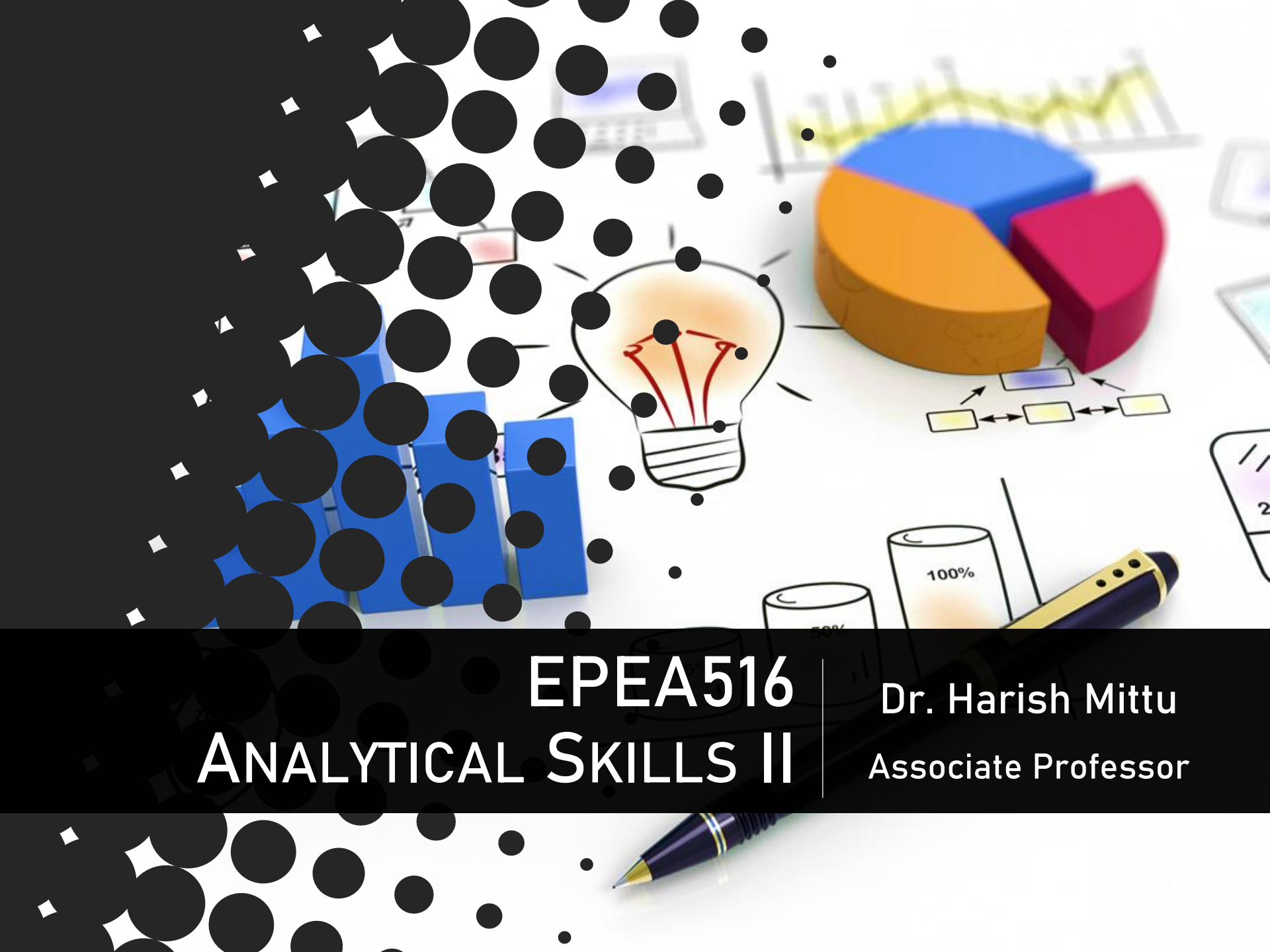

EPEA516
Analytical Skills II

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Learning Outcomes

After this lecture, you will be able to

- solve problems based on time and amount computation.

Problem 1

- A sum of money placed at C.I. doubles in 3 years. In how many years will it become four times?
- n = 2
- t = 3 years
- m = 2 (four times i.e. 2 x 2 = 2^2 or n^m)
- T = ?

