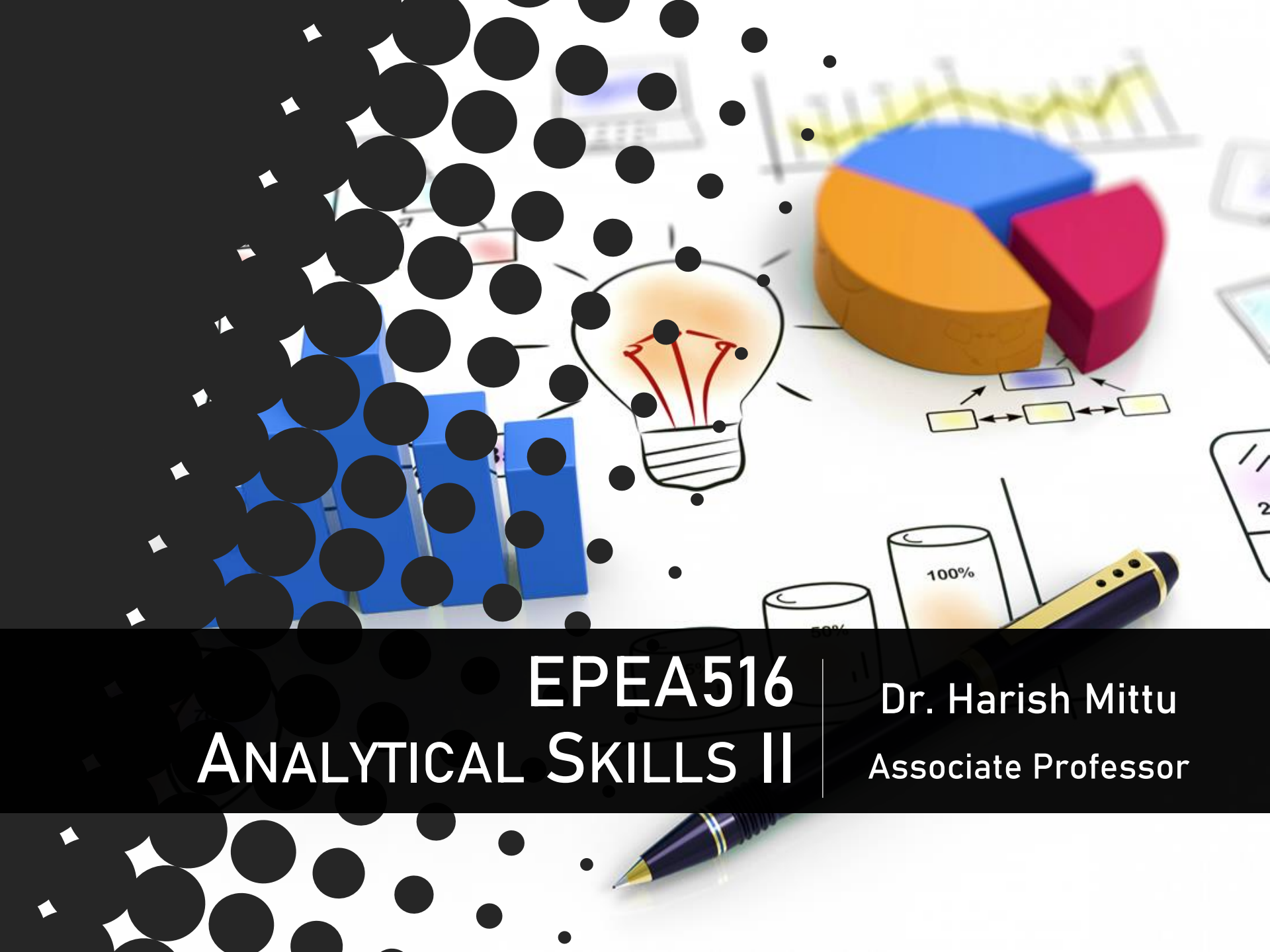

EPEA516
Analytical Skills II

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Learning Outcomes

After this lecture, you will be able to

- solve problems relating to time and work,
- develop insight to solve various life problems efficiently.

