

## U4 Day 6 - Solving Exponential Equations

SWBAT: \_\_\_\_\_

### Using Logs to Solve Exponential Functions

1. Isolate the exponential function
2. Take the common log of both sides
3. Solve for x

<p>1. <math>e^{2x} = 8</math></p> $\frac{2x}{2} = \frac{\ln 8}{2}$ $x = \ln 8 / 2 \approx 1.04$	<p>2. <math>2e^x = 8</math></p> $\frac{2}{2} \frac{e^x}{2} = \frac{8}{2}$ $e^x = 4$ $x = \ln 4 \approx 1.39$
<p>3. <math>2e^x = 4</math></p> $\frac{2}{2} \frac{e^x}{2} = \frac{4}{2}$ $e^x = 2$ $x = \ln 2 \approx .693$	<p>4. <math>5^{x+1} = 25</math></p> $\log_5 5^{x+1} = \log_5 25$ $x+1 \log_5 5 = 2$ $x+1 = 2$ $x = 1$
<p>5. <math>5 + 2^{x+6} = 9</math></p> $\frac{-5}{-5} \frac{2^{x+6}}{-5} = \frac{9}{-5}$ $2^{x+6} = 4$ $\log_2 2^{x+6} = \log_2 4$ $(x+6) \log_2 2 = 2$ $(x+6) \cdot 1 = 2$ $x+6 = 2$ $x = -4$	<p>6. <math>4^x - 5 = 3</math></p> $\frac{+5}{+5} \frac{4^x}{+5} = \frac{8}{+5}$ $4^x = 8$ $\log_4 4^x = \log_4 8$ $x \log_4 4 = \log_4 8$ $x = \log_4 8$ $x = 1.5$
<p>7. <math>e^{3x} = 124</math></p> $3x = \ln 124$ $x = \frac{\ln 124}{3} = 1.61$	<p>8. <math>\frac{12e^{3x-2}}{12} = \frac{8}{12}</math></p> $e^{3x-2} = 2/3$ $3x-2 = \ln(2/3)$ $\frac{+2}{+2} \frac{3x-2}{+2} = \frac{\ln(2/3)+2}{+2}$ $3x = \ln(2/3) + 2$ $x = \frac{\ln(2/3) + 2}{3}$
<p>9. <math>4^{3x+2} = 3</math></p> $\frac{-2}{-2} \frac{4^{3x+2}}{-2} = \frac{3}{-2}$ $4^{3x} = 1$ $3x = \log_4 1$ $3x = 0$ $x = 0$	<p>10. <math>2^{3x-2} = 15</math></p> $\frac{+2}{+2} \frac{2^{3x-2}}{+2} = \frac{15}{+2}$ $2^{3x} = 15$ $3x = \log_2 15$ $x = \frac{\log_2 15}{3}$ $x = 1.30$
<p>11. <math>5^{2x+7} - 1 = 8</math></p> $\frac{+1}{+1} \frac{5^{2x+7}}{+1} = \frac{9}{+1}$ $5^{2x+7} = 9$ $.682$ $2x+7 = \log_5 9$ $\frac{-7}{-7} \frac{2x+7}{-7} = \frac{\log_5 9 - 7}{-7}$ $2x = \log_5 9 - 7$ $x = \frac{\log_5 9 - 7}{2}$	<p>12. <math>7 - 2^{x+7} = 5</math></p> $\frac{-7}{-7} \frac{7 - 2^{x+7}}{-7} = \frac{5}{-7}$ $-2^{x+7} = -2$ $2^{x+7} = 2$ $x+7 = 1$ $x = -6$ $x+7 = 1$

### Solve Exponential Equations Using a Calculator

1. Set the equation equal to zero
2. Graph in Y=
3. Find the zeros!

<p>13. <math>7 - 5^{2x-1} = 4</math></p> <p style="margin-left: 20px;">-4                  -4</p> <p style="margin-left: 40px;"><math>3 - 5^{2x-1} = 0</math></p> <p style="margin-left: 100px;"><math>x = .841</math></p>	<p>14. <math>4e^{2x} = 5</math></p> <p style="margin-left: 20px;">-5   -5</p> <p style="margin-left: 40px;"><math>4e^{2x} - 5 = 0</math></p> <p style="margin-left: 100px;"><math>.112</math></p>
<p>15. <math>5^x + 4 = 8</math></p> <p style="margin-left: 20px;">-8   -8</p> <p style="margin-left: 40px;"><math>5^x - 4 = 0</math></p> <p style="margin-left: 100px;"><math>x = .861</math></p>	<p>16. <math>3^{(x+8)} = 12</math></p> <p style="margin-left: 20px;">-12   -12</p> <p style="margin-left: 40px;"><math>3^{(x+8)} - 12 = 0</math></p> <p style="margin-left: 100px;"><math>x = -5.738</math></p>

### Reminder: Change of Base Formula

$$\log_m n = \frac{\log n}{\log m}$$

Evaluate using the change of base formula - round to 2 decimal places.

<p>17. <math>\log_2 7</math></p> <p style="margin-left: 40px;"><math>\frac{\log 7}{\log 2} \approx 2.807</math></p>	<p>18. <math>\log_7 75</math></p> <p style="margin-left: 40px;"><math>\frac{\log 75}{\log 7} \approx 2.219</math></p>
<p>19. <math>\log_5(1/10)</math></p> <p style="margin-left: 40px;"><math>\frac{\log(.1)}{\log 5} = -1.431</math></p>	<p>20. <math>\log_{2.9} 7.5</math></p> <p style="margin-left: 40px;"><math>\frac{\log 7.5}{\log 2.9} \approx 1.892</math></p>

$$\frac{\log(.1)}{\log 5}$$