1. Algebraic Expression: The combination of numbers and variables with mathematical operations is called an Alg. Exp.
   Eg- $4x+3y+5$
2. Equation: The statement of equality of two alg. Exp. is called an Equation. An eqn. may be of one or more variables. Eg. $4x+3 = -2x+4y+3$
3. Simple Linear Eqn or Eqn of one variable
   An eqn. of degree one containing only one variable is called a simple lin- Eqn or Eqn of one variable.
   Eg. ① $5x+2 = \frac{x}{3} - 2$.
   ② $\frac{y-1}{6} + \frac{2y+5}{3} = \frac{5}{9}$.
4. Solution or Root of an Eqn :-
   The value of the variable containing in the Eqn is its soln or Root.
   Eg. $ax+b=0$
   $\Rightarrow x = -b/a$, is the soln or root of the Eqn $ax+b=0$.
5. Rules for solving Eqns
   ⊗ "Method of Transposition".

—— x ——

Exercise - 15A

Q.2. $5y + 18 = 11 - 2y$

$\Rightarrow 5y + 2y = 11 - 18$

$\Rightarrow 7y = -7$

$\Rightarrow y = \frac{-7}{7} = -1$.

Q.4/ $3(y-7) - 2(3y-4) = 2 - 5y$

$\Rightarrow 3y - 21 - 6y + 8 = 2 - 5y$.

$\Rightarrow 3y - 6y + 5y = 2 + 21 - 8$

$\Rightarrow 2y = 15$

$\Rightarrow y = 15/2$

Q.6/ $\frac{3x}{4} - \frac{x-4}{5} = \frac{5}{3}$.

$\Rightarrow \frac{9x - 4x + 16}{12} = \frac{5}{3}$

$\Rightarrow \frac{5x + 16}{4} = 5$

$\Rightarrow 5x + 16 = 20$

$\Rightarrow 5x = 4 \Rightarrow x = 4/5$.

Q.10/ $\frac{2x-3}{3x-1} = \frac{2x+3}{3x+4}$

$\Rightarrow (2x-3)(3x+4) = (2x+3)(3x-1)$

$\Rightarrow 6x^2 - 8x - 9x - 12 = 6x^2 - 2x + 9x - 3$

$\Rightarrow -8x - 9x + 2x - 9x = -3 + 12$

$\Rightarrow -24x = 9 \Rightarrow x = -9/24 \Rightarrow x = -3/8$

Q.7. $\frac{(4x+1)}{3} + \frac{(2x-1)}{2} - \frac{(3x-7)}{5} = 6$

$\Rightarrow \frac{10(4x+1) + 15(2x-1) - 6(3x-7)}{30} = 6$ [Lcm of 3, 2, 5 = 30]

$\Rightarrow 40x + 10 + 30x - 15 - 18x + 42 = 6 \times 30$

$\Rightarrow 40x + 30x - 18x = 180 - 10 + 15 - 42$

$\Rightarrow 52x = 143$

$\Rightarrow x = 143/52 = 11/4$

Q.9. $\frac{2-9z}{17-4z} = 4/5$

$\Rightarrow 5(2-9z) = 4(17-4z)$

$\Rightarrow 10 - 45z = 68 - 16z$

$\Rightarrow 10 - 68 = 45z - 16z$.

$\Rightarrow -58 = 29z$.

$\Rightarrow z = \frac{-58}{29} = -2$.

Q.13/ $\frac{3}{2x-1} + \frac{4}{2x+1} = \frac{7}{2x}$.

$\Rightarrow \frac{3(2x+1) + 4(2x-1)}{(2x-1)(2x+1)} = \frac{7}{2x}$.

$\Rightarrow \frac{6x+3+8x-4}{4x^2+2x-2x-1} = \frac{7}{2x}$

$\Rightarrow \frac{14x-1}{4x^2-1} = \frac{7}{2x}$.

$\Rightarrow 2x(14x-1) = 7(4x^2-1)$

$\Rightarrow 28x^2 - 2x = 28x^2 - 7$

$\Rightarrow -2x = -7 \Rightarrow x = 7/2$.

