

# Section 5.4: Solving Equations

Thursday, November 20, 2014  
8:42 AM

Solving exponential equations:

$$3^{5-x} = 81$$

$$3^{5-x} = 3^4$$

$$5-x = 4$$

$$\boxed{x = 1}$$

} if bases match,  
the exponents  
match

$$\text{or } \boxed{\{1\}}$$

$$3^{5+x} = 79$$

$$3^{5+x} = 79$$

$$5+x = \log_3 79$$

$$x = \log_3 79 - 5$$

$$= \frac{\log 79}{\log 3} - 5$$

$$\approx -1.02276$$

exact

$$3^{5+x} = 79$$

$$\log 3^{5+x} = \log 79$$

$$(5+x)\log 3 = \log 79$$

$$5+x = \frac{\log 79}{\log 3}$$

$$x = \frac{\log 79}{\log 3} - 5$$

note:  $\log_3 79 - 5$

~~$\log_3 74$~~

$\sqrt{79} - 5 \neq \sqrt{74}$

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Solve, giving an exact answer and a decimal approx to 3 places

$$e^{3x} = 0.573$$



$$e^{3x} = 0.573$$

$$3x = \ln 0.573$$

$$x = \frac{1}{3} \ln 0.573$$

$$\approx -0.185623$$

$$\approx -0.186$$

$$e^{3x} = 0.573$$

$$\ln e^{3x} = \ln 0.573$$

$$3x \ln e = \ln 0.573$$

$$3x = \ln 0.573$$

as before

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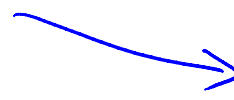
What if there's a coefficient?

$$3e^{2x} = 12$$

easy way



hard way



$$3e^{2x} = 12$$

$$e^{2x} = 4$$

$$2x = \ln 4$$

$$x = \frac{1}{2} \ln 4 \quad \leftarrow \text{acceptable}$$

$$= \ln 4^{\frac{1}{2}}$$

$$= \ln 2$$

$$\ln(3e^{2x}) = \ln 12$$

$$\ln 3 + \ln e^{2x} = \ln 12$$

$$\ln 3 + 2x \ln e = \ln 12$$

$$\ln 3 + 2x = \ln 12$$

$$2x = \ln 12 - \ln 3$$

$$2x = \ln \frac{12}{3}$$

$$2x = \ln 4$$

} and so on

divide by coefficient first!

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solving equations with logs:

$$\log_3 (x-8) = \log_3 (3x-28)$$

$$x-8 = 3x-28$$

$$20 = 2x$$

$$\boxed{x = 10}$$

Why? one-to-one property for logs

if  $\log_a M = \log_a N$ , then  $M = N$

what if there's only one log?

$$\log_3 (1-x) = 2$$

$$1-x = 3^2$$

$$1-x = 9$$

$$-8 = x$$

$$x = -8$$

check:  $\log_3 9 = 2$  ✓