

Exponential Equations

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Ditto 4.1

1) \$1.16 Million

2) a) $C(t) = 150(1.08)^t$
b) \$277.64

$$25,600 : 25(2)^{t/2}$$

$$1024 = 2^{t/2}$$

3) 9.1%

4) 20 days

5) a) 23 years 22.5
b) 22 1/4 years 22.1

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Exponential Equations

PreCalc
Unit 4 Day 7An exponential equation is an equation in which the variable is in the exponent.

When bases are not the same, follow these steps:

Steps:

Example:

- Express each side of the equation in terms of the same base.
- Set the exponents equal.
- Solve.

$$2^{x-3} = 64$$

$$2^{x-3} = 2^6$$

$$x-3 = 6$$

$$x = 9$$

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Solve.

1. $4^{2x-3} = 4^{x+1}$

$$\frac{2x-3}{x} = \frac{x+1}{4} \quad \{4\}$$

$$2x-3 = x+1$$

$$x = 4$$

2. $5^{1-3x} = 25^x$

$$5^{1-3x} = 5^{2x}$$

$$1-3x = 2x$$

$$+3x \quad +3x$$

$$1 = 5x$$

$$x = \frac{1}{5} \quad \left\{ \frac{1}{5} \right\}$$

3. $9^x = 27^{x-1}$

$$3^{2x} = 3^{3(x-1)}$$

$$2x = 3x-3$$

$$\frac{-2x}{-2x} = \frac{3x-3}{-2x}$$

$$-x = -3$$

$$x = 3$$

4. $81^{3x+3} = 9$

$$9^{2(3x+3)} = 9^1$$

$$6x+6 = 1$$

$$6x = -5$$

$$x = -\frac{5}{6} \quad \left\{ -\frac{5}{6} \right\}$$

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5. $125^{-2x} = 25^{x+1}$

$$5^{3(-2x)} = 5^{2(x+1)}$$

$$\frac{-6x}{-2x} = \frac{2x+2}{-2x}$$

$$\frac{-8x}{-8} = \frac{2}{-8}$$

$$x = -\frac{1}{4}$$

6. $\left(\frac{1}{16}\right)^x = 64^{1-x}$

$$4^{-2x} = 4^{3(1-x)}$$

$$\frac{-2x}{-2x} = \frac{3-3x}{-2x}$$

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

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

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If you can't get a common base...

Steps:

- Isolate the exponential term
- Take the log of both sides. ($\ln$ if e)
- Use the power rule.
- Isolate the variable.
- Use calculator!

$9^x = 43$

$$\log 9^x = \log 43$$

$$x \log 9 = \log 43$$

$$\frac{\log 9}{\log 9} = \frac{\log 43}{\log 9}$$

$$x \approx 1.712$$

$$9^x = 43 \rightarrow \log_9 43 = x$$

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Solve. Round all answers to the nearest thousandth. *Alpha Window*

1. $5^{2x} = 15$
 $\frac{2x \log 5}{2 \log 5} = \frac{\log 15}{2 \log 5}$ $\log_5 15 = 2x$
 $x = \frac{\log 15}{2}$
 $x = .841$

3. $6 = e^t$
 $\log_e 6 = t$
 $t = \ln 6$
 $t = 1.792$

2. $\frac{8 \cdot 13^x}{8} = \frac{61}{8}$
 $13^x = \frac{61}{8}$
 $\log_{13} \frac{61}{8} = x$
 $\frac{x \log 13 = \log \frac{61}{8}}{\log 13}$
 $x = .792$

4. $14 = 2e^{3t}$
 $7 = e^{3t}$
 $\log_e 7 = 3t$
 $\frac{\log_e 7}{3} = t$
 $t = .649$

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5. $6^{x+1} = 7^{2-x}$
 $\log 6^{x+1} = \log 7^{2-x}$ $\log_e = \ln$
 $(x+1) \log 6 = (2-x) \log 7$
 $x \log 6 + \log 6 = 2 \log 7 - x \log 7$
 $x \log 6 + x \log 7 = 2 \log 7 - \log 6$
 $x(\log 6 + \log 7) = 2 \log 7 - \log 6$
 $x = \frac{2 \log 7 - \log 6}{\log 6 + \log 7}$
 $x = .562$

6. $-4e^{2x-3} + 1 = -59$
 $-4e^{2x-3} = -60$
 $e^{2x-3} = 15$
 $\ln e^{2x-3} = \ln 15$
 $2x-3 = \ln 15$
 $2x = \ln 15 + 3$
 $x = \frac{\ln 15 + 3}{2}$
 $x = 2.854$

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