Q.14/ $\frac{3}{x-2} - \frac{2}{x-3} = \frac{4}{x-3} - \frac{3}{x-1}$

$\Rightarrow \frac{3(x-3)-2(x-2)}{(x-2)(x-3)} = \frac{4(x-1)-3(x-3)}{(x-3)(x-1)}$

$\Rightarrow \frac{3x-9-2x+4}{x-2} = \frac{4x-4-3x+9}{x-1}$

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

$\Rightarrow (x-5)(x-1) = (x+5)(x-2)$

$\Rightarrow x^2 - x - 5x + 5 = x^2 - 2x + 5x - 10$

$\Rightarrow -x - 5x + 2x - 5x = -10 - 5$

$\Rightarrow -9x = -15$

$\Rightarrow x = \frac{15}{9} = \frac{5}{3}$.

Q.16/ $y(2y+3) - 2y(y-5) = 26$

$\Rightarrow 2y^2 + 3y - 2y^2 + 10y = 26$

$\Rightarrow 13y = 26 \Rightarrow y = \frac{26}{13} = 2$.

Q.17/ $\frac{x+6}{4} - \frac{5x-4}{8} + \frac{x-3}{5} = 0$

$\Rightarrow \frac{10(x+6) - 5(5x-4) + 8(x-3)}{40} = 0$ [L.C.M of 4, 8, 5 = 40]

$\Rightarrow 10x + 60 - 25x + 20 + 8x - 24 = 0 \times 40$

$\Rightarrow 10x - 25x + 8x = 24 - 20 - 60$

$\Rightarrow -7x = -56$

$\Rightarrow x = \frac{-56}{-7} = 8$.

Q.18/ $\frac{3}{4}(7x-1) - (2x - \frac{1-x}{2}) = x + \frac{3}{2}$.

$\Rightarrow \frac{21x-3}{4} - \frac{4x-1+x}{2} = \frac{2x+3}{2}$

$\Rightarrow \frac{21x-3-2(5x-1)}{4} = \frac{2x+3}{2}$

$\Rightarrow \frac{21x-3-10x+2}{2} = 2x+3$

$\Rightarrow 11x - 1 = 4x + 6$

$\Rightarrow 7x = 7 \Rightarrow x = 1$.

Ex-15.B

Q.1. let the no. $= x$.

So, According to question (ATQ),

$4x - 17 = 11$

$\Rightarrow 4x = 28$

$\Rightarrow x = 7$

So, the no. is 7.

Q.2. let the no. $= x$.

So, ATQ,

$4x + 10 = 5x - 5$

$\Rightarrow 10 + 5 = 5x - 4x$.

$\Rightarrow 15 = x$

So, the no. is 15.

Q.3. let the original no. $= x$

ATQ, $\frac{2}{3}x = x - 20$

$\Rightarrow 2x = 3(x-20)$

$\Rightarrow 2x = 3x - 60$

$\Rightarrow 60 = x$

So, the original no. is 60.

Q.4. let the no. $= x$

So, ATQ, $x = \frac{5}{6}x + 25$

$\Rightarrow x - \frac{5x}{6} = 25$

$\Rightarrow \frac{6x-5x}{6} = 25$

$\Rightarrow x = 25 \times 6 = 150$

So, the no. is $= 150$

Q.5. let the no. $= x$.

ATQ,

$x - 21 = 71 - x$

$\Rightarrow x + x = 71 + 21$

$\Rightarrow 2x = 92 \Rightarrow x = 46$.

So, the no. is 46.

Q.6. let the no. $= x$

So, ATQ, $\frac{1}{4}x + 6 = \frac{2}{5}x$.

$\Rightarrow \frac{x}{4} - \frac{2x}{5} = -6$

$\Rightarrow \frac{5x - 8x}{20} = -6$

$\Rightarrow -3x = -180$

$\Rightarrow x = 60$.

So, the no. is $= 60$

Q.7. let the no. $= x$

So, ATQ, $\frac{1}{3}x - \frac{1}{4}x = 15$

$\Rightarrow \frac{4x - 3x}{12} = 15$

$\Rightarrow x = 15 \times 12 = 180$

So, the no. is 180.

Q.8. let the no. $= x$

ATQ, $\frac{1}{5}x - 5 = 16$

$\Rightarrow \frac{x}{5} = 21 \Rightarrow x = 105$.

So the no. $= 105$.

