

Handbook for Formulas

List of formulas for
CFA® Level 1



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Centre for Financial Learning

TIME VALUE OF MONEY	
1	Nominal interest rate = real risk-free rate + expected inflation rate
2	Required interest rate on security = nominal risk-free rate + default risk premium + liquidity premium + maturity risk premium
3	Effective Annual Return (EAR) = $EAR = (1 + \text{periodic rate})^m - 1$ Periodic rate = stated annual rate/m M = number of compounding periods per year
4	$FV = PV(1 + I/Y)^N$ $PV = \frac{FV}{\left(1 + \frac{I}{Y}\right)^N}$ FV = future value PV = Present value I/Y = Rate of return per compounding period N = Number of compounding periods
5	$PV \text{ perpetuity} = \frac{PMT}{(I/Y)}$ PMT = Fixed periodic cash flow
DISCOUNTED CASH FLOW APPLICATION	
6	$NPV = \sum \frac{CF}{(1+r)^t}$ CF = Expected cash flow r = Discount rate
7	IRR $0 = CF + \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3}$ IRR = Internal rate of return.
8	$HPR = \frac{(\text{Ending Value} - \text{Beginning Value})}{(\text{Beginning Value})}$ HPR = Holding period return
9	$RBD = D/F * 360/t$ RBD = Annualised yield on a bank discount basis D = Dollar discount = purchase price - face value F = Face value t = Number of days until maturity 360 = Bank convention of number of days in a year
10	Effective Annual Yield (EAY) = $(1 + HPY)^{365/t} - 1$ HPY = Holding period yield

11	RMM = 360/days*HPY RMM = Money market yield
12	Bond equivalent yield = $\{(1 + \text{effective annual yield})^{1/2} - 1\} * 2$
13	Geometric Mean = $[(1 + R_1)(1 + R_2) \dots (1 + R_n)]^{1/n} - 1$ Geometric mean return is also known as compound annual rate of return
14	Harmonic Mean = $\frac{N}{\sum(1/x)}$
15	Position of observation at a given percentile $Ly = (n + 1) \frac{Y}{100}$
16	Range = Maximum Value - Minimum Value
17	Mean Absolute Deviation (MAD) = $\frac{(\sum Xi - X)}{n}$ X = Arithmetic mean
18	Population Variance $\sigma^2 = \frac{(\sum (Xi - \mu)^2)}{N}$
19	Standard Deviation σ = square root of variance
20	Sample Variance $\sigma^2 = \frac{(\sum (Xi - \mu)^2)}{N - 1}$
21	Chebyshev's Inequality Percentage of observations that lie within k standard deviations of the mean is at least = $1 - 1/k^2$
22	Coefficient of Variation $CV = \frac{(\text{standard deviation of } x)}{(\text{average value of } x)}$
23	Sharpe Ratio = $\frac{(Rp - RFR)}{\sigma_p}$ Rp = Portfolio Return RFR = Risk Free Rate σ_p = standard deviation of portfolio return
24	Sample Skewness (Sk) = $\frac{(\sum (Xi - x)^3)}{s^3}$ s = sample standard deviation
25	Sample Skewness (Sk) = $\frac{(\sum (Xi - x)^4)}{s^4}$
26	Excess Kurtosis = Sample Kurtosis - 3

