Formula Sheet

1. Relation between Future Value (FV) & Present Value (PV) at yearly compounding interest rate r for a period of t years: $FV = PV(1+r)^t$
   - Compounding $m - times$ in a year: $FV = PV\left(1+\frac{r}{m}\right)^{m.t}$
   - Compounding continuously: $FV = PV.e^{r.t}$

2. PV of cash flow for t years: $PV = \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_t}{(1+r)^t} = \sum_{i=1}^{t} \frac{C_i}{(1+r)^i}$

3. Net Present value $NPV = PV - Cost$

4. Perpetuity: The value of C received each year, for ever: $PV = \frac{C}{r}$

5. Annuity: The value of C received each year, for m years

$$PV = \frac{C}{r}\left[1 - \frac{1}{(1+r)^m}\right] = C\left[\frac{1}{r} - \frac{1}{r(1+r)^m}\right] = C \times A_r^m$$

6. Growing Perpetuity at a constant rate g , for ever

$$PV = \frac{C_1}{(1+r)} + \frac{C_1(1+g)}{(1+r)^2} + \frac{C_1(1+g)^2}{(1+r)^3} + \cdots = \frac{C_1}{r-g}$$

7. Growing Annuity at a constant rate g for m years

$$PV = \frac{C_1}{(1+r)} + \frac{C_1(1+g)}{(1+r)^2} + \cdots + \frac{C_1(1+g)^{m-1}}{(1+r)^m} = \frac{C_1}{r-g}\left[1 - \frac{(1+g)^m}{(1+r)^m}\right]$$

8. Future Value of an Annuity: $FV = PV \times (1+r)^m = \frac{C}{r}[(1+r)^m - 1]$

9. The relationship between effective annual rate (r) and nominal (quoted) annual rate (i):

$$r = \left(1 + \frac{i}{n}\right)^n - 1$$

10. PV of bonds & frequency of payments: $PV = \frac{C}{r}\left[1 - \frac{1}{\left(1+\frac{r}{f}\right)^{f\times t}}\right] + \frac{Face\,Value}{\left(1+\frac{r}{f}\right)^{f\times t}}$

11. PV of stocks:

$$zero\ growth: \qquad P_0 = \frac{Div}{r}$$

$$constant\ growth: \qquad P_0 = \frac{Div}{r-g}$$

$$Differential\ growth: \quad P_0 = \sum_{t=1}^{T} \frac{Div(1+g_1)^t}{(1+r_1)^t} + \frac{\frac{Div_{T+1}}{r-g_2}}{(1+r)^T}$$

12. Standard deviation of the asset i's return: $\sigma_i = \sqrt{E(r_i - E(r_i))^2}$

13. Covariance between the returns of assets 1 and 2:

$$\sigma_{12} = cov(r_1, r_2) = E([r_1 - E(r_1)] . [r_2 - E(r_2)])$$

14. Correlation coefficient: $\rho = \frac{\sigma_{12}}{\sigma_1 .\ \sigma_2}$

15. Expected portfolio return: $E(r_p) = \overline{r_p} = E(\omega_1 r_1 + \omega_2 r_2) = \omega_1 E(r_1) + \omega_2 E(r_2)$

16. Variance of the portfolio:
$\sigma_p^2 = Var(\omega_1 r_1 + \omega_2 r_2) = \omega_1^2 . \sigma_1^2 + \omega_2^2 . \sigma_2^2 + 2\omega_1\omega_2 . \sigma_{12} = \omega_1^2 . \sigma_1^2 + \omega_2^2 . \sigma_2^2 + 2\omega_1\omega_2 . \rho . \sigma_1 .\ \sigma_2$

17. Variance of a portfolio with three assets:
$Var(\omega_1 r_1 + \omega_2 r_2 + \omega_3 r_3) = \omega_1^2\sigma_1^2 + \omega_2^2\sigma_2^2 + \omega_3^2\sigma_3^2 + 2\omega_1\omega_2\sigma_{12} + 2\omega_1\omega_3\sigma_{13} + 2\omega_2\omega_3\sigma_{23}$

18. Capital Allocation Line (CAL): $E(r_p) = r_f + \left(\frac{E(r_A) - r_f}{\sigma_A}\right)\sigma_p$

19. Capital Market Line (CML): $E(r_p) = r_f + \left(\frac{E(r_M) - r_f}{\sigma_M}\right)\sigma_p$

20. Security Market Line (SML): $E(r_i) = r_f + \left(E(r_m) - r_f\right) . \beta_i$ (where $\beta_i = \frac{\sigma_{im}}{\sigma_m^2}$)

21. Expected risk premium (APT):
$Expected\ risk\ premium = r - r_f = \beta_1\left(r_{F_1} - r_f\right) + \beta_2\left(r_{F_2} - r_f\right) + \cdots + \beta_k\left(r_{F_k} - r_f\right)$

22. Company cost of capital (WACC):
$$r_{WACC} = \frac{D}{V} . r_D + \frac{E}{V} . r_E = \frac{D}{D+E} . r_D + \frac{E}{D+E} . r_E$$

23. Call Value at expiration: $C = \max(S - K,\ 0)$

24. Put value at expiration: $P = \max(K - S,\ 0)$

25. Put-Call Parity: $S + P = C + PV(K)$

26. Black-Scholes formula: $C = S \times N(d_1) - PV(K) \times N(d_2)$
$$d_1 = \frac{Ln\left[\frac{S}{PV(K)}\right]}{\sigma\sqrt{T}} + \frac{\sigma\sqrt{T}}{2} \text{ And } d_2 = d_1 - \sigma\sqrt{T}$$

27. Interest rate parity: $F = S \times \frac{(1 + r_{\$}^*)}{(1 + r_{FC}^*)}$