Q.9. let the no. $= x$

So, ATQ, $\frac{x}{6} = x - 40$

$\Rightarrow \frac{x}{6} - x = -40$

$\Rightarrow \frac{x - 6x}{6} = -40$

$\Rightarrow -5x = -240 \Rightarrow x = 48$.

So the no. is $= 48$.

Q.10. Let the no. $= x$

ATQ, $\frac{4}{5}x = \frac{2}{3}x + 10$

$\Rightarrow \frac{4x}{5} - \frac{2x}{3} = 10$

$\Rightarrow \frac{12x - 10x}{15} = 10$

$\Rightarrow 2x = 150 \Rightarrow x = 75.$

So, the no. $= 75$

Q.11. The given ratio is $= 3:4$

Let the numbers are $3x$ and $4x$

So, ATQ, $3x + 4x = 84$

$\Rightarrow 7x = 84 \Rightarrow x = 12.$

So, the numbers are, $3x = 3 \times 12 = 36$

$4x = 4 \times 12 = 48.$

Q.12. The given ratio is, $4:5:6$

Let the nos. are $4x$, $5x$ and $6x$.

ATQ, $4x + 5x + 6x = 135$

$\Rightarrow 15x = 135$

$\Rightarrow x = 9$

$\therefore$ The nos. are, $4x = 4 \times 9 = 36$

$5x = 5 \times 9 = 45$

$6x = 6 \times 9 = 54$

Q. 13. Given: two nos. are in the ratio 3:5
let the nos. are: $3x$ and $5x$
so, ATQ, $\frac{3x+10}{5x+10} = \frac{5}{7}$.

$\Rightarrow 7(3x+10) = 5(5x+10)$

$\Rightarrow 21x+70 = 25x+50$

$\Rightarrow -4x = -20 \Rightarrow x = 5$

so, the nos. are, $3x = 3\times5 = 15$

$5x = 5\times5 = 25$.

Q. 14. let the three consecutive odd nos. are,
x, $x+2$ $x+4$.

so, ATQ, $x+(x+2)+(x+4) = 75$

$\Rightarrow 3x+6 = 75$

$\Rightarrow 3x = 69 \Rightarrow x = \frac{69}{3} = 23$

so, The consecutive odd nos. are —

$x = 23$

$x+2 = 23+2 = 25$

$x+4 = 23+4 = 27$.

Q. 15. let one part $= x$

so, other part $= 25-x$

so, ATQ, $7x + 5(25-x) = 139$

$\Rightarrow 7x + 125 - 5x = 139$

$\Rightarrow 2x = 14$

$\Rightarrow x = 7$

$\therefore$ 1st part $= 7$ other part $= 25-7 = 18$.

Q. 18. Let the Numerator = x
the Denominator = $2x+1$
$\therefore$ the fractional no. = $\frac{x}{2x+1}$.

ATQ, $\frac{x+2}{2x+1-3} = 1$.

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

$\Rightarrow x+2 = 2x-2$

$\Rightarrow 4 = x$

$\therefore$ the fractional no. = $\frac{4}{2\times 4+1} = \frac{4}{9}$.

Q. 19. Let the unit-place digit = x
$\therefore$ the Ten's place digit = $5-x$
So, the 2-digit no. = $10(5-x)+x$.

ATQ, $10(5-x)+x+27 = 10x+5-x$

$\Rightarrow 50-10x+x+27 = 9x+5$

$\Rightarrow -9x-9x = 5-50-27$

$\Rightarrow -18x = -72$.

$\Rightarrow x = 4$

$\therefore$ the two-digit no. = $10(5-4)+4$
$= 14$.

Q.20. let the number $= x$.

So, the given numbers will become

$15+x, 23+x, 29+x, 44+x$

Now, we know that

product of extremes = Product of means

$\Rightarrow (15+x)(44+x) = (23+x)(29+x)$

$\Rightarrow 660 + 15x + 44x + x^2 = 667 + 23x + 29x + x^2$

$\Rightarrow 59x + 660 = 667 + 52x.$

$\Rightarrow 7x = 7 \quad \Rightarrow x = 1.$

So, 1 should be added to each of the numbers 15, 23, 29, 44 to obtain numbers which are in proportion.