	PROBABILITY CONCEPTS
27	Multiplication Rule Of Probability, $P(AB) = P(A/B) * P(B)$
28	Addition Rule Of Probability, $P(A \text{ or } B) = P(A) + P(B) - P(AB)$
29	Total Probability Rule (Used to determine unconditional probability of an event) $P(A) = P(A/B1)P(B1) + P(A/B2)P(B2) + \dots + P(A/BN)P(BN)$
30	Expected value of random variable = weighted average of possible outcomes, Weights = probabilities that the outcome will occur
31	Covariance $Cov(R_i, R_j) = E\{[R_i - E(R_i)][R_j - E(R_j)]\}$ $Cov(R_i, R_j) = Corr(R_i, R_j) \sigma(R_i)\sigma(R_j)$
32	Correlation Coefficient $Corr(R_i, R_j) = \frac{Cov(R_i, R_j)}{(\sigma(R_i)\sigma(R_j))}$
33	Weight of asset in portfolio, $w = \text{market value of investment in asset } i / \text{market value of the portfolio}$
34	Portfolio Expected Value $E(R_p) = w_1E(R_1) + w_2E(R_2) + \dots + w_nE(R_n)$
35	Variance of 2 Asset Portfolio
36	Variance of 3 asset Portfolio
37	Bayes Formula, Updated Probability = (Probability of new information for a given event / unconditional probability of new event) * (prior probability of event)
38	Factorial $n! = n * (n-1) * (n-2) * (n-3) * \dots * 1$ $0! = 1$
39	Labelling, $n! / (n_1!) * (n_2!) * \dots (n_n!)$
40	Combination, $nCr = n! / (n-r)!r!$
41	Permutation, $n! / (n-r)!$
	COMMON PROBABILITY DISTRIBUTIONS
42	To standardize a normal variable, $z = \frac{(\text{Observation} - \text{Population Mean})}{(\text{Standard Deviation})}$

43	Roy's safety first criteria, $SFR = \frac{((E(R_p) - R_f))}{(\sigma_p)}$ <p>**Choose the portfolio with largest SFR</p>
44	Continuously compounded rate of return, $R_{cc} = \ln(1 + HPR)$
SAMPLING AND ESTIMATION	
45	Standard Error of sample Mean, $\sigma_x = \sigma / \sqrt{n}$ σ = Standard deviation of population n = Size of the sample
46	t-distribution to construct a confidence interval, When variance is unknown, $x = t_{\alpha/2} * s / \sqrt{n}$ When variance is known, $x = t_{\alpha/2} * \sigma / \sqrt{n}$ x = Point estimate of population mean $t_{\alpha/2}$ = The t-reliability factor s / \sqrt{n} = Standard error of sample mean
SAMPLING AND ESTIMATION	
47	Test Statistic = $\frac{(\text{Sample Mean} - \text{Hypothesized Mean})}{(\text{Standard Error of Sample Mean})}$
48	t-statistic When population variance is unknown, $T_{n-1} = \frac{(x - \mu)}{(s / \sqrt{n})}$ When population variance is known, $T_{n-1} = \frac{(x - \mu)}{(\sigma / \sqrt{n})}$
49	Chi-square test: $\chi^2 = \frac{(n-1)s^2}{\sigma^2}$
50	F-distribution test, $F = s_1^2 / s_2^2$
TECHNICAL ANALYSIS	
51	Arms Index or Short Term Trading Index, $TRIN = \frac{(\text{Number of advancing Issues} / \text{Number of declining issues})}{(\text{Volume of advancing issues} / \text{Volume of declining issues})}$

DEMAND AND SUPPLY ANALYSIS: INTRODUCTION	
52	Demand function for good X, $Q_{dx} = f(P_x, I, P_y, \dots)$ P_x = Price of good X, I = Some measure of average income per year, P_y = Prices of related goods
53	Price Elasticity of Demand = $\frac{\% \Delta \text{Quantity Demanded}}{\% \Delta \text{Price}}$ Δ = change
54	Cross Price Elasticity = $\frac{\% \Delta \text{Quantity Demanded}}{\% \Delta \text{Price Of Related Goods}}$ Δ = change
55	Income Elasticity = $\frac{\% \Delta \text{Quantity Demanded}}{\% \Delta \text{ in Income}}$ Δ = change
DEMAND AND SUPPLY ANALYSIS: THE FIRM	
56	Accounting profit = total revenue - total accounting costs
57	Economic profit = accounting profit - implicit opportunity costs Or Economic profit = total revenue - total economic costs
58	Normal profit, Economic profit = accounting profit - normal profit = 0 Normal profit is the accounting profit that makes economic profit equal to zero
59	Marginal Cost, MC = change in total cost / change in output
AGGREGATE OUTPUT, PRICES AND ECONOMIC GROWTH	
60	Nominal GDP = $\sum P_{i,t} Q_{i,t}$ $P_{i,t}$ = Price of good i in year t . $Q_{i,t}$ = Quantity of good i produced in year t
61	GDP deflator = $(\text{nominal GDP} / \text{value of year } t \text{ output at year } t) \times 100$
62	Per Capita Real GDP = GDP / population
63	GDP by expenditure approach, $GDP = C + I + G + (X - M)$ C = Consumption spending, I = Business investment, G = Government purchases, X = Exports, M = Imports
64	GDP by Income Approach, $GDP = \text{national income} + \text{capital consumption allowance} + \text{statistical discrepancy}$
65	National Income = compensation of employees (wages and benefits) + corporate and government enterprise profits before taxes + Interest Income + Unincorporated business net income (business owner's income) + rent + indirect business taxes - subsidies

