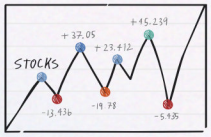
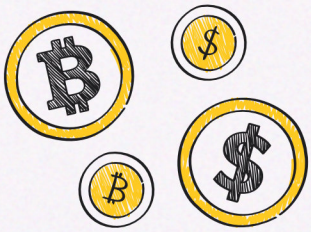
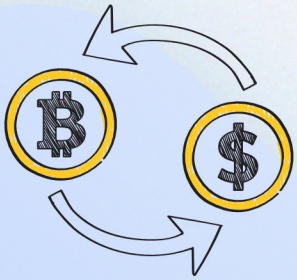
Krivii Eduspace
CA, FRM Jatin Nagpal

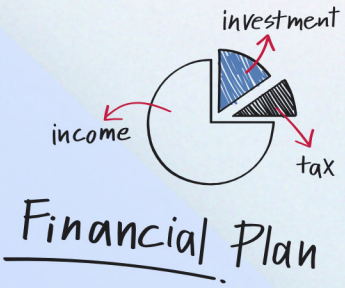
FIN FUNDAS

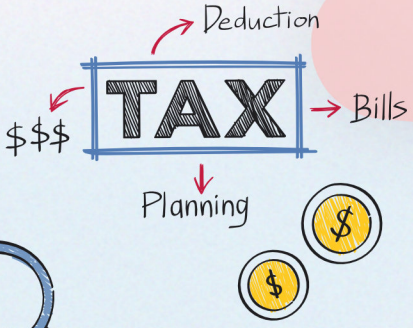
Lets learn with Fun

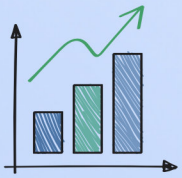












Finance Acharya

Jatin Nagpal (CA, FRM)

A Big thanks to ...

The Almighty – I bow down to your gentle feet. Nothing can be achieved without your ultimate blessing.

My Parents & Elder brother – Whose continuous support & efforts made this book possible.

My Teachers and guides – The one who enlightens the path and make us capable of walking on that path.

Team Krivi – Everyone for your relentless efforts.

And yes.... **TO YOU ALL STUDENTS** – For showering us with your love, faith and support.

Every effort has been taken to avoid any error or omission in this book. However, if you still find any error or omission then please share it at any of the following-

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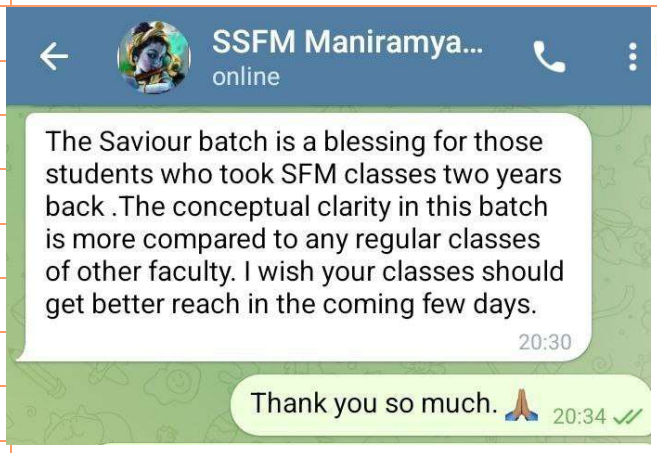


Anil Gupta • 22 hr ago

Why don't seniors refer teacher like you, taken classes someone, all the things were rutta even they were rank 1 , just watched theire classes nd had to made own concepts, alot of time consumed, even ears were fed up of listening, nd watching.
Now watched two chapters , both were full of enjoyment and learning nd now going to watch next part.
Tq , uh made mah day❤️

H • 42 min ago

Revising portfolio management in 5hrs including every minute detail(basic se bhi basic detail) is really an art sir
You have mastered it sir
I can confidently say i dont have to mug up any formula now onwards

Thank you so much sir

And guys if you are in doubt whether to trust these young dynamic Faculty or to go for the so called legends
I have spent 20k for SFM alone and trust me they taught only what sir has taught in the lecture nothing more nothing less and their books were neither updated upto date nor were as per ICAI standards
But sir's books are also simplified and has everything covered with wide variety of qstns and he has provided them for free dev manush hain sir
So you can happily trust Jatin sir

Thank you once again sir

PART A: Your First Steps...

1. Let's buy some vegetables

I) WHEN YOU GO TO A VEGETABLE MARKET

- There are large number of different vegetables
- There are many buyers & sellers. The buyers & sellers negotiate to arrive at a price.
- The buyer will aim for maximum bargain and the seller aims for a higher price.
- The price where the transaction takes place is the price at which both the buyer & seller agrees to transact.
- This price is determined by factors of demand & supply.

II) HOW THE PROCESS MOVES...

Step 1: Buyer decides what he wants to buy, say he wants to purchase potatoes.

Step 2: Buyer will find a person who is selling potatoes. The potato seller **ASKS** for a price of ₹60/kg.

Step 3: Negotiate. Now here can be multiple possibilities.

(i) Buyer will agree to the price of ₹60/kg.

(ii) Buyer may try to bargain and **BID** at Rs. 50/kg.

(iii) The seller & buyer may both compromise to some extent & agree to a price of ₹55/kg.

2. When you go to stock market

NSE

- You can buy or sell the shares of various companies.
- Just like in a vegetable market, the price of shares are determined largely by demand & supply factors.
- There are a lot of other factors as well & that's what we will study in this subject.

II) **HOW THE PROCESS MOVES...**

Step 1: Buyer will decide which share he wants to buy, say he wants to buy the shares of **Tata Motors**.

Step 2: Buyer will check what price the sellers are asking for Tata Motors. Say the seller of Tata Motors' shares **ASKS** for a price of ₹200/share.

Step 3: Again (like vegetable market) the buyer has 3 choices -

(i) Agree to the price of ₹200/share.

(ii) Try to bargain & **BID** at a price of Rs. 190/share.

(iii) The seller & buyer may both compromise to some extent & agree to a price of ₹194/share.

3. Learnings from the above story

1. The price which seller asks is known as **ASK RATE** or **OFFER RATE**.
2. The price at which buyer offers to purchase the share is known as **BID RATE**.
3. Share price which you see on TV or stock exchange is **LAST TRADED PRICE (LTP)**. This is the price at which the last trade has happened. LTP is discovered using the market mechanisms of bid-ask only.
4. The difference between the Ask price (₹200) & bid price (₹190) is known as **BID-ASK SPREAD** (₹10).

4. Practical Example

TCS 0.11 % ^ 2130.70

BID	ORDERS	QTY.	OFFER	ORDERS	QTY.
2130.50	1	28	2131.00	7	126
2130.45	6	60	2131.10	1	15
2130.40	2	115	2131.35	2	82
2130.30	1	9	2131.60	2	16
2130.25	1	1	2131.65	1	40
Total		2,06,308	Total		2,25,573

The Bid-ask table of TCS share.

Here the buyer with the highest bid is placed on the top on the Bid side of the table and the seller with the lowest ask price is placed on the top of the ask side of the table.

For a trade to happen, either the buyer will have to increase his bid or the seller shall reduce his ask price.

5. 2 Types of people in stock market

		INVESTOR	TRADER
-	Investment horizon	Long term- 1 year, 2 years, 5 years...	Short term- 1 day to 1 week (generally)
-	Focus on	Fundamental analysis (company's future earnings, its competitiveness etc.) – We will study a lot about it later.	Technical analysis (studying charts and patterns to enter into short term trade) (Can refer CMT for this)
-	Contract type	Enter into delivery contracts	Traders do a lot of Intraday trading

Author note – Students interested in 'Investing' can refer CFA for in-depth knowledge.
Those interested in Technical analysis can check out 'CMT' (Chartered Market Technician) by CMT Association.

II) THE ULTIMATE GOAL

Ultimate goal of everyone dealing in stock market (investor & trader) -> ***BUY LOW & SELL HIGH***

6. 2 types of Equity Contracts

There are 2 types of contracts - (i) Intraday (same day) (ii) Delivery (unlimited period)

I) INTRADAY CONTRACTS – In intraday trades you buy & sell the shares on the very same day.

Ex: Intraday buy say Wipro

First buy:	1,000 shares x 240	=	2,40,000
Then sell:	1,000 shares x 243	=	2,43,000
	Gross profit	=	3,000

Ex: Intraday sell say Voltas

First sell:	2000 shares x 700	=	14,00,000
Then buy:	2000 shares x 694	=	13,88,000
	Gross profit	=	12,000

Yes, you can first sell & then buy in case of intraday contracts. This is known as '**SHORT SELLING**'.

Imp: ***In India - Short selling is allowed only in intraday trades (& NOT in delivery contracts).***

II) DELIVERY CONTRACTS – You buy the shares of a company but are under no restriction to sell it.

7. Basic terminology

I) LONG POSITION

Long position means buying. It is represented by '+' sign.

Ex: Infosys 1000+ means = I have bought 1000 shares of Infosys. Or I am long on Infosys.

II) SHORT POSITION

Short position means Selling. It is represented by '-' sign.

Ex: Wipro 500- means = I have sold 500 shares of Wipro. Or I am short on Wipro.

III) BULL & BEAR MARKET

BULL MARKET – When the market is rising. (upward trend)

BEAR MARKET – When the market is falling. (downward trend)

IV) MARKET CAPITAL OR MARKET VALUE

Market Cap = Number of outstanding shares Market x price per share

Market capitalization or Market value tells us about the size of the company.

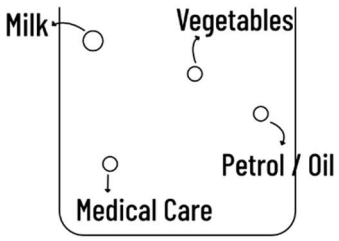
PART B: The Indices

1. Introduction to Index

INDEX MEANS INDICATOR

- Index gives us a **GENERAL IDEA** whether most of the stocks have gone up or down.

Ex: CONSUMER PRICE INDEX (CPI) tells whether the price of **SELECTED** goods in economy has increased or decreased.



Basket of Goods/ Services

Only Essential goods / Serivices

Not all the goods/Services

- Similarly, there are stock index such as SENSEX or NIFTY.
- These indices measure the change in price of selected group of companies
- It gives us an overall idea whether the **OVERALL MARKET** has increased or decreased.

II) SENSEX

Sensex = **SEN**sitivity Ind**EX**. It comprises 30 of the largest and most actively-traded stocks on the BSE.

III) NIFTY

NIFTY – NSE Fifty. This is also an index like Sensex. However, there are 50 companies in Nifty.

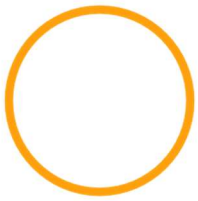
IV) WHY DO WE EVEN NEED AN INDEX?

- There are more than 6000 companies listed on BSE & 1600+ companies on NSE.
- Investors are not really concerned in all the companies listed on BSE/NSE. Therefore, including those companies in the index will not be meaningful.

V) SOME OTHER INDICES

INDIAN – Nifty IT, Nifty Midcap 100, Nifty Bank, Bankex etc.

GLOBAL – S&P 500 (US), DJIA (US), NASDAQ (US), FTSE (UK), CAC 40 (France), DAX (Germany), Nikkei 225 (Japan)



PART C: Get Set Go... Real Trading!

