Name:____________________________

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 $h(r) = -5$.

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

(d) 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 $x = 2$.

Multiple Choice and FRQ practice

1. If f is continuous for $a \le x \le b$ and differentiable for $a < x < b$, which of the following could be false?

(A) $f'(c) = \dfrac{f(b) - f(a)}{b - a}$ for some c such that $a < c < b$

(B) $f'(c) = 0$ for some c such that $a < c < b$

(C) f has a minimum value on $a \le x \le b$

(D) f has a maximum value on $a \le x \le b$

(E) $\int_a^b f(x)\,dx$ exists.

2. The function f is continuous for $-2 \le x \le 1$ and differentiable for $-2 < x < 1$. If $f(-2) = -5$ and $f(1) = 4$, which of the following statements could be false?

(A) There exists c, where $-2 < c < 1$, such that $f(c) = 0$

(B) There exists c, where $-2 < c < 1$, such that $f'(c) = 0$

(C) There exists c, where $-2 < c < 1$, such that $f(c) = 3$

(D) There exists c, where $-2 < c < 1$, such that $f'(c) = 3$

3. The function f is defined by $f(x) = 4x^2 - 5x + 1$. The application of the Mean Value Theorem to f on the interval $0 < x < 2$ guarantees the existence of a value c, where $0 < c < 2$ such that $f'(c) =$

(A) 1 (B) 3 (C) 7 (D) 8

---

4. Let f be a function with first derivative defined by $f'(x) = \dfrac{2x^2 - 5}{x^2}$ for $x > 0$. It is known that $f(1) = 7$ and $f(5) = 11$. What value of x in the open interval (1, 5) satisfies the conclusion of the Mean Value Theorem for f on the closed interval [1, 5]?

(A) 1 (B) $\sqrt{\dfrac{5}{2}}$ (C) $\sqrt[3]{10}$ (D) $\sqrt{5}$

t (minutes)	0	1	2	3	4	5	6
$C(t)$ (ounces)	0	5.3	8.8	11.2	12.8	13.8	14.5

Hot water is dripping through a coffeemaker, filling a large cup with coffee. The amount of coffee in the cup at time t, $0 \le t \le 6$, is given by a differentiable function C, where t is measured in minutes. Selected values of $C(t)$, measured in ounces, are given in the table above.

Is there a time t, $2 \le t \le 4$ at which $C'(t) = 2$? Justify your answer.

Ex. (2018 AB/BC 4)

t (years)	2	3	5	7	10
$H(t)$ (meters)	1.5	2	6	11	15

The height of a tree at time t is given by a twice-differentiable function H, where $H(t)$ is measured in meters and t is measured in years. Selected values of $H(t)$ are given in the table above.

(a) Use the data in the table to estimate $H'(6)$. Using correct units, interpret the meaning of $H'(6)$ in the context of the problem.

(b) Explain why there must be at least one time t, for $2 < t < 10$, such that $H'(t) = 2$.