4.4 cont'd

68. The learning curve is given by the function $P(t) = M - Ce^{-kt}$.

a) Express the learning time as a function of P.

We want to solve $P = M - Ce^{-kt}$ for t.

$$P = M - Ce^{-kt}$$
$$P - M = -Ce^{-kt}$$
$$\frac{P-M}{-C} = e^{-kt}$$

Now we have moved everything not involving t to the left and have all the t's on the right.

$$\ln\left(\frac{P-M}{-C}\right) = \ln e^{-kt}$$
$$\ln\left(\frac{P-M}{-C}\right) = -kt$$
$$t = \frac{1}{-k}\ln\left(\frac{P-M}{-C}\right)$$
$$= \frac{1}{-k}\ln\left(\frac{M-P}{C}\right)$$
$$= \ln\left(\frac{M-P}{C}\right)^{-\frac{1}{k}}$$

This is good enough, but we could simplify, since $\frac{P-M}{-C} = \frac{M-P}{C}$.

Thus $t(P) = \ln\left(\frac{M-P}{C}\right)^{-\frac{1}{k}}$.

"t of P"

b) Use the formula from part a using $M = 20$, $C = 14$, $k = 0.024$, $P = 12$.
You should get $t = 23.32$ months.

69, 76 Use the graphing calculator to find the intersections of the two graphs. Be sure you find all of them by zooming out far enough. For 76 you should get $x = -0.8856$ and $x = 0.7059$

79. $2 < 10^x < 5$

$$\log 2 < \log 10^x < \log 5$$
$$\log 2 < x \log 10 < \log 5$$
$$\log 2 < x < \log 5$$

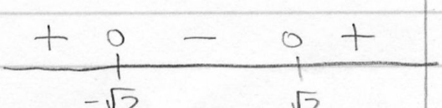
Applying log does not change the direction of the inequalities.

80. $x^2e^x - 2e^x < 0$

$$(x^2 - 2)e^x < 0$$

Use a sign chart and check certain values.

$x^2 - 2 = 0$ when $x = \pm\sqrt{2}$. $e^x > 0$ for all x, so $e^x \neq 0$ for any x.



Therefore $x^2e^x - 2e^x < 0$ for the interval $(-\sqrt{2}, \sqrt{2})$

4.4

50. $\ln(x-1)+\ln(x+2)=1$

$\ln((x-1)(x+2))=1$

$e^{\ln((x-1)(x+2))} = e^1$

$(x-1)(x+2)=e$

$x^2+x-2-e=0$

$x^2+x-(e+2)=0$

$x=\dfrac{-1\pm\sqrt{1-4\cdot1(-(e+2))}}{2}$

$=\dfrac{-1\pm\sqrt{1+4e+8}}{2}$

$=\dfrac{-1\pm\sqrt{9+4e}}{2}$

$x \approx 1.729$ and $x \approx -2.729$ are the solutions

52. $(\log x)^3 = 3\log x$

$(\log x)^3 - 3(\log x)=0$

$\log x((\log x)^2-3)=0$ Factor out a $\log x$.

So $\log x=0$ or $(\log x)^2-3=0$

$\log x=0$ means $x=1$

$(\log x)^2-3=0$ means $(\log x)^2=3$

$\log x = \pm\sqrt{3}$

$10^{\log x} = 10^{\pm\sqrt{3}}$

$x = 10^{-\sqrt{3}}$ or $10^{\sqrt{3}}$

Thus $x=1$, $10^{-\sqrt{3}}$, and $10^{\sqrt{3}}$ are the three values for which $(\log x)^3=3\log x$ is true.