In this part, we will learn to operate a Demat account.

It is highly recommended that students should open a Demat account. (It is very simple)

This part will be practically understood in the class.

I) BASIC TERMS

Pay In – To put money in Demat account.

Pay Out – To withdraw money from your demat account.

(Note: Pay In & out is only possible from the linked bank account and not any other account.)

Market Order – Order will be placed at CMP.

Limit order – Order will be placed at a pre-determined price. (Note: Limit orders are used to negotiate price in stock market as discussed earlier)

Stoploss order – An order to sell a security at a specified price in order to limit loss. Example: Setting a SL order at 5% will limit the losses to 5%.

Market Timings – 9:15 am – 3:30 pm (Pre-open at 9:00 am)

II) SQUARING OFF

It means exiting a position. When you buy a stock, you will have to sell it to exit from your position. Similarly, when you 1st sell a stock (in case of Intraday short selling), you will have to Buy the stock to to exit from your short position. This exiting from a position is known as Squaring off.

1. Two basic conditions of Money

We can Add, subtract etc. different amounts only if -

The amounts are in same currency

The amounts are standing at same point of time

Ex: You have ₹1000 and $10 with you. What is your total worth?

Can you say I have 1010... something ... something... NO!

A: First convert $ to ₹ (or ₹ to $). If 1$ = ₹80, then -

Total wealth = 1000 + 80x10 = ₹1800.

Ex: You have ₹1000 today and you'll receive ₹550 after 1 year.

Is you wealth today ₹1550? NO!

A: First find PV of ₹550. If discount rate = 10%, then PV = $550/1.10^1$ = ₹500.

Total wealth = 1000 + 500 = ₹1500.

2. Calculating FV & PV – Compound Interest

I) FUTURE VALUE (FV)

$$FV = PV \times (1 + r)^n$$

Where: r = Rate per period

n = number of compounding periods

Ex: You invested ₹100 today at 10% p.a. Find future value (FV) after 1-year and 2-year.

A: FV after 1-year = $100 \times (1 + 0.1)^1$ = ₹110.

FV after 2-years = $100 \times (1 + 0.1)^2$ = ₹121.

II) PRESENT VALUE (PV)

$$PV = FV \div (1 + r)^n$$

Note - $1/(1+r)^n$ is also known as FV factor.

Ex: Find PV if interest rate is 10%. Case 1 – Amount after 1 year = ₹110.

Case 2 – Amount after 2 years = ₹121

A: Case 1 – PV = $110 / 1.10^1$ = ₹100

Case 2 – PV = $121 / 1.10^2$ = ₹100

3. PV of multiple cash flows

I) MULTIPLE UNEQUAL CASH FLOWS

This is like calculating PV of single cash flows. Calculate PV of each cash flow & add them to get Total PV.

Ex:

Time (in years) -	1	2	3	4
Cash flow -	130	150	290	400

A: $PV = \frac{130}{(1.08)^1} + \frac{150}{(1.08)^2} + \frac{290}{(1.08)^3} + \frac{400}{(1.08)^4}$

PV = 120.37 + 128.60 + 230.21 + 294.01 = ₹773.19

II) MULTIPLE EQUAL CASH FLOWS

PV = Cash flow per period x PVAF(r %, n periods)

Where: PVAF = Present value annuity factor

Ex: Cash flow of ₹100 p.a. will be received for next 5 years. Find its PV today. Discount rate = 8% p.a.

A: PV = 100 x PVAF (8%, 5)

PV = 100 x 3.9927 = ₹399.27

4. PV of Perpetual cash flows

I) PERPETUAL EQUAL CASH FLOW

(also known as Infinite / indefinite / forever cash flows.)

PV of perpetual cash flows = $\frac{\text{Cash flow p.a.}}{\text{Discount rate}}$

Ex: You found an ancient tree will live for next thousands of years (perpetuity). You can sell the herbs from this tree and can earn revenue. Find the value of this tree today (or PV of cash flows from this tree) if you expect to that revenue from sale of herbs will be ₹2,50,000 p.a. Discount rate = 8%.

A: PV of cash flows = $\frac{\text{Cash flow p.a.}}{\text{Discount rate}} = \frac{2,50,000}{0.08}$ = ₹31,25,000.

II) SPECIAL CATCH

Let us say that the ancient tree (from above example) will start producing herbs only after 4 years.

What should be the PV of its cash flows now?

A: $PV = \frac{\text{Cash flow p.a.}}{\text{Discount rate}} \times \frac{1}{(1+r)^3}$

$PV = \frac{2,50,000}{0.08} \times \frac{1}{1.08^3} = ₹24,80,725$

Logic of above

Perpetuity formula pulls the total value of perpetual CFs to 1 yr before the starting year.

- If perpetual CFs are starting from year 1, then this formula will provide us value @ Year 0.
- Similarly, if perpetual CFs are starting from year 4, then this formula will provide us value @ Year 3.

So, to calculate its PV we have to discount it with $(1+r)^3$.

III) PV OF PERPETUAL & GROWING CASH FLOWS

PV of Perpetual & Growing CFs = $\frac{1^{st} \text{ CF of growth series}}{\text{Discount Rate} - \text{Growth rate}}$

Ex: Let us say in the previous example of ancient tree, you expect annual cash flows to grow at 3% p.a.

Find PV of cash flows now.

A: PV of cash flows = $\frac{2,50,000}{0.08 - 0.03} = ₹50,00,000.$

Ex: Same as above example. But herbs will grow after 5 years. So, revenue will start after 5 years.

A: PV of cash flows = $\frac{2,50,000}{0.08 - 0.03} \times \frac{1}{1.08^4} = ₹36,75,150.$

5. Two Special Cases

Basic rule – Rate is always quoted on p.a. basis (unless specifically mentioned otherwise)

I) SPECIAL CASE 1 -- Period < 1 year

Ex: Interest rate for 3-months = 2%. It will be quoted as 2 x 4 = 8% p.a.

So, if ques mention 8% p.a. and you require quarterly interest → Then it means 8 x 3/12 = 2% per quarter.

Ex: Invested ₹1000 for 6-months @ 8% p.a. Find future value @ end of 6-months.

A: Future value = 1000 x (1 + 0.08 x 6/12) = ₹1040.

Ex: You will receive ₹1040 after 6 months. Find its PV if interest rate = 8% p.a.

A: $PV = \frac{1040}{(1 + 0.08 \times 6/12)} = ₹1000.$

II) SPECIAL CASE 2 -- Compounding frequency specifically given

Concept – The formula for PV and FV remains same with 2 additional steps.

Step 1: Get rate per compounding period (r) = Rate p.a. ÷ Number of compounding in a year

Step 2: Calculate number of compounding periods (n) = Number of years x Number of compounding in year

Ex: Amount invested today ₹1000 for 1.5 years at 10% p.a. compounded semi-annually. Find FV.

A: r = Rate per compounding period = 10% / 2 = 5% per 6-months.

n = Total number of compounding periods = 1.5 x 2 = 3

$FV = 1000 \times (1 + 0.05)^3 = ₹1157.625$

Ex: Amount receivable after 2 years = ₹20,000. Rate = 12% p.a. compounded quarterly. Find PV.

A: r = Rate per compounding period = 12% / 4 = 3% per quarter.

n = Total number of compounding periods = 2 x 4 = 8

$PV = 20{,}000 / (1 + 0.03)^8 = ₹15{,}788.18$

III) CRUX (V.Imp)

	PERIOD < 1 YEAR	PERIOD > 1 YEAR
-	$FV = PV(1 + r \times months/12)$	$FV = PV(1 + r)^n$
-	$PV = \frac{FV}{(1 + r*months/12)}$	$PV = \frac{FV}{(1 + r)^n}$
*	In case if period is in days, then it will be days / 360 or 365 and so on...	Where r = rate per compounding period n = Total number of compounding periods

6. Dirty power

Ex: Amount invested today = ₹1000. Rate = 12% p.a. compounded semi-annually. Find FV after 15 months.

A: r = Rate per compounding period = 12% / 2 = 6% per 6-months.

n = Total number of compounding periods = 15/6 = 2.5 periods

$FV = 1000 \times (1 + 0.06)^{2.5}$

BUT HOW SOLVE $1.06^{2.5}$

Such odd powers are also known as Dirty power.

STEPS TO SOLVE DIRTY POWER - A^B

√a 12 times	---	Enter 'a' and then press under-root button 12 times
-1	---	Subtract 1
x b	---	Multiply with power
+ 1	---	Add 1
x = 12 times	---	Press 'multiply equal to' 12 times

Applying in above case -> Calculating $1.06^{2.5}$

√ 1.06 - 12 times

- 1

x 2.5

+ 1

x = - 12 times

We'll get $1.06^{2.5} = 1.1568$

Hence, FV = 1000 x 1.1568 = ₹1156.8

7. Spot Rates (SR) vs Forward Rates (FR).

I) SPOT RATES (ALSO KNOWN AS ZERO RATES).

Ex: You want to invest ₹100. Banker has quoted following SPOT rates. Find the future value of investment.

1 year SPOT RATE ($r_{0,1}$) = 10% p.a.

2 years SPOT RATE ($r_{0,2}$) = 11% p.a.

3 years SPOT RATE ($r_{0,3}$) = 12% p.a.

A: If you invest for 1 year, then future value of investment = ₹100 x 1.10 = ₹110 (easy).

ii) Invest for 2 years.

Earn 11% p.a. for next 2 years. i.e. Interest for 1st year = 11% and also interest rate for 2nd year = 11%.

FV of investment = $100 \times 1.11 \times 1.11 = 100 \times 1.11^2 = 123.21$

iii) Invest for 3 years.

You will earn 12% p.a. for next 3 years.

FV = $100 \times 1.12 \times 1.12 \times 1.12 = 100 \times 1.12^3 = 140.49$

II) FORWARD RATE (FR)

Ex: You want to invest ₹100. Banker has quoted following forward rates: Find future value of investment.

Forward Rate of year 1 ($f_{0,1}$) = 10% p.a.

Forward Rate of year 2 ($f_{1,2}$) = 11% p.a.

Forward Rate of year 3 ($f_{2,3}$) = 12% p.a.

A: Year 1 is same. You invest and earn 10%. FV of investment = 100×1.10 = ₹110

ii) Invest for 2 years

Earn 10% interest for 1st year (i.e. 1st year FR) and 11% for second year (i.e. 2nd year FR).

FV of investment = $100 \times 1.10 \times 1.11$ = ₹122.1

iii) Invest for 3 years

Earn 10% for 1st year, 11% for 2nd year and 12% for 3rd year.

FV of investment = $100 \times 1.10 \times 1.11 \times 1.12$ = ₹136.752

III) NOTATIONS

$r_{(0,2)}$ means SR for 2 years. Similarly, $r_{(0,3)}$ means SR for 3 years and so on.

$f_{(1,2)}$ means FR for 2nd year. Similarly, $f_{(2,3)}$ means FR for 3rd year and so on.

How much for a water bottle?

Mr. CA forgot his water bottle while going to his office.

Shopkeeper – Here it is sir. 1 water bottle for ₹40

Mr. CA – Oh it's too expensive. Let it be. I will go back home and pick up my bottle.

After a few days...

