

April 28

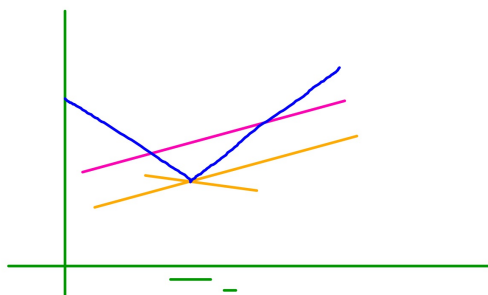
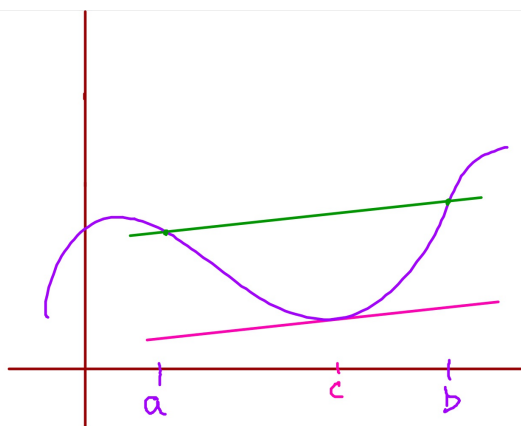
What does the Mean Value Theorem say?

If f is continuous & differentiable

average rate of change = instantaneous rate of change (slope at 1 pt)

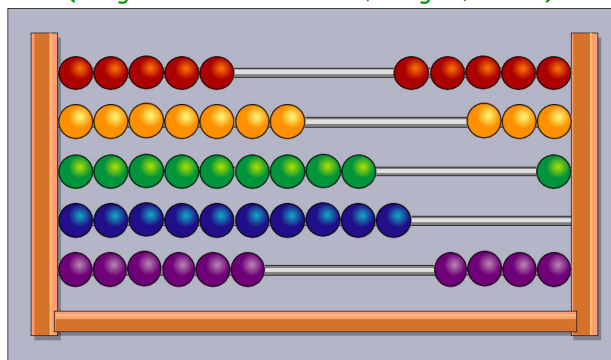
$$\frac{f(b)-f(a)}{b-a} = f'(c)$$

$$a < c < b$$

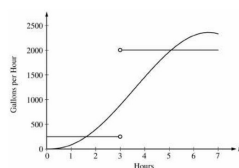


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Students will verbally explain how to solve problems with calculus (using the words: derivative, integral, solve...)



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2. The amount of water in a storage tank, in gallons, is modeled by a continuous function on the time interval $0 \leq t \leq 7$, where t is measured in hours. In this model, rates are given as follows:
- The rate at which water enters the tank is $f(t) = 100t^2 \sin(\sqrt{t})$ gallons per hour for $0 \leq t \leq 7$.
 - The rate at which water leaves the tank is $g(t) = \begin{cases} 250 & \text{for } 0 \leq t < 3 \\ 2000 & \text{for } 3 \leq t \leq 7 \end{cases}$ gallons per hour.
- The graphs of f and g , which intersect at $t = 1.617$ and $t = 5.076$, are shown in the figure above. At time $t = 0$, the amount of water in the tank is 3000 gallons.
- How many gallons of water enter the tank during the time interval $0 \leq t \leq 7$? Round your answer to the nearest gallon.
 - For $0 \leq t \leq 7$, find the time intervals during which the amount of water in the tank is decreasing. Give a reason for each answer.
 - For $0 \leq t \leq 7$, at what time t is the amount of water in the tank greatest? To the nearest gallon, compute the amount of water at this time. Justify your answer.

WRITE ALL WORK IN THE PINK EXAM BOOKLET.

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x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	6	4	2	5
2	9	2	3	1
3	10	-4	4	2
4	-1	3	6	7

3. The functions f and g are differentiable for all real numbers, and g is strictly increasing. The table above gives values of the functions and their first derivatives at selected values of x . The function h is given by $h(x) = f(g(x)) - 6$.
- Explain why there must be a value r for $1 < r < 3$ such that $h(r) = -5$.
 - Explain why there must be a value c for $1 < c < 3$ such that $h'(c) = -5$.
 - Let w be the function given by $w(x) = \int_1^x f(t) dt$. Find the value of $w'(3)$.
 - If g^{-1} is the inverse function of g , write an equation for the line tangent to the graph of $y = g^{-1}(x)$ at $x = 2$.

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END OF PART A OF SECTION II