66	Personal Income= national Income + transfer payments to households -indirect business taxes -corporate income taxes -undistributed corporate profits
67	Personal disposable income=personal income-personal taxes
68	Quantity Theory Of Money, $MV=PY$ M=Money Supply, V=Velocity of money in transactions, P=Price level Y=Real GDP
69	Recessionary Gap or Output Gap=Real GDP-Full Employment GDP
70	Potential GDP=aggregate hours worked*labour productivity In terms of economic growth, Growth in potential GDP=growth in labour force+ growth in labour productivity
71	Production Function, $Y=A*f(L,K)$ Y=Aggregate economic output, L=Size of labour force, K=Amount of capital available, A=Total factor productivity
UNDERSTANDING BUSINESS CYCLES	
72	$CPI = (\text{Cost of basket at current prices} / \text{cost of basket at base period prices}) * 100$
73	Total amount of money that can be created, Money created= new deposit/reserve requirement
74	Money Multiplier= 1/Reserve Requirement
75	Fisher Effect, $R_{nom} = R_{real} + E(I) + RP$ R _{nom} =Nominal interest rate, R _{real} =Real Interest rate RP=Risk premium for uncertainty
76	Neutral Interest Rate= Real trend rate of economic growth + inflation target
77	Fiscal Multiplier= $1/[1-MPC(1-t)]$
78	Relation between trade deficit, saving and domestic investment, Exports-imports= private savings+ government savings+ domestic investment
CURRENCY EXCHANGE RATES	
79	Real Exchange Rate= $\frac{\text{Nominal Exchange Rate}(d/f)^*}{\frac{(\text{CPI foreign})}{(\text{CPI domestic})}}$

80	Interest Rate Parity, $\frac{\text{forward}}{\text{spot}} = \frac{(1 + \text{interest rate (domestic)})}{(1 + \text{interest rate (foreign)})}$
FINANCIAL STATEMENT ANALYSIS: AN INTRODUCTION	
81	Accounting Equation, (Balance Sheet) Assets = liabilities + equity Assets = liabilities + contributed capital + ending retained earnings Assets = liabilities + contributed capital + beginning retained earnings + revenue - expenses - dividends
82	Income statement equation, Net income = revenues - expenses
83	Straight line depreciation expense = $\frac{(\text{cost} - \text{residual value})}{(\text{useful life})}$
84	Accelerated depreciation- double declining balance method $\text{DDB depreciation} = \left(\frac{2}{\text{useful life}} \right) (\text{cost} - \text{accumulated depreciation})$
85	Basic EPS = $\frac{(\text{net income} - \text{preferred dividends})}{(\text{weighted average number of common shares outstanding})}$
86	Diluted EPS = $\frac{(\text{Adjusted income for common shareholders})}{(\text{weighted average common and potential common shares outstanding})}$ Diluted EPS = $\frac{([\text{Net income} - \text{preferred dividends}] + [\text{convertible preferred dividends}] + [\text{convertible debt interest}](1 - \text{tax rate}))}{([\text{Weighted average shares}] + [\text{shares from conversion of converted preferred shares}] + [\text{shares from conversion of debt}] + [\text{shares issuable from stock options}])}$
UNDERSTANDING CASHFLOW STATEMENTS	
87	Free Cash flow to firm, FCFF = NI + NCC + Interest(1-Tax Rate) - FC Inv - WC Inv FCFF = CFO + Interest(1-Tax Rate) - FC Inv NI = Net income NCC = Non cash charges FC Inv = Fixed capital investment WC Inv = Working Capital Investment
88	Free cash flow to equity, FCFE = CFO - FC Inv + net borrowing Net borrowing = debt issued - debt repaid