Mr. CA went to tour UAE and got lost in a dessert. After 2 days without food & water he finally found a man selling 1 water bottle for ₹10,000. He purchased it instantaneously to save his life.

☞ **Why it is so?** To understand it, we must first understand 2 terms – Value and Price.

I) VALUE

- Amount determined by investor as the amount that he/she **SHOULD PAY** to get an asset.
- This is amount that you feel is **'RIGHT OR FAIR'** for the asset.
- Also known as Fair value or Fair price or equilibrium value or theoretical value.

II) PRICE

Price prevailing in the market i.e. amount at which you can **ACTUALLY BUY OR SELL** an asset.

In the above example, the rate quoted by shopkeeper (₹40 or ₹10,000) is the price.

III) CRUX

In case 1 - Value of 1 water bottle was probably less than the price (₹40) for Mr. CA. So, he didn't buy it.

In case 2 - Value of 1 water bottle was way higher than ₹10,000 for Mr. CA (as his life was at stake).

So, he promptly bought the bottle for even ₹10,000.

IV) OVER-VALUED & UNDER-VALUED

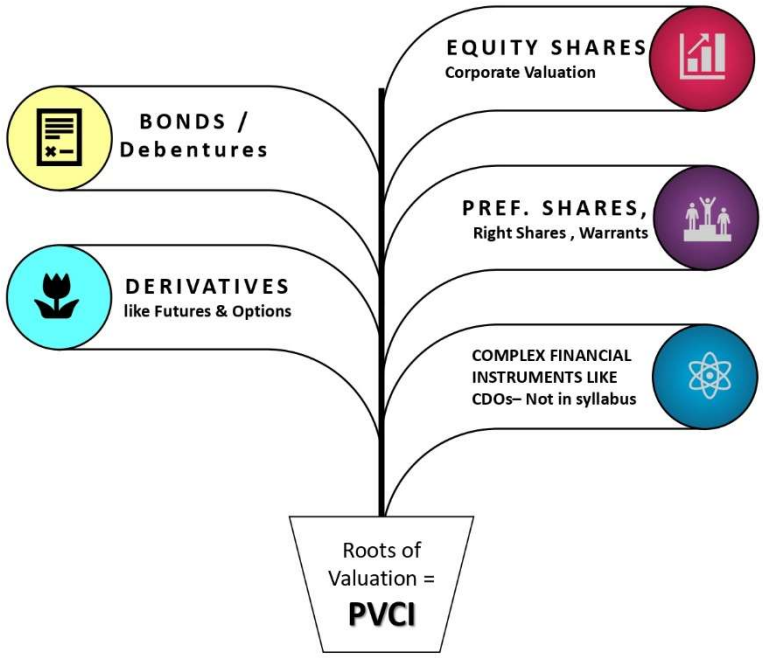
If price > Value = The asset is overpriced & I am not willing to buy it.

If price < Value = The asset is under-priced & I am eager to buy it (since I am getting discount!)

V) HOW TO FIND VALUE AND PRICE?

Price = Simply check what the price prevailing in the market. It cannot be calculated as such.

Value = PV of expected cash inflows from an asset.



From the outside, you may feel that each financial asset has a different way of calculating its value.

However, you will observe that the base of every such calculation is nothing but the present value of cash inflows.

Let's recall some ratios

I) PROFITABILITY RATIOS (BASE = SALES)

1. GP ratio = GP/Sales
2. COGS ratio = COGS / Sales or 100% - GP Ratio
3. Operating expense = Operating expense / Sales
4. Operating profit (OP) ratio = EBIT / Sales
5. Operating ratio = (COGS + Operating expenses) / Sales or 100% - OP ratio
6. NP ratio = NP/Sales

II) TURNOVER (TO) RATIOS

1. Asset Turnover ratio = Sales / Assets
2. Fixed Asset Turnover ratio = Sales / Fixed Assets
3. Current Asset Turnover ratio = Sales / Current Assets
4. Inventory Turnover ratio = **COGS** / Average Inventory or closing inventory
5. Debtor Turnover ratio = **CREDIT SALES** / Debtors

III) PER SHARE RATIOS

1. EPS = $\frac{\text{Earnings available for Equity shareholders (EAESHs)}}{\text{Total Number of Equity Shares}}$

* EAESHS= PAT – (Preference dividend + Any tax on preference dividend)

2. Dividend per share (DPS) = $\frac{\text{Total dividend paid for ESHs}}{\text{Total number of equity shares}}$

3. Market Value per share (MPS) = $\frac{\text{Total Market value of the company}}{\text{Total number of Equity shares}}$

4. Book Value per share (BVPS) = $\frac{\text{Total Equity shareholders funds}}{\text{Total number of Equity shares}}$

* Total ESHs funds = Paid up SC + Reserve & Surplus. This is also known as the **NET WORTH** of the company.

5. Retained earnings per share (REPS) = EPS – DPS
6. Dividend payout ratio (DPR) = DPS / EPS or 100% - Retention ratio
7. Retention ratio = REPS / EPS or 100% - DPR

IV) EARNING OR RETURN BASED RATIOS

1. Dividend rate = $\frac{\text{Dividend per share (DPS)}}{\text{Face value per share}} \times 100$

* Dividend rate is always calculated w.r.t to the **FACE VALUE** of the share & not the MPS.

2. Dividend yield = $\frac{\text{DPS}}{\text{MPS}} \times 100$

* The MPS that needs to be considered is the price at which the investment was made. Therefore, if P0 & P1 are separately given in ques, always prefer P0.

8. Earning yield = $\frac{\text{EPS}}{\text{MPS}} \times 100$

9. Return on Equity (ROE) = $\frac{\text{Earning available for equity shareholders (EAESHs)}}{\text{Total ESHs funds (i.e. Paid up SC + R\&S)}} = \frac{\text{EPS}}{\text{BVPS}}$

10. Return on capital employed (ROCE) = $\frac{\text{EBIT}}{\text{Capital Employed}}$

V) RATIOS RELATED TO MARKET PRICE OF SHARE (MPS)

1. PE Ratio = MPS/EPS
2. Market capitalization (or M-Cap) = MPS x Number of equity shares

VI) RATIOS RELATED TO CAPITAL STRUCTURE

1. ***Capital employed (CE) = Equity SC + Reserve & Surplus + Preference share capital + Debt***

or CE (from asset side) = Total assets (Fixed + Current) – Current liabilities

(Subtract any preliminary expenses or P&L debit balance or any such fictious assets)

2. Debt equity ratio = Debt / Equity
3. Debt ratio or Debt to CE ratio = Debt / CE or 1 – Equity ratio
4. Equity ratio or Equity to CE ratio = Equity / CE or 1 – Debt ratio
5. Capital gearing ratio = Debt + Preference share capital / ESH's Funds

* ESH's funds (Equity shareholder funds) = ESC + R&S

6. Asset to sales ratio = Assets / Sales

7. Interest coverage ratio = EBITDA / Interest

8. Fixed interest & fixed dividend coverage ratio = $\frac{\text{Net profit + Interest}}{\text{Interest + Preference dividend}}$

VII) EQUITY MULTIPLIER (ICAI FAVOURITE)

Financial leverage = Equity multiplier = $\frac{\text{Total assets}}{\text{Equity SC}} = \frac{\text{Equity + Debt}}{\text{Equity SC}} = 1 + \frac{\text{Debt}}{\text{Equity}}$

DUPONT ANALYSIS

ROE = Total asset turnover x Net profit margin x Equity Multiplier (or Financial leverage)

Logic: ROE = $\frac{\text{Sales}}{\text{Total assets}} \times \frac{\text{Net profit}}{\text{Sales}} \times \frac{\text{Total assets}}{\text{Equity SC}} = \frac{\text{Net profit}}{\text{Equity SC}}$

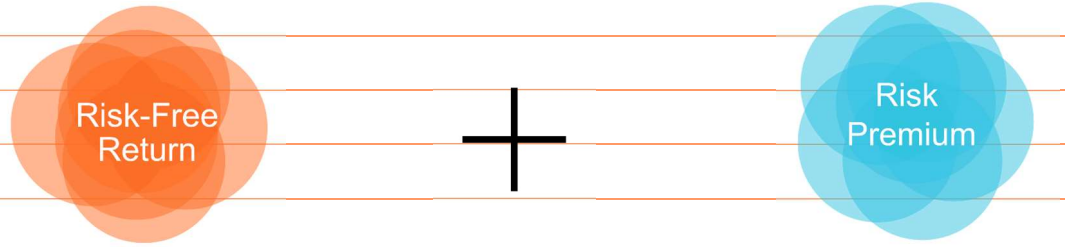
1. Understanding Required return

TWO COMPONENTS OF REQUIRED RETURN

There are different methods to calculate the required return from a financial asset.

Base of all these methods remains same. The required return is made up of two basic components -

a) Risk Free return b) Risk premiums



RISK-FREE RETURN = The return that an investor will earn if he invests in an absolute risk-free investment. Conventionally, the return offered by Govt. securities (Govt. bonds) is treated as Rf.

RISK PREMIUM = Risk premiums are demanded for the risks that an investor assumes in a financial asset.

Ex: Default risk premium.

2. Breaking down Rf into Real Rf & Nominal Rf

Ex: I invest ₹100 today in a Govt. bond that will pay me ₹105 after one year. Inflation in India = 3%.

The total return earned by me = 5%.

Inflation in India = 3%. So, out of ₹5 earned, ₹3 is merely a compensation towards inflation.

So, real earning = ₹5 – ₹3 = ₹2 only.

As seen in the above example, the risk-free rate (Rf) can be broken down into two components

1) METHOD 1 - Simple Addition Method

Real Rf + Inflation rate = Nominal Rf

Ex 1: The real rf in India is 4%. Calculate Nominal Rf if inflation rate in India is expected to be 5%.

Ans: Nominal Rf = Real Rf + Inflation rate

Nominal Rf = 4% + 5% = 9%

II) **METHOD 2 – Multiplication Method (more accurate)**

(1 + real Rf) x (1 + inflation rate) = (1 + Nominal Rf)

Ex 2: The real rf in India is 4%. Calculate Nominal Rf if inflation rate in India is expected to be 5%.

Ans: (1 + Nominal Rf) = (1 + 0.04) x (1 + 0.05)

(1 + Nominal Rf) = 1.04 x 1.05 = 1.092

Nominal Rf = 0.092 or 9.2%

3. Which is better?

Story of Kido's Gift

Kido's Mom gifted her ₹1000 to purchase a special Pen that she wanted. On the gift shop she saw a beautiful keyring for ₹20. Now she wants both.

Kido knows that Govt. bonds are currently providing a **REAL-RISK FREE RETURN** of 2% p.a.

So, she can invest in Govt. bonds and have ₹1020 after 1 year. Hurray...

she goes to the Govt. bonds seller and demands a 2% return.

Q Do you think Kido will be able to achieve his target if inflation in economy is 5%?

A: Total investment value after 1 year if invested at 2% real return = ₹1000 x 1.02 = ₹1020

Price of Notebook after 1 year = ₹1000 + 5% = ₹1050.

Oh... this won't be even sufficient to buy notebook after 1 year. (Forget keyring)

So, practically Kido is losing in this case (instead of earning anything) due to inflation.

Q Will Kido achieve his objective if he demands 7% return i.e. **REAL RETURN + INFLATION PREMIUM**?