Q.21. let one no. $= x$

$\therefore$ other no. $= 110 - x$

ATQ, $\frac{1}{5}x = 8 + \frac{1}{9}(110 - x)$

$\Rightarrow \frac{x}{5} = 8 + \frac{110-x}{9}.$

$\Rightarrow \frac{x}{5} = \frac{72 + 110 - x}{9}$

$\Rightarrow 9x = 360 + 550 - 5x.$

$\Rightarrow 14x = 910$

$\Rightarrow x = 65$

$\therefore$ One no. $= 65$

other no. $= 110 - 65$

$= 45$

Q.22. given fraction $= \frac{12}{13}$.

let the no. number $= x$.

$\therefore$ ATQ, $\frac{12-x}{13+6x} = \frac{1}{11}$

$\Rightarrow 11(12-x) = 13+6x$.

$\Rightarrow 132 - 11x = 13 + 6x$

$\Rightarrow 132 - 13 = 17x$.

$\Rightarrow 119 = 17x \Rightarrow x = 7$

So, the no. $= x$.

Q.23. The ratio of the perpendicular sides of right triangle $= 5:12$

let the sides are $5x$ and $12x$.

$\therefore$ hypotenuse $= \sqrt{(12x)^2 + (5x)^2}$

$= \sqrt{144x^2 + 25x^2}$

$= \sqrt{169x^2}$

$= 13x$

Given, Perimeter $= 120$

$\Rightarrow 5x + 12x + 13x = 120$

$\Rightarrow 30x = 120$

$\Rightarrow x = 4$

$\therefore$ The sides are: $5 \times 4 = 20$ cm

$12 \times 4 = 48$ cm

$13 \times 4 = 52$ cm.

Q.24. Let one's place digit $= x$

$\therefore$ ten's place digit $= 9-x$

So, the two-digit no. $= 10(9-x)+x$.

Now, ATQ, $10x+(9-x)+9 = 3\{10(9-x)+x\}$

$\Rightarrow 10x+9-x+9 = 3(90-10x)+3x$

$\Rightarrow 9x+18 = 270-30x+3x$

$\Rightarrow 9x+30x-3x = 270-18$

$\Rightarrow 36x = 252$

$\Rightarrow x = \frac{252}{36} = 7.$

$\therefore$ The original no. $= 10(9-x)+x$

$= 10(9-7)+7$

$= 27.$

Q.25. Let breadth of rect. plot $= x$

$\therefore$ length " " " $= x+23$

$\therefore$ Area " " " $= l \times b$

$= x(x+23)$

Again, length $= x+23-15 = x+8$

breadth $= x+7.$

$\therefore$ Area $= l \times b$

$= (x+8)(x+7)$

Now, ATQ, ~~$x(x+23)-360 = (x+8)(x+7)$~~

$(x+8)(x+7) = x(x+23)-360$

$\Rightarrow x^2+7x+8x+56 = x^2+23x-360$

$\Rightarrow 15x-23x = -360-56$

$\Rightarrow -8x = -416 \Rightarrow x = 52$

$\therefore$ breadth $= 52$ cm / length $= 52+23 = 75$ cm.

Q.26. let the breadth = x
∴ the length = 2x
ATQ, Perimeter = 2(l+b)
⇒ 186 = 2(2x+x)
⇒ 186 = 6x ⇒ x = 31.
∴ breadth = 31 cm / length = 2×31 = 62 cm.

Q. 27. let the breadth of rect. = x
∴ length of the rect. = x+7.
ATQ, Perimeter = 90
⇒ 2(l+b) = 90
⇒ 2(x+7+x) = 90
⇒ 2(2x+7) = 90
⇒ 4x+14 = 90
⇒ x = $\frac{76}{4}$ = 19.
∴ breadth = 19 cm / length = 19+7 = 26 cm.

Q.28. let breadth = x
∴ length = 2x−7
ATQ, Perimeter = 66 cm.
⇒ 2(l+b) = 66 cm.
⇒ 2{(2x−7) − 2 + (x+3)} = 66.
⇒ 4x − 14 − 4 + 2x + 6 = 66
⇒ 6x = 66 + 12
⇒ x = $\frac{78}{6}$ = 13 = breadth
∴ length = 2×13 − 7 = 19 cm.

Q.29. let present age of the son = x yrs.
So, " " " man = 5x yrs.

So, After 2 years,
son → (x+2) yrs.
man → (5x+2) yrs.

