TIME VALUE OF MONEY FORMULA SHEET

#	TVM Formula For:	Annual Compounding	Compounded/Payments (m) Times per Year	Continuous Compounding
1	Future Value of a Lump Sum. ($FVIF_{i,n}$)	$FV_n = PV(1+i)^n$	$FV_n = PV\left(1+i/m\right)^{(m\times n)}$	$FV_n = PV\left(e\right)^{(i\times n)}$
2	Present Value of a Lump Sum. ($PVIF_{i,n}$)	$PV = \frac{FV}{(1+i)^n}$ or $PV = FV(1+i)^{-n}$	$PV = \frac{FV}{\left(1+i/m\right)^{(m\times n)}}$ or $PV = FV\left(1+i/m\right)^{(-m\times n)}$	$PV = \frac{FV}{(e)^{(i\times n)}}$ or $PV = FV(e)^{(-i\times n)}$
3	Future Value of an Annuity. ($FVIFA_{i,n}$)	$FVA_n = CF\left[\frac{(1+i)^n - 1}{i}\right]$	$FVA_n = CF\left[\frac{(1+i/m)^{(m\times n)} - 1}{i/m}\right]$	
4	Present Value of an Annuity. ($PVIFA_{i,n}$)	$PVA_n = CF\left[\frac{1-(1+i)^{-n}}{i}\right]$	$PVA_n = CF\left[\frac{1-\left(1+i/m\right)^{(-m\times n)}}{i/m}\right]$	
5	Present Value of Perpetuity. (PVA_∞)	$PVA_\infty = \frac{CF}{i}$	$PVA_\infty = \frac{CF}{[(1+i/m)^m - 1]}$	
6	Effective Annual Rate given the APR.	$EAR = APR = i$	$EAR = \left(1+\frac{i}{m}\right)^m - 1$	$EAR = e^i - 1$
7	The length of time required for a PV to grow to a FV.	$n = \frac{\ln(FV/PV)}{\ln(1+i)}$	$n = \frac{\ln(FV/PV)}{m \times \ln(1+i/m)}$	$n = \frac{\ln(FV/PV)}{i}$
8	The APR required for a PV to grow to a FV.	$i = \left(\frac{FV}{PV}\right)^{(1/n)} - 1$	$i = m \times \left[\left(\frac{FV}{PV}\right)^{[1/(m\times n)]} - 1\right]$	$i = \frac{\ln(FV/PV)}{n}$
9	Present Value of a Growing Annuity.	$PVA_n = \frac{CF_0(1+g)}{(i-g)}\left[1-\left(\frac{1+g}{1+i}\right)^n\right]$		
10	Present Value of a Growing Perpetuity.	$PVA_\infty = \frac{CF_0(1+g)}{(i-g)}$		
11	The length of time required for a series of PMT's to grow to a future amount (FVA_n).	$n = \frac{\ln\left[\frac{(FVA)(i)}{CF}+1\right]}{\ln(1+i)}$	$n = \frac{\ln\left[\left(\frac{i}{m}\right)\left(\frac{FVA}{CF}+\frac{m}{i}\right)\right]}{m \times [\ln(1+i/m)]}$	
12	The length of time required for a series of PMT's to exhaust a specific present amount (PVA_n).	$n = -\frac{\ln\left[1-\frac{(PVA)(i)}{CF}\right]}{\ln(1+i)}$, for $PVA(i) < CF$	$n = -\frac{\ln\left[1-\frac{(PVA)(i/m)}{CF}\right]}{m \times [\ln(1+i/m)]}$, for $PVA(i/m) < CF$	

Legend

i = APR, the nominal or Annual Percentage Rate	*n* = the number of periods
m = the number of compounding periods per year	*EAR* = the Effective Annual Rate
ln = the natural logarithm, the logarithm to the base *e*	*e* = the base of the natural logarithm ≈ 2.71828… (Calculator: 1 → e^x)
CF = *PMT* = the periodic payment or cash flow	*Perpetuity* = an infinite annuity

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