89	Performance Ratio: Cash flow to revenue = $\frac{\text{CFO}}{\text{Net Revenue}}$ CFO = Cash flow from operations
90	Performance Ratio: Cash return on asset ratio = $\frac{\text{CFO}}{\text{Average total assets}}$
91	Performance Ratio: Cash return on equity ratio = $\frac{\text{CFO}}{\text{Average total equity}}$
92	Performance Ratio: Cash to income ratio: $\frac{\text{CFO}}{\text{Operating Income}}$
93	Cash flow per share = $\frac{(\text{CFO} - \text{Preferred Dividends})}{(\text{Weighted Average Number Of Common Shares})}$
94	Coverage Ratio: Debt coverage = $\frac{\text{CFO}}{(\text{Total Debt})}$
95	Coverage Ratio: Interest coverage ratio: $\frac{(\text{CFO} + \text{interest paid} + \text{taxes paid})}{(\text{interest paid})}$ If interest paid is classified as a financing activity under ifrs, no interest adjustment is necessary
96	Reinvestment Ratio = $\frac{\text{CFO}}{(\text{Cash paid for long term assets})}$
97	Debt payment Ratio = $\frac{\text{CFCFO}}{(\text{Cash long term debt repayment})}$
98	Dividend Payment Ratio = $\frac{\text{CFO}}{(\text{Dividends paid})}$
99	Investing and Financing Ratio = $\frac{\text{CFO}}{(\text{Cash outflow from investing and financing activities})}$
FINANCIAL ANALYSIS TECHNIQUES	
ACTIVITY RATIOS:	
100	Receivables Turnover = $\frac{\text{net annual sales}}{\text{average receivables}}$
101	Days of sales outstanding = $\frac{365}{(\text{Receivables turnover})}$
102	Inventory Turnover = $\frac{(\text{Cost of goods sold})}{(\text{Average inventory})}$
103	Days of inventory in hand = $\frac{365}{(\text{Inventory turnover})}$

104	Payables turnover = $\frac{\text{Purchases}}{(\text{Average trade payables})}$
105	Number of days of payables = $\frac{365}{(\text{Payable turnover})}$
106	Total asset turnover = $\frac{(\text{Revenue})}{(\text{Average total assets})}$
107	Fixed asset turnover = $\frac{\text{Revenue}}{(\text{Average net fixed assets})}$
108	Working capital turnover = $\frac{\text{Revenue}}{(\text{Average working capital})}$
LIQUIDITY RATIOS	
109	Current Ratios = $\frac{(\text{Current Assets})}{(\text{Current Liabilities})}$
110	Quick Ratio = $\frac{(\text{Cash} + \text{Marketable Securities} + \text{Receivables})}{(\text{Current Liabilities})}$
111	Cash Ratio = $\frac{(\text{Cash} + \text{Marketable Securities})}{(\text{Current Liabilities})}$
112	Defensive Interval = $\frac{(\text{Cash} + \text{Marketable Securities} + \text{Receivables})}{(\text{Average Daily Expenditures})}$
113	Cash Conversion Cycle = $(\text{Days sales outstanding}) + (\text{days on inventory on hand}) - (\text{number of days of payables})$
SOLVENCY RATIOS	
114	Debt to equity ratio = $\frac{(\text{Total debt})}{(\text{Total Shareholders Equity})}$
115	Debt To Capital = $\frac{(\text{Total debt})}{(\text{Total Debt} + \text{Total Shareholders Equity})}$
116	Debt To Assets = $\frac{(\text{Total Debt})}{(\text{Total Assets})}$
117	Financial Leverage = $\frac{(\text{Average Total Assets})}{(\text{Average Total Equity})}$
118	Interest Coverage Ratio = $\frac{(\text{Earnings Before Interest and taxes})}{(\text{Interest payments})}$
119	Fixed Charge Coverage = $\frac{(\text{Earnings Before Interest \& Taxes} + \text{Lease Payments})}{(\text{Interest payments} + \text{Lease payments})}$