A: After 1 year

Price of Notebook = 1000 x 1.05 = ₹1050

Price of Keyring = **20 X 1.05** = ₹21

Total funds required = ₹1071

Total investment value = 1000 x 1.07 = ₹1070.

Alas!!! The investment value is still not sufficient to meet the investment objective.

So, simple addition method FAILED to achieve the investment objective.

Q Lets try with Multiplicative method.

Required return in this case = (1 + real Rf) (1 + inflation premium) = (1 + Nominal Rf)

1 + Nominal Rf = 1.02 x 1.05

So, required return (Nominal Rf) = 7.1%

Let's check if this works...

Total funds required after 1 year = ₹1071

Investment value after 1 year = 1000 x 1.071 = ₹1071

Hurray... It works. Hence, Multiplicative method is best (most accurate).

Author Note – Although Multiplicative method works best. But even simple addition quite a close answer to multiplicative method. So, at some places even simple addition is also used due to its simplicity.

CREDIT RATINGS! - Know "How risky a bond is"

For this one need to analyse a lot of factors to assess the safety of a bond. Such as -

- Cash earning capacity of the company
- Existing liabilities of the company
- Industry understanding in which the company operates

and a host of other factors.

PROBLEM...

An average don't have much time and knowledge to do all this.

SOLUTION...

To solve this problem, we have Credit Rating Agencies (CRAs).

These agencies specialise in assessing the financial health of a bond issuer and assigns a credit rating to it.

GENERAL HIERARCHY OF CREDIT RATINGS

AAA	Investment grade bonds (Less risky)	Clearly, the higher the rating is, the better the company is assumed to be.
AA		
A		
BBB		This is just like grading system of high school where AAA is best, AA is next to it & so on.
BB	Speculative or Junk bonds (carry substantial risk)	
B		
CCC		
CC		Rating D is worst of all. It is given to a company which has defaulted or is expected to default very soon.
C		
D		

So when a rating is assigned to a company's bond issue, the retail investor readily knows how safe/risky the bonds are. For ex: If the bonds are rated AA -> they are quite safe. But if they are rated B -> they carry some good amount of risks.

Base: Learning basics of Data Analysis (Mean, SD, Cov., Correlation)

1. Mean (Average / Expected Value)

I) WHEN HISTORICAL DATA IS GIVEN

Mean = Sum of all items ÷ Number of items

Ex: Vikram Kohli scored the following scores in his last 4 innings. Find his mean / average score.

Innings	1	2	3	4
Score	30	40	40	50

A: Average score = $\frac{30 + 40 + 40 + 50}{4} = 40$

II) MEAN WHEN PROBABILITIES IS GIVEN

Mean = $\sum Xi \times Pi$ or $Item_1 \times Prob._1 + Item_2 \times Prob._2 + \ldots\ldots$

Ex: Find Expected value of Vikram Kohli's score using following data:

Score:	30	40	50
Probability:	0.25	0.5	0.25

A: Average score = $30 \times 0.25 + 40 \times 0.5 + 50 \times 0.25 = 40$

Note: If you observe then you'll find that both the methods are essentially the same.

III) WHY IS MEAN ALSO CALLED EXPECTED VALUE?

Let us say that average travel time from your home to coaching class is 15 minutes.

If you leave your home by 7:20, then you can expect to reach your class by 7:35 (i.e. in 15 minutes).

☞ Clearly, MEAN helps us in forming an expectation about some and hence is also known as expected value.

IV) MEAN HAS A PROBLEM

Mean does not provide us any info about the deviations. For ex: If average score of Vikram Kohli is 40, then it does not mean that he will score exactly 40 in his next match. His ACTUAL SCORE can definitely be different from the AVERAGE SCORE. But this info is not provided by mean.

2. Standard Deviation (σ)

The name itself says: Standard deviation i.e. Standard (Mean) se Deviation.

SD tells us about the Deviation from the standard (Mean) on an average basis.

I) THE PROBLEM – 'AVERAGE OF DEVIATIONS' = 0.

Ex: Calculate the standard deviation of Vikram Kohli's score.

Innings	Score	Deviation from Mean (i.e. Score – Mean)
1	30	30 – 40 = -10
2	40	40 – 40 = 0
3	40	40 – 40 = 0
4	50	50 – 40 = 10
Total	160	0
Average	= 160/4 = 40	= 0/4 = 0

Average deviation = 0. This is NOT a co-incidence. This is true for all the cases.

THIS IS BECAUSE NEGATIVE DEVIATIONS AND POSITIVE DEVIATIONS CANCELS OUT EACH OTHER.

II) THE SOLUTION – TAKE AVERAGE OF 'SQUARED DEVIATIONS'

Take the square of the deviation first and then take square root of the final answer.

Innings	Score	Deviation from Mean	Square of deviations
1	30	30 – 40 = -10	= -10^2 = 100
2	40	40 – 40 = 0	= 0^2 = 0
3	40	40 – 40 = 0	= 0^2 = 0
4	50	50 – 40 = 10	= 10^2 = 100
Total	160	0	200
Average	40	0	50 (this is average of squared deviations)

Finally, take square root - √50 = 7.07

III) SD – FORMULA (Understand, don't cram)

SD = 'Average Squared deviations' ka Square root.

SD = $\sqrt{\frac{\sum(x-\bar{x})^2}{n}}$ or $\sqrt{\sum P(x-\bar{x})^2}$

IV) SD = MEASURE OF 'TOTAL' RISK

Let us understand this with an example.

Ex: Following are the scores scored by Rohit Verma in the last 4 matches. Find its mean & SD.

Probability	Score	Deviations from mean	Square of deviations	Prob. x Squared deviations
0.25	10	10 – 40 = -30	900	900 x 0.25 = 225
0.5	15	15 – 40 = -25	625	625 x 0.5 = 312.5
0.25	120	120 – 40 = 80	6400	6400 x 0.25 = 1600
				Total = 2137.5

A: Mean = 10 x 0.25 + 15 x 0.5 + 120 x 0.25 = 40

Standard deviation = Square root of "Average squared deviation" = $\sqrt{2137.5}$ = 46.23

Interpretation

Though the average score of both Vikram & Rohit is same (40). But the SD of Vikram is lesser (7.07).

Whereas SD of Rohit is quite high (46.23).

If I have to choose one player out of the two, I will prefer Vikram as he is more stable player.

Rohit on the other hand can be a quite risky choice.

V) CRUX

1. SD = 'Average Squared deviations' ka Square root.
2. SD is measure of **TOTAL RISK**. Higher the SD, the riskier an item is. Hence, in stock market, we prefer stocks with lower SD (other things remaining same).

3. Variance (σ^2)

Variance = Square of standard deviation

or simply – 'Average Squared deviation'.

Variance = $\frac{\sum (x - \bar{x})^2}{N}$ or $\sum P(x - \bar{x})^2$

Ex: SD of a stock is 15%. Find its variance.

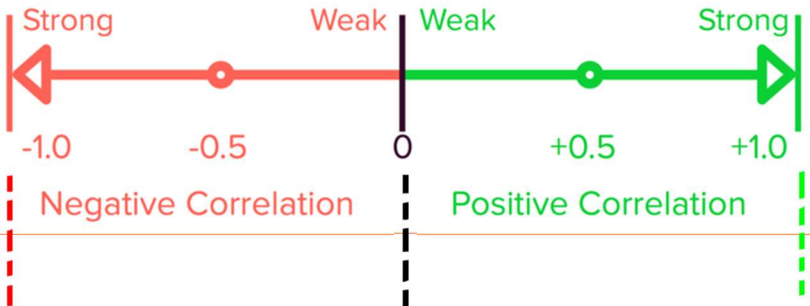
A: Variance = $(15\%)^2$ = $225\%^2$

Ex: Variance of a stock is $400\%^2$. Find its SD.

A: SD = $\sqrt{\text{Variance}}$ = $\sqrt{400}$ = 20%

4. Correlation

Correlation tells us the relation between 2 items. It always lies between -1 to +1..



Army vs Terrorist
Wherever army goes...
Terrorists are killed!
Perfect -ve correl (-1)

Relation b/w Number of Cricket matches played & Number of Teddy bears sold
There is no relation b/w the 2. An increase in cricket maths cannot be used to predict teddy bear sales!
Hence, No correlation (correl = 0)

Relation b/w Mother & Child
Wherever mother goes...
Child follows!
Perfect +ve correl (+1)

II) CORRELATION FORMULA

$$\text{Correlation}_{(x,y)} = \frac{\text{Covariance}_{(x,y)}}{\sigma_x \sigma_y}$$

Ex: Find the correlation between X & Y, if: $\text{Covariance}_{(x,y)} = 3600$, $\sigma_x = 150$, $\sigma_y = 60$

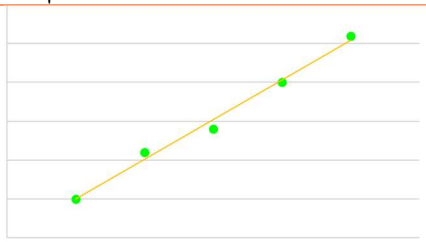
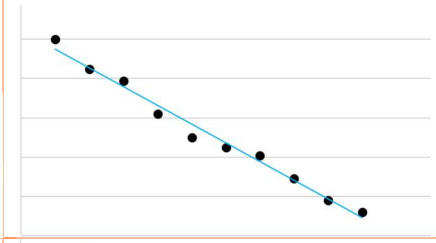
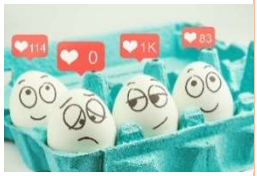
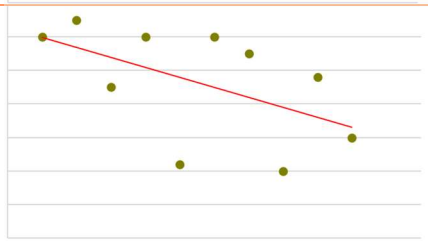
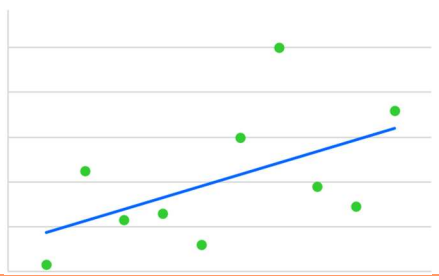
A: $\text{Correlation}_{(x,y)} = \frac{3600}{150 \times 60} = 0.4$ or 40%

III) CORRELATION INTERPRETATION

Correlation tells us about 2 things:

NATURE OF RELATION (Positive or negative)

STRENGTH OF RELATION (ex: 1 = very strong relation, 0 = no relation etc.)

	Scenario	Graph	Expected correlation
1.	Number of Cows I have & Quantity of milk I get every day. 		Close to +1. Milk quantity is directly proportional to number of cows.
2.	 Number of seeds sown & the number of new plants.		Close to +1. The more seeds I sow, the more plants will grow.
3.	Number of cars in a city Vs the air quality (cleanliness) of that city. 		Close to -1. More cars = More pollution = decrease in air quality.
4.	Time spent on social media vs 'real' happiness 		Clearly a -ve relation. But it is not perfectly -ve relation. It may be close to -0.5.
5.	 Number of marriages in a year vs Number of Gold medal won in Olympics.		Expected correlation = 0. Clearly, there isn't any relation b/w the two.
6.	Number of new mobiles sold vs New Facebook app installs 		Close to +0.5. (The dots are loosely scattered around the line.)

