Precalculus
Logarithmic equations involving quadratics

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Example

Solve the equation.

$$\log_3(2x^2 + 1) = 2$$

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| Exponentiate base 3

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$$\begin{aligned} \log_3(2x^2+1) &= 2 && \text{Exponentiate base 3} \\ 3^{\log_3(2x^2+1)} &= 3^2 \\ 2x^2+1 &= 9 \\ 2x^2 &= 8 \end{aligned}$$

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$$
\begin{array}{rcll}
\log_3(2x^2+1) & = & 2 & \text{Exponentiate base 3} \\
3^{\log_3(2x^2+1)} & = & 3^2 & \\
2x^2+1 & = & 9 & \\
2x^2 & = & 8 & \\
x^2 & = & \dfrac{8}{2}=4 & \\
x & = & \pm\sqrt{4}=\pm 2 & \\
x=2 & \text{or} & x=-2 & \text{final answer}
\end{array}
$$