Intermediate Value Theorem

4. (calculator not allowed)

x	0	1	2
$f(x)$	1	k	2

The function f is continuous on the closed interval [0, 2] and has values that are given in the table above. The equation $f(x)=\frac{1}{2}$ must have at least two solutions in the interval [0, 2] if $k =$

(A) 0
(B) $\frac{1}{2}$
(C) 1
(D) 2
(E) 3

12. (calculator allowed)
Let f be a continuous function on the closed interval [–3, 6]. If $f(-3)=-1$ and $f(6)=3$, then the Intermediate Value Theorem guarantees that

(A) $f(0)=0$
(B) $f'(c)=\frac{4}{9}$ for at least one c between –3 and 6
(C) $-1 \le f(x) \le 3$ for all x between –3 and 6
(D) $f(c)=1$ for at least one c between –3 and 6
(E) $f(c)=0$ for at least one c between –1 and 3

t (minutes)	0	2	5	8	12
$v_A(t)$ (meters/min)	0	100	40	-120	-150

4. Train A runs back and forth on an east-west section of railroad track. Train A's velocity, measured in meters per minute, is given by a differentiable function $v_A(t)$, where time t is measured in minutes. Selected values for $v_A(t)$ are given in the table above.

   b) Do the data in the table support the conclusion that train A's velocity is -100 meters per minute at some time t with $5 < t < 8$? Give a reason for your answer.

t (minutes)	0	2	5	8	12
$v_A(t)$ (meters/min)	0	100	40	-120	-150

4. Train A runs back and forth on an east-west section of railroad track. Train A's velocity, measured in meters per minute, is given by a differentiable function $v_A(t)$, where time t is measured in minutes. Selected values for $v_A(t)$ are given in the table above.

   b) Do the data in the table support the conclusion that train A's velocity is 50 meters per minute at some time t with $0 < t < 2$? Give a reason for your answer.

Question 2

t (hours)	0	1	3	4	7	8	9
$L(t)$ (people)	120	156	176	126	150	80	0

Concert tickets went on sale at noon ($t = 0$) and were sold out within 9 hours. The number of people waiting in line to purchase tickets at time t is modeled by differentiable function L for $0 \le t \le 9$. Values of L(t) at various times t are shown in the table above.

How many times during the first 4 hours will L(t) equal 150? Give a reason for your answer.

Question 2

t (hours)	0	1	3	4	7	8	9
$L(t)$ (people)	120	156	176	126	150	80	0

Concert tickets went on sale at noon (t = 0) and were sold out within 9 hours. The number of people waiting in line to purchase tickets at time t is modeled by differentiable function L for $0 \le t \le 9$. Values of L(t) at various times t are shown in the table above.

How many times during the last 5 hours will L(t) equal 50? Give a reason for your answer.

Question 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

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 $h(r) = -5$.

Intermediate Value Theorem Notes

t (minutes)	0	2	5	8	12
$v_A(t)$ (meters/min)	0	100	40	-120	-150

1(FR). Train A runs back and forth on an east-west section of railroad track. Train A's velocity, measured in meters per minute, is given by a differentiable function $v_A(t)$, where time t is measured in minutes. Selected values for $v_A(t)$ are given in the table above.

b) Do the data in the table support the conclusion that train A's velocity is 60 meters per minute at some time t with 2 < t < 5? Give a reason for your answer.

x	0	1	2	3
f(x)	3	0	k	1

2(MC). The function f is continuous on the closed interval [0, 3] and has values that are given in the table above. The equation f(x) = 1.5 must have at least 3 solutions in the [0, 3] if k =

A) -1 B) 0 C) .5 D) 1 E) 2

3(MC). Let f be a continuous function on the closed interval [-2, 4]. If f(-2) = -3 and f(4) = 5, then the Intermediate Value Theorem guarantees that

A) f(c) = 1 for at least one c between -3 and 5 B) $-3 \leq f(x) \leq 5$ for all x between -2 and 4

C) $f'(c) = \frac{4}{3}$ for at least one value of c between -2 and 4

D) f(1) = 2 E) f(c) = 2 for at least one c between -2 and 4

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

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
5	12	1	12	15

4(FR) Explain why there must be a value r for 2 < r < 4 such that h(r) = 5.

t (hours)	0	1	3	4	7	8	9
$L(t)$ (people)	120	156	176	126	150	80	0

5(FR). Concert tickets went on sale at noon (t = 0) and were sold out within 9 hours. The number of people waiting in line to purchase tickets at time t is modeled by the differentiable function L for $0 \le t \le 9$. Values of L(t) at various times t are shown in the table above.

How many times during the last 5 hours will L(t) equal 130? Give a reason for your answer.