ATQ, $5x+2 = 4(x+2)$
$\Rightarrow 5x+2 = 4x+8$.
$\Rightarrow x = 6$

∴ Present age of son = 6 yrs.
Present age of man = $5 \times 6 = 30$ yrs.

Q.30. let Present age of son = x yrs.
So, present age of man = 2x yrs.

So, 12 yrs ago,
age of son = (x-12) yrs.
age of man = (2x-12) yrs.

ATQ, $2x-12 = 3(x-12)$
$\Rightarrow 2x-12 = 3x-36$
$\Rightarrow x = 24$

∴ Present age of son = 24 yrs.
Present age of man = $2 \times 24 = 48$ yrs

Q. 32. Let 5 yrs. ago, age of son = x yrs.

So, age of Parvathi = $4x$ yrs.

So, Present age of son = $(x+5)$ yrs.

and " " " Parvathi = $(4x+5)$ yrs.

ATQ, $(x+5) + (4x+5) = 55$

$\Rightarrow 5x + 10 = 55$

$\Rightarrow 5x = 45 \Rightarrow x = 9.$

∴ So, Parvathi's present age = $(4 \times 9 + 5)$

~~= 50 yrs.~~

= 41 yrs.

Q. 31. given ratio of age of Seema and Rekha is 5:3.

Let Seema's age = $5x$

Rekha's age = $3x$.

ATQ, $5x = 3x + 10$

$\Rightarrow 2x = 10 \Rightarrow x = 5.$

∴ Age of Seema = $5 \times 5 = 25$ yrs.

Age of Rekha = $3 \times 5 = 15$ yrs.

Q.33. Given, Present age of father = 56 yrs.
Present age of son = 24 yrs.
Let in x yrs. father will be twice as old as his son.
So, ATQ, $56+x = 2(24+x)$
$\Rightarrow 56+x = 48+2x.$
$\Rightarrow 8 = x$
So, in 8 yrs.

Q.34. Let present age of the girl = x yrs.
So, 9 yrs hence, the age of girl = $(x+9)$ yrs.
And 9 yrs ago " " " " = $(x-9)$ yrs.
∴ ATQ,
$x+9 = 3(x-9)$
$\Rightarrow x+9 = 3x-27.$
$\Rightarrow 36 = 2x \Rightarrow x = 18.$
So, her present age is 18 yrs.

Q.35. Given; Total Distance = 480 km
Total time taken = 9 hrs.

Let, x km distance is covered at 60 km/h.
So, $(480-x)$ km is covered at 45 km/h.

Now, we have,

$$\text{Time} = \frac{\text{Distance}}{\text{speed}}$$

$$\Rightarrow 9 = \frac{x}{60} + \frac{480-x}{45}$$

$$\Rightarrow 9 = \frac{3x + 4(480-x)}{180}$$

$$\Rightarrow 1620 = 3x + 1920 - 4x$$

$$\Rightarrow 1620 - 1920 = -x$$

$$\Rightarrow -300 = -x \Rightarrow x = 300 \text{ km}.$$

So, 300 km is covered at 60 km/h.

Q.36. Let the distance between A to B = x km.
So, Time taken to go from A to B = $\frac{D}{T} = \frac{x}{54}$

Again, time taken to come from B to A = $\frac{D}{T} = \frac{x}{60}$

Now, Total time = $9\frac{1}{2}$ hrs.

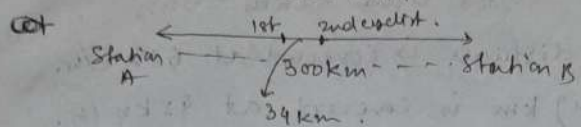
$$\Rightarrow \frac{x}{54} + \frac{x}{60} = \frac{19}{2}$$

$$\Rightarrow \frac{10x + 9x}{540} = \frac{19}{2}.$$

$$\Rightarrow \frac{19x}{540} = \frac{19}{2} \Rightarrow x = \frac{540}{2} = 270 \text{ km}.$$

So, Dist. bet^n A and B is 270 km.

Q.37. Given, Total distance between two stations = 300 km.



Let speed of 1st one = x km/h.

Speed of 2nd one = (x+7) km/h.

Now, After 2 hrs. dist. covered by them = (300 − 34) km

= 266 km.