Problem 1

- 45 men can complete a work in 16 days. Six days after they started working, 30 more men joined them. How many days will they now take to complete the remaining work ?

- Given, 45 men's 1 days' work $= \frac{1}{16}$

- 45 men's 6 days' work $= \cancel{6}^{3} \times \frac{1}{\cancel{16}_{8}}$

$= \frac{3}{8}$

Problem 1

- Given, 45 men's 1 days' work $= \frac{1}{16}$
- (45 × 16 = 720) men can complete the work in 1 day
- 1 man's 1 day's work $= \frac{1}{720}$
- Remaining work $= 1 - \frac{3}{8}$

$= \frac{5}{8}$

Problem 1

- 1 man's 1 day's work $= \frac{1}{720}$
- 75 men's 1 day's work $= \cancel{75}^{5} \times \frac{1}{\cancel{720}_{48}} = \frac{5}{48}$
- $\frac{5}{48}$ work is done by 75 men in 1 day
- 1 work is done by 75 men in $\frac{48}{5}$ day
- $\frac{5}{8}$ work is done by 75 men in $\cancel{\frac{5}{8}} \times \cancel{\frac{48}{5}}^{6}$ = 6 days

Problem 2

- 3 men and 4 women can earn Rs. 3780 in 7 days. 11 men and 13 women can earn Rs. 15040 in 8 days. In what time will 7 men and 9 women earn Rs. 12400?
- Let 1 man's 1 day's earning be Rs. x

  1 woman's 1 day's earning be Rs. y

$$3x + 4y = \frac{3780}{7}^{540} = 540$$

$$11x + 13y = \frac{15040}{8}^{1880} = 1880$$

Problem 2

$3x + 4y = 540$

$11x + 13y = 1880$

X 11 $\quad 33x + 44y = 5940$

X 3 $\quad 33x + 39y = 5640$

$- \quad - \quad -$

$5y = 300$

$y = 60$

$3x + 4y = 540$

$3x + 4.60 = 540$

$3x + 240 = 540$

$3x = 540 - 240$

$3x = 300$

$x = 100$

- $x = 100, y = 60$
- (7 men + 9 women)'s 1 day's earning = Rs.(7×100 + 9×60)

  = Rs. 1240= Rs. 1240
- Hence, required time = $\frac{12400}{1240}$ days

  = 10 days

Problem 3

- 9 children can complete a piece of work in 360 days. 18 men can complete the same piece of work in 72 days and 12 women can complete it in 162 days. In how many days can 4 men, 12 women and 10 children together complete the piece of work?

9 child's 1 day's work $= \frac{1}{360}$

18 men's 1 day's work $= \frac{1}{72}$

12 women's 1 day's work $= \frac{1}{162}$

Problem 3

- 9 child's 1 day's work = $\frac{1}{360}$
- 18 men's 1 day's work = $\frac{1}{72}$
- 12 women's 1 day's work = $\frac{1}{162}$
- 1 man's 1 day's work = $\frac{1}{72 \times 18}$ = $\frac{1}{1296}$
- 1 woman's 1 day's work = $\frac{1}{162 \times 12}$ = $\frac{1}{1944}$
- 1 child's 1 day's work = $\frac{1}{360 \times 9}$ = $\frac{1}{3240}$

Problem 3

- (4 men + 12 women + 10 children)'s 1 day's work

$$= \cancel{4} \times \frac{1}{\cancel{1296}\ 324} + \cancel{12} \times \frac{1}{\cancel{1944}\ 162} + \cancel{10} \times \frac{1}{3240}$$

$$= \frac{1}{324} + \frac{1}{162} + \frac{1}{324}$$

$$= \frac{1+2+1}{324}$$

$$= \frac{\cancel{4}}{\cancel{324}\ 81} = \frac{1}{81}$$

- Hence, 4 men, 12 women and 10 children can complete the work in 81 days.