5. Covariance

- Covariance calculation is quite similar to that of variance.
- Covariance has no range. It can range from $-\infty$ to $+\infty$. (Unlike correlation which is always b/w -1 to 1)
- Hence, covariance cannot tell about the strength of relation but only the nature of relation. (+ve / -ve).

II) FORMULAS (similar to Variance)

Variance = $\frac{\sum (x - \bar{x})^2}{N}$ or $\sum P(x - \bar{x})^2$

Covariance = $\frac{\sum (x - \bar{x})(y - \bar{y})}{N}$ or $\sum P(x - \bar{x})(y - \bar{y})$

or Covariance = Correlation $_{A,B} \times \sigma_A \times \sigma_B$

-> Refer Ques 2 and 3 from Simplified AFM Ques book for practice.

III) COVARIANCE OF AN ITEM WITH ITSELF = VARIANCE

Covariance = $\frac{\sum (x-\bar{x})(y-\bar{y})}{N}$

- In case of same security:

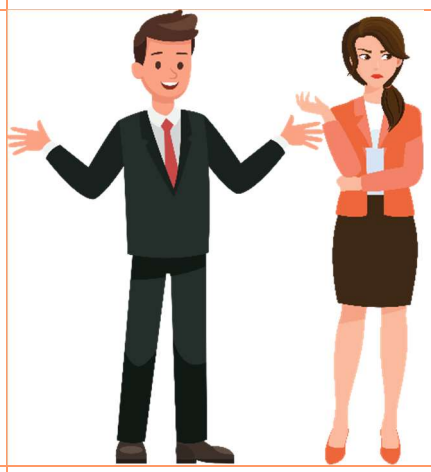
Covariance = $\frac{\sum (x-\bar{x})(x-\bar{x})}{N} = \frac{\sum (x-\bar{x})^2}{N}$ i.e. variance of the security

IV) CORRELATION OF AN ITEM WITH ITSELF = +1

Correlation(a,a) = $\frac{\text{Covariance}(a,a)}{\sigma_a \sigma_a}$

Correlation (a,a) = $\frac{\text{Variance}(a)}{\text{Variance}(a)} = +1$

Section 1 – 'I Love ~~you~~ Betting' (Net settlement)



Boy - Today's weather is so pleasant at 30°C. It will be even cooler tomorrow. Maybe at 25°C.
Girl - Oh! I Don't think so. As per me, tomorrow will be a warm day, with temperature above 30°C.

Boy – If you are so confident, then why don't **we place a bet on it**?
For every 1 degree increase in temperature (above 30°C), I will pay you $1. But if temperature falls you shall pay me $1 for every 1 degree fall in temperature below 30°C.
Girl – Deal.

I) FIND THE PROFIT / LOSS IF

Temperature next day	Boy	Girl
28°C	$2	-$2
34°C	-$4	$4
30°C	0	0

II)	LAYMAN LANGUAGE	INVESTMENT PROFESSIONALS' LANGUAGE
i.	Boy & Girl ARE BETTING on next day's temperature.	Boy & Girl have ENTERED INTO A FUTURES CONTRACT (with underlying item being 'temperature')
ii.	Boy has a DOWNSIDE bet.	Boy is SHORT futures (i.e. F-)
iii.	Whereas, Girl is betting on UPSIDE.	Girl is LONG futures (i.e. F+)

III) CAN YOU SENSE A BIG RISK IN THE ABOVE DEAL?

Yes. The party who lost the bet may refuse to pay.

This is known as COUNTERPARTY CREDIT RISK (CPCR).

Ex: If temperature next day is 28°C, then Girl shall pay $2 to Boy. But what if she refuses to pay?

(Similarly, if temperature next day is 34°C, then Boy may refuse to pay $4 to Girl.)

IV) SOLUTION TO COUNTERPARTY CREDIT RISK.

Both the parties i.e. Boy & Girl, deposit a security amount of say $10 to a trusted 3rd Party.

Let us see how things will work out in this case.

Temp. Next day	Boy gain / (loss)	Boy Net Pay	Girl Gain / (loss)	Girl Net pay
28°C	$2	10 + 2 = 12	-$2	10 - 2 = 8
34°C	-$4	10 - 4 = 6	$4	10 + 4 = 14
30°C	0	10 + 0 = 10	0	10 + 0 = 10

V) SPEAKING TECHNICALLY

1. The security deposit is known as '**INITIAL MARGIN**'. In our example initial margin = $10.
2. The trusted party with whom Margin Money is deposited can be an exchange (in case of Exchange traded derivatives) or a CCP i.e. Central Counterparty (in case of OTC derivatives).

VI) CRUX

- We just saw an example of betting on Temperature. Similarly, we can bet on virtually any item. It can be a cricket match or on a STOCK or COMMODITY or even BONDS.
- The above illustration is of – **NET SETTLEMENT OF FUTURES CONTRACT.**

Section 2 - A Genuine case of a Wheat Farmer!

A wheat farmer will be harvesting 100 Kg wheat after 3 months.
However, he is afraid that the price of Wheat may fall by that time.

Currently the prevailing price is ₹15 per Kg. Any **FALL** in wheat price will directly impact the income of this farmer.

A wheat mill purchases wheat from farmers to make bread & cakes.

The Miller is afraid that the wheat price may **INCREASE** in the coming months. This will directly affect the profitability of his mill.

I)	**SOLUTION = Futures contract**
	In this case, the wheat farmer and the Mill owner can enter into a contract to trade 100 Kg wheat after
	3 months at a **PRE-DETERMINED RATE. Let us say that the price is fixed today at ₹16/kg.**
	THIS IS KNOWN AS A FUTURES CONTRACT.
	Wheat Farmer -> Will supply 100 Kg wheat, after 3 months at the pre-fixed rate of ₹16/kg.
	Mill owner -> Will purchase 100 Kg wheat, after 3 months at the pre-fixed rate of ₹16/kg.
II)	**IMPORTANT POINTS!**
-	The contract is entered today only. The rate at which wheat will be delivered is also fixed today only.
	Even the quantity of wheat is also fixed today.
-	Only the delivery of the wheat by Farmer and the payment by Miller will be made at a future date.
III)	**WHO IS LONG, WHO IS SHORT?**
-	Wheat farmer will Sell wheat in future -> He has sold futures contract. i.e. he has **SHORT** position.
-	The Miller will Buy wheat in future -> He has bought futures contract. i.e. he has **LONG** position.
IV)	**VERY EASY WAY TO DETERMINE POSITION**
	If you want to buy in future -> Buy futures contract i.e. Long futures (F^+)
	If you want to sell in future -> Sell futures contract i.e. Short futures (F^-)
V)	**BASIC TERMINOLOGY OF FUTURES CONTRACT**
1.	The quantity decided of 100kg is known as 'Lot size of futures contract.'
2.	The period of 3 months is known as 'Expiry of futures contract'
3.	The price that is fixed today (of ₹16/kg) is known as the 'price of futures contract'
VI)	**CRUX**
-	**THE ABOVE ILLUSTRATION IS OF – PHYSICAL DELIVERY FUTURES CONTRACT.**
-	Technically speaking, the above case is of 'Forward' (more detail later).

Section 3 - Airlines are worried!

Problem – Gogo Airlines is worried about an increase in oil prices (as it means higher operational costs). It will need 1 Lakh barrels of oil after 2 months.

At the same time, oil producers are concerned about a fall in oil price (as it means lower revenue).

The current oil price is $75/barrel.
2-months oil futures are trading at $74/barrel.

I) SOLUTION

Enter into a 2-month futures contract for 1 lakh barrel at a rate of say $74 per barrel.

Gogo airlines -> Wants to buy oil in future -> Buy futures (i.e. Long futures)

Oil company -> Wants to sell oil in future -> Sell futures (i.e. Short futures)

II) SETTLEMENT UNDER NET SETTLEMENT

Under this only profit / loss is net settled.

Price on expiry i.e. after 2m	Profit / loss to Airline co.	Profit / loss to oil co.
80	6 x 1 lakh = $6,00,000	-6 x 1 lakh = -$6,00,000
65	-9 x 1 lakh = -$9,00,000	9 x 1 lakh = $9,00,000

III) SETTLEMENT UNDER PHYSICAL DELIVERY

Under this Gogo ltd will purchase oil at $74/barrel from the oil co. irrespective of the prevailing price.

Market Price on expiry (after 2m)	Price at which Gogo ltd. will buy & oil co. will sell	Profit / (loss) to Gogo ltd.	Profit / (loss) to Oil co.
80	$74 / barrel	(80 - 74) x 1L = $6L	(74 – 80) x 1L= -$6L
65	$74 / barrel	(65 – 74) x 1L = -$9L	(74 – 65) x 1L = $9L

IV) CRUX - BOTH ARE SAME

Clearly, it can be seen from above that both the methods essentially lead to same financial outcome.

Note: We have assumed that oil price after 2 months turns out to be: Case 1 - $80 / barrel
Case 2 - $65 / barrel

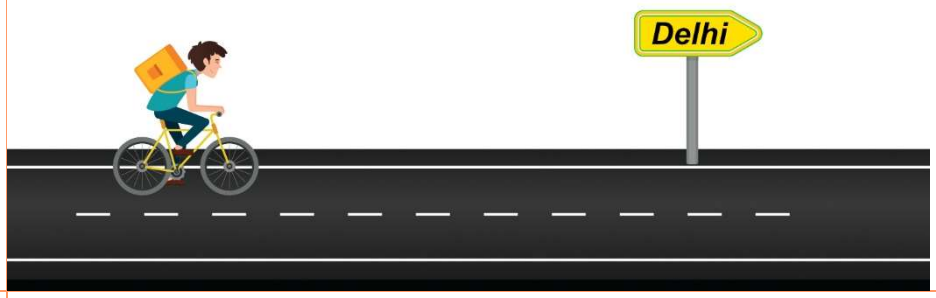
You can take any other assumption. Net conclusion will remain same.

Section 3 (I) – Smart Boy can Profit from Apples!

(Theory of No Arbitrage)

Price of Apples in
Delhi = ₹60/kg
Gurgaon = ₹50/kg

Smart boy quickly identified a profit-making opportunity here.



He bought 20 Kg apples @ ₹50/kg from Gurgaon and sold them at ₹60/kg in Delhi.

GRABBING THE OPPORTUNITY

A lot people will identify this opportunity & will start doing the same.

BUT SOON... Gurgaon → Increase in Demand → Price increase

Delhi → Increase in Supply → Price decrease

THIS WILL CONTINUE TILL – PRICE IN GURGAON = PRICE IN DELHI

II) STOCK MARKET ARBITRAGE – IF PRICE ON BSE ≠ PRICE ON NSE

Ex: If price of Infosys is ₹880 on BSE but price on NSE = ₹900

Then -> You can buy Infosys at ₹880 (from BSE) and immediately sell it for ₹900 (at NSE). Profit = ₹20.

BUT SOON... NSE → Huge selling pressure → Price will fall

BSE → Huge buying pressure → Price will rise

This will continue till PRICE ON BSE = PRICE ON NSE.

