Section 5.4: Solving Equations

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8:42 AM

Solving exponential equations:

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

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

$$5 - x = 4$$

} if bases match, the exponents match

$$\boxed{x = 1} \quad \text{or} \quad \boxed{\{1\}}$$

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

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$$5 + x = \log_3 79$$

$$x = \log_3 79 - 5$$

exact

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

$$\approx -1.02276$$

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

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

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

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

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

note: $\log_3 79 - 5 \neq \log_3 74$

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

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

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

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$3x = \ln 0.573$

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

≈ -0.185623

≈ -0.186

$e^{3x} = 0.573$

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

$3x \ln e = \ln 0.573$ (ln e = 1)

$3x = \ln 0.573$

{ as before

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what if there's a coefficient?

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

easy way

hard way

$3e^{2x} = 12$

$e^{2x} = 4$

$2x = \ln 4$

$x = \frac{1}{2}\ln 4$ ← 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: $\log_3 9 = 2$ ✓