## Exercise 277

For the following exercises, solve the exponential equation exactly.

$$e^{3x} - 15 = 0$$

---

**Solution**

There are three properties of logarithms to know.

$$\ln(ab) = \ln a + \ln b \tag{1}$$

$$\ln\left(\frac{a}{b}\right) = \ln a - \ln b \tag{2}$$

$$\ln a^b = b \ln a \tag{3}$$

Property (3) is most useful for solving equations in which the variable is in an exponent.

$$e^{3x} - 15 = 0$$

Isolate the term with the variable.

$$e^{3x} = 15$$

Since the base is $e$, take the natural logarithm of both sides.

$$\ln e^{3x} = \ln 15$$

Use property (3) to bring the variable down in front.

$$3x \ln e = \ln 15$$

Solve for $x$.

$$x = \frac{\ln 15}{3 \ln e} = \frac{\ln 15}{3} \approx 0.903$$