Quotient rule

6 questions | 14 marks

Equivalent correct methods earn the corresponding marks.

1. Differentiate $\frac{3x+1}{x+2}$. [2 marks]

The numerator is $3(x+2)-(3x+1)=5$.

Divide by $(x+2)^2$.

Answer: $\frac{5}{(x+2)^2}$, $x \neq -2$

2. Differentiate $\frac{x^2-4}{x}$ efficiently. [2 marks]

Rewrite as $x-4x^{-1}$.

Use the power rule.

Answer: $1+\frac{4}{x^2}$, $x \neq 0$

3. Find $f'(2)$ if $f(x)=\frac{x^2}{x+1}$. [2 marks]

The derivative is $\frac{2x(x+1)-x^2}{(x+1)^2}$.

Substitute 2 to obtain $\frac{8}{9}$.

Answer: $\frac{8}{9}$

4. Differentiate $\frac{e^x}{x+1}$. [2 marks]

The numerator is $e^x(x+1) - e^x = xe^x$.

Retain the excluded input.

Answer: $\frac{xe^x}{(x+1)^2}$, $x \neq -1$

5. Find the tangent to $y = \frac{x+1}{x-1}$ at $x = 0$. [3 marks]

The point is $(0, -1)$.

The derivative is $-\frac{2}{(x-1)^2}$, so its value is -2.

Use point-gradient form.

Answer: $y = -2x - 1$

6. Why is the derivative formula for $\frac{x^2-1}{x-1}$ not valid at $x = 1$, even though cancellation gives $x + 1$ elsewhere? [3 marks]

Cancellation is valid only for $x \neq 1$.

A derivative at an input requires the original function to be defined there.

Answer: The original function is undefined at 1.