So, ATQ,

Distance = speed × Time

$\Rightarrow 266 = 2 \times x + 2 \times (x+7)$

$\Rightarrow 266 = 2x + 2x + 14$

$\Rightarrow 252 = 4x$

$\Rightarrow x = \frac{252}{4} = 63$ km/h.

So, speed of 1st one = 63 km/h.

Speed of 2nd one = (63+7) = 70 km/h.

Q.44. Let 1st part = x / 2nd part = 600 − x

So, ATQ, 40% of x − 60% of (600 − x) = 120

$\Rightarrow \frac{40x}{100} - \frac{60(600-x)}{100} = 120$

$\Rightarrow 40x - 36000 + 60x = 12000$

$\Rightarrow 100x = 48000$

$\Rightarrow x = 480$, 1st part

So, 2nd part = 600 − 480 = 120.

Q. 38. Let speed of boat in still water = x km/h.
and speed of stream = 5 km/h.
So, speed of boat in upstream = $(x-5)$ km/h
And speed of boat in downstream = $(x+5)$ km/h
So, ATQ,

Time taken in upst. = Time taken in downst.

$$\Rightarrow \frac{30}{x-5} = \frac{50}{x+5}$$

$$\Rightarrow 30(x+5) = 50(x-5)$$
$$\Rightarrow 30x + 150 = 50x - 250$$
$$\Rightarrow 20x = 400 \Rightarrow x = 20$$

So, speed of boat in still water = 20 km/h.

Q. 39. Let the base = x cm.
∴ Each side of Isosceles $\triangle$le = $(x+4)$ cm.
ATQ, Perimeter = 62

$$\Rightarrow x + 2(x+4) = 62$$
$$\Rightarrow 3x + 8 = 62$$
$$\Rightarrow 3x = 54$$
$$\Rightarrow x = 18.$$

∴ So, base = 18 cm.
The equal sides = $(18+4)$ cm
= 22 cm each.

Q.40. Let total number of students = x

ATQ,

$$\left(\frac{1}{5}x+16\right)+\left(\frac{1}{4}x+15\right)+\left(\frac{1}{4}x-25\right)+60=x$$

$$\Rightarrow \left(\frac{x}{5}+\frac{x}{4}+\frac{x}{4}\right)+(16+15+60-25)=x$$

$$\Rightarrow \frac{4x+5x+5x}{20}+66=x.$$

$$\Rightarrow 14x+1320=20x.$$

$$\Rightarrow 1320=6x \Rightarrow x=220.$$

So, Total No. of students = 220.

Q.41. Let, Amount that Kamal have = x

$\therefore$ Raman has = $3x$.

NOW, ATQ, $2(3x-750)=x+750$

$$\Rightarrow 6x-1500=x+750$$

$$\Rightarrow 5x=2250$$

$$\Rightarrow x=450.$$

So Kamal has Rs 450

And Raman has $3\times 450=1350$.

Q.42. Given, ratio of $\angle$les of a $\triangle$le = 2 : 3 : 4

Let the angles are, $2x°$, $3x°$ and $4x°$.

So, $2x°+3x°+4x°=180°$ ($\because$ sum of 3 $\angle$les of a $\triangle$le = 180°)

$$\Rightarrow 10x°=180°$$

$$\Rightarrow x=18$$

$\therefore$ The angles are, $2\times 18°=36°$

$3\times 18°=54°$

$4\times 18°=72°$

Q. 43. Let total no. of men = x.
So, x men can finish the work in 50 days.
⇒ x men's 1 day's work = $\frac{1}{50}$
⇒ 1 man's 1 day's work = $\frac{1}{50x}$
Again,
(x+7) men's 1 day's work = $\frac{1}{40}$
⇒ 1 man's 1 day's work = $\frac{1}{40(x+7)}$

Hence, $\frac{1}{50x} = \frac{1}{40(x+7)}$.

⇒ $40(x+7) = 50x$
⇒ $40x + 280 = 50x$
⇒ $280 = 10x \Rightarrow x = 28$.

So, Total no. of workers = 28.

Q.45. Total no. of days = 30
Let no. of absent days = x
So, no. of present days = 30 − x

ATQ, $(30-x)\times 150 + 50\times x = 2100$
⇒ $4500 - 150x - 50x = 2100$
⇒ $2400 = 200x$
⇒ $x = 12$

So, the man remained absent for 12 days