PROFITABILITY RATIOS

120	$\text{Net profit margin} = \frac{(\text{Net Income})}{\text{Revenue}}$ <p>Net income = earnings after taxes but before dividends</p>
121	$\text{Gross Profit Margin} = \frac{(\text{Gross profit})}{\text{Revenue}}$ <p>Gross profit = Net Sales - COGS</p>
122	$\text{Operating profit margin} = \frac{(\text{Operating Income (EBIT)})}{\text{Revenue}}$
123	$\text{Pretax margin} = \frac{\text{EBT}}{\text{Revenue}}$
124	$\text{Return on assets (ROA)} = \frac{(\text{Net Income})}{(\text{Average Total Assets})}$
125	$\text{Operating return on assets} = \frac{(\text{Operating Income})}{(\text{Average Total Assets})}$
126	$\text{Return on Total Capital} = \frac{\text{EBIT}}{(\text{Average Total Capital})}$
127	$\text{Return On Equity} = \frac{(\text{Net Income})}{(\text{Average Total Equity})}$ <p>Or</p> $\text{Return On Equity} = \frac{(\text{Net Income})}{\text{Revenue}} * \frac{\text{Revenue}}{\text{Equity}}$ <p style="text-align: center;">= Net Profit Margin * Equity Turnover</p> <p>Return On Equity By Du Pont Equation,</p> $\text{Return On Equity} = \frac{(\text{Net Income})}{\text{Sales}} * \frac{(\text{Sales})}{\text{Assets}} * \frac{(\text{Assets})}{\text{Equity}}$ <p style="text-align: center;">= Net Profit Margin * Asset Turnover * Leverage Ratio</p> <p>ROE By Extended Dupont Equation,</p> $\text{ROE} = \frac{(\text{Net Income})}{\text{EBT}} * \frac{\text{EBT}}{\text{EBIT}} * \frac{\text{EBIT}}{\text{Revenue}} * \frac{\text{Revenue}}{(\text{Total Assets})} * \frac{(\text{Total Assets})}{(\text{Total Equity})}$ <p style="text-align: center;">= Tax Burden * Interest Burden * EBIT Margin * Asset turnover * financial leverage</p>
128	$\text{Return on common equity} = \frac{(\text{Net Income} - \text{Preferred Dividends})}{(\text{Average Common Equity})}$
129	<p>Sustainable growth rate = $\text{RR} * \text{ROE}$</p> <p>RR = Retention rate</p> <p style="text-align: center;">= 1 - dividend payout</p>

130	Coefficient of variation sales = $\frac{(\text{Standard deviation of operating income})}{(\text{Mean sales})}$
131	CV Operating Income = $\frac{(\text{Standard deviation of operating income})}{(\text{mean operating income})}$
132	CV Net Income = $\frac{(\text{Standard deviation of net income})}{(\text{Mean net income})}$
INVENTORIES	
133	COGS = beginning inventory + purchases - ending inventory
LONG LIVED ASSETS	
134	<p>Depreciation methods,</p> <p>i) straight line and ii) ddb covered earlier.</p> <p>li) units of production depreciation =</p> $\frac{(\text{Original cost-salvage value})}{(\text{life in output units})} * \text{Output units in the period}$
INCOME TAXES	
135	Effective tax rate = $\frac{(\text{Income tax expense})}{(\text{Pretax income})}$
136	<p>Income tax expense = taxes payable + ΔDTL-ΔDTA</p> <p>DTL = Deferred tax liability</p> <p>DTA = Deferred tax asset</p>
CAPITAL BUDGETING	
137	<p>Profitability Index (PI) = $\frac{(\text{PV Of future cash flows})}{\text{CF}_0}$</p> $= 1 + \frac{\text{NPV}}{\text{CF}_0}$
COST OF CAPITAL	
138	<p>WACC = $(w_d)[k_d(1-t)] + (w_{ps})(k_{ps}) + (w_{cc})(K_{cc})$</p> <p>W_d = percentage of debt in capital structure.</p> <p>W_{ps} = percentage of preferred stock in the capital structure.</p> <p>W_{cc} = percentage of common stock in the capital structure</p>
139	After tax cost of debt = $k_d(1-t)$
140	<p>Cost of preferred stock (k_{ps})</p> $K_{ps} = D_{ps}/p$

