

2. Differentiation: Definition and Fundamental Properties

Starter Quiz ·

AP Calculus AB

Name: _____ Score: _____

1. Find the average rate of change of $f(x) = x^2$ on $[1, 3]$.

2. Which expression is the limit definition of $f'(x)$?

☐ $\frac{f(x+h) - f(x)}{h}$ with $h = 0$

☐ $\lim_{h \rightarrow 0} (f(x+h) - f(x))$

☐ $f(x+h) - f(x)$

☐ $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

3. A table gives $f(1.9) = 4.2$ and $f(2.1) = 5.8$. Use the symmetric difference quotient to estimate $f'(2)$.

4. Which implication is **true**?

☐ discontinuous at $c \Rightarrow$ differentiable at c

☐ continuous at $c \Rightarrow$ differentiable at c

☐ neither implies anything

☐ differentiable at $c \Rightarrow$ continuous at c

5. What is $\frac{d}{dx}[x^5]$?

☐ $5x^4$

☐ x^4

☐ $4x^5$

☐ $5x^6$

6. What is $\frac{d}{dx}[12]$?

7. What is $\frac{d}{dx}[\sin x]$?

☐ $-\cos x$

☐ $\cos x$

☐ $-\sin x$

☐ $\sin x$

8. The derivative of $f \cdot g$ equals $f' \cdot g'$.

☐ True ☐ False

9. The Quotient Rule numerator for $\frac{f}{g}$ is...

☐ $f'g + fg'$

☐ $fg' - f'g$

☐ $f'g - fg'$

☐ $f'g'$

10. The derivatives of $\cot x$ and $\csc x$ both carry a minus sign.

☐ True ☐ False

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Answers ·

AP Calculus AB

1. **4**

$$\frac{9-1}{3-1} = \frac{8}{2} = 4.$$

2. $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

The derivative is the limit of the difference quotient as $h \rightarrow 0$.

3. **8**

$$\frac{5.8 - 4.2}{2(0.1)} = \frac{1.6}{0.2} = 8.$$

4. **differentiable at $c \Rightarrow$ continuous at c**

Differentiable forces continuous; the reverse is false.

5. $5x^4$

Bring down 5, reduce exponent: $5x^{5-1} = 5x^4$.

6. **0**

The derivative of any constant is 0.

7. $\cos x$

$$\frac{d}{dx}[\sin x] = \cos x.$$

8. **False**

It is $f'g + fg'$, not $f'g'$.

9. $f'g - fg'$

Numerator is $f'g - fg'$, over g^2 .

10. **True**

$-\csc^2 x$ and $-\csc x \cot x$ – the "co-" functions carry a minus.