Question 1

Suppose $y = f(x)$ is an arbitrary function. The difference quotient

$$\frac{f(a+h) - f(a)}{h}$$

represents:

1. The slope of the tangent line at $x = a$
2. The instantaneous rate of change of f at $x = a$
3. The slope of the secant from $(a, f(a))$ to $(a+h, f(a+h))$
4. The average rate of change of f from a to $a+h$
5. 1. and 2.
6. 3. and 4.

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4. The average rate of change of f from a to $a + h$
5. 1. and 2.
6. 3. and 4.

6. (3 and 4 both)

Question 2

Suppose $y = f(x)$ is an arbitrary function. If it exists, the limit

$$\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

represents:

1. The slope of the tangent line at $x = a$
2. The instantaneous rate of change of f at $x = a$
3. The slope of the secant from $(a, f(a))$ to $(a+h, f(a+h))$
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5. (1 and 2 both)

Question 3

Suppose f is differentiable at $x = a$. Then $f'(a)$ represents:

1. The slope of the tangent line at $x = a$
2. The instantaneous rate of change of f at $x = a$
3. The slope of the secant from $(a, f(a))$ to $(a + h, f(a + h))$
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5. 1. and 2.
6. 3. and 4.

5. (1 and 2 both)

Question 4

Suppose $y = f(t)$ represents the position of a particle at time t. The difference quotient

$$\frac{f(t+h) - f(t)}{h}$$

represents:

1. The instantaneous velocity at time t
2. The average velocity from time t to $t + h$
3. The instantaneous velocity at time $t + h$
4. The instantaneous acceleration at time t
5. The average acceleration from time t to $t + h$
6. The position at time $t + h$

Question 4

Suppose $y = f(t)$ represents the position of a particle at time t. The difference quotient

$$\frac{f(t+h) - f(t)}{h}$$

represents:

1. The instantaneous velocity at time t
2. The average velocity from time t to $t + h$
3. The instantaneous velocity at time $t + h$
4. The instantaneous acceleration at time t
5. The average acceleration from time t to $t + h$
6. The position at time $t + h$

2.

Question 5

Suppose $y = f(t)$ represents the position of a particle at time t. If it exists, the limit

$$\lim_{h \to 0} \frac{f(t+h) - f(t)}{h}$$

represents:

1. The instantaneous velocity at time t
2. The average velocity from time t to $t + h$
3. The instantaneous velocity at time $t + h$
4. The instantaneous acceleration at time t
5. The average acceleration from time t to $t + h$
6. The position at time $t + h$

Question 5

Suppose $y = f(t)$ represents the position of a particle at time t. If it exists, the limit

$$\lim_{h \to 0} \frac{f(t+h) - f(t)}{h}$$

represents:

1. The instantaneous velocity at time t
2. The average velocity from time t to $t + h$
3. The instantaneous velocity at time $t + h$
4. The instantaneous acceleration at time t
5. The average acceleration from time t to $t + h$
6. The position at time $t + h$

1.

Question 6

Suppose $y = f(t)$ is differentiable and represents the position of a particle at time t. If it exists, the limit

$$\lim_{h \to 0} \frac{f'(t+h) - f'(t)}{h}$$

represents:

1. The instantaneous velocity at time t
2. The average velocity from time t to $t+h$
3. The instantaneous velocity at time $t+h$
4. The instantaneous acceleration at time t
5. The average acceleration from time t to $t+h$
6. The position at time $t+h$

Question 6

Suppose $y = f(t)$ is differentiable and represents the position of a particle at time t. If it exists, the limit

$$\lim_{h \to 0} \frac{f'(t+h) - f'(t)}{h}$$

represents:

1. The instantaneous velocity at time t
2. The average velocity from time t to $t+h$
3. The instantaneous velocity at time $t+h$
4. The instantaneous acceleration at time t
5. The average acceleration from time t to $t+h$
6. The position at time $t+h$

4.

Question 7

Suppose $f(x)$ is a function. Which of the following are true?

