

Sec 4.4 Solving Exponential Equations

Solve-

$$10^x = 8.07$$

$$\log 10^x = \log 8.07 \quad e^x = .83$$

$$x \log 10 = \log 8.07 \quad \ln e^x = \ln .83$$

$$x = \log 8.07 \quad x = \ln .83$$

$$\approx .907$$

-steps-
*isolate base

*log/ln
both sides

expand

*solve
resulting
equation

. . .

$$e^{4x-5} - 7 = 11,243$$

$$\ln e^{4x-5} = \ln 11250$$

$$\begin{array}{lcl} 4x-5 & = \ln 11250 & \downarrow +5 \\ x \approx 3.58 & & \div 4 \end{array}$$

$$7^{2x+1} = 3^{x+2}$$

$$\log 7^{2x+1} = \log 3^{x+2}$$

$$(2x+1)\log 7 = (x+2)\log 3$$

$$1.69x + .845 = .477x + .954$$

$$1.213x = .109$$

$$x \approx .089$$

∴

$$e^{2x} - 2e^x - 3 = 0$$
$$(e^x)^2 - 2e^x - 3$$

Use "u" substitution

$$\text{Let } u = e^x$$

$$u^2 - 2u - 3 = 0$$

$$(u - 3)(u + 1) = 0$$

$$u = 3 \quad \text{or} \quad u = -1$$

reverse your
substitution-

$$\ln 3 = \ln e^x$$

$$\boxed{\ln 3 = x}$$

$$\ln -1 = \ln e^x$$

$$= x \cancel{\ln e}$$

$$\ln -1 = x$$

~~x~~

$$e^{4x} - 3e^{2x} - 18 = 0$$

Rewrite-
 $(e^{2x})^2 - 3e^{2x} - 18 = 0$
 So, let $u = e^{2x}$

$$2^{2x} + 2^x - 12 = 0$$

Rewrite-
 $(2^x)^2 + 2^x - 12 = 0$
 Let $u = 2^x$

$$\begin{cases} u^2 + u - 12 = 0 \\ (u+4)(u-3) = 0 \\ u = -4 \text{ & } 3 \\ 3 = 2^x \\ \log 3 = \log 2^x \\ \frac{\log 3}{\log 2} = x \log 2 \\ x \approx 1.58 \end{cases}$$

now -4

$$-4 = 2^x$$

$$\log -4 = \log 2^x$$

cannot

$$\begin{cases} u^2 - 3u - 18 = 0 \\ (u-6)(u+3) = 0 \\ u = 6 \text{ & } -3 \\ 6 = e^{2x} \end{cases}$$

take log
of a
negative
so no
solution
here

$$\ln 6 = \ln e^{2x}$$

$$\begin{cases} \ln 6 = 2x \\ \frac{\ln 6}{2} = x \end{cases}$$

one answer

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

$$\begin{cases} \ln -3 = \ln e^{2x} \\ \text{cannot, so no solution here} \end{cases}$$

Suggested Practice
Sec 4.4 page 490
23-47
odds

$$23. .59$$

$$31. 1.3$$

$$39. 11.48$$

$$25. 1.74$$

$$33. -1.14$$

$$41. -2.8$$

$$\left. \begin{array}{l} \\ \\ \end{array} \right\} 47.0$$

$$27. 1.76$$

$$35. 2.45$$

$$43. .69$$

$$29. 1.53$$

$$37. 1.09$$

$$45. .55$$

