1. Suppose you put a single deposit of $5,000 into a CD with an APR of 6%, compounded daily. How much money will you have in 3 years?

Single Deposit $\Rightarrow$ Use the General Compound Interest Formula.

$$A = P \times \left(1 + \frac{APR}{n}\right)^{n \cdot Y} = \$5{,}000 \times \left(1 + \frac{.06}{365}\right)^{365 \cdot 3} = \boxed{\$5986.00}$$

$n = 365$ because of daily compounding

2. Find the approximate doubling time for the population of Arizona, which increases by 0.3% per year.

Use the "Rule of 70" $\quad T_d = \frac{70}{P\%} = \frac{70}{0.3} = \boxed{233.\overline{33} \text{ years}}$

3. Suppose there are 3 bacteria in a bottle at 5pm and that the doubling time for bacteria is 3 minutes. How many bacteria will there be in the bottle at 5:09pm?

$$NV = IV \times 2^{t/T_d}$$

$$NV = 3 \times 2^{9/3} = \boxed{24}$$

"t" = 9 minutes since the difference between 5:09 and 5:00 is 9 minutes.

T_d = 3 minutes (the doubling time)

4. You have a car loan of $7,500 at a fixed APR of 5.8% for 3 years. Calculate your monthly payments and **next** calculate the total amount that you paid in interest over 3 years.

Use the Loan Payment Formula

$$Pmt = \frac{P \times \left(\frac{APR}{n}\right)}{\left[1-\left(1+\frac{APR}{n}\right)^{-nY}\right]} = \frac{\$7{,}500 \times \left(\frac{.058}{12}\right)}{\left[1-\left(1+\frac{.058}{12}\right)^{-3\cdot 12}\right]} = \boxed{\$227.49}$$

$\$227.49 \times 3 \times 12 = \$8{,}189.64$ Interest $= 8189.64 - 7{,}500 = \boxed{\$689.64}$

5. You set up an IRA (individual retirement account) with an APR 7% at age 30. At the end of each month, you deposit $100 in the account. How much money will you have in the account when you retire at the age of 60?

Use the Savings Plan Formula

$Y = 60 - 30 = \boxed{30}$

$$A = \$100 \times \left[\frac{\left(1+\frac{.07}{12}\right)^{12\cdot 30} - 1}{\frac{.07}{12}}\right] = \boxed{\$121{,}997.10}$$

6. You have $20,000 to deposit into a savings account. Which out of the following options is your best choice for your savings account?

   (a) Quarterly compounding with an APR of 4.0%.

   (b) Daily compounding with an APR of 3.9%.

Accumulated after 1 year (a) $A = P \times \left(1 + \frac{APR}{4}\right)^{4\cdot 1}$

(b) $A = P \times \left(1 + \frac{APR}{365}\right)^{365\cdot 1}$

$\Rightarrow$ the answer is independent of the principal amount.

Compare $\left(1+\frac{.04}{4}\right)^4 = \boxed{1.0406}$ to $\left(1+\frac{.039}{365}\right)^{365} = \boxed{1.0398}$

$\boxed{APY \approx 4.06\%}$ $\boxed{APY \approx 3.98\%}$

Option (a) is better.

Relative Change   Absolute Change

7. Determine whether the following examples are exponential or linear growth (or decay).

   (a) The price of gasoline is increasing by 2 cents per month.

   Linear Growth

   (b) The price of my car is decreasing by 12% per year.

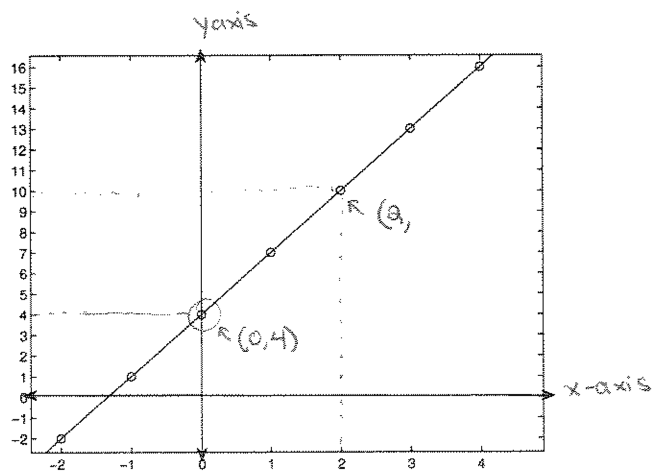
   Exponential Decay

   (c) The population of New Jersey is increasing by 2% per year.

   Exponential Growth

8. The following graph is the plot of a line.

line intersects y-axis at $y=4. \Rightarrow b=4$



   (a) Label the x-axis (independent variable) and the y-axis (dependent variable) on the plot above.

   (b) Find the y-intercept of the graph, b.

   $\boxed{b=4}$

   (c) Find the slope of the line m (i.e. the rate of change).

   Pick 2 points and find the "rise over the run".

   $m = \frac{\text{rise}}{\text{run}} = \frac{10-4}{2-0} = \frac{6}{2} = \boxed{3}$

   (d) Write the equation for the line as a function, $y = f(x) = mx + b$.

   $\boxed{y = 3x + 4}$

9. A savings account has an APR of 3.1% compounded quarterly. Find the APY (annual percentage yield) of this account.

$\Rightarrow n=4$

$$\left(1+\frac{APR}{n}\right)^n = (1+APY)^1 \Rightarrow APY = \left(1+\frac{.031}{4}\right)^4 - 1$$

$$= 0.03136$$

$$APY \approx 3.14\%.$$

10. The half-life of aspirin in your blood stream is 3.1 hours. What percent does it decrease by per hour (i.e. what is the rate or decay)?

Solve for "P" $\quad T_d = \frac{70}{P} \Rightarrow P = \frac{70}{3.1} = 22.6\% \leftarrow$ Higher than 15%!

$\Rightarrow$ Need exact formula. $\quad 2 = (1+r)^{T_H}$

$$2^{1/T_H} - 1 = r \Rightarrow 2^{1/3.1} - 1 = \boxed{25\%}$$

11. Using the information in the previous question answer the following question. If you take 2 aspirin (650mg) at 8 o'clock in the morning, at what time should you take a second dose? (Assume that you take the second dose when your headache returns - when there is only 100mg left in your bloodstream.)

$$NV = IV \times \left(\tfrac{1}{2}\right)^{t/T}$$

$$100mg = 650mg \times \left(\tfrac{1}{2}\right)^{t/3.1}$$

$T_{Half} = 3.1$ hours

We are solving for "t", the time at which the New Value $NV = 100mg$.

We need to use logarithms to solve this problem.

$$\frac{100}{650} = \left(\tfrac{1}{2}\right)^{t/3.1}$$

$$\log_{10}\left(\frac{100}{650}\right) = \frac{t}{3.1} \cdot \log_{10}\left(\tfrac{1}{2}\right)$$

$$\frac{3.1 \cdot \log_{10}\left(\frac{100}{650}\right)}{\log_{10}\left(\frac{1}{2}\right)} = t \Rightarrow \boxed{t = 8.37 \text{ hours}}$$