Key

Solving Exponential Equations Using Logarithms

Use the properties of logarithms to solve the exponential equations.

1) $2^x = 45$

$x \cdot \log 2 = \log 45$

$x = \frac{\log 45}{\log 2} = \boxed{5.49}$

2) $3^x = 3.6$

$x \cdot \log 3 = \log 3.6$

$x = \frac{\log 3.6}{\log 3} = \boxed{1.17}$

3) $10^{2y} = 52$

$2y \cdot \log 10 = \log 52$

$2y = 1.1716$

$y = \boxed{.858}$

4) $7^{3y} = 126$

$3y \cdot \log 7 = \log 126$

$3y = 2.485357$

$\boxed{y = .8284}$

5) $3^{x+4} = 6$

$(x+4) \cdot \log 3 = \log 6$

$x + 4 = 1.6309$

$\boxed{x = -2.369}$

6) $10^{x+6} = 250$

$(x+6) \log 10 = \log 250$

$x + 6 = 2.3979$

$\boxed{x = -3.6}$

7) $3e^x = 42$

$e^x = 14$

$x = \ln(14)$

$\boxed{x = 2.639}$

8) $\frac{1}{4}e^x = 5$

$e^x = 20$

$x = \ln(20)$

$\boxed{x = 2.996}$

9) $\frac{1}{2}e^{3x} = 20$

$e^{3x} = 40$

$3x = \ln(40)$

$3x = 3.688$

$\boxed{x = 1.229}$

10) $250(1.04)^x = 1000$

$1.04^x = 4$

$x \cdot \log(1.04) = \log(4)$

$x = \frac{\log(4)}{\log(1.04)} = \boxed{35.35}$

11) $300e^{\frac{x}{2}} = 9000$

$e^{\frac{x}{2}} = 30$

$\frac{x}{2} = \ln(30)$

$\frac{x}{2} = 3.401$

$\boxed{x = 6.802}$

12) $1000^{0.12x} = 25000$

$.12x \cdot \log 1000 = \log 25000$

$.12x = 1.4659$

$\boxed{x = 12.217}$

13) $\frac{1}{5}\left(4^{x+2}\right) = 300$

$4^{x+2} = 1500$

$(x+2) \cdot \log 4 = \log 1500$

$x + 2 = 5.275$

$\boxed{x = 3.275}$

14) $6 + 2^{x-1} = 1$

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

$(x-1) \cdot \log 2 = \log(-5)$

No solution

15) $7 + e^{2-x} = 28$

$e^{2-x} = 21$

$2 - x = \ln(21)$

$-x = 1.0445$

$\boxed{x = -1.0445}$

16) $8-12e^{-x}=7$

$-12e^{-x}=-1$

$12e^{-x}=1$

$-x=\ln(\frac{1}{12})$

$\boxed{x=2.485}$

17) $4+e^{2x}=10$

$e^{2x}=6$

$2x=\ln(6)$

$\boxed{x=.8958}$

18) $32+e^{7x}=46$

$e^{7x}=14$

$7x=\ln(14)$

$\boxed{x=0.377}$

19) $23-5e^{x+1}=3$

$-5e^{x+1}=-20$

$e^{x+1}=4$

$x+1=\ln(4)$

$\boxed{x=.386}$

20) $4\left(1+e^{\frac{x}{3}}\right)=84$

$1+e^{x/3}=21$

$e^{x/3}=20$

$\frac{x}{3}=\ln(20)$ $\boxed{x=8.987}$

23) The population P of a city is given by the function $P = 2500e^{kt}$, where $t = 0$ represents the year 1990. In 1945 the population was 1350. Find the value of k, and use this value to predict the population in the year 2010.

45 years ago

($t=-45$) $1350=2500e^{(k\cdot -45)}$

$.54=e^{-45k}$

$\ln(.54)=-45\cdot k$

$.01369=k$

$P=2500e^{(.01369\cdot 20}$

$P=3287.58\approx$ $\boxed{3287}$

Solve each equation

24. $4^{1-2x}=2$

$(1-2x)\cdot\log 4=\log 2$

$1-2x=.5$

$-2x=-.5$

$\boxed{x=.25}$

25. $5^x=3^{x+2}$

$\frac{x\cdot\log 5}{\log 3}=\frac{(x+2)\log 3}{\log 3}$

$1.465x=x+2$

$.465x=2$

$\boxed{x=4.301}$

26. $9^{2x}=27^{3x-4}$

$\frac{2x\cdot\log 9=(3x-4)\cdot\log 27}{\log 27}$

$1.33x=3x-4$

$-1.66x=-4$ $\boxed{x=2.4}$

27. $e^{1-x}=5$

$1-x=\ln(5)$

$-x=.6094$

$x=-.6094$

28. $2^{3x}=3^{2x+1}$

$\frac{3x\cdot\log 2}{\log 3}=\frac{(2x+1)\cdot\log 3}{\log 3}$

$1.8927x=2x+1$

$-.1072x=1$

$\boxed{x=-9.327}$