1. Solve the equation:
$$4^x = 3$$
$$\begin{aligned} \ln 4^x &= \ln 3 \\ x \cdot \ln 4 &= \ln 3 \\ x &= \frac{\ln 3}{\ln 4} \\ x &= .792481 \end{aligned}$$

2. Solve the equation:
$$7^{x+2} = 1$$
$$\begin{aligned} \ln 7^{x+2} &= \ln 1 \\ (x+2) \cdot \ln 7 &= 0 \\ x+2 &= 0 \\ x &= -2 \end{aligned}$$

3. Simplify the expression as much as possible:
$$\log_5 25$$
$$\log_5 25 = \log_5 5^2 = 2$$

4. Simplify the expression as much as possible:
$$\log_9 3$$
$$\log_9 3 = \log_9 \sqrt{9} = \log_9 9^{1/2} = \frac{1}{2}$$

5. A company starts selling a new product. After an initial burst of strong sales, the number of units sold begins to level off. The total number of sales (in thousands) during the t^{th} month (with the first month being $t = 1$) is given by
$$S(t) = 5(.9)^{3t}$$
How many units of this product did the company sell in the 4^{th} month?
$$\begin{aligned} S(4) &= 5(.9)^{(3)(4)} \\ &= 1.412 \end{aligned}$$
The company sold 1412 units.

6. For the company in problem 5, what is the first month in which the monthly sales figure is below 500 sales for this product?
$$\begin{aligned} .5 &= 5(.9)^{3t} \\ 0.1 &= (.9)^{3t} \\ \ln 0.1 &= \ln (.9)^{3t} \\ \ln 0.1 &= 3t \cdot \ln 0.9 \\ 3t &= \frac{\ln 0.1}{\ln 0.9} \\ t &= \frac{\ln 0.1}{3 \ln 0.9} \\ &= 7.284781776 \end{aligned}$$

The 8th month. (Although, the 7th month is an acceptable answer under a particular interpretation of the problem.)

7. Suppose that a person opens a savings account with an initial balance of $5,000. If the annual interest rate is 4% compounded quarterly, how much is in the account after 2 years?

$$\begin{aligned} S &= P\left(1+\frac{r}{n}\right)^{nt} \\ &= 5000\left(1+\frac{0.04}{4}\right)^{(4)(2)} \\ &= \$5414.28 \end{aligned}$$

8. If you borrow $3500 from a bank and the bank charges an annual interest rate of 5% compounded continuously, how much do you owe the bank after 6 months?

$$\begin{aligned} S &= Pe^{rt} \\ &= 3500e^{(0.05)(1/2)} \\ &= \$3588.60 \end{aligned}$$

9. Bob borrowed some money from his aunt and uncle. They charged him an annual interest rate of 1% compounded continuously. After 5 years, Bob paid his aunt and uncle back with a check for $746.40. How much money did Bob borrow originally?

$$\begin{aligned} S &= Pe^{rt} \\ 746.40 &= Pe^{(0.01)(5)} \\ P &= \frac{746.40}{e^{0.05}} \\ &= \$710.00 \end{aligned}$$

10. What is the annual percentage yield (APY) for a savings account with an annual interest rate of 6% compounded 3 times a year?

Assume $100 is deposited for one year.

$$\begin{aligned} S &= P\left(1+\frac{r}{n}\right)^{nt} \\ &= 100\left(1+\frac{0.06}{3}\right)^{(3)(1)} \\ &= \$106.12 \end{aligned}$$

So, in one year $6.12 of interest is earned from $100.

$$\text{APY} = \frac{6.12}{100} = 0.0612 = 6.12\%$$

11. Sarah is saving for the future. She deposits $250 of her take-home pay at the end of each month in an account that gains interest at an annual rate of 4% compounded monthly. When Sarah retires

in 35 years, how much will she have in this account?

$$
\begin{aligned}
S &= R\left(\frac{(1+i)^h - 1}{i}\right) \\
&= 250\left(\frac{\left(1+\frac{0.04}{12}\right)^{(12)(35)} - 1}{\frac{0.04}{12}}\right) \\
&= \$228,432.73
\end{aligned}
$$

12. James and Tasha are interested in buying a house. They have $\$30,000$ for a down payment and the only loan they can get is a 30-year mortgage with an annual interest rate of 5.5% compounded monthly. If they buy a house that costs $\$180,000$, how much will their monthly payment be?

$$A = 180,000 - 30,000 = 150,000$$

$$
\begin{aligned}
R &= A\left(\frac{i}{1-(1+i)^{-h}}\right) \\
&= 150,000\left(\frac{\frac{0.55}{12}}{1-\left(1+\frac{0.55}{12}\right)^{-(12)(30)}}\right) \\
&= \$851.68
\end{aligned}
$$

13. Suppose the couple in problem 12 decides that the highest monthly payment they can afford is $1500. What is the most expensive house they can afford?

$$
\begin{aligned}
R &= A\left(\frac{i}{1-(1+i)^{-h}}\right) \\
1500 &= A\left(\frac{\frac{0.55}{12}}{1-\left(1+\frac{0.55}{12}\right)^{-(12)(30)}}\right) \\
A &= \frac{1500}{\left(\frac{\frac{0.55}{12}}{1-\left(1+\frac{0.55}{12}\right)^{-(12)(30)}}\right)} \\
&= \$264,182.64
\end{aligned}
$$

Since they have $30,000 to put down, they can afford a house worth $\$264,182.64 + \$30,000 = \$294,182.64$

14. Jerome gets an amortized car loan of $13,000 to be paid back with monthly payments over 5 years and an annual interest rate of 2% compounded monthly. How much does Jerome owe at the end of 2 years?

$$
\begin{aligned}
R &= A\left(\frac{i}{1-(1+i)^{-h}}\right) \\
&= 13,000\left(\frac{\frac{0.02}{12}}{1-\left(1+\frac{0.02}{12}\right)^{-(12)(5)}}\right) \\
&= \$227.86
\end{aligned}
$$

$$
\begin{aligned}
U &= R\left(\frac{1-(1+i)^{k-h}}{i}\right) \\
&= 227.86\left(\frac{1-\left(1+\frac{0.02}{12}\right)^{(12)(2)-(12)(5)}}{\frac{0.02}{12}}\right) \\
&= \$7955.29
\end{aligned}
$$

15. How much does Jerome pay in interest for the entire loan in problem 14?

$$\text{Altogether he pays } (227.86)\,(12)\,(5) = \$13,671.60$$

Since the original loan amount was $13,000, he has paid $671.60 in interest.