

1. C.1 · Single-variable calculus and applications

Starter Quiz ·

GRE Subject Test · GRE Mathematics

Name: _____ Score: _____

1. At $x = 0$, the function $f(x) = |x|$ is

- ☐ continuous but not differentiable
- ☐ neither continuous nor differentiable
- ☐ differentiable but not continuous
- ☐ continuous and differentiable

2. Find the derivative of $\ln(x^2 + 1)$ at $x = 1$.

3. If $F(x) = \int_0^{x^2} e^t dt$, find $F'(1)$ to two decimal places.

4. Evaluate $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \left(\frac{k}{n}\right)^2$.

- ☐ $\frac{1}{3}$
- ☐ 0
- ☐ The limit diverges.
- ☐ $\frac{1}{2}$

5. Although $1/k \rightarrow 0$, the series $\sum_{k=1}^{\infty} 1/k$ diverges.

- ☐ True ☐ False

6. For $x \neq 1$, $f(x) = (x^2 - 1)/(x - 1)$, and $f(1) = 5$. Find $\lim_{x \rightarrow 1} f(x)$.

7. If $y = \sin(x^2)$, find $y''(0)$.

8. Why does the mean value theorem not guarantee a point with zero derivative for $f(x) = |x|$ on $[-1, 1]$?

- ☐ The endpoint values are unequal
- ☐ The interval is not closed
- ☐ The function is not continuous
- ☐ The function is not differentiable at the interior point 0

9. For $B(x) = \int_x^{x^2} e^t dt$, find $B'(1)$ to two decimal places.

10. Find $\lim_{n \rightarrow \infty} \frac{2}{n} \sum_{k=1}^n (2 + 2k/n)$.

☐ 6

☐ 4

☐ 8

☐ 2

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1. **continuous but not differentiable**

The one-sided derivatives are -1 and 1 .

2. **1**

$\frac{2x}{x^2+1}$ at $x = 1$ is 1 .

3. **5.44**

$F'(x) = 2xe^{x^2}$, so $F'(1) = 2e$.

4. **$\frac{1}{3}$**

It is $\int_0^1 t^2 dt = 1/3$.

5. **True**

True. Terms tending to 0 is necessary but not sufficient; the harmonic series diverges (compare with $\int_1^\infty dx/x$ or group terms).

6. **2**

Away from 1 the expression equals $x+1$. Its limit is 2, independently of the assigned value 5.

7. **2**

$y' = 2x \cos(x^2)$, so $y'' = 2 \cos(x^2) - 4x^2 \sin(x^2)$. Substituting zero gives 2.

8. **The function is not differentiable at the interior point 0**

The function is continuous and has equal endpoint values, but the required derivative does not exist at 0. The theorem therefore cannot be applied.

9. **2.72**

$Bl(x) = 2xe^{x^2} - e^x$, so $Bl(1) = e \approx 2.72$. Equal bounds at a point do not make the derivative zero.

10. **6**

Use width $2/n$ and right endpoints $2 + 2k/n$ on $[2, 4]$. The limit is $\int_2^4 t dt = 6$.