1. f can be differentiable but not continuous at $x = a$
2. f can be continuous but not differentiable at $x = a$
3. If f is continuous at $x = a$, it is differentiable there
4. If f is differentiable at $x = a$, it is continuous there
5. (both 1 and 3)
6. (both 2 and 4)

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6. (both 2 and 4)

Question 8

Suppose $f(x)$ is a function defined for all real numbers and $a < b$. To apply the Intermediate Value Theorem on the interval from a to b, it must be true that:

1. f is continuous on (a, b)
2. f is continuous on $[a, b]$
3. $f(a) = f(b)$
4. $f(a) \neq f(b)$
5. (both 1 and 3)
6. (both 2 and 4)

Question 8

Suppose $f(x)$ is a function defined for all real numbers and $a < b$. To apply the Intermediate Value Theorem on the interval from a to b, it must be true that:

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5. (both 1 and 3)
6. (both 2 and 4)

6. (both 2 and 4)

Question 9

Suppose $f(x)$, $g(x)$, and $h(x)$ are functions and

$$f(x) \leq g(x) \leq h(x) \quad \text{for all } x$$

To determine $\lim_{x \to a} g(x)$ using the squeeze theorem, it must be true that:

1. $\lim_{x \to a} f(x)$ exists
2. $\lim_{x \to a} g(x)$ exists
3. $\lim_{x \to a} h(x)$ exists
4. $\lim_{x \to a} f(x) = \lim_{x \to a} h(x)$
5. All of the above
6. (1,3, and 4 only)

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Suppose $f(x)$, $g(x)$, and $h(x)$ are functions and

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1. $\lim_{x \to a} f(x)$ exists
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5. All of the above
6. (1,3, and 4 only)

6. (1, 3, and 4)

Question 10

Suppose $f(x)$ is defined piecewise by

$$f(x) = \begin{cases} |x-1| & \text{if} \quad x < 0 \\ ab^x & \text{if} \quad x \geq 0 \quad b > 0 \end{cases}$$

What value of a makes f continuous at $x = 0$?

1. $a = 0$
2. $a = -1$
3. $a = 1$
4. $a = 2$
5. Cannot be determined
6. None of the above

Question 10

Suppose $f(x)$ is defined piecewise by

$$f(x) = \begin{cases} |x-1| & \text{if} \quad x < 0 \\ ab^x & \text{if} \quad x \geq 0 \quad b > 0 \end{cases}$$

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1. $a = 0$
2. $a = -1$
3. $a = 1$
4. $a = 2$
5. Cannot be determined
6. None of the above

3. $a = 1$

Question 11

Find the derivative of

$$f(x) = \frac{1}{x}$$

directly from the definition as a limit of a difference quotient.

1.	$-1/x$	4.	$-1/x^2$
2.	$1/x$	5.	$1/x^2$
3.	$\ln x$	6.	none of the above

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1. $-1/x$
2. $1/x$
3. $\ln x$
4. $-1/x^2$
5. $1/x^2$
6. none of the above

4.

Question 12

A particle moves along a straight line with its position at time t given by the function

$$f(t) = 10 + 50t - 12t^2$$

Find a formula for the **average velocity** from $t = 0$ to $t = a$.

1. $50 - 12a^2$
2. $50a - 12$
3. $50a - 12a^2$
4. $50 + 12a$
5. $50 + 12a^2$
6. none of the above

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1. $50 - 12a^2$
2. $50a - 12$
3. $50a - 12a^2$
4. $50 + 12a$
5. $50 + 12a^2$
6. none of the above

6. The average velocity from $t = 0$ to $t = a$ is $50 - 12a$

Question 13

A particle moves along a straight line with its position at time t given by the function

$$f(t) = 10 + 50t - 12t^2$$

Find a formula for the **instantaneous velocity** at $t = a$.

1. $50 - 12a$
2. $50 - 24a$
3. $50 - 12a^2$
4. $50 - 24a^2$
5. $50 + 12a^2$
6. none of the above

Question 13

A particle moves along a straight line with its position at time t given by the function

$$f(t) = 10 + 50t - 12t^2$$

Find a formula for the **instantaneous velocity** at $t = a$.

1.	$50 - 12a$	4.	$50 - 24a^2$
2.	$50 - 24a$	5.	$50 + 12a^2$
3.	$50 - 12a^2$	6.	none of the above

2.

Question 14

A particle moves along a straight line with its position at time t given by the function

$$f(t) = 10 + 50t - 12t^2$$

Find a formula for the **instantaneous acceleration** at $t = a$.

1. $-12a$
2. $-24a$
3. $-12a^2$
4. $24a$
5. -24
6. none of the above

Question 14

A particle moves along a straight line with its position at time t given by the function

$$f(t) = 10 + 50t - 12t^2$$

Find a formula for the **instantaneous acceleration** at $t = a$.

1. $-12a$
2. $-24a$
3. $-12a^2$
4. $24a$
5. -24
6. none of the above

5.

