Differentiating logarithms and composite logarithms

6 questions | 16 marks

Equivalent correct methods earn the corresponding marks.

1. Differentiate $\ln(7x)$, retaining its domain. [2 marks]

$u'/u = 7/(7x) = 1/x$.

Answer: $1/x$, $x > 0$

2. Differentiate $\log_3(2x + 5)$. [2 marks]

Use change of base, then apply the chain rule.

Answer: $2/((2x + 5)\ln 3)$, $x > -5/2$

3. Differentiate $(\ln x)^2$. [2 marks]

The outer square contributes $2\ln x$ and the inner derivative is $1/x$.

Answer: $2\ln x/x$, $x > 0$

4. Differentiate $y = \ln(x^2 - 9)$ and state the domain. [3 marks]

Solve $x^2 - 9 > 0$ before applying the chain rule.

Answer: $y' = 2x/(x^2 - 9)$; $x < -3$ or $x > 3$

5. Find the stationary point of $f(x) = \ln x - x/2$ and classify it. [4 marks]

$f' = 1/x - 1/2 = 0$ gives $x = 2$.

$f'' = -1/x^2 < 0$.

Answer: $(2, \ln 2 - 1)$, a local maximum.

6. Find the tangent to $y = \ln(2x - 1)$ at $x = 1$. [3 marks]

The point is $(1, 0)$ and the gradient is $2/(2 - 1) = 2$.

Answer: $y = 2x - 2$