Managing Money , Doubling Time , Half Life & Logistic Growth Formula Sheet

Simple Interest	Compounded Interest
$A = P(1+rt)$	$A = P\cdot\left(1+\frac{r}{n}\right)^{nt}$
$e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^{n} \approx 2.72$	**Compounded Continuously** $A = Pe^{rt}$
Loan Formula	
$P = PMT \times \frac{\left[1-\left(1+\frac{r}{n}\right)^{-nt}\right]}{\left(\frac{r}{n}\right)}$	$PMT = \frac{P\times\left(\frac{r}{n}\right)}{\left[1-\left(1+\frac{r}{n}\right)^{-nt}\right]}$
Saving Plan Formula	
$A = PMT \times \frac{\left[\left(1+\frac{r}{n}\right)^{nt}-1\right]}{\left(\frac{r}{n}\right)}$	$PMT = \frac{A\left(\frac{r}{n}\right)}{\left[\left(1+\frac{r}{n}\right)^{nt}-1\right]}$
Present Value of an Annuity (r = Interest rate Compounded Continuously)	**The Amount of an Annuity** (r = Interest rate Compounded Continuously)
$P = \frac{n(PMT)}{r}\times\left[1-e^{-rT}\right]$	$A = \frac{n(PMT)}{r}\times\left[e^{rT}-1\right]$
Annual Percentage Yield	**Annual Return**
$APY = \left[\left(1+\frac{r}{n}\right)^{n}-1\right]\times 100\%$	$\text{Annual Return} = \left(\frac{A}{P}\right)^{\frac{1}{t}}-1$
Doubling Time	**Half − Life**
$Q = Q_0\cdot(1+r)^t \Leftrightarrow T_{double} = \frac{\log_{10}2}{\log_{10}(1+r)}$	$Q = Q_0\cdot(1-r)^t \Leftrightarrow T_{half} = \frac{\log_{10}\left(\frac{1}{2}\right)}{\log_{10}(1-r)}$
$Q = Q_0\cdot e^{rt} \Leftrightarrow T_{double} = \frac{\ln 2}{r}$	$Q = Q_0\cdot e^{-rt} \Leftrightarrow T_{half} = -\frac{\ln\left(\frac{1}{2}\right)}{r} = \frac{\ln 2}{r}$
Callculations with the Doubling Time	**Callculations with the Half − Life Time**
$Q = Q_0\cdot 2^{t/T_{double}}$	$Q = Q_0\cdot\left(\frac{1}{2}\right)^{t/T_{half}}$
Logistic Growth Rate	**Logistic Function- S - Curve**
$Logistic\ Growrh\ Rate = r\times\left(1-\frac{N(t)}{K}\right)$ $\frac{dN(t)}{dt} = N(t)\cdot r\times\left(1-\frac{N(t)}{K}\right) \quad \Rightarrow$	*Assuming the envioronmental conditions will not influence the carrying capacity $K(t)$.* $\lim_{t\to\infty}N(t) = K(t) = K$ $N(t) = \frac{K}{1+\left(\frac{K-N_0}{N_0}\right)e^{-rt}}$

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