Problem 1

- n = 2, t = 3 years, m = 2, & T = ?
- We know that if a certain sum becomes n times in t years at compound interest, then the same sum becomes n^m times in mt years.
- T = m x t
- T = 2 x 3
- T = 6 years

Problem 2

- A sum of money doubles itself at C.I. in 15 years. In how many years will it become eight times?
- n = 2
- t = 15 years
- m = 3 (Eight times i.e. 2 x 2 x 2 = 2^3 or n^m)
- T = ?

Problem 2

- n = 2, t = 15 years, m = 3, & T = ?
- We know that if a certain sum becomes n times in t years at compound interest, then the same sum becomes n^m times in mt years.
- T = m x t
- T = 3 x 15
- T = 45 years

Problem 3

- In how many years Rs.1,00,000 will become Rs.1,33,100 at compound interest rate of 10% p.a.?
- P = Rs. 1,00,000
- R = 10% p.a.
- A = Rs. 1,33,100
- n = ?
- $A = P\left[1 + \frac{R}{100}\right]^{n}$

Problem 3

- P = Rs. 1,00,000; R = 10% p.a.; A = 1,33,100; and n = ?
- $A = P\left[1 + \frac{R}{100}\right]^n$
- $\frac{A}{P} = \left[1 + \frac{R}{100}\right]^n$
- $\frac{\overset{1331}{\cancel{1,33,100}}}{\underset{1000}{\cancel{1,00,000}}} = \left[1 + \frac{\cancel{10}}{\underset{10}{\cancel{100}}}\right]^n$
- $\frac{11 \times 11 \times 11}{10 \times 10 \times 10} = \left[1 + \frac{1}{10}\right]^n$

Problem 3

- $\frac{11 \times 11 \times 11}{10 \times 10 \times 10} = \left[1 + \frac{1}{10}\right]^{n}$
- $\left[\frac{11}{10}\right]^{3} = \left[\frac{10 + 1}{10}\right]^{n}$
- $\left[\frac{11}{10}\right]^{3} = \left[\frac{11}{10}\right]^{n}$
- 3 = n
- n = 3 years

Problem 4

- Mehak invested an amount of Rs. 18,000 at compound interest rate 4% p.a. for a period of 3 years. What amount will she receive at the end of 3 years?
- P = Rs. 18,000
- R = 4% p.a.
- n = 3 years
- A = ?
- $A = P\left[1 + \frac{R}{100}\right]^{n}$

Problem 4

- P = Rs. 18000, R = 4% p.a., n = 3 years, and A = ?
- $A = P\left[1 + \frac{R}{100}\right]^{n}$
- $A = 18000 \times \left[1 + \frac{4}{100}\right]^{3}$
- $A = 18000 \times \left[\frac{100 + 4}{100}\right]^{3}$

Problem 4

- $A = 18000 \times \left[\frac{100 + 4}{100}\right]^3$
- $A = 18000 \times \left[\frac{104}{100}\right]^3$
- $A = \frac{18000 \times 104 \times 104 \times 104}{100 \times 100 \times 100}$
- $A = \frac{18 \times 104 \times 104 \times 104}{1000}$
- $A = \frac{20247552}{1000}$
- A = Rs. 20,247.552

Problem 5

- Rohit invested an amount of Rs. 1,000 at 4% p.a. compounded half-yearly for a period of 2 years. What amount will he receive at the end of 2 years?
- P = Rs. 1,000
- R = 4% p.a. ($\frac{4}{2}$ % = 2 % half-year)
- n = 2 years (4 half-years)
- A = ?
- $A = P\left[1 + \frac{R}{\frac{2}{100}}\right]^{2n}$

Problem 5

- P = Rs. 1,000; $\frac{R}{2}$ = 2%; 2n = 2 x 2 = 4; and A = ?
- $A = P\left[1 + \frac{\frac{R}{2}}{100}\right]^{2n}$
- $A = 1000 \times \left[1 + \frac{2}{100}\right]^{4}$
- $A = 1000 \times \left[\frac{100 + 2}{100}\right]^{4}$
- $A = 1000 \times \left[\frac{102}{100}\right]^{4}$

Problem 5

- $A = 1000 \times \left[\frac{102}{100}\right]^4$
- $A = \cancel{1000} \times \frac{102}{\cancel{100}} \times \frac{102}{100\cancel{0}} \times \frac{102}{100} \times \frac{102}{100}$
- $A = \frac{108243216}{100000}$
- A = Rs. 1082.43 (aprrox.)