141	<p>Capital asset pricing model (CAPM)</p> $K_{ce} = RFR + \beta[E(R_m) - RFR]$ <p>K_{ce} = Cost of equity capital RFR = Risk free rate $E(R_m)$ = Expected return on market.</p>
142	<p>Dividend discount model,</p> $P_0 = \frac{D_1}{(k-g)}$ <p>D_1 = Next year dividend. K = Required rate of return on common equity. g = Firm's expected constant growth rate.</p>
143	<p>Bond yield plus risk premium approach,</p> $K_{ce} = \text{bond yield} + \text{risk premium}$
144	<p>Asset Beta,</p> $B_{\text{Asset}} = \beta_{\text{Equity}} \frac{1}{1 + \frac{(1-t)D}{E}}$ <p>D/E = Comparable company's debt to equity ratio</p>
145	<p>Project Beta,</p> $B_{\text{Project}} = \beta_{\text{Asset}} \left(1 + (1-t) \frac{D}{E} \right)$
146	<p>Revised CAPM using country risk premium,</p> $K_{ce} = Rf + \beta[E(R_m) - RFR] + CRP$ <p>CRP = Country risk premium</p>
147	$CRP = \frac{\text{(Annualised standard deviation of equity index of developing country)}}{\text{(Annualised standard deviation of sovereign bond Market in terms of the developed market currency)}}$ <p>Sovereign yield spread = difference between the yields of government bonds in the developing country and treasury bonds of similar maturities</p>
148	<p>Break Point (any time the cost of one of the components of the company's WACC changes.)</p> $\text{Break Points} = \frac{\text{(Amount Of Capital at which the components cost of capital changes)}}{\text{(weight of the component in the capital structure)}}$

MEASURES OF LEVERAGE

149 Degree of operating leverage,

$$DOL = \frac{\text{Percentage change in EBIT}}{\text{Percentage change in sales}}$$

DOL for a particular level of units,

$$DOL = \frac{Q(P-V)}{(Q(P-V)-F)} = \frac{(S-TVC)}{(S-TVC-F)}$$

Q= Quantity of units sold

P=Price per unit

V= Variable cost per unit

F= Fixed costs

S= Sales

TVC= Total variable costs

150 Degree of financial leverage,

$$DFL = \frac{\text{Percentage change in EPS}}{\text{Percentage change in EBIT}}$$

DFL for particular level of operating units,

$$DFL = \frac{EBIT}{(EBIT-Interest)}$$

151 Degree Of Total Leverage
 DTL=DOL + DFL

$$DTL = \frac{(\% \text{ change in EBIT})}{(\% \text{ change in Sales})} * \frac{(\% \text{ change in EPS})}{(\% \text{ change in EBIT})} = \frac{(\% \text{ change in EPS})}{(\% \text{ Change in Sales})}$$

$$DTL = \frac{Q(P-V)}{(Q(P-V)-F-I)} = \frac{(S-TVC)}{(S-TVC-F-I)}$$

152 Breakeven Quantity Of Sales,

$$QBE = \frac{(\text{Fixed operating costs} + \text{Fixed financing costs})}{(\text{Price}-\text{Variable cost per unit})}$$

DIVIDENDS AND SHARE REPURCHASE BASICS

153 Eps after buyback=
$$\frac{(\text{Total earnings}-\text{After tax cost of funds})}{(\text{Shares outstanding after buyback})}$$

WORKING CAPITAL MANAGEMENT

154 Cost of trade credit=
$$\left(1 + \frac{(\% \text{discount})}{(1-\% \text{discount})}\right) \frac{365/\text{days past discount} - 1}{1}$$

