Cheat Sheet 2

Let \( A = \) accumulated balance after \( Y \) years
\( P = \) starting principal
\( APR = \) annual percentage rate (as a decimal)
\( n = \) number of compounding periods per year
\( Y = \) number of years (may be a fraction)
\( PMT = \) regular payment (deposit) amount
\( a = \) inflation rate (a decimal)
\( i = \) interest rate (a decimal)

Simple Interest Formula:
\[
A = P(1 + APR \cdot Y)
\]

Compound Interest Formula:
\[
A = P \left(1 + \left(\frac{APR}{n}\right)^n\right) Y
\]

Annual Percentage Yield: APY
\[
APY = \left(1 + \frac{APR}{n}\right)^n - 1
\]

Formula for Continuous Compounding:
\[
A = P \cdot e^{APR \cdot Y}
\]

Savings Plan Formula:
\[
A = PMT \cdot \frac{\left[\left(1 + \frac{APR}{n}\right)^{nY} - 1\right]}{\frac{APR}{n}}
\]

Total and Annual Return:
\[
total\ return = \frac{A - P}{P} \quad \text{annual\ return} = \left(\frac{A}{P}\right)^{(1/Y)} - 1
\]

Current Yield of a Bond:
\[
current\ yield = \frac{\text{annual\ interest\ payment}}{\text{current\ price\ of\ bond}}
\]

Loan Payment Formula:
\[
PMT = P \cdot \frac{\frac{APR}{n}}{1 - \left(\frac{1 + \frac{APR}{n}}{1 + a}\right)^{-nY}}
\]

The CPI Formula
\[
\frac{CPI_X}{CPI_Y} = \frac{\text{price}_X}{\text{price}_Y}
\]

The Present Value of a principal \( P \), \( Y \) years into the future, \( r=APR \), \( a=\text{annual\ inflation} \):
\[
A = P \cdot \left[\left(1 + \frac{r}{1+a}\right)^Y\right]
\]

Real Growth \( g \):
\[
g = \frac{r-a}{1+a}
\]

Real Growth over \( Y \) years:
\[
g(Y) = \left[1 + \frac{r-a}{1+a}\right]^Y - 1
\]

The Tax Table:

<table>
<thead>
<tr>
<th></th>
<th>single</th>
<th>m(joint)</th>
<th>m(separate)</th>
<th>head_household</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>1 - 7,550</td>
<td>1-15,100</td>
<td>1 - 7,550</td>
<td>10,751 - 11,050</td>
</tr>
<tr>
<td>15%</td>
<td>7,551 - 30,650</td>
<td>15,101 - 61,300</td>
<td>7,551 - 30,650</td>
<td>41,051 - 41,050</td>
</tr>
<tr>
<td>25%</td>
<td>30,651 - 74,200</td>
<td>61,301 - 123,700</td>
<td>30,651 - 61,850</td>
<td>106,051 - 106,000</td>
</tr>
<tr>
<td>28%</td>
<td>74,201 - 154,800</td>
<td>123,701 - 188,450</td>
<td>61,851 - 94,225</td>
<td>171,651 - 171,650</td>
</tr>
<tr>
<td>35%</td>
<td>336,551+</td>
<td>336,551+</td>
<td>168,276+</td>
<td>336,551+</td>
</tr>
</tbody>
</table>
The mean of $x_1, x_2, ... x_n$ is 
$$\mu = \frac{x_1 + x_2 + ... + x_n}{n}.$$ 

The variance $s^2$ of $x_1, x_2, ... x_n$ is 
$$s^2 = \frac{(x_1 - \mu)^2 + (x_2 - \mu)^2 + ... + (x_n - \mu)^2}{n-1}.$$ 

The standard deviation $s$ is the square root of the variance $s^2$. 

Quartiles of Normal Distributions: 
$$Q_1 = \text{mean} - 0.67 * s$$ 
$$Q_3 = \text{mean} + 0.67 * s$$ 

The 68 – 95 – 99.7 Rule for normal distributions: 
68% of the observations fall within 1 standard deviation of the mean. 
95% of the observations fall within 2 standard deviations of the mean. 
99.7% of the observations fall within 3 standard deviations of the mean.

Given data $(x_1, y_1), (x_2, y_2), ... (x_n, y_n)$, with means $\mu_x, \mu_y$ and standard deviations $s_x, s_y$. The correlation between variables $x$ and $y$ is 
$$r = \frac{1}{(n-1)s_x s_y} \left[ (x_1 - \mu_x)(y_1 - \mu_y) + (x_2 - \mu_x)(y_2 - \mu_y) + ... + (x_n - \mu_x)(y_n - \mu_y) \right].$$ 

The least squares regression line is 
$$y = ax + b,$$

where 
$$a = r \frac{s_y}{s_x} \text{ and } b = \mu_y - a\mu_x.$$ 

For a simple random sample of size $n$, the sample proportion of successes is 
$$p' = \frac{\text{count of successes in the sample}}{n}.$$ 

The mean of the sampling distribution is $p$ and the standard deviation is 
$$\sqrt{\frac{p(1-p)}{n}}.$$ 

The 68 – 95 – 99.7 Rule applies here as well.