Problem 6

- Neha invested an amount of Rs. 24,000 at 12% p.a. compounded quarterly for a period of 1 year. What amount will she receive at the end of 1 year?
- P = Rs. 24,000
- R = 12% p.a. ($\frac{12}{4}$ % = 3 % per quarter)
- n = 1 year (4 quarters)
- A = ?
- $A = P\left[1 + \frac{\frac{R}{4}}{100}\right]^{4n}$

Problem 6

- P = Rs. 24,000; $\frac{R}{4}$ = 3%; 4n = 4 x 1 = 4; and A = ?
- $A = P\left[1 + \frac{\frac{R}{4}}{100}\right]^{4n}$
- $A = 24000 \times \left[1 + \frac{3}{100}\right]^{4}$
- $A = 24000 \times \left[\frac{100 + 3}{100}\right]^{4}$
- $A = 24000 \times \left[\frac{103}{100}\right]^{4}$

Problem 6

- $A = 24000 \times \left[\frac{103}{100}\right]^4$
- $A = 24000 \times \frac{103}{100} \times \frac{103}{100} \times \frac{103}{100} \times \frac{103}{100}$
- $A = \frac{2701221144}{100000}$
- A = Rs. 27012.21 (approx.)

Problem 7

- Find the amount on Rs. 4,000 at 10% p.a. for 2 years 6 months, compounded annually.
- P = Rs. 4,000
- R = 10 % p.a.
- $n \frac{1}{m}$ = 2 years 6 months = $2 \frac{\cancel{6}}{\cancel{12}_{2}}$ years = $2 \frac{1}{2}$ years
- A = ?
- $A = P\left\{\left[1 + \frac{R}{100}\right]^{n} \times \left[1 + \frac{\frac{1}{m} R}{100}\right]\right\}$

Problem 7

- P = Rs. 4,000; R = 10 %; n = 2; $\frac{1}{m} = \frac{1}{2}$; and A = ?
- $A = P\left\{\left[1 + \frac{R}{100}\right]^{n} \times \left[1 + \frac{\frac{1}{m}R}{100}\right]\right\}$
- $A = 4000 \times \left\{\left[1 + \frac{10}{100}\right]^{2} \times \left[1 + \frac{\frac{1}{2} \times 10}{100}\right]\right\}$

  10 20
- $A = 4000 \times \left\{\left[1 + \frac{1}{10}\right]^{2} \times \left[1 + \frac{1}{20}\right]\right\}$

Problem 7

- $A = 4000 \times \left\{ \left[1 + \frac{1}{10} \right]^2 \times \left[1 + \frac{1}{20} \right] \right\}$
- $A = 4000 \times \left\{ \left[\frac{10 + 1}{10} \right]^2 \times \left[\frac{20 + 1}{20} \right] \right\}$
- $A = 4000 \times \left\{ \left[\frac{11}{10} \right]^2 \times \left[\frac{21}{20} \right] \right\}$
- $A = 4000 \times \left\{ \frac{121}{100} \times \frac{21}{20} \right\}$

Problem 7

- $A = 4000 \times \left\{\frac{121}{100} \times \frac{21}{20}\right\}$
- $A = 4000 \times \left\{\frac{2541}{2000}\right\}$ (1.2705)
- $A = 4000 \times \{1.2705\}$
- $A = Rs.\ 5{,}082$

Problem 8

- Amit invests Rs. 5,000 in a bond which gives interest at 2%p.a. during the first year, 5% p.a. during the second year and 10% p.a. during the third year. How much does he get at the end of the third year.
- P = Rs. 5,000
- R_1 = 2% p.a.
- R_2 = 5% p.a.
- R_3 = 10% p.a.
- A = ?

Problem 8

- P = Rs. 5,000; R_1 = 2% p.a.; R_2 = 5% p.a.; R_3 = 10% p.a. &

  A = ?

