MVT
Rolles
Ch 3

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

DO for Homework

1. 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 $h(x) = f(g(x)) - 6$.

(a) Explain why there must be a value r for $1 < r < 3$ such that $h(r) = -5$.

(b) Explain why there must be a value c for $1 < c < 3$ such that $h'(c) = -5$.

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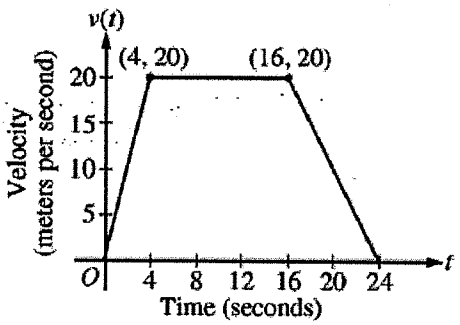

2. A car is traveling on a straight road. For $0 \le t \le 24$ seconds, the car's velocity $v(t)$, in meters per second, is modeled by the piecewise-linear function defined by the graph above.

(d) Find the average rate of change of v over the interval $8 \le t \le 20$. Does the Mean Value Theorem guarantee a value of c, for $8 < c < 20$, such that $v'(c)$ is equal to this average rate of change? Why or why not?

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t (minutes)	0	5	10	15	20	25	30	35	40
$v(t)$ (miles per minute)	7.0	9.2	9.5	7.0	4.5	2.4	2.4	4.3	7.3

DO for Homework

3. A test plane flies in a straight line with positive velocity $v(t)$, in miles per minute at time t minutes, where v is a differentiable function of t. Selected values of $v(t)$ for $0 \le t \le 40$ are shown in the table above.

(b) Based on the values in the table, what is the smallest number of instances at which the acceleration of the plane could equal zero on the open interval $0 < t < 40$? Justify your answer.

$v'(t) = a(t)$

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t (hours)	$R(t)$ (gallons per hour)
0	9.6
3	10.4
6	10.8
9	11.2
12	11.4
15	11.3
18	10.7
21	10.2
24	9.6

4. The rate at which water flows out of a pipe, in gallons per hour, is given by a differentiable function R of time t. The table above shows the rate as measured every 3 hours for a 24-hour period.

(b) Is there some time t, $0 < t < 24$, such that $R'(t) = 0$? Justify your answer.

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5 If f is continuous on [2, 5] and differentiable on (2, 5) with $f(2) = -4$ and $f(5) = 14$, then which of the following statements must be true?

I. $f(x) = 6$ has a solution in (2, 5)

II. $f'(x) = 6$ has a solution in (2, 5)

III. $f''(x) = 6$ has a solution in (2, 5)

6 *Now find the value that satisfies the MVT for* $y = \frac{x+1}{x}$ *for* $\left[\frac{1}{2}, 2\right]$

Always begin by writing out the MVT statement. [yes, always]

7 Try: $-3x\sqrt{x+1}$ on $[-1, 0]$

Determine if Rolle's Theorem can be applied, and if so, then find the value(s) that fulfill Rolle's Theorem.