# Econ435 – Financial Markets and the Macroeconomy Formula Sheet[1]

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## Essential course-wide formulas

1. rate of return: $R = \frac{Net\ profit}{Initial\ investment}$

## Chapter 1

None

## Chapter 2

2. equivalent taxable yield (munis): $r = \frac{r_m}{1-t}$
3. tax bracket (munis): $t = 1 - \frac{r_m}{r}$
4. price-weighted index: $I = \frac{\sum p_i}{d}$; also need to know how to calculate the divisor $d$
5. value-weighted index: $I_1 = \frac{\sum p_i^1 N_i^1}{\sum p_i^0 N_i^0} \cdot I_0$

## Chapter 3

6. margin: $m = \frac{Equity}{Value\ of\ stock}$

## Chapter 4

7. net asset value: $NAV = \frac{Market\ value\ of\ assets - Liabilities}{Number\ of\ outstanding\ shares}$
8. value of an investment in a mutual fund: $V_n = (1-f) \cdot I \cdot (1+r-e-b)^n \cdot (1-s)$

[1] This formula sheet is meant to point to the most important formulas in the class. It is not meant to replace reading the lecture notes or class notes! Please do NOT bring it to the exam.

## Chapter 6

9. utility function for a risk-averse individual: $U = E(r) - 0.005A\sigma^2$

10. expected return on a portfolio: $E(r_p) = w_1E(r_1) + w_2E(r_2)$ (note: if asset 2 is the risk-free asset, then $E(r_2) = r_f$)

11. risk (variance) of a portfolio: $\sigma_p^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_{12}$ (note: if asset 2 is the risk-free asset, then $\sigma_2^2 = 0$ and $\sigma_{12} = 0$)

## Chapter 7

12. expected return and variance of the complete portfolio (same as above, with asset 2 being the risk-free rate and $w_1 = y$)

13. slope of the Capital Allocation Line (Sharpe ratio): $S = \dfrac{E(r_p) - r_f}{\sigma_p}$

14. optimal weight of the risky portfolio in the complete portfolio: $y^* = \dfrac{E(r_p) - r_f}{0.01A\sigma_p^2}$

## Chapter 8

15. weights of two perfectly negatively correlated assets in the zero-risk portfolio: $w_D = \dfrac{\sigma_E}{\sigma_D + \sigma_E}$ and $w_E = \dfrac{\sigma_D}{\sigma_D + \sigma_E}$

## Chapter 9

16. beta coefficient of an asset: $\beta_i = \dfrac{Cov(r_i, r_m)}{\sigma_m^2}$ (note: $\beta_m = 1$ and $\beta_{r_f} = 0$)

17. beta coefficient of a portfolio of $n$ assets: $\beta_p = w_1\beta_1 + w_2\beta_2 + \ldots + w_n\beta_n$

18. Capital Asset Pricing Model: $E(r_i) = r_f + \beta_i[E(r_M) - r_f]$

19. alpha coefficient of an asset: $\alpha_i = E^a(r_i) - E(r_i)$

## Chapter 10

20. Single Index Model: $r_i - r_f = \alpha_i + \beta_i[r_m - r_f] + e_i$, or $R_i = \alpha_i + \beta_i R_m + e_i$ (note: for a well-diversified portfolio, $e_i = 0$)

21. variance of an asset: $\sigma_i^2 = \beta_i^2\sigma_m^2 + \sigma_e^2$ (note: for a well-diversified portfolio, $\sigma_e = 0$)

## Chapter 11

22. Arbitrage Pricing Theory: $E(r_p) = r_f + \beta_{p1}[E(r_1)r_f] + \beta_{p2}[E(r_2)r_f]$, or $E(r_p) = r_f + \beta_{p1}RP_1 + \beta_{p2}RP_2$ (note: in principle, you can have more than two factors, but for the purpose of this course, a two-factor model is enough)

## Chapter 12

None

## Chapter 20

23. payoff and profit for a call option:

    (i) for holder: $Payoff_h = \begin{cases} S_T - X, & \text{if } S_T > X, \\ 0, & \text{if } S_T \leq X. \end{cases}; \quad Profit_h = Payoff_h - C$

    (ii) for writer: $Payoff_w = -Payoff_h$ and $Profit_w = -Profit_h$

24. payoff and profit for a put option:

    (i) for holder: $Payoff_h = \begin{cases} 0, & \text{if } S_T > X, \\ X - S_T, & \text{if } S_T \leq X. \end{cases}; \quad Profit_h = Payoff_h - P$

    (ii) for writer: $Payoff_w = -Payoff_h$ and $Profit_w = -Profit_h$

    Note: you should be able to derive the payoff and profit for any investment strategy involving stock and options.

25. put-call parity: $C + \dfrac{X}{(1+r_f)^T} = S_0 + P$

## Chapter 21

None
Note: Although you don't need to know the option pricing formulas, the Black-Scholes model is one of the most important (and widely used in practice) models in modern finance.