Tabular Data (IVT and MVT)

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

Estimate s'(7). Include units of measure.

(1, 4) (10, 8) $\frac{8-4}{10-1} = \frac{4}{9}$ ft/sec

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

Estimate s'(12). Include units of measure.

$(10, 8)$ $(12, 3)$

$$\frac{3-8}{12-10} = \frac{-5}{2} \text{ ft/sec}$$

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For 0< t <12, must there be a time t such that s(t) = 6?
How many? twice

IVT

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For 0< t <12, must there be a time t such that s(t) = 6?

Since s(1)< 6 < s(10) and s(t) is continuous, by IVT
there must exist a value c, 1 < c < 10, such that s(c) = 6
AND
since s(12) < 6 < s(10) there must exist
a value c, 10 < c < 12, such that s(c) = 6

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For 0< t <12, must there be a time t such that s(t) = 0?

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

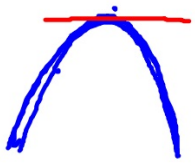
t	0	1	10	12
s(t)	3	4	8	3

For 0< t <12, must there be a time t such that s(t) = 0?

No. IVT does not apply. s(t) is continuous but there are no intervals (a, b) such that $s(a) < 0 < s(b)$

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3



For $0 < t < 12$, must there be a time t such that $s'(t) = 0$?

(0, 3) (12, 3)

$m = 0$

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For $0 < t < 12$, must there be a time t such that $s'(t) = 0$?

Yes, since s(t) is continuous and differentiable and $[s(12) - s(0)]/[12 - 0] = 0$, by MVT, there exists a value c, $0 < c < 12$, such that $s'(c) = 0$.

slope of 2 points

Rolle's: since s(t) is continuous and differentiable and s(0) = s(12) by Rolle's there must exist a value c, $0 < c < 12$, such that $s'(c) = 0$

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For $0 < t < 10$, must there be a time t such that $s'(t) = 0$?

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For $0 < t < 10$, must there be a time t such that $s'(t) = 0$?
Using Rolle's Theorem as a justification

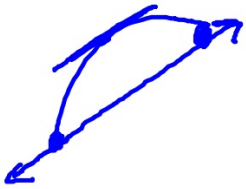
No. Rolle's theorem does not apply.
s(t) is continuous and differentiable,
but there are no intervals (a,b) on $0 < t < 10$ such
that $f(a) = f(b)$.

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For $0 < t < 10$, must there be a time t such that $s'(t) = 0$?
Using MVT as a justification
No. MVT does not apply.
s(t) is continuous and differentiable,
but there are no intervals (a,b) on $0 < t < 10$, such that
$\frac{s(b) - s(a)}{b - a}$ equals zero.

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet



t	0	1	10	12
s(t)	3	4	8	3

For $0 < t < 10$, must there be a time t such that $s'(t) = 1/2$?

$(0, 3)$ $(10, 8)$

$$\frac{8-3}{10-0} = \frac{5}{10} = \frac{1}{2}$$

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For $0 < t < 10$, must there be a time t such that $s'(t) = 1/2$?

Yes, since s(t) is continuous and differentiable, by MVT and $[s(10) - s(0)]/[10 - 0] = 1/2$, there exists a value c, $0 < c < 10$, such that $s'(c) = 1/2$

Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For $0 < t < 1$, must there be a time t such that $s'(t) = 2$?

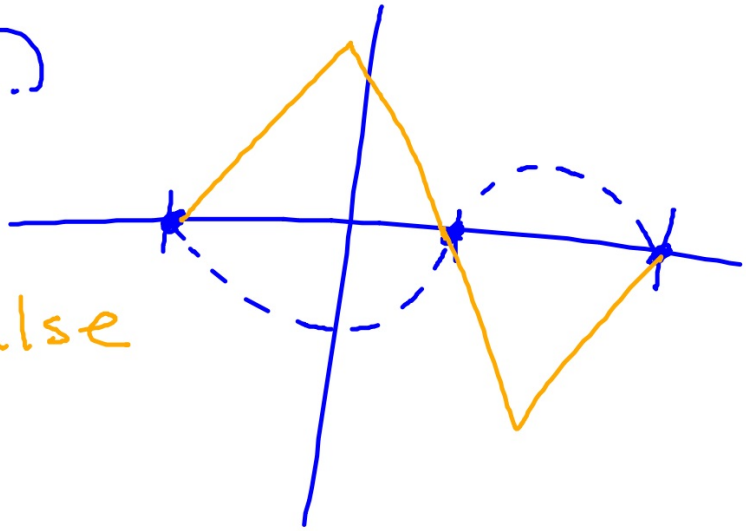
Let s(t) be a differentiable function where
t is in seconds and s(t) is feet

t	0	1	10	12
s(t)	3	4	8	3

For $0 < t < 1$, must there be a time t such that $s'(t) = 2$?

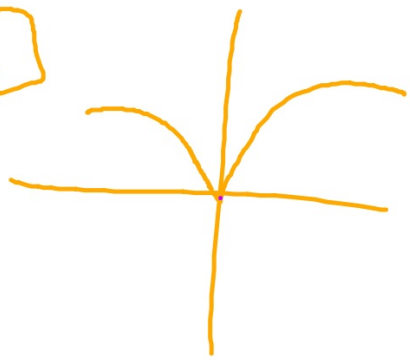
No. MVT does not apply.
s(t) is continuous and differentiable,
but on the interval $0 < t < 1$,
$\frac{s(1) - s(0)}{1 - 0}$ does not equal 2

78.)



False

43.) $f(x) = x^{2/3}$ $[0,1]$



Continuity $[0,1]$ ✓

diff. $(0,1)$ ✓

$m_{sec} = m_{tan}$

$$\frac{f(1)-f(0)}{1-0}$$

$$1 = \frac{2}{3}x^{-1/3}$$

$$1 = \frac{2}{3x^{1/3}}$$

$$3x^{1/3} = 2$$

$$x^{1/3} = \frac{2}{3}$$

$$x = \frac{8}{27}$$