Question 23:
Let the marks obtained by Kamal in Mathematics and English be x and y

$$\therefore \quad x + y = 40 \quad ---(1)$$

$$\text{and } (x+3)(y-4) = 360 ---(2)$$

From (1) $y = 40 - x$

Putting value of y in (2)

$$(x+3)(40 - x - 4) = 360$$

$$\Rightarrow (x+3)(36 - x) = 360$$

or $36x - x^2 + 108 - 3x = 360$

$$\Rightarrow -x^2 + 33x - 252 = 0 \quad \text{or} \quad x^2 - 33x + 252 = 0$$

$$\Rightarrow x^2 - 21x - 12x + 252 = 0$$

or $x(x - 21) - 12(x - 21) = 0$

$$\Rightarrow (x - 21)(x - 12) = 0$$

$\therefore$ when $x - 21 = 0$, $x = 21$

when $x - 12 = 0$, $x = 12$

for $x = 21$, $21 + y = 40 \quad \therefore y = 19$

for $x = 12$, $12 + y = 40 \quad \therefore y = 28$

The marks obtained by Kamal in Mathematics and English respectively are (21,19) or (12,28).

Question 24:
Let A and B take x days and x + 10 respectively to finish a piece of work

$$\frac{1}{x} + \frac{1}{x + 10} = \frac{1}{12}$$

Work done by A and B in 1 day =

$$\Rightarrow \frac{x+10+x}{x(x+10)} = \frac{1}{12}$$

$$\Rightarrow 12(2x+10) = x^2 + 10x$$

$$\Rightarrow 24x + 120 = x^2 + 10x$$

$$\Rightarrow x^2 - 14x - 120 = 0$$

$$\Rightarrow x^2 - 20x + 6x - 120 = 0$$

$$\Rightarrow x(x-20) + 6(x-20) = 0$$

$$\Rightarrow (x-20)(x+6) = 0$$

$$x = 20, -6$$

But x cannot be negative

Then, B will finish work in x + 10 days = 20 + 10 = 30 days

Question 25:
Let x kmph be the speed of the passenger train
time taken to move 300 km = 300/x hours
When speed is (x + 5) km/h, time taken to move 300 km
= 300/(x+5) hours

$$\therefore \frac{300}{x} - \frac{300}{x+5} = 2 \Rightarrow \frac{1}{x} - \frac{1}{x+5} = \frac{2}{300} = \frac{1}{150}$$

$$\Rightarrow \frac{x+5-x}{x(x+5)} = \frac{1}{150}$$

$$\Rightarrow \frac{5}{x(x+5)} = \frac{1}{150}$$

$$\therefore x(x+5) = 750 \quad \text{or} \quad x^2 + 5x - 750 = 0$$

$$\Rightarrow x^2 + 30x - 25x - 750 = 0$$

$$\Rightarrow x(x+30) - 25(x+30) = 0 \quad \text{or} \quad (x+30)(x-25) = 0$$

$$\therefore x + 30 = 0, x = -30, \quad \text{but x cannot be negative}$$

$$\therefore x - 25 = 0, x = 25$$

Speed of passenger train is 25km/h.

Question 26:
Let the original speed of the train be x km/h
Then, increased speed = (x + 5) km/h
Time taken at original speed = 360/x
Time taken at increased speed = 360/(x+5)

$$\therefore \frac{360}{x} - \frac{360}{x+5} = 1$$

$$\Rightarrow \frac{1}{x} - \frac{1}{(x+5)} = \frac{1}{360}$$

$$\Rightarrow \frac{x+5-x}{x(x+5)} = \frac{1}{360} \Rightarrow \frac{5}{x(x+5)} = \frac{1}{360}$$

$$\Rightarrow x(x+5) = 1800 \Rightarrow x^2 + 5x - 1800 = 0$$

$$\Rightarrow x^2 + 45x - 40x - 1800 = 0$$

$$\Rightarrow x(x+45) - 40(x+45) = 0$$

$$\Rightarrow (x+45)(x-40) = 0$$

$$\Rightarrow x = -45 \text{ or } x = 40$$

$$\Rightarrow x = 40 \text{ (since speed cannot be negative)}$$

Then original speed is 40 km/h.

Question 27:
Let the original speed of the train be x km.hour
Then speed increases by 15 km/ph = (x + 15)km/hours
Then time taken at original speed = 90/x hours
Then, time taken at in increased speed = 90/(x+15) hours
Difference between the two lines taken 1/2 h

$$\frac{90}{x} - \frac{90}{x+15} = \frac{1}{2} \Rightarrow \frac{1}{x} - \frac{1}{x+15} = \frac{1}{180}$$

$$\Rightarrow \frac{x+15-x}{x(x+15)} = \frac{1}{180} \Rightarrow \frac{15}{x(x+15)} = \frac{1}{180}$$

$$\Rightarrow x^2 + 15x - 2700 = 0$$

$$\Rightarrow x^2 + 60x - 45x - 2700 = 0$$

$$\Rightarrow x(x+60) - 45(x+60) = 0$$

$$\Rightarrow (x+60)(x-45) = 0$$

$$\Rightarrow x = -60 \text{ or } x = 45$$

$$\Rightarrow x = 45 \text{ (}\because \text{ speed cannot be negative)}$$

Then, original speed of the train = 45 km/h.

********** END *********