III) WHAT IS ARBITRAGE?

The ₹20 earned in above ex is called arbitrage profit. Arbitrage profit generally has 3 characteristics -:

a) No risk b) Sure shot profit

c) No initial outlay of funds i.e. मैं अपनी जेब से पैसा नहीं खर्चूंगा !

IV) PRINCIPAL OF NO ARBITRAGE (PNA) or LAW OF ONE PRICE

In real life, you will hardly observe any arbitrage opportunities. This is because the actions of arbitragers themselves vanishes such opportunities and brings price to where it should be.

For ex: i) Apple price in Gurgaon & Delhi became equal

ii) Infosys price on BSE & NSE became equal

This is known as **'PRINCIPAL OF NO ARBITRAGE (PNA)'.**

This is also known as 'Law of one price'. i.e. 2 securities or portfolios that have identical cash flows in the future, regardless of future events, should have the same price.

V) ARBITRAGE USING BOND STRIPS

We read in 'Bonds' that: Value of Interest strip + Value of Principal strip = Value of Bond

Ex: If the current market yield is 9%. Then price of a 3-year, 9% bond = 1,000

Price of interest only strip (IO strip) = 227.82. Price of Principal only strip (PO strip) = 772.18

i.e. Bond price = IO strip + PO strip → 1000 = 227.82 + 772.18

Q: Construct arbitrage if bond is trading at 1005 and IO strip = 225 & PO strip = 770.

Arbitrage -> Sell the bond and Buy IO strip + PO strip

Arbitrage profit = 1005 - (225 + 770) = ₹10

Why is this arbitrage profit?

a) Sure shot profit of ₹10

b) Since it includes simultaneous buying and selling of the bond and its strips, there is no risk and also no funds are required to be invested.

BUT SOON... IO & PO → Huge buying pressure due to increase in demand → Price will increase

Bond → Huge selling pressure will lead to increased supply → Price will fall.

This will continue till → Price of Bond = Price of IO + PO strip

THIS DIWALI – LET'S BUY A FINANCIAL LOTTERY

A conversion between Lottery uncle Mr. Yadav and a professional finance student.

Student: Hi, I want to purchase a lottery.

Mr. Yadav: Regular lotteries are now bygone. Why don't you try new age 'Financial lotteries.'

We have 2 types of financial lotteries

Type 1 - चढ़ने पर मालामाल Lottery

Type 2 - गिरने पर मालामाल Lottery

1) 1-MONTH चढ़ने पर मालामाल LOTTERY

1) First you decide a stock & and strike price. Say you decided TVS stock and strike price of ₹500.

2) You buy this lottery by paying the lottery ticket price (also known as lottery premium). Ticket price for TVS stock at a strike price of ₹500 is ₹25.

3) Reward on expiry - You will gain if price on expiry exceeds the strike price of ₹500.

चढ़ने पर मालामाल LOTTERY

If Stock Price on expiry > Strike price	If Stock Price on expiry ≤ Strike price
Wohooo..... 😍 Lottery Nikal gai.	Lottery Fusssss..... 😭 But no tension....
Gain = Stock price - Strike price	Kuch Dena nhi h So, Payoff = '0' ☺
Ex: If Stock Price on expiry = ₹540, then Gain = 40 (i.e. 540 - 500)	Ex: If Stock Price on expiry = ₹470, then Payoff = 0

II) **1-MONTH गिरने पर मालामाल LOTTERY**

Almost same as चढ़ने पर मालामाल Lottery but here you'll gain if price on expiry falls below strike price.

गिरने पर मालामाल LOTTERY

If Stock Price on expiry ≥ Strike price	If Stock Price on expiry < Strike price
Fussss..... 😪 But its ok. Because	You won..... 😎 Lottery Nikal padi
Kuch Dena nhi h So, Payoff = '0' ☺	Payoff = Strike Price - Stock price
Ex: If Stock Price on expiry = ₹540, then Payoff = 0	Ex: If Stock Price on expiry = ₹470, then Payoff = 30 (500 - 470)

III) **NET PROFIT = Payoff – Option Premium Paid**

Ex: You won ₹40 from the lottery. But you earlier paid ₹25 as lottery ticket price.

Then your Net profit = ₹15 only (40 – 25).

IV) **Technical Learnings from Above Story**

1. These financial lotteries are called 'options'.

   चढ़ने पर मालामाल Lottery is called call options.

   गिरने पर मालामाल Lottery is called put option.

2. Ticket price is paid at the time of purchasing the option. This is known as option premium (OP).

   Once paid, this option premium is non-refundable.

3. 'Strike price' is used to calculate reward of winner. Strike price is denoted by denoted by k.

   - Call option buyer will win if Stock price on expiry (S_T) is more than the strike price (k) i.e. betting on upside.
   - Put option buyer will win if stock price on expiry (S_T) is less than the strike price (k) i.e. betting on downside.

4. The period of option is known as expiry period. This is denoted by 't'.

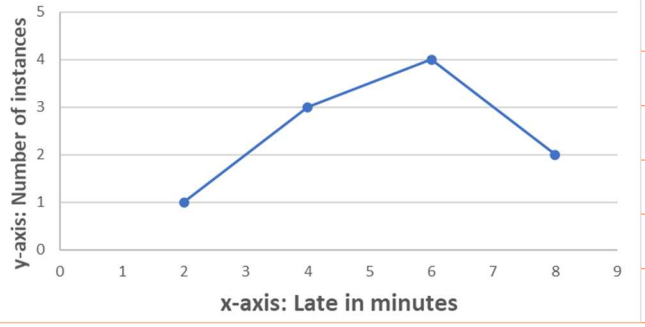
5. Winning lottery is also called exercising the option.

PART A: Setting the base!

Let us discuss a very (very) basic Graph → Line Graph!

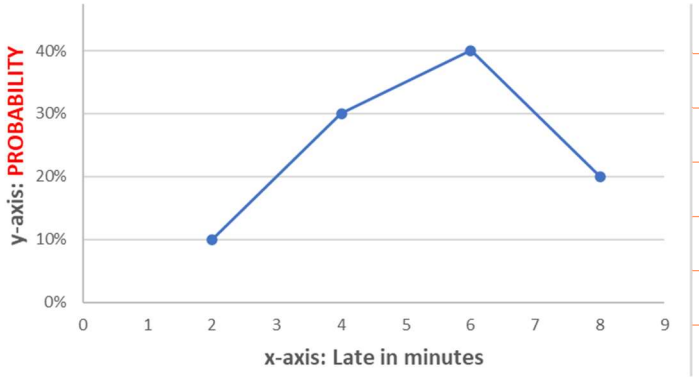
Ex: A student named 'Happy' has following track record in terms of class discipline.

Late in class (in minutes)	Number of instances
2	1
4	3
6	4
8	2



or, the above question may be framed in the terms of probability instead of absolute instance:

Late in class (in minutes)	Number of instances	Probability
2	1	10%
4	3	30%
6	4	40%
8	2	20%
Total:	10	100%



DID YOU OBSERVE?

The shape of the graph in both the cases remains absolutely same. The only difference is that in case of:

1st Graph -> Y-axis contains figures in absolute terms.

2nd Graph -> Y-axis contains figures in terms of probability.

Important -- When y-axis contains figures in terms of probability ->

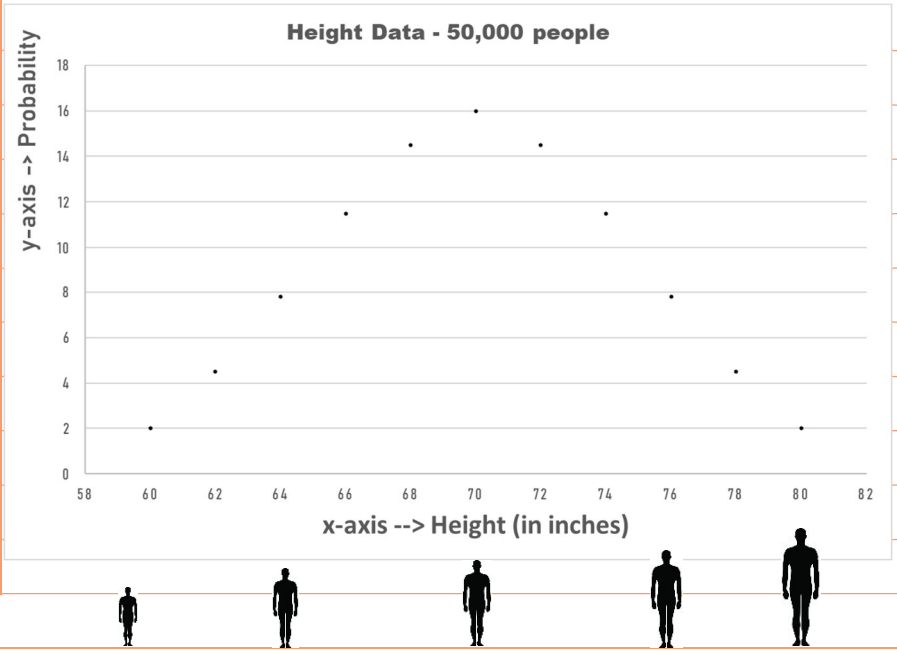
Then such line Graph is known as 'Probability Distribution.'

2. Practical Case- Height Data

Following height data is collected using a sample of 50,000 people. Average height is 70 inches.

Height	Probability (%)
60	2
62	4.5
64	7.8
66	11.5
68	14.5
70	16
72	14.5
74	11.5
76	7.8
78	4.5
80	2

Probability Distribution (your childhood line graph with prob. on y-axis)



CONCLUSION

Average height = 70 inches. A lot of people have height around the average height.

Probability decreases as we move away from the average.

The further we move, the lesser the probability gets.

At the extremes (such as 60 inches or 80 inches, the probability) the probability reduces significantly.

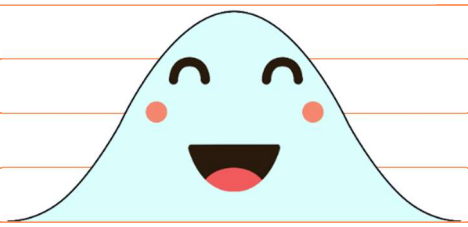
Crux - Probability is highest at Mean and it decreases as we move away from it.