Problem 4

- 2 men and 3 boys can do a piece of work in 10 days while 3 men and 2 boys can do the same work in 8 days. In how many days can 2 men and 1 boy do the work?
- Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y

$$2x + 3y = \frac{1}{10}$$

$$3x + 2y = \frac{1}{8}$$

Problem 4

$$2x + 3y = \frac{1}{10}$$

$$3x + 2y = \frac{1}{8}$$

X 3

X 2

$$\cancel{6x} + 9y = \frac{3}{10}$$

$$\cancel{6x} + 4y = \frac{1}{4}$$

$$- \quad - \quad - \quad -$$

$$5y = \frac{6-5}{20} = \frac{1}{20}$$

$$y = \frac{1}{100}$$

$$2x + 3\frac{1}{100} = \frac{1}{10}$$

$$2x + 3\frac{1}{100} = \frac{1}{10}$$

$$2x = \frac{1}{10} - \frac{3}{100}$$

$$2x = \frac{10-3}{100}$$

$$2x = \frac{7}{100}$$

$$x = \frac{7}{200}$$

- $x = \frac{7}{200}$, $y = \frac{1}{100}$

- (2 men + 1 boy)'s 1 day's work = $(2\times \frac{7}{200} + 1\times \frac{1}{100}) = \frac{14+2}{200}$

$$= \frac{16}{200}$$

Problem 4

- (2 men + 1 boy)'s 1 day's work $= \frac{\cancel{16}^{2}}{\cancel{200}_{25}}$

$= \frac{2}{25}$

- So, 2 men and 1 boy together can finish the work in

$\frac{25}{2}$ or $12\frac{1}{2}$ days

Problem 5

- A man and a boy can do a piece of work in 24 days. If the man works alone for the last 6 days, it is completed in 26 days. How long would the boy take to do it alone?

- (Men + Boy)'s 1 days' work = $\frac{1}{24}$

- (Men + Boy)'s 20 days' work = $\frac{\cancel{20}^{5}}{} \times \frac{1}{\cancel{24}_{6}} = \frac{5}{6}$

- We know that

- (1 Men + 1 Boy)'s 20 days' work + 1 Men's 6 days' work = 1

Problem 5

- We know that
- (1 Men + 1 Boy)'s 20 days' work + 1 Men's 6 days' work = 1
- 1 Men's 6 days' work = 1 – (1 Men + 1 Boy)'s 20 days' work

$$= 1 - \frac{5}{6} = \frac{1}{6}$$

- 1 Men's 6 days' work = $\frac{1}{6}$
- Men's 1 day's work = $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

Problem 5

- Men's 1 day's work = $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$
- We know that,
- Men's 1 days' work + Boy's 1 days' work = $\frac{1}{24}$
- $\frac{1}{36}$ + Boy's 1 days' work = $\frac{1}{24}$
- Boy's 1 day's work = $\frac{1}{24} - \frac{1}{36} = \frac{3-2}{72} = \frac{1}{72}$
- Therefore, the boy alone can do the work in 72 days.

Problem 6

- 10 men can complete a piece of work in 15 days and 15 women can complete the same work in 12 days. If all the 10 men and 15 women work together, in how many days will the work get completed ?

- 10 men's 1 day's work = $\frac{1}{15}$

- 15 women's 1 day's work = $\frac{1}{12}$

- 1 day's work of 10 men's and 15 women's = $\frac{1}{15} + \frac{1}{12}$

Problem 6

- 1 day's work of 10 men's and 15 women's $= \frac{1}{15} + \frac{1}{12}$

$$= \frac{4 + 5}{60}$$

$$= \frac{9}{60} \quad \begin{matrix} 3 \\ 20 \end{matrix}$$

$$= \frac{3}{20}$$

- 10 men & 15 women will complete the work $= \frac{20}{3} = 6\frac{2}{3}$ days

Problem 7

- A job can be done by 3 skilled men in 20 days or by 5 boys in 30 days. How many days will they take if they work together?
- 3 men's 1 day's work = $\frac{1}{20}$
- 5 boys' 1 day's work = $\frac{1}{30}$
- (3 men + 5 boys)'s 1 day's work = $\frac{1}{20} + \frac{1}{30} = \frac{3+2}{60}$

$$= \frac{5}{60_{12}} = \frac{1}{12}$$

- 3 men and 5 boys will complete the work in 12 days.

