1) **Return:** Return may be defined as total income (or cash inflows including price change) generated by investment expressed as a percentage of the cost of investment

→ Income from Investment may be revenue income (such as interest & dividends) and capital income (or capital gain or loss)

→ The revenue income is generated on regular basis say every year the capital gain/Loss is the difference in the end price (selling price) and beginning price (purchase price) of the investment. It is generated only at the end of the investment period

2) **Holding period Return:** (HPR) is the total return earned during the holding period of investment.

→ It is not expressed in per annum form rather it is the absolute return over a specified holding period such as a 3 year return, 5 year return etc

$$H.P.R = \frac{TI + (P_n - P_0)}{P_0}$$

$$HPR = \frac{Income + Price\ appreciation/decrease}{Purchase\ price} \times 100$$

TI = Total Income (or dividends) received during the holding period
$P_0$ = Purchase price
$P_n$ = Sale price at the end of holding period (1 year)
n = no. of years for which shares are held (i.e holding period in years)

a) **Return on equity share:**

$$= \frac{Dividend + Capital\ gain}{purchase\ price} \times 100$$

$$= \left(\frac{Dividend}{Purchase\ Price} \times 100\right) + \left(\frac{Capital\ gain}{Purchase\ price} \times 100\right)$$

$$= Dividend\ yield + Capital\ gain\ yield$$

b) **Return of a bond:**

$$= \frac{Interest + (P_n - P_0)}{Purchase\ Price\ (P_0)} \times 100$$

→ Bond interest is always calculated on its face value even you buy at a lesser price or higher price from the market

<div align="center">

Calculation of Return
(single Investment/Share)

</div>

| Average Return (Past data) | Expected Return (future data) |
|---|---|

**Average Return (Past data)**

1) Arithmetic mean / simple

$$\frac{R_1 + R_2 + R_3 + \cdots R_n}{n}$$

2) geometric mean

$$\left[(1+R_1)(1+R_2)\cdots(1+R_n)\right]^{\frac{1}{n}} - 1$$

**Expected Return (future data)**

Probabilities

$$\overline{x} = \Sigma P \times R$$

* Sum of probabilities is always equal to 1

Return of a portfolio (more than one security)
= weighted avg return

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<div align="center">How to measure risk</div>

* Risk is measured with the help of Standard deviation
$$\sigma^2 = Variance$$

<div align="center">Risk of single security</div>

| Past data | Future data |
|---|---|

**Past data**

$$d^2 = (x - \overline{x})^2$$

$$\sigma = \sqrt{\frac{\Sigma(x - \overline{x})^2}{n}}$$

$$= \sqrt{\frac{\Sigma d^2}{n}}$$

d = deviation

**Future data**

$$d^2 = (x - \overline{x})^2$$

$$\sigma = \sqrt{\Sigma P(x - \overline{x})^2}$$

$$\sigma = \sqrt{\Sigma P \times d^2}$$

* Coefficient of variation : when return and risk of two securities are different then we need to calculate co-efficient of variation (cv) → calculates `risk' per unit of return

$$CV = \frac{Risk}{Return} = \frac{\sigma}{\overline{x}}$$

* This is also known as rule of dominance

**Q1)** Mr Misra purchased a share of RTL Ltd at a price of Rs 950. He sold the share after receiving dividend income of Rs 50 at the end of one year at a price of Rs 1075. Calculate his total return from the share. How much is the dividend yield and how much is capital gain yield on this share?

$$\text{Return from the share} = \frac{\text{Dividend} + \text{Capital gain}}{\text{Purchase price}} \times 100$$

$$= \frac{50 + (1075 - 950)}{950} \times 100$$

$$= \frac{50 + 125}{950} \times 100$$

$$= \boxed{18.42\%}$$

$$\text{Dividend yield} = \frac{\text{Dividend}}{\text{market price}} \times 100$$

$$= \frac{50}{950} \times 100 = \boxed{5.26\%}$$

$$\text{Capital gain yield} = \left(\frac{P_n - P_0}{P_0}\right) \times 100$$

$$= \frac{1075 - 950}{950} \times 100$$

$$= \boxed{13.16\%}$$

**Q2)** Mr Misra purchased a Rs 1000, 10% bond maturing after 5 years at a price of Rs 950. He sold the bond after receiving interest income at the end of one year at a price of Rs 975. Calculate his total return from the bond.

$$\text{Return from the bond} = \frac{(1000 \times 10\%) + (975 - 950)}{950} \times 100$$

$$= \frac{(100 + 25)}{950} \times 100 = \boxed{13.16\%} \text{ approx}$$

**Q3)** Mr Trivedi has purchased an equity share at a price of Rs 220 in the beginning of year 2015. He sold the share at a price of Rs 240 at the end of year 2015 after receiving a dividend of Rs 2 from the share. What is the holding period return on equity share? How much is dividend yield & capital gain yield?

