

Justification Day

1. Justify why $f(x)$ has a minimum at $x = 5$. (there are two options)

Option #1:	Option #2:
because $f'(x)$ changes from negative to positive at $x=5$.	because $f''(5) > 0$ and $f'(5) = 0$ or DNE.

2. Using correct units, explain the meaning of $\int_2^{10} Q(x) dx$ where $Q(x)$ is the rate money is earned in \$/hour.

$\int_2^{10} Q(x) dx$ is the amount of money (\$) earned between $t=2$ and $t=10$.

3. Using correct units, explain the meaning of $\frac{1}{8} \int_2^{10} Q(x) dx$ where $Q(x)$ is the rate money is earned in \$/hour.

$\frac{1}{8} \int_2^{10} Q(x) dx$ is the average rate of the money earned from $t=2$ to $t=10$ given in \$/hr

4. Using correct units, explain the meaning of $P'(2)$ where $P(t)$ is the population of the US t years after 1776.

$P'(2)$ is the rate at which the US population is increasing/decreasing at 2 years after 1776, or 1778.

5. Justify why $g(x)$ has an inflection point at $x = 14$.

because $g''(x)$ changes signs at $x=14$

6. Explain why $f(x)$ must equal 2 at least twice on $[-3, 2]$ given that $f(x)$ is continuous

x	-3	-1	2	4
$f(x)$	10	1	3	0

$$f(-1) < 2 < f(-3)$$

and

$$f(-1) < 2 < f(-3)$$

• by the IVT, $f(x) = 2$ at least 2 times!

7. Explain why $f'(x) = 0$ on $[-3, 2]$ given that $f(x)$ is continuous and differentiable

x	-3	-1	2	4
$f(x)$	3	1	3	0

$$\frac{f(2) - f(-3)}{2 - (-3)} = \frac{3 - 3}{5} = \frac{0}{5} = 0$$

MVT is applicable, so avg slope is 0 over $[-3, 2]$
so $f'(x) = 0$ over that interval.

8. Justify why the absolute max of $h(t)$ on $[-3, 4]$ occurs when $t = 1$. (give two different examples of how this could be done)

Option #1:	Option #2:
$h(-3) = 0$ $h(4) = 2$ $h(1) = 7$	By EVT, 7 is the largest value over $[-3, 4]$. $h'(t) > 0$ for $[-3, 1]$ and $h'(t) < 0$ for $[1, 4]$, $\therefore h(1)$ is a maximum

9. Justify why the particle is speeding up at $t = 10$

because $a(10)$ and $v(10)$ have the same sign

10. Explain why cost is increasing at $t = 4$

because $c'(4) > 0$

11. Why does the linear approximation for $f(x)$ at $x = 5$ give an underestimate at $f(5.2)$?

because $f''(5) > 0$ or $f(x)$ is concave up at $x=5$

12. Why does the MVT not guarantee that $R(x) = \frac{2}{3}$ on the interval $[4, 8]$?

• Function is not differentiable over $[4, 8]$
 or • Function is not continuous over $[4, 8]$

or • $\frac{f(8) - f(4)}{8 - 4} \neq \frac{2}{3}$

13. Explain how you know that the car turned around at $t = 12$?

$v(t)$ changes signs at $t=12$