Problem 8

- Five men are working to complete a work in 15 days. After five days 10 women are accompanied by them to complete the work in next 5 days. If the work is to be done by women only, then in how many days could the work be over if 10 women have started it ?
- 5 men's 15 days' work

  = 5 men's 10 days' work + 10 women's 5 days' work
- 5 men's 15 days' work – 5 men's 10 days' work

  = 10 women's 5 days' work
- 5 men's 5 days' work = 10 women's 5 days' work

Problem 8

- 5 men's 15 days' work – 5 men's 10 days' work

  = 10 women's 5 days' work

- 5 men's 5 days' work = 10 women's 5 days' work

- 5 men's 1 days' work = $\frac{1}{15}$ (Given)

- 5 men's 5 days' work = 5 x $\frac{1}{15}$

- 5 x $\frac{1}{15}$ = 10 women's 5 days' work

Problem 8

- $5 \times \frac{1}{15}$ = 10 women's 5 days' work
- 10 women's 5 days' work = $5 \times \frac{1}{15}$
- 10 women's 1 day's work = $\cancel{5} \times \frac{1}{15} \times \cancel{\frac{1}{5}}$

$$= \frac{1}{15}$$

- 10 women can complete the work in 15 day.

Problem 9

- Seven men can complete a work in 12 days. They started the work and after 5 days, two men left. In how many days will the work be completed by the remaining men ?
- (7 × 12 = 84) men can complete the work in 1 day.
- 1 man's 1 day's work = $\frac{1}{84}$
- 7 man's 1 day's work = ~~7~~ x $\frac{1}{\cancel{84}\ 12}$ = $\frac{1}{12}$
- 7 men's 5 days' work = 5 x $\frac{1}{12}$ = $\frac{5}{12}$

Problem 9

- 7 man's 1 day's work = $\frac{1}{12}$ & 7 men's 5 days' work = $\frac{5}{12}$
- Remaining work = $1 - \frac{5}{12} = \frac{12-5}{12} = \frac{7}{12}$
- 1 man's 1 day's work = $\frac{1}{84}$
- 5 men's 1 day's work = $5 \times \frac{1}{84}$
- $\frac{5}{84}$ work is done by 5 men's in 1 day.
- $\frac{7}{12}$ work is done by 5 men's in 1 day in $\frac{\cancel{7}}{\cancel{12}} \times \frac{\cancel{84}^{7}}{5} = \frac{49}{5}$

$= 9\frac{4}{5}$ days

Problem 10

- A man, a woman and a boy can complete a job in 3, 4 and 12 days respectively. How many boys must assist 1 man and 1 woman to complete the job in $\frac{1}{4}$ of a day ?

- (1 man + 1 woman)'s 1 day's work = $\frac{1}{3} + \frac{1}{4}$

$$= \frac{4 + 3}{12} \quad = \frac{7}{12}$$

- Work done by 1 man and 1 woman in $\frac{1}{4}$ day = $\frac{1}{4} \times \frac{7}{12} = \frac{7}{48}$

Problem 10

- Work done by 1 man and 1 woman in $\frac{1}{4}$ day = $\frac{7}{48}$
- Remaining work = 1 – $\frac{7}{48}$ = $\frac{48 - 7}{48}$ = $\frac{41}{48}$
- Work done by 1 boy in $\frac{1}{4}$ day = $\frac{1}{4}$ x $\frac{1}{12}$ = $\frac{1}{48}$
- Number of boys required for assisting 1 man and 1 woman to complete the job in $\frac{1}{4}$ of a day = $\frac{41}{\cancel{48}}$ x $\cancel{48}$ = 41