**Q4)** Mr A had purchased a bond at a price of Rs 800 with a coupon payment of Rs 150 and sold it for Rs 1000. what is the holding period return. If the bond is sold for Rs 750 after receiving coupon payment then what is his holding period return?

**Q5)** You are required to calculate total return for each year starting from 2008 for which following information about the year end values of a share and its dividends for the last 9 years. Assume that the year end price of a year becomes the beginning price for the next year i.e year end of 2007 is the beginning price for year 2008 and so on.

| Year | Year end share price (Rs) | Dividends (Rs) |
|------|---------------------------|----------------|
| 2015 | 260 | 2 |
| 2014 | 280 | 3 |
| 2013 | 200 | 5 |
| 2012 | 180 | 4 |
| 2011 | 190 | 3 |
| 2010 | 180 | 2 |
| 2009 | 170 | 2 |
| 2008 | 160 | 1 |
| 2007 | 150 | 1 |

**Q6)** An investor buys a share of Rs 20. At the end of year 1 its price becomes Rs 25 but investor holds it. In the end of second year it again becomes Rs 20. Thus it gives 25% return in first year and 20% loss in second year. Find out average return using arithmetic mean

$$
\begin{array}{ccc}
0 & \xrightarrow{+5} & \xrightarrow{-5} \\
& ① & ② \\
P_0 \; 20 & 25 & 20
\end{array}
$$

$$= \frac{-5}{25} \times 100$$

$$= -20\% \; R_2$$

$$= \frac{5}{20} \times 100 = 25\% \; R_1$$

Simple average $= \dfrac{25+(-20)}{2} = \dfrac{5}{2} = \boxed{2.5\% \; P.a}$

$$HPR = \frac{0+0}{20} \times 100 = 0$$

→ Due to drawbacks of arithmetic mean it is always better to calculate geometric mean

$$GM = \left[(1+R_1)(1+R_2)\right]^{\frac{1}{2}} - 1 = \left[(1+0.25)(1+(-0.2))\right]^{\frac{1}{2}} - 1$$

$$= \left[1.25 \times 0.8\right]^{\frac{1}{2}} - 1 = \sqrt{1} - 1 = 1 - 1 = \boxed{0}$$

**Q7)** Calculate average return using geometric mean from the following data

| Year | 1 | 2 | 3 | 4 |
|------|-----|-------|-------|-------|
| Return % | 18 | 10.17 | -7.69 | 16.67 |

$$GM(Avg) = \left[(1+R_1)(1+R_2)(1+R_3)(1+R_4)\right]^{\frac{1}{4}} - 1$$

$$\left[(1+0.18)(1+0.1017)(1-0.0769)(1+0.1667)\right]^{\frac{1}{4}} - 1$$

$$\left[(1.18)(1.1017)(0.9231)(1.1667)\right]^{\frac{1}{4}} - 1$$

$$\left[1.40008146\right]^{\frac{1}{4}} - 1$$

$$1.088 - 1 = 0.088 \text{ or } \boxed{8.8\% \text{ P.a}}$$

**Q8)** Mr Pandey invested Rs 100 in a mutual fund which earned 25% annually for 3 years. Unfortunately it lost 75% during the fourth year and earned 25% annually for next 4 years. Can we say that a total of 100% return is earned by Mr Pandey over a period of 8 years which is 12.5% p.a?

$$GM(Avg) = \left[(1+0.25)(1+0.25)(1+0.25)(1-0.75)(1+0.25)(1+0.25)(1+0.25)(1+0.25)\right]^{\frac{1}{8}} - 1$$

$$\boxed{2.22\%}$$

**Q9)** Mr Mehta wants to calculate average return of a share of Infy com Ltd currently available at a price of Rs 260 on 31st December 2013. The share price at the end of year 2007, 2008, 2009, 2010, 2011 and 2012 were Rs 100, 125, 118, 130, 120, and Rs 140. The share did not pay any dividend over these years. Calculate average return on the shares of Infy.com Ltd.