II) THE ORIGIN OF NORMAL DISTRIBUTION

- This phenomenon is very commonly found in nature. For example – Weight of population, Employee review in an organisation, Lifespan of an organism etc.
- This was first published by Mr. Johann Gauss. He named this type of distribution as Gaussian distribution.
- This distribution was so normal in so many fields that it came to be known as Normal Distribution.*

* (Statement not completely correct. Many modern applications suggest diversion from assumption of ND)

PART B: Your baby steps with ND

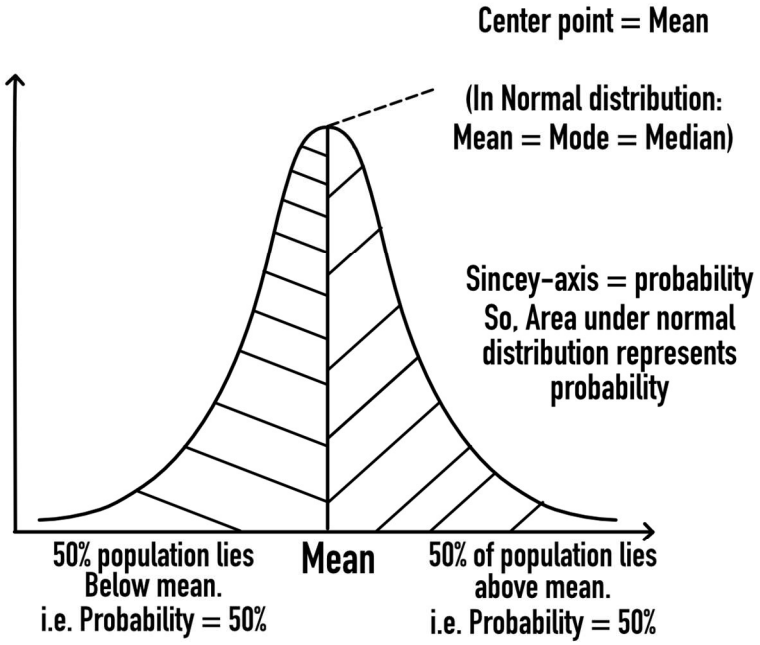


LEARNING TO READ THE NORMAL DISTRIBUTION

(Every Distribution says something... but can you hear it?)

If an item follows normal distribution in real sense, then :-

1. The mean of that item lies in the middle of the entire population.
2. This means that if we divide normal distribution into 2 halves (from its centre point i.e. Mean), then each half will contain 50% of population. ∴ Probability of each half = 50%.



II) UNDERSTANDING WITH EXAMPLE

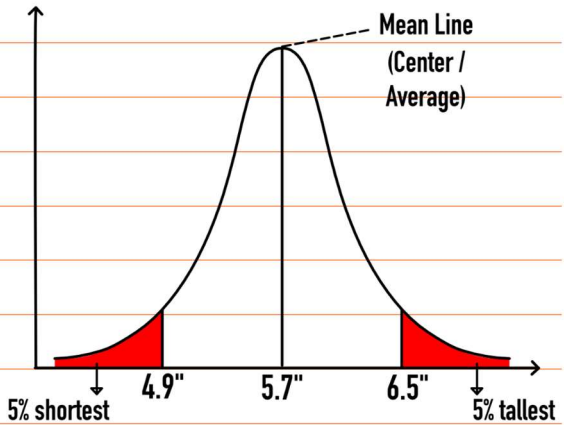
Ex: Sample of 50,000 people. Based on sample, we found that -

Average height = 5'7" (i.e. 5 feet & 7 inches)

Only 5% people have height > 6'5"

Out of the 50,000 people, only 5% have height < 4'9"

We found that the height data follows normal distribution.



i) How many people have height less than 5.7" i.e. the mean height? Or find probability of height < 5.7".

A: In case of ND, 50% of items are less than the mean value.

∴ Number of people with height < 5.7" = 50,000 x 50% = = 25,000

Prob.(Height < 5.7") = 25000/50000 = 50%

ii) What is the probability that a randomly selected person will have height > 6.5"?

A: Probability = 5% (given in ques)

iii) What is the probability that a randomly selected person will have height < 6.5"?

A: Prob. (Height < 6.5") = 100% - 5% = 95%

iv) Probability that a randomly selected person will have height > 4.9".

A: Only 5% people have height < 4.9".

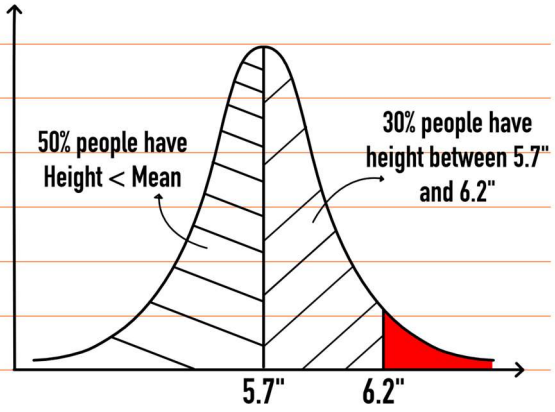
Prob. (Height < 6.5") = 100% - 5% = 95%

v) If 30% of people have height between 5.7" – 6.2", then what is the probability that a randomly selected person will have height less than 6.2"?

A: We know that in case of ND, 50% of items lies below mean. Hence, 50% people will have height < 5.7".

Also, we are given that 30% of people have height between 5.7" & 6.2".

∴ Total people with height < 6.2" = 50% + 30% = 80%.



vi) If 37.5% people have height between 5.0" and 5.7", then what is the probability of:

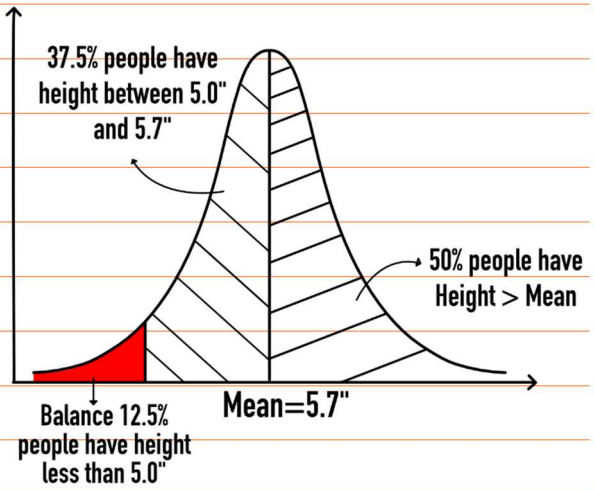
- Prob. (Height > 5.0") - Prob. (Height < 5.0")

Ans: Prob.(Height > 5.0") = 37.5% + 50%

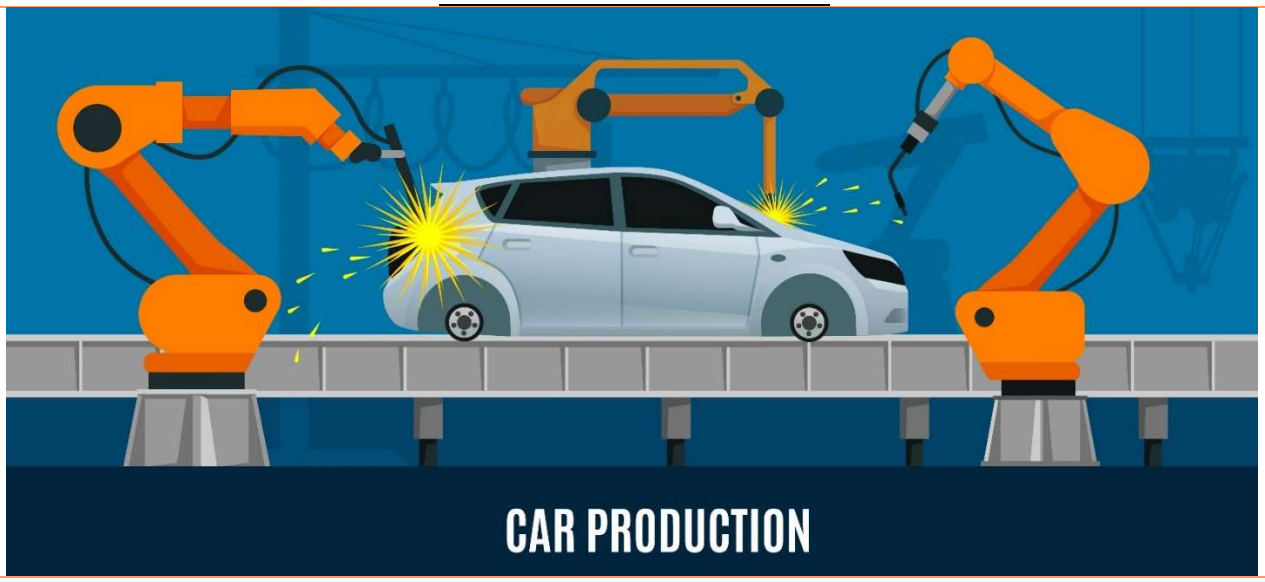
= 87.5%

Prob.(Height < 5.0") = 100% - 87.5% = 12.5%

or = 50% - 37.5% = 12.5%



Case – One car "cannot" suit all!

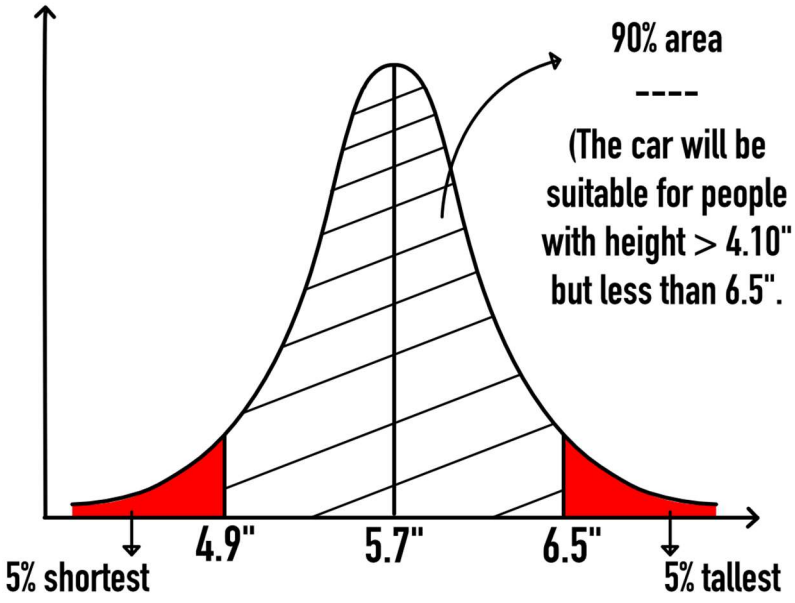


Mahindra ltd. wants to design its new car in such a way that it is comfortable for at least 90% people.

The car may not be suitable for the 10% of extreme population.

Note: 10% extreme means -> 5% on both the sides. i.e. 5% of the shortest people, and 5% of the tallest people.

Ans:



If the co. designs the car such that it is suitable for people with height between the range 4.10" – 6.5",

then it can be ***confident that the car will be suitable for at least 90% of people.***

This can be called as **"90% CONFIDENCE LEVEL"**.

PART C: Introduction To Z-scores

1. Introduction to Z-scores

Ex: Let us say that mean weight of an adult is 70 Kg, with a SD of 10 Kg. Weight data follows ND.

- Mr. Fluffy weights 90 Kg. We can say that:

Mr. Fluffy has 20 Kg (90-70) more weight than an average person (70 Kg).

Or

Fluffy's weight is 2 SD higher from the mean weight. i.e. (90-70)/10 = +2

When distance is defined in terms of SD, then it is known as Z-score.