PORTFOLIO RISK AND RETURN: PART II

155	Expected return when one asset is invested in risky asset and one asset in risk free asset $E(R_p) = W_A E(R_A) + w_B E(R_B)$ $W_B = 1 - W_A$
156	Capital market line equation, $E(R_p) = R_f + \frac{(E(R_M) - R_f)}{(\sigma_M)} \sigma_p$
157	Total Risk = systematic risk + unsystematic risk
158	General form of multifactor model, $E(R_i) - R_f = \beta_{i1} E(\text{Factor 1}) + \beta_{i2} E(\text{factor 2}) + \dots \dots \dots \beta_{ik} E(\text{Factor k})$
159	Equation of SML, $E(R_i) = RFR + \frac{(E(R_M) - RFR)}{(\text{Variance of Market})} (\text{Cov } i, \text{mkt})$
160	M Square = $(R_p - R_f) \frac{(\text{Std Dev of m})}{(\text{Std Dev of p})} - (R_M - R_f)$
161	Treynor Measure = $\frac{(R_p - R_f)}{\beta_p}$
162	Jenson's Alpha = $\alpha_p = R_p - [R_f + \beta_p(R_M - R_f)]$
MARKET ORGANISATION AND STRUCTURE	
163	Margin call price = $P_o \frac{((1 - \text{initial margin}))}{((1 - \text{maintenance margin}))}$ P_o = initial purchase price
SECURITY MARKET INDICES	
164	Compounded Returns, $R_p = (1 + R_1)(1 + R_2)(1 + R_3) \dots \dots (1 + R_k) - 1$ K = last sub period
165	Price weighted Index = $\frac{(\text{Sum of stock prices})}{(\text{Number of stocks in index adjusted for splits})}$
166	Market weighted Index, $\text{Current index value} = \frac{(\text{Current total market value of index stocks})}{(\text{Base year total market value of index stocks})} * \text{Base year index value}$
167	Equal weighting index, $\text{New index value} = \text{Initial index value} (1 + \text{Change in index})$

EQUITY VALUATION: CONCEPTS AND BASIC TOOLS

168	<p>Dividend discount model, One year holding period:</p> $V_0 = \frac{D_t}{(1+ke)} + \frac{(\text{Year End Price})}{(1+ke)}$ <p> V_0 = Current stock value D_t = Dividend at time t Ke = Required rate of return </p> <p>Two year holding period DDM,</p> $\text{Value} = \frac{D_1}{(1+ke)} + \frac{D_2}{(1+ke)^2} + \frac{P_2}{(1+ke)^2}$ <p>Multi-stage dividend discount model:</p> $\text{Value} = \frac{D_1}{(1+ke)} + \frac{D_2}{(1+ke)^2} + \frac{D_n}{(1+ke)^n} + \frac{P_n}{(1+ke)^n}$ $P_n = \frac{(D_{n+1})}{(Ke-gc)}$
169	<p>Free cash to equity,</p> <p>FCFE = net income + depreciation - increase in working capital - fixed capital investment - debt principal repayments + new debt issues</p> <p>FCFE = CFO - FC investment + net borrowing CFO = Cash flow from operations.</p>
170	<p>Preferred stock value = $\frac{D_p}{k_p}$</p> <p> D_p = Fixed dividend K_p = Required rate of return </p>
171	<p>Enterprise Value (EV)</p> <p>EV = market value of common and preferred stock + market value of debt - cash and short term investment</p>
172	<p>Trailing P/E = $\frac{(\text{Market price per share})}{(\text{EPS over previous 12 months})}$</p>
173	<p>Leading P/E = $\frac{(\text{Market price per share})}{(\text{Forecast EPS over next 12 months})}$</p>
174	<p>P/B Ratio = $\frac{(\text{Market value of equity})}{(\text{Book value of equity})} = \frac{(\text{Market price per share})}{(\text{Book value per share})}$</p> <p>Book value of equity = common shareholders equity = (total assets - total liabilities) - preferred stock</p>

