8.4 Log and Exponential Equations

Ex 1 \[ \log_6 (2x-1) = \log_6 11 \]

\[ 2x - 1 = 11 \]
\[ 2x = 12 \]
\[ x = 6 \]

Check \( \checkmark \)

- Be there is only one log on each side of the equation, and they have the same base, we can ignore the logs and solve.
- Check: You can't take the log of a negative number.

Ex 2 \[ \log \left( \frac{8x+4}{x+1} \right) = 1 + \log(x+1) \]
\[ \log \left( \frac{8x+4}{x+1} \right) - \log(x+1) = 1 \]
\[ \log \frac{8x+4}{x+1} = 1 \]
\[ 8x + 4 = 10 \]
\[ x + 1 \]
\[ 8x + 4 = 10x + 10 \]
\[-6 = 2x \]
\[-3 = x \]

\( \uparrow \) reject

Try this \( \log_2 (x-6) = 3 - \log_2 (x-4) \)

Ex 3 \[ \log_3 \left( \frac{x^2 - 8x}{5} \right) = 10 \]
\[ 5 \log_3 \left( \frac{x^2 - 8x}{5} \right) = 10 \]
\[ \log_3 \left( \frac{x^2 - 8x}{5} \right) = 2 \]
\[ \frac{x^2 - 8x}{5} = 3^2 \]
\[ x^2 - 8x = 9 \]
\[ x^2 - 8x - 9 = 0 \]
\[ (x-9)(x+1) = 0 \]
\[ x = 9, x = -1 \]
Using logarithms to solve exponential equations.

ExA. \[ 4^x = 605 \]
\[
\log 4^x = \log 605
\]
\[
x \log 4 = \log 605
\]
\[
\frac{x \log 4}{\log 4} = \frac{\log 605}{\log 4}
\]
\[
x = \frac{\log 605}{\log 4}
\]

• Take the log of both sides of the equation.
• Use the power law to bring \( x \) in front of the log.

Calculator exact form

\[ 4.62 \]
\[ \log_4 605 \]

You try: \[ 8(3^{2x}) = 568 \]
\[ 3^{2x} = 71 \]
\[ 2x \log 3 = \log 71 \]
\[ x = \frac{\log 71}{2 \log 3} \]

\[ 1.91 \]

ExB. \[ \frac{4x + 2}{2x - 1} = 3 \]
\[ (2x - 1) \log 4 = (x + 2) \log 3 \]
\[ 2x \log 4 - \log 4 = x \log 3 + 2 \log 3 \]
\[ 2x \log 4 - x \log 3 = 2 \log 3 + \log 4 \]
\[ x(2 \log 4 - \log 3) = 2 \log 3 + \log 4 \]
\[ x = \frac{2 \log 3 + \log 4}{2 \log 4 - \log 3} \]

• Distributive property to multiply.
• Collect like terms.
• Factor out \( x \).

\[ x = \frac{\log 9 + \log 4}{\log 16 - \log 3} \]

\[ \log (9)(4) \]

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1-8 ev. 0th. odd.
\[ x = \frac{\log_{16} 36}{\log_{143} 36} \]

Calculator: 2.14

Exact form: \( \log_{143} 36 \)