Question 15

Suppose

$$\frac{x-\sqrt{2}}{x^2-2} \leq g(x) \leq \frac{x^2-4}{x-2}$$

If possible, use the squeeze theorem to find the limit of $g(x)$ as $x \to 2$.

1. 2
2. -2
3. $-1/2$
4. $1/4$
5. $1/2$
6. cannot be determined

Question 15

Suppose

$$\frac{x-\sqrt{2}}{x^2-2} \le g(x) \le \frac{x^2-4}{x-2}$$

If possible, use the squeeze theorem to find the limit of $g(x)$ as $x \to 2$.

1. 2
2. -2
3. $-1/2$
4. $1/4$
5. $1/2$
6. cannot be determined

6.

Question 16

Suppose $f(x) = 3 + x$ and $g(x) = 3x^2$, can we use the Intermediate Value Theorem to show that

$$f(x) - g(x)$$

has a root in the interval $[0, 1]$?

1. Yes
2. No, because $(f - g)(x)$ is not continuous on $[0, 1]$
3. No, because $(f - g)(0) = (f - g)(1)$
4. No, because 0 is not between $(f - g)(0)$ and $(f - g)(1)$

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4. No, because 0 is not between $(f - g)(0)$ and $(f - g)(1)$

4.

Question 17

Suppose

$$f(x) = \begin{cases} \frac{x^2-1}{x-1} & \text{if} \quad x < 2 \\ x^2 & \text{if} \quad x \geq 2 \end{cases}$$

Then f is continuous everywhere except:

1. $\{0\}$
2. $\{1\}$
3. $\{0, 1\}$
4. $\{1, 2\}$
5. $\{0, 2\}$
6. f is continuous everywhere

Question 17

Suppose

$$f(x) = \begin{cases} \frac{x^2-1}{x-1} & \text{if} \quad x < 2 \\ x^2 & \text{if} \quad x \geq 2 \end{cases}$$

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2. $\{1\}$
3. $\{0,1\}$
4. $\{1,2\}$
5. $\{0,2\}$
6. f is continuous everywhere

4.

Question 18

Suppose

$$f(x) = \begin{cases} \frac{x^2-1}{x-1} & \text{if} \quad x < 2 \\ x^2 & \text{if} \quad x \geq 2 \end{cases}$$

Is f continuous from the left at $x = 2$?

1. Yes
2. No because $f(2)$ does not exist
3. No because $\lim_{x \to 2^-} f(x)$ does not exist
4. No because $\lim_{x \to 2^-} f(x) \neq f(2)$

Question 18

Suppose

$$f(x) = \begin{cases} \frac{x^2-1}{x-1} & \text{if} \quad x < 2 \\ x^2 & \text{if} \quad x \geq 2 \end{cases}$$

Is f continuous from the left at $x = 2$?

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2. No because $f(2)$ does not exist
3. No because $\lim_{x \to 2^-} f(x)$ does not exist
4. No because $\lim_{x \to 2^-} f(x) \neq f(2)$

4.

Question 19

Suppose

$$f(x) = \begin{cases} \frac{x^2-1}{x-1} & \text{if} \quad x < 2 \\ x^2 & \text{if} \quad x \geq 2 \end{cases}$$

Is f continuous from the right at $x = 2$?

1. Yes
2. No because $f(2)$ does not exist
3. No because $\lim_{x\to 2^+} f(x)$ does not exist
4. No because $\lim_{x\to 2^+} f(x) \neq f(2)$

Question 19

Suppose

$$f(x) = \begin{cases} \frac{x^2-1}{x-1} & \text{if} \quad x < 2 \\ x^2 & \text{if} \quad x \geq 2 \end{cases}$$

Is f continuous from the right at $x = 2$?

1. Yes
2. No because $f(2)$ does not exist
3. No because $\lim_{x \to 2^+} f(x)$ does not exist
4. No because $\lim_{x \to 2^+} f(x) \neq f(2)$

1.

Question 20

Suppose

$$f(x) = x^2 - 4x - 4$$

Find the equation of the tangent line at $x = 3$

1. $y = 2x + 13$
2. $y = -2x + 13$
3. $y = -2x - 13$
4. $y = 2x + 7$
5. $y = 2x - 13$
6. none of the above

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Suppose

$$f(x) = x^2 - 4x - 4$$

Find the equation of the tangent line at $x = 3$

1. $y = 2x + 13$
2. $y = -2x + 13$
3. $y = -2x - 13$
4. $y = 2x + 7$
5. $y = 2x - 13$
6. none of the above

5. $y = 2x - 13$