175	$P/S \text{ Ratio} = \frac{(\text{Market value of equity})}{(\text{Total sales})}$
176	$P/CF \text{ Ratio} = \frac{(\text{Market value of equity})}{(\text{Cash flow})}$
INTRODUCTION TO FIXED INCOME VALUATION	
177	<p>Price of annual coupon bond,</p> $\text{Price} = \frac{\text{Coupon}}{((1+YTM))} + \frac{\text{Coupon}}{((1+YTM)^2)} + \dots + \frac{(\text{Principal} + \text{Coupon})}{((1+YTM)^n)}$ <p>YTM = Yield to maturity</p> <p>Price of semi-annual coupon bond,</p> $\text{Price} = \left(1 + \frac{YTM}{2}\right) \left(1 + \frac{YTM}{2}\right)^2 + \dots + \left(1 + \frac{YTM}{2}\right)^{n*2}$
178	Full Price = Flat price + Accrued interest
179	$\text{Current Yield} = \frac{(\text{Annual cash coupon payment})}{(\text{Bond price})}$
180	<p>Relation between forward rates and spot rates,</p> $(1 + s_2) = (1 + s_1)(1 + 1y_1y)$
181	Option Value = z spread – OAS
UNDERSTANDING FIXED INCOME RISK AND RETURN	
182	<p>Modified duration,</p> <p>For annual pay bond: Modified duration = Maculay duration / (1 + YTM)</p> <p>For semi-annual bond, ModDursemi = MacDur / (1 + YTM/2)</p> <p>V_{-} = price increase V_{+} = price decrease V_0 = current price</p> $\text{Approximate modified duration} = \frac{(V_{-} - V_{+})}{2V_0\Delta ytm}$
183	Approximate % change in bond price = -ModDur*ΔYTM
184	$\text{Effective duration} = \frac{(V_{-} - V_{+})}{2V_0\Delta \text{Curve}}$

185	<p>Portfolio duration = $W_1D_1 + W_2D_2 + \dots + W_nD_n$</p> <p>W = Weight = Full price/total value</p> <p>D = Duration on bond</p>
186	<p>Money duration = annual modified duration * full price of bond position</p> <p>Money Duration per 100 units of par value = annual modified duration * full price per 100 of par value</p>
187	<p>Price value of a basis point (PVBp) = Average of decrease in value of bond when YTM increases and increase in value of bond when YTM decreases</p>
188	<p>Approximate Convexity = $\frac{V_{-} - V_{+} - 2V_0}{(\Delta \text{curve})^2 V_0}$</p>
189	<p>% change in Bond Price (when duration and convexity are given)</p> <p>$\% \Delta \text{Bond Value} = -\text{duration} (\Delta \text{spread}) + \frac{1}{2} \text{convexity} (\Delta \text{spread})^2$</p>
190	<p>Duration Gap = Macaulay duration - Investment horizon</p>
191	<p>Return impact (% change in bond price)</p> <p>For small spread changes, Return impact \approx -Modified duration * ΔSpread</p> <p>For larger spread changes, Return impact \approx -Modified duration * ΔSpread + $\frac{1}{2} \text{convexity} (\Delta \text{spread})^2$</p>
192	<p>Yield spread = liquidity premium + credit spread</p>
193	<p>Payment to the long at settlement,</p> $(\text{floating-foward}) \left(\frac{\text{days}}{360} \right) \frac{(\text{notional principal})}{1 + [(\text{floating}) \left(\frac{\text{days}}{360} \right)]}$ <p>Days = number of days in the loan term</p>
194	<p>Intrinsic value of call option,</p> <p>$C = \max [0, S - X]$</p> <p>C = Intrinsic Value of Call option</p> <p>S = Spot price</p> <p>X = Strike price</p>
195	<p>Intrinsic value of a put option,</p> <p>$P = \max [0, X - S]$</p> <p>P = intrinsic value of put</p>

196	Option value= intrinsic value+ time value
197	Put-call parity: $C + X/(1 + RFR)^t = S + P$ C= Call P=Put S=Stock X=Present value
198	Put call parity with assets cashflows, $C + X/(1 + RFR)^t = (S_0 - PVcf) + P$
199	Plain vanilla interest rate swap, $(\text{Net fixed rate payment})_t = (\text{Swap rate} - \text{LIBOR}_t - 1) \frac{((\text{Number of days})}{360})^* \text{ notional principal}$

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