Equation Solving and Modeling

Students will solve exponential equations that cannot be solved using One-to-One properties.

Honors Precalculus

Day 1 Key

One-to-One Properties

How do you solve exponential equations?

For any exponential function $f(x) = b^x$

If $b^u = b^v$, then $u = v$

Example 1: Solve

a. $6(2^x) = 24$.

$2^x = 4$

$2^x = 2^2$

$x = 2$

b. $1 + 5(3^{x-4}) = 46$

$5(3^{x-4}) = 45$

$3^{x-4} = 9$

$3^{x-4} = 3^2$

$x - 4 = 2$

$x = 6$

How do you solve exponential equations if you can't get the bases to match?

If you cannot use the above method, you can use logarithms to solve an exponential equation.

1. Isolate the exponential expression (if necessary).
2. Take the logarithm of both sides of the equation.
3. Use "basic" algebra to finish solving for the unknown.

Example 2: Solve

a. $5^x = 134$

$\log_5 134 = x$

$x = 3.043$

b. $2.13^x = 6.4$

$\log_{2.13} 6.4 = x$

$x = 2.455$

c. $3(5^x) = 72$

$5^x = 24$

$\log_5 24 = x$

$x = 1.975$

d. $15 + 7(8^x) = 99$

$7(8^x) = 84$

$8^x = 12$

$\log_8 12 = x$

$x = 1.195$

e. $5e^x = 35$

$e^x = 7$

$\ln 7 = x$

$x = 1.946$

3.5 Equation Solving and Modeling

Students will solve exponential equations that cannot be solved using One-to-One properties.

Honors Precalculus

Day 1

Your turn—solve the equations for *x*.

5. $4^x = 17$

$\log_4 17 = x$

$x = 2.044$

6. $5^{x-1} = 7$

$\log_5 7 = x - 1$

$x = 2.209$

7. $15 + 3^x = 25$

$3^x = 10$

$\log_3 10 = x$

$x = 2.096$

8. $4 - 3(2^{x+5}) = -11$

$-3(2^{x+5}) = -15$

$2^{x+5} = 5$

$\log_2 5 = x + 5$

$x = -2.678$

9. $4 + 7e^{3x} = 32$

$7e^{3x} = 28$

$e^{3x} = 4$

$\ln 4 = 3x$

$x = 0.462$

Solving Exponential Equations
Using Properties of Logarithms

Name_____

Solve each exponential equation for x.

1. $3^x = 7$

$\log_3 7 = x$

$1.771 = x$

2. $13^x = 129$

$\log_{13} 129 = x$

$1.895 = x$

3. $5(7^x) = 125$

$7^x = 25$

$\log_7 25 = x$

$1.654 = x$

4. $5 + 9^x = 32$

$9^x = 27$

$\log_9 27 = x$

$1.5 = x$

5. $12^x - 4 = 14$

$12^x = 18$

$\log_{12} 18 = x$

$1.163 = x$

6. $6 - 4(2^x) = 5$

$-4(2^x) = -1$

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

$\log_2\left(\frac{1}{4}\right) = x$

$x = -2$

7. $e^x = 32$

$\ln 32 = x$

$3.466 = x$

8. $2e^x = 48$

$e^x = 24$

$\ln 24 = x$

$3.178 = x$

9. $1 + 3e^x = 37$

$3e^x = 36$

$e^x = 12$

$\ln 12 = x$ $2.485 = x$

10. $7e^x - 12 = 51$

$7e^x = 63$

$e^x = 9$

$\ln 9 = x$

$2.197 = x$

11. $6^{(x-5)} = 13$

$\log_6 13 = x - 5$

$\log_6(13) + 5 = x$

$6.432 = x$

12. $3(5^{(2x-3)}) = 27$

$5^{(2x-3)} = 9$

$\log_5 9 = 2x - 3$ $2.183 = x$

$\frac{(\log_5 9) + 3}{2} = x$

13. $14 + 5(7^{(x+1)}) = 29$

$5(7^{x+1}) = 15$

$7^{x+1} = 3$

$\log_7 3 = x + 1$

$(\log_7 3) - 1 = x$

$-0.435 = x$

14. $7 - 9e^{(x-5)} = -2$

$-9e^{x-5} = -9$

$e^{x-5} = 1$

$\ln 1 = x - 5$

$(\ln 1) + 5 = x$

$5 = x$

15. $12 + 2e^{(4x-7)} = 22$

$2e^{4x-7} = 10$

$e^{4x-7} = 5$

$\ln 5 = 4x - 7$

$\frac{(\ln 5) + 7}{4} = x$

$2.152 = x$