Problem 11

- If 2 men or 6 women or 4 boys can finish a work in 99 days, how many days will one man, one woman and one boy together take to finish the same work?
- 2 men's 1 day's work = $\frac{1}{99}$
- 1 man's 1 day's work = $\frac{1}{2} \times \frac{1}{99} = \frac{1}{198}$
- 6 women's 1 day's work = $\frac{1}{99}$
- 1 woman's 1 day's work = $\frac{1}{6} \times \frac{1}{99} = \frac{1}{594}$
- 4 boy's 1 day's work = $\frac{1}{99}$
- 1 boy's 1 day's work = $\frac{1}{4} \times \frac{1}{99} = \frac{1}{396}$

Problem 11

- 1 man's 1 day's work $= \frac{1}{198}$
- 1 woman's 1 day's work $= \frac{1}{594}$
- 1 boy's 1 day's work $= \frac{1}{396}$
- (1 man + 1 woman + 1 boy)'s 1 day's work $= \frac{1}{198} + \frac{1}{594} + \frac{1}{396}$

$$= \frac{6 + 2 + 3}{1188} = \frac{\cancel{11}}{\cancel{1188}\ 108} = \frac{1}{108}$$

- Therefore, 1 man, 1 woman and 1 boy together take 108 days to finish the same work.

Problem 12

- Twelve children take sixteen days to complete a work which can be completed by eight adults in twelve days. Sixteen adults started working and after three days ten adults left and four children joined them. How many days will they take to complete the remaining work ?

- 12 child's 1 day's work = $\frac{1}{16}$
- 1 child's 1 day's work = $\frac{1}{12} \times \frac{1}{16} = \frac{1}{192}$
- 8 adult's 1 day's work = $\frac{1}{12}$
- 1 adult's 1 day's work = $\frac{1}{8} \times \frac{1}{12} = \frac{1}{96}$

Problem 12

- 1 child's 1 day's work = $\frac{1}{192}$
- 1 adult's 1 day's work = $\frac{1}{96}$
- 16 adult's 1 day's work = $16 \times \frac{1}{96}$
- 16 adult's 3 day's work = $\cancel{3} \times \cancel{16} \times \frac{1}{\cancel{96}_{\cancel{6}_{2}}} = \frac{1}{2}$
- Remaining work = $1 - \frac{1}{2} = \frac{2-1}{2} = \frac{1}{2}$

Problem 12

- Remaining work = $\frac{1}{2}$
- 1 child's 1 day's work = $\frac{1}{192}$ & 1 adult's 1 day's work = $\frac{1}{96}$
- (6 adults + 4 children)'s 1 day's work = $\frac{6}{96} + \frac{4}{192}$ (16, 48)

$$= \frac{1}{16} + \frac{1}{48} = \frac{3+1}{48} = \frac{4}{48} = \frac{1}{12}$$ (12)

- $\frac{1}{12}$ work is done by them in 1 day.

  1 work is done by them in 12 day.
- $\frac{1}{2}$ work is done by them in $12 \times \frac{1}{2}$ days (6) = 6 days

Problem 13

- 6 men can complete a piece of work in 12 days, 8 women can complete the same piece of work in 18 days and 18 children can do it in 10 days. 4 men, 12 women and 20 children do the work for 2 days. If the remaining work be completed by men only in 1 day, how many men will be required?
- 6 men will complete the work in 12 days.
- 1 man will complete the work in = 6 × 12

  = 72 days
- 1 men's 1 day's work = $\frac{1}{72}$

Problem 13

- 8 women can complete the work in 18 day.
- 1 woman will complete the work in = 8 × 18 = 144 days
- 1 woman's 1 day's work $= \frac{1}{144}$
- 18 children can complete the work in 10 days.
- 1 child will complete the work in = 18 × 10 = 180 days
- 1 child's 1 day's work $= \frac{1}{180}$

