1$ , what are the absolute extrema of  $f$ ?

On the interval  $-2 \leq x \leq 6$ , what are the absolute extrema of  $g$ ?

When the domain is restricted to a particular closed interval, at what three places can the absolute extrema exist?

**The Extreme Value Theorem (E. V. T.):**

Use the extreme value theorem to locate the absolute extrema of the function

$f(x) = -x^3 - 6x^2 - 9x + 2$  on the given closed intervals.

Interval: $-4 \leq x \leq -1$	Interval: $-4 \leq x \leq 1$
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For each of the following functions, state specifically why the E. V. T. is or is not applicable on the given interval.

Interval: $-5 \leq x \leq 0$	
$H(x) = \frac{3x+2}{x+3}$	
$G(x) = 2x\sqrt{x-3}$	
$f(x) = \ln(x+7)$	

Given the functions below, determine the absolute extreme values of the function on the given interval, provided the extreme value theorem is applicable. If it is not, state specifically why it is not.

1.  $f(x) = x^3 - 2x^2 - 3x - 2$  on  $[-1, 3]$

2.  $g(x) = \sin^2 x + \cos x$  on  $\frac{\pi}{2} \leq x \leq 2\pi$

3.  $f(x) = (x + 2)^{\frac{2}{3}}$  on  $[-3, 6]$

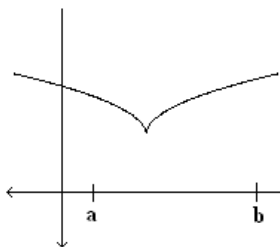
4.  $h(x) = \ln(x^2 - 4)$  on  $[-1, 3]$

**AP Calculus AB**  
**Unit 5 – Day 1 – Assignment**

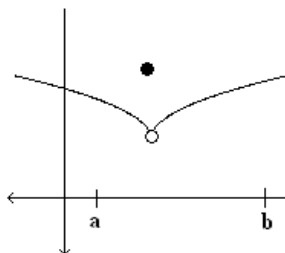
Name: \_\_\_\_\_

1. For which of the following functions is the Extreme Value Theorem NOT APPLICABLE on the interval  $[a, b]$ ? Give a reason for your answer.

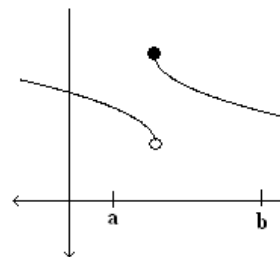
Graph I



Graph II

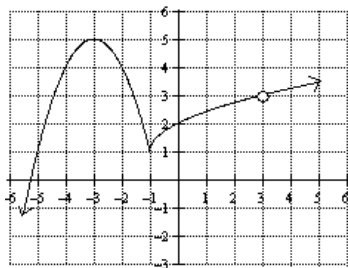


Graph III



For exercises 2 – 4, determine the critical numbers for each of the functions below.

2.



3.  $g(x) = \ln(x^2 + 4)$

4.  $h(x) = \sqrt[3]{x+3}$

5. Given the function below, apply the Extreme Value Theorem to find the absolute extrema of  $f(x)$  on the indicated interval.

$$f(x) = \sin x \cdot \ln(x + 1) \text{ on the interval } [1, 6]$$

For exercises 6 – 9, determine the absolute extreme values on the given interval. You should do each of these independent from a calculator.

6.  $f(x) = x^3 - 3x^2$  on the interval  $[-1, 3]$

7.  $g(x) = \sqrt[3]{x+2}$  on the interval  $[-3, 6]$

8.  $h(x) = \frac{x}{x+2}$  on the interval  $[-4, 0]$

9.  $f(x) = 3x^{\frac{2}{3}} - 2x$  on the interval  $[-1, 1]$