Z-SCORE = $\frac{X - MEAN}{SD}$ (Don't cram the formula. Its v.easy)

Ex: If mean weight = 70 Kg & SD = 10 Kg, Find the z-score in the following cases:

i) Weight of Mr. Chubby = 85 Kg

Z-score = $\frac{X - Mean}{SD} = \frac{85 - 70}{10} = 1.5$

ii) Weight of Mrs. Zero figure = 45 Kg

Z-score = $\frac{X - Mean}{SD} = \frac{45 - 70}{10} = -2.5$

iii) Weight of Mr. Adequate = 70 Kg

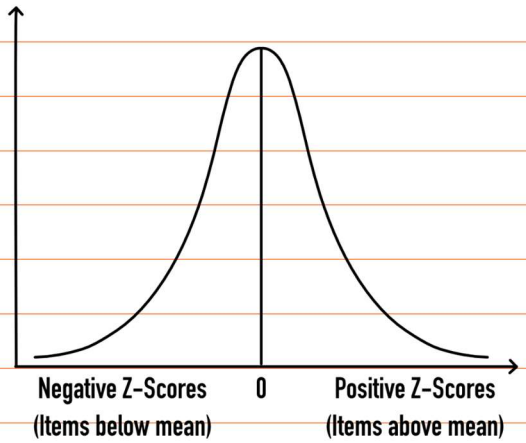
Z-score = $\frac{X - Mean}{SD} = \frac{70 - 70}{10} = 0$

2. NEGATIVE & POSITIVE Z-SCORES

Positive Z-score = Item is above mean.

Negative Z-score = Item is below mean.

Zero Z-score = Item = mean.



3. Why do we even need Z-scores?

Because the rules of normal distribution are very precise. If something truly follows a Normal distribution,

then the distance between mean & SD conveys the probability of an item.

Illus: If mean weight = 75 Kg & SD = 20, then:

- If we move 1.645 SD away from mean, we will cover 95% of the population.

  i.e. 1.645 x 20 = 32.9 Kg away from mean.

  i.e. 75 + 32.9 = 107.9 Kg

  ∴ we can confidently say 95% of population have weight ≤ 107.9 Kg.

- If we move 1.96 SD higher from mean, then we will cover 97.5% of all the population.

  i.e. 75 + 1.96 x 20 = 114.2 Kg

  ∴ we can confidently say 97.5% of population have weight ≤ 114.2 Kg.

Or, FORMULA WISE

To cover a certain probability, we need the z-score corresponding to it.

Then formula = Mean + Z.SD

4. Important Z-scores

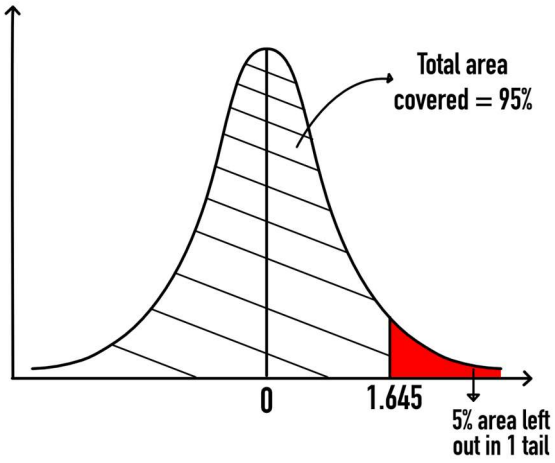
ONE TAIL PROBABILITY			TWO TAIL PROBABILITY		
Confidence level	Significance level	Prob - 1 tail	Confidence level	Significance level	Prob - 2 tail
90%	10%	1.28	90%	10%	1.645
95%	5%	1.645	95%	5%	1.96
97.5%	2.5%	1.96	97.5%	2.5%	2.24
99%	1%	2.33	99%	1%	2.58

SIGNIFICANCE LEVEL = 100% - Confidence Level

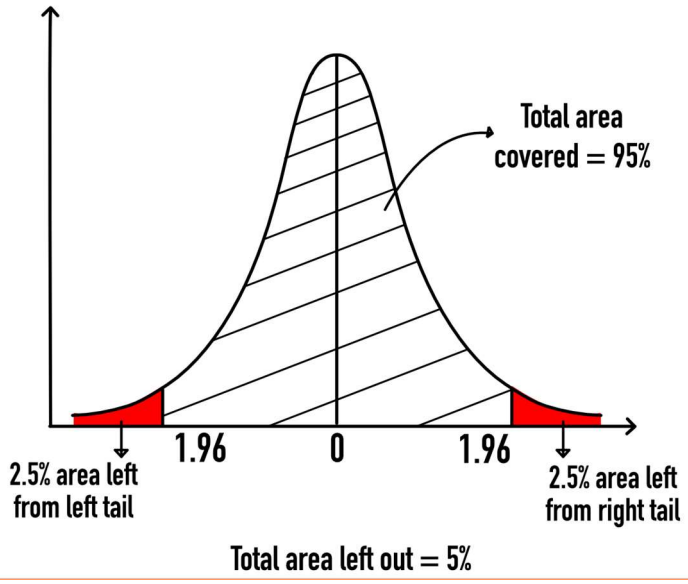
(For exams – At least learn one tail probabilities)

5. Visual presentation of Z-scores

I) ILLUSTRATION 1 – One tail z-score of 1.645 covers 95% population



II) ILLUSTRATION 2 – Two tail z-score of 1.96 covers 95% population



Case 4: Two tailed Z-score of 1.96 covers 95%

5. Applications using Z-scores

The following scenarios assumes Normal distribution.

Case 1: Strong ltd, a construction co. wants to design the door height for the flats. According to a survey, the average height is 160 cm and SD = 15 cm. Find the appropriate door height such that at least 95% of people can easily pass through.

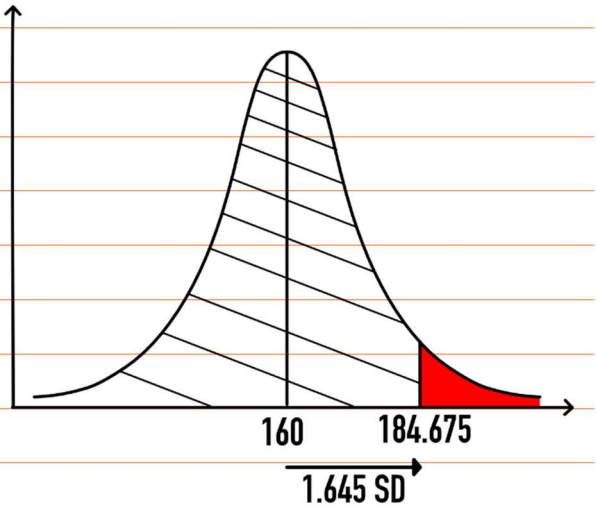
Ans: I know, if I move 1.645 SD away from mean, then I will cover 95% of population.

Therefore, relevant Z-score for 95% prob. = 1.645.

Required door height = Mean + Z.SD

= 160 + 1.645 x 15

= 184.675 cm



Case 2: Mr. Smart started a new printing business. The average initial required capital would be ₹10 lakh. However, this amount can vary and have a standard deviation of ₹60,000. Mr. Smart wants to be 99% sure that there is no shortage of funds. How much money should he keep aside?

Ans: Z-score for 99% probability = 2.33

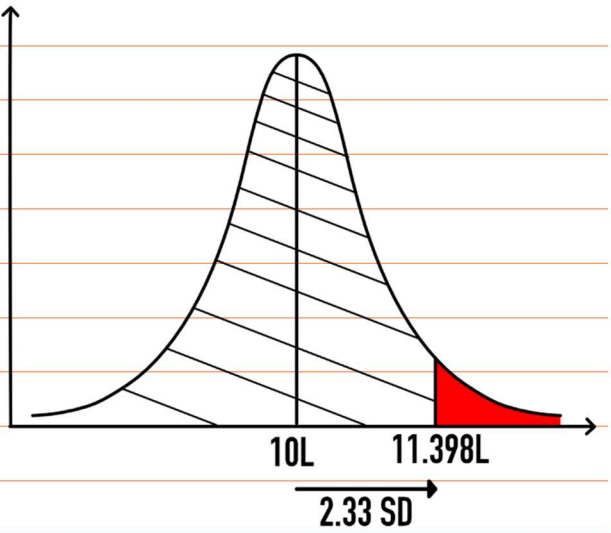
∴ Required funds = Mean + z.SD

= 10,00,000 + 2.33 x 60,000

= ₹11,39,800

i.e. we are 99% confident that the fund requirement of the company will not exceed ₹11,39,800.

Hence, -> Max required funds at 99% confidence level is ₹11,39,800.



Case 3: Mr. Daring started a new start-up co. The expected next year profits of the company is ₹5 Lakh with a standard deviation of ₹3,50,000. Mr. Daring wants to know the maximum loss that the company may incur **at 99% confidence level.**

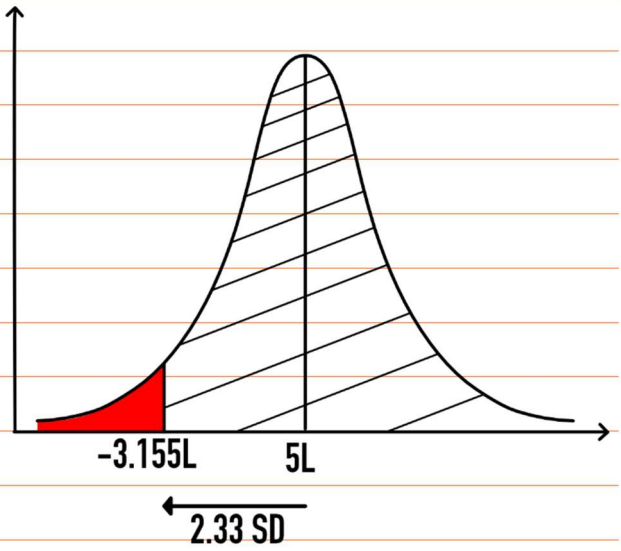
Ans: Z-score for 99% probability = 2.33

∴ Max. loss = Mean – z.SD

= 5L – 2.33x3.5L

= -3.155 Lakh

Hence, we can be 99% confident that the max. loss that will be incurred by the co. in one-year time frame will be ₹3.155 lakhs.



This Maximum Loss is known as Value at Risk (VaR)

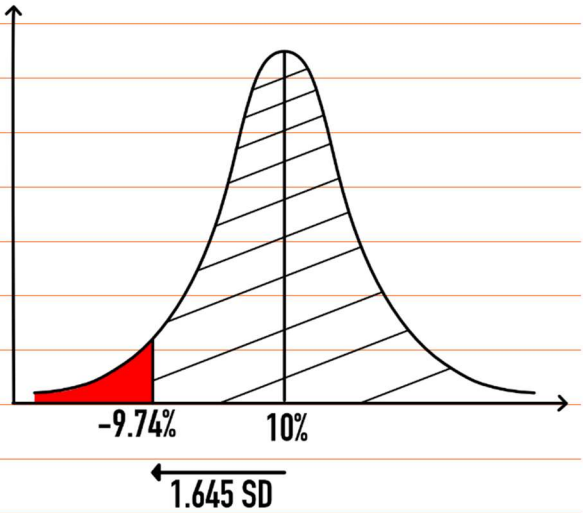
Case 4: A stock has a mean of 10% and a standard deviation of 12%. Find the max. loss that may be incurred on this stock at 95% confidence level. Or in other words, find the Value at Risk (VaR) at 95% confidence level.

Ans: Z-score for 95% probability = 1.645

∴ 95% VaR = Mean – z.SD

(or Max. loss at 95% confidence) = 10% - 1.645x12% = -9.74%

Hence, we can be 95% confident that the max. loss that may be incurred is 9.74%.



Finance Acharya
Jatin Nagpal (CA, FRM)

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