- $A = P\left\{\left[1+\frac{R_1}{100}\right] x \left[1+\frac{R_2}{100}\right] x \left[1+\frac{R_3}{100}\right]\right\}$

- $A = 5000 \times \left\{\left[1+\frac{\cancel{2}}{\cancel{100}_{50}}\right] \times \left[1+\frac{\cancel{5}}{\cancel{100}_{20}}\right] \times \left[1+\frac{\cancel{10}}{\cancel{100}_{10}}\right]\right\}$

- $A = 5000 \times \left\{\left[1+\frac{1}{50}\right] \times \left[1+\frac{1}{20}\right] \times \left[1+\frac{1}{10}\right]\right\}$

Problem 8

- $A = 5000 \times \left\{ \left[1 + \frac{1}{50} \right] \times \left[1 + \frac{1}{20} \right] \times \left[1 + \frac{1}{10} \right] \right\}$
- $A = 5000 \times \left\{ \left[\frac{50 + 1}{50} \right] \times \left[\frac{20 + 1}{20} \right] \times \left[\frac{10 + 1}{10} \right] \right\}$
- $A = 5000 \times \left\{ \left[\frac{51}{50} \right] \times \left[\frac{21}{20} \right] \times \left[\frac{11}{10} \right] \right\}$
- $A = 5000 \times \left\{ \left[\frac{11781}{10000} \right] \right\}$
- $A = 5000 \times \{1.1781\}$

Problem 8

- A = 5000 x {1.1781}

- A = Rs. 5890.50

Problem 9

- If a sum of Rs. 13040 is to be paid back in two equal annual instalments at $3\frac{3}{4}$ % p.a., what is the amount of each instalment?
- P = Rs. 13,040
- R = $3\frac{3}{4}$ % p.a. = $\frac{15}{4}$ % p.a.
- No. of instalments = 2
- Amount of each instalment = ?

Problem 9

- P = Rs. 13,040; R = $\frac{15}{4}$ % p.a.; No. of instalments = 2; and

  Amount of each instalment = ?

- Amount of each instalment

$$= \frac{P}{\left[\frac{100}{100+R}\right]^1 + \left[\frac{100}{100+R}\right]^2}$$

$$= \frac{13040}{\left[\frac{100}{100+\frac{15}{4}}\right]^1 + \left[\frac{100}{100+\frac{15}{4}}\right]^2}$$

Problem 9

- Amount of each instalment

$$= \frac{13040}{\left[\frac{100}{100 + \frac{15}{4}}\right]^1 + \left[\frac{100}{100 + \frac{15}{4}}\right]^2}$$

$$= \frac{13040}{\left[\frac{100}{\frac{400 + 15}{4}}\right]^1 + \left[\frac{100}{\frac{400 + 15}{4}}\right]^2}$$

$$= \frac{13040}{\left[\frac{100 \times 4}{415}\right]^1 + \left[\frac{100 \times 4}{415}\right]^2}$$

$$= \frac{13040}{\left[\frac{400}{415}\right]^1 + \left[\frac{400}{415}\right]^2}$$

Problem 9

- Amount of each instalment

$$= \frac{13040}{\left[\frac{400}{415}\right]^1 + \left[\frac{400}{415}\right]^2}$$

$$= \frac{13040}{\left[\frac{400}{415}\right] x \left[1 + \frac{400}{415}\right]}$$

$$= \frac{13040}{\left[\frac{400}{415}\right] x \left[\frac{815}{415}\right]}$$

$$= \frac{13040 \text{ x } 415 \text{ x } 415}{400 \text{ x } 815}$$

$$= \text{Rs. } 6{,}889$$

Conclusion

- If a certain sum becomes n times in t years at compound interest, then the same sum becomes n^m times in mt years.

$$T = m \times t$$

- If A, P, and R is given.

$$\frac{A}{P} = \left[1 + \frac{R}{100}\right]^n$$

Conclusion

- When interest is compounded annually
  - $A = P\left[1 + \frac{R}{100}\right]^{n}$
- When interest is compounded half-yearly
  - $A = P\left[1 + \frac{\frac{R}{2}}{100}\right]^{2n}$
- When interest is compounded quarterly
  - $A = P\left[1 + \frac{\frac{R}{4}}{100}\right]^{4n}$

Conclusion

- When interest is compounded annually but time is in fraction, $n\frac{1}{m}$ years.
  - $A = P\left\{\left[1 + \frac{R}{100}\right]^{n} \times \left[1 + \frac{\frac{1}{m}R}{100}\right]\right\}$
- When rates are different for different years
  - $A = P\left\{\left[1 + \frac{R_1}{100}\right] \times \left[1 + \frac{R_2}{100}\right] \times \left[1 + \frac{R_3}{100}\right]\right\}$
- Amount of each instalment = $\frac{P}{\left[\frac{100}{100 + R}\right]^{1} + \left[\frac{100}{100 + R}\right]^{2}}$

Summary

- Computation of
  - Time
  - Amount

That’s all for now…