Quiz 2 Solutions

1. Use logarithm rules to evaluate the expression:

\[
\log_5(30) - \log_5(12) + \log_5(50).
\]

**Solution:** The main idea here is to play with logarithms.

\[
\log_5(30) - \log_5(12) + \log_5(50) = \log_5\left(\frac{30}{12}\right) + \log_5(50)
\]

[Using \(\log_b a - \log_b b = \log_b \frac{a}{b}\).]

\[
= \log_5\left(\frac{5}{2}\right) + \log_5(50)
\]

\[
= \log_5\left(\frac{5}{2} \cdot 5^2\right)
\]

[Using \(\log_5(ab) = \log_5 a + \log_5 b\) and cancelling.]

\[
= \log_5(125)
\]

\[
= \log_5(5^3)
\]

\[
= 3
\]

[Using \(\log_5 5^y = y\).]

2. Differentiate the following function:

\[
f(x) = \log_2(x^3 + 2).
\]

**Solution:**

Use the change of base formula to rewrite \(\log_2(x^3 + 2) = \frac{\ln(x^3 + 2)}{\ln 2}\).

Now, differentiate to find:

\[
\frac{d}{dx} \left[\log_2(x^3 + 2)\right] = \frac{d}{dx} \left[\frac{\ln(x^3 + 2)}{\ln 2}\right]
\]

\[
= \left(\frac{1}{\ln 2}\right) \cdot \left(\frac{1}{x^3 + 2}\right) \cdot (3x^2)
\]

\[
= \frac{3x^2}{(\ln 2)(x^3 + 2)}.
\]

Or you may directly use the formula \(\frac{d}{dx} (\log_a g(x)) = \frac{g'(x)}{g(x) \ln(a)}\).