§4.3 #s 50, 52, 62, 68, 70, 76, 78, 84, 98*

* Do 2 versions:

(1) Mattie says $A = P(1+r)^t$ (compounded annually) Book

(2) I say $A = Pe^{rt}$ (compounded continuously) Convenient

Version (2) should be a slightly smaller r-value.

§4.4 #s 44, 48, 54, 76 → K-Ar

After this, we jump to §8.1

Sequences, Series, *Geometric Series* * → Annuities

The value of a savings account into which money is being deposited monthly.

$$P(1+r)^n + P(1+r)^{n-1} + P(1+r)^{n-2} + \dots + P(1+r) + P$$

Animals invading an area & then breeding.

→ Monthly payment

→ Exponential Growth → Earning interest.

§ 4.3

one like #50 in yesterday's notes

#52 $\sqrt[3]{x-1} = (x-1)^{\frac{1}{3}}$

#67 $(1.06)^x = 2$

$\log_{1.06}(1.06^x) = \log_{1.06}(2)$

Change-of-Base

$x = \log_{1.06}(2)$

$= \dfrac{\log(2)}{\log(1.06)} = \dfrac{\ln(2)}{\ln(1.06)}$

$= \dfrac{\log_{13}(2)}{\log_{13}(1.06)} \approx 11.89566105$

≈ 11.8957

$= \dfrac{\frac{\ln(2)}{\ln(13)}}{\frac{\ln(1.06)}{\ln(13)}} = \dfrac{\ln(2)}{\ln(13)} \cdot \dfrac{\ln(13)}{\ln(1.06)} = \dfrac{\ln(2)}{\ln(1.06)}$

$3^x = 2$

$\log_3(3^x) = \log_3 2$

$x = \log_3 2$

$= \dfrac{\ln(2)}{\ln(3)}$

Since you KNOW there'll be a change of base, why not just do $\ln(*)$ to start?

#67 $(1.06)^x = 2$

$\log_{1.06}(1.06^x) = \log_{1.06}(2)$

Change-of-Base

$x = \log_{1.06}(2)$

$= \dfrac{\ln(2)}{\ln(1.06)}$

≈ 11.89566105

≈ 11.8957

$\ln(1.06^x) = \ln(2)$

$x \ln(1.06) = \ln(2)$

$x = \dfrac{\ln(2)}{\ln(1.06)}$

#83 $2\left(1+\frac{r}{12}\right)^{360} = 8.4$

$\sqrt[2]{x^2} = |x|$

$(x^2)^{\frac{1}{2}} = x$, if $x \geq 0$

$\left(1+\frac{r}{12}\right)^{360} = 4.2$

$\sqrt[360]{\left(1+\frac{r}{12}\right)^{360}} = \sqrt[360]{4.2} = 4.2^{\frac{1}{360}}$

$\left|1+\frac{r}{12}\right| = 4.2^{\frac{1}{360}}$

$1+\frac{r}{12} = \pm 4.2^{\frac{1}{360}}$

$\frac{r}{12} = -1 \pm 4.2^{\frac{1}{360}}$

$r = 12\left(-1 \pm 4.2^{\frac{1}{360}}\right)$

$r \approx .0479316234$

$r \approx -24.0479316 2$

TI-30 IIX or ... IIXS lets you do these in one step, like on my graphing calculator.

```
12*(-1+4.2^(1/36
0))
     .0479316234
12*(-1-4.2^(1/36
0))
    -24.04793162
█
```

4.4's

43 $e^{x+1} = 10^x$

$\ln(e^{x+1}) = \ln(10^x)$

$x+1 = x\ln(10)$

Let $b = \ln(10)$

$x+1 = bx$

$x - bx = -1$

$x(1-b) = -1$

$x = \dfrac{-1}{1-b} = \dfrac{-1}{1-\ln(10)}$

$\log(e^{x+1}) = \log(10^x)$

$(x+1)\log(e) = x$

Let $b = \log(e)$

$(x+1)b = x$

$bx + b = x$

$bx - x = -b$

$x(b-1) = -b$

$x = \dfrac{-b}{b-1}$

$= \dfrac{-\log(e)}{\log(e)-1}$

```
         -24.04793162
-1/(1-ln(10))
          .7677041641
-log(e^(1))/(log
(e^(1)-1)
         -1.847319574
-log(e^(1))/(log
(e^(1))-1)
```

here, I entered $\log(e-1)$. I got confused, because my calculator does "e^(1)" and "e" as lost track of parentheses.

```
          .7677041641
-log(e^(1))/(log
(e^(1)-1)
         -1.847319574
-log(e^(1))/(log
(e^(1))-1)
          .7677041641
```

Yes!

For #48:

$a^b a^c = a^{b+c}$

$3^{x^2-5} \cdot 3^{2x} \cdot 3^{27}$

$= 3^{x^2-5+2x+27} = 3^{x^2+2x+22}$

Back to §4.3 for a smidge.

Like #98 - See note about $P(1+r)^t$ and Pe^{rt} methods.

#97

Maverick (1970, 1995)

(2009, 10,890)

Use the compound interest formula to find annual INFLATION rate.

Book wants $A=P(1+r)^t$

Let t = time, in years after 1970

(0, 1995)

(39, 10890)

$$\begin{array}{r} 2009 \\ -1970 \\ \hline 39 \end{array}$$

$A = P(1+r)^t = A(t)$

$= 1995(1+r)^t$

And $A(39) = 1995(1+r)^{39} = 10890.$

Solve for r.

Take 39th root, at some point.

$A = Pe^{rt}$

$= 1995e^{rt} = A(t)$

$A(39) = 1995e^{39r} = 10890$

Solve for r

Involves ln at some point.