Problem 13

- 1 men's 1 day's work = $\frac{1}{72}$
- 1 woman's 1 day's work = $\frac{1}{144}$
- 1 child's 1 day's work = $\frac{1}{180}$
- (4 men + 12 women + 20 children)'s 1 days' work

$$= \frac{\cancel{4}}{\cancel{72}_{18}} + \frac{\cancel{12}}{\cancel{144}_{12}} + \frac{\cancel{20}}{\cancel{180}_{9}} = \frac{1}{18} + \frac{1}{12} + \frac{1}{9}$$

Problem 13

- (4 men + 12 women + 20 children)'s 2 days' work

$$= 2\left(\frac{1}{18} + \frac{1}{12} + \frac{1}{9}\right) = 2\left(\frac{2 + 3 + 4}{36}\right) = \frac{2 \times 9}{36} = \frac{\cancel{18}}{\cancel{36}}\ {}^{2}$$

$$= \frac{1}{2}$$

Remaining work $= 1 - \frac{1}{2} = \frac{1}{2}$

Required number of men $= \cancel{72}^{36} \times \frac{1}{\cancel{2}}$

$= 36$

Problem 14

- 25 men with 10 boys can do in 6 days as much work as 21 men with 30 boys can do in 5 days. How many boys must help 40 men to do the same work in 4 days?
- Let 1 man's 1 day's work = x

  1 boy's 1 day's work = y
- According to Question,

$$6\,(25x + 10y) = 5\,(21x + 30y)$$

$$150x + 60y = 105x + 150y$$

$$45x = 90y$$ (2)

$$x = 2y$$

Problem 14

- Let the required number of boys = z
- According to Question, 4 (40x + zy) = 6 (25x + 10y)
- 4 (40(2y) + zy) = 6 (25(2y) + 10y) (Because x = 2y)
- 4 (80y + zy) = 6 (50y + 10y) or ~~y~~ (320 + 4z) = 6 (60 ~~y~~)
- 320 + 4z = 360
- 4z = 360 – 320 = 40
- $z = \frac{\cancel{40}^{10}}{\cancel{4}}$
- z = 10

Problem 15

- If 12 men and 16 boys can do a piece of work in 5 days; 13 men and 24 boys can do it in 4 days, then calculate the ratio of the daily work done by a man to that of a boy.
- Let 1 man's 1 day's work = x

  1 boy's 1 day's work = y
- According to Question,

$$12x + 16y = \frac{1}{5}$$

$$13x + 24y = \frac{1}{4}$$

Problem 15

$12x + 16y = \frac{1}{5}$ } X 13

$13x + 24y = \frac{1}{4}$ } X 12

$156x + 208y = \frac{13}{5}$

$156x + 288y = \frac{12}{4}$

$-80y = \frac{52 - 60}{20} = \frac{-8}{20}$

$-80y = \frac{-8}{20}$ Or $y = \frac{1}{200}$

$12x + 16\frac{1}{200} = \frac{1}{5}$

$12x + \frac{16}{200} = \frac{1}{5}$

$12x = \frac{1}{5} - \frac{16}{200}$

$12x = \frac{40 - 16}{200}$

$12x = \frac{24}{200}$

$x = \frac{1}{100}$

$x = \frac{1}{100}, y = \frac{1}{200}$

- Required ratio = $x : y = \frac{1}{100} : \frac{1}{200} = 200 : 100$

$= 2 : 1$

Conclusion

- Computation of Time and Work
  - Time
  - Work Completed - Men, Women & Children Together
  - Men/Women/Children – Time Taken to do Work Alone
  - Days Requires to Complete Remaining Work
  - Number of Men/Women/Children Required
  - Ratio of the Daily Work Done

Summary

- Time and Work
    - Men, Women, and Children Based Problems

That's all for now...