① using arithmetic mean
② using geometric mean
③ what will be your answer in ① & ② if the company paid a dividend of Rs 2 per share every year

| year | Price | Return |
|------|-------|--------|
| 07 | 100 | — |
| 08 | 125 | 25 |
| 09 | 118 | -5.6 |
| 10 | 130 | 10.17 |
| 11 | 120 | -7.69 |
| 12 | 140 | 16.67 |
| 13 | 260 | 85.71 |

$AM = 17.27\%$

$$\frac{124.26\%}{6} = 20.71\%$$

**Q10)** Calculate expected return of a security from the following
data

| Return | Prob. | $P_i R_i$ |
|--------|-------|-----------|
| 30% | 0.40 | 0.12 |
| -20% | 0.40 | -0.08 |
| 50% | 0.20 | 0.10 |
| | 1.00 | 0.14  or  14% |

Expected return = $\Sigma P_i R_i$ = 14%
* expected return is weighted average return with probabilities
being assigned weights $\Sigma P \times R$

**Q11)** Calculate total risk of the security for which past returns
are given below:

| year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------|----|----|---|---|----|----|---|---|---|----|
| $R_i$ % | 10 | 12 | 8 | 5 | 10 | 13 | 7 | 5 | 8 | 12 |

| year | Return $(x)$ % | $d = x - \bar{x}$ | $d^2$ |
|------|------------|-------------|-------|
| 1 | 10 | 1 | 1 |
| 2 | 12 | 3 | 9 |
| 3 | 8 | -1 | 1 |
| 4 | 5 | -4 | 16 |
| 5 | 10 | 1 | 1 |
| 6 | 13 | 4 | 16 |
| 7 | 7 | -2 | 4 |
| 8 | 5 | -4 | 16 |
| 9 | 8 | -1 | 1 |
| 10 | 12 | 3 | 9 |
| | 90 | 0 | 74 |

i) $\bar{x}$

ii) $d = (x - \bar{x})$

iii) $d^2$

iv) $\dfrac{d^2}{n} = \dfrac{74}{10} = 7.4$

v) $\sigma = \sqrt{\dfrac{\Sigma d^2}{n}} = \sqrt{7.4} = 2.72$

$$\boxed{\sigma = 2.72\%}$$

$\bar{x} = \dfrac{90}{10} = \boxed{9}$

**Q12)** An investment analyst wants to analyze risk and
return on security A, for which he has constructed
the following return distribution

| Return $(R_i)$ in % | Prob $(P_i)$ |
|----------------------|--------------|
| 20 | 0.1 |
| 15 | 0.2 |
| -5 | 0.2 |
| 10 | 0.3 |
| 25 | 0.2 |

Calculate expected return & total risk

**Q12)**

| Probability $P_i$ | $R_i$ | $P_i \times R_i$ $\overline{R}$ | $d = R - \overline{R}$ $\overline{R} = 12$ | $d^2$ | $P_i \times d^2$ |
|---|---|---|---|---|---|
| 0.1 | 20 | 2 | 8 | 64 | 6.4 |
| 0.2 | 15 | 3 | 3 | 9 | 1.8 |
| 0.2 | −5 | (−1) | (17) | 289 | 57.80 |
| 0.3 | 10 | 3 | (2) | 4 | 1.20 |
| 0.2 | 25 | 5 $\overline{R}=12 \%$ | 13 | 169 | 33.80 |
| | | | | | 101 |

$$\sigma = \sqrt{\Sigma P d^2} = \sqrt{101} = 10.05$$

**Q13)** A security analyst wants to analyze the following two securities with respect to risk

| Security | Expected Return (%) | SD of Return (%) |
|---|---|---|
| A | 20 | 15 |
| B | 30 | 18 |

Can it be concluded that security B is more risky than security A

| | A | B | |
|---|---|---|---|
| S.D | 15 | 18 | |
| Mean $\overline{x}$ | 20 | 30 | |
| COV $\dfrac{\sigma}{\overline{x}}$ | 0.75 | 0.6 | → Per unit return lesser risk |

select with lower CV (B security)