Linear Equations

Linear Equations in One Variable

$9+5 = 14$ Statement of equality. (✓)

$9+5 \neq 15$ Statement of inequality (✗)

$9+5 = 14$

$2\times(3+7) = 2\times3 + 2\times7$

} Statement of equality.

None of them involves a variable (literal)

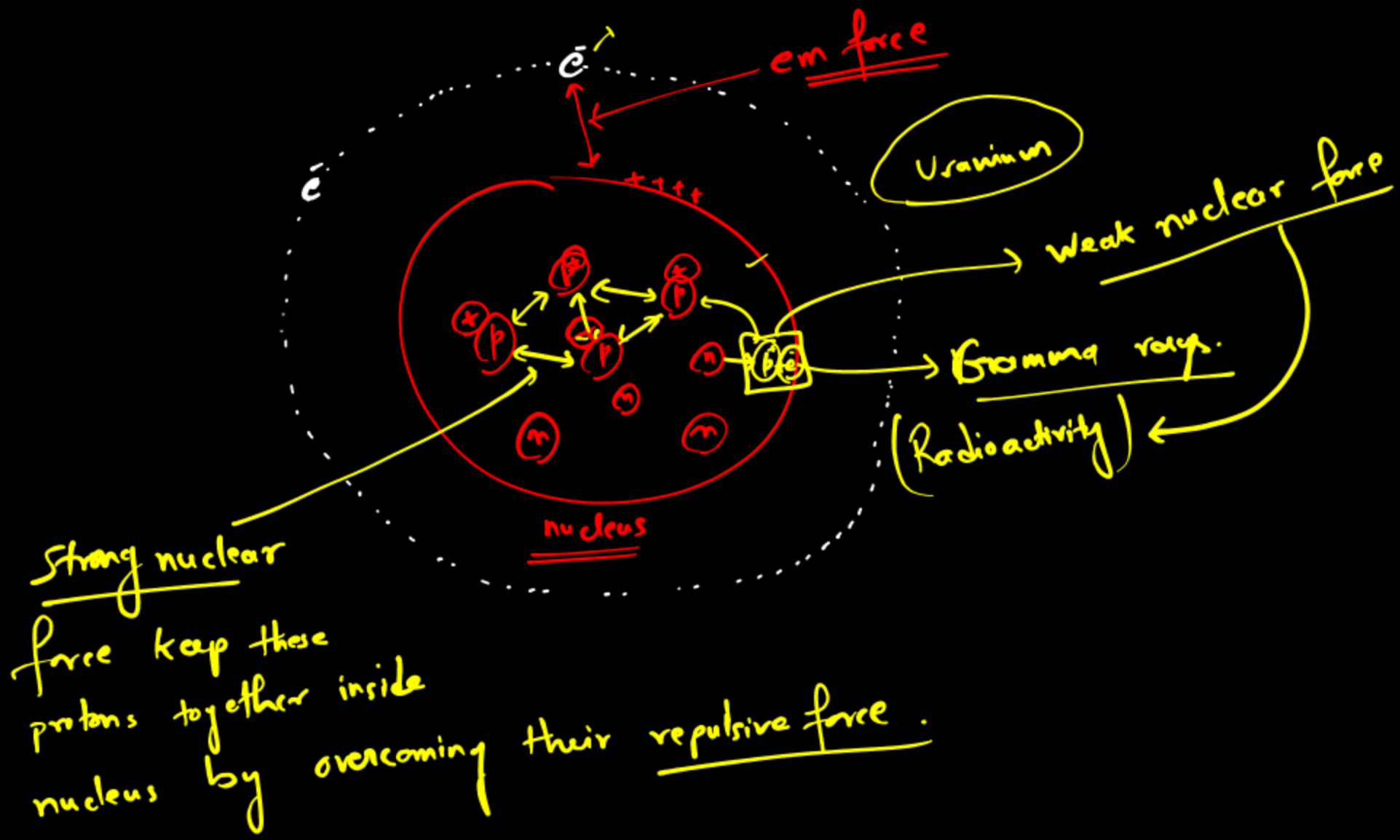
- 3 added to x is 8.

$$3 + x = 8$$

equations

$\Rightarrow x = 8-3$

$$x = 5$$



Linear equation in one variable

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A statement of equality which involves one or more variables (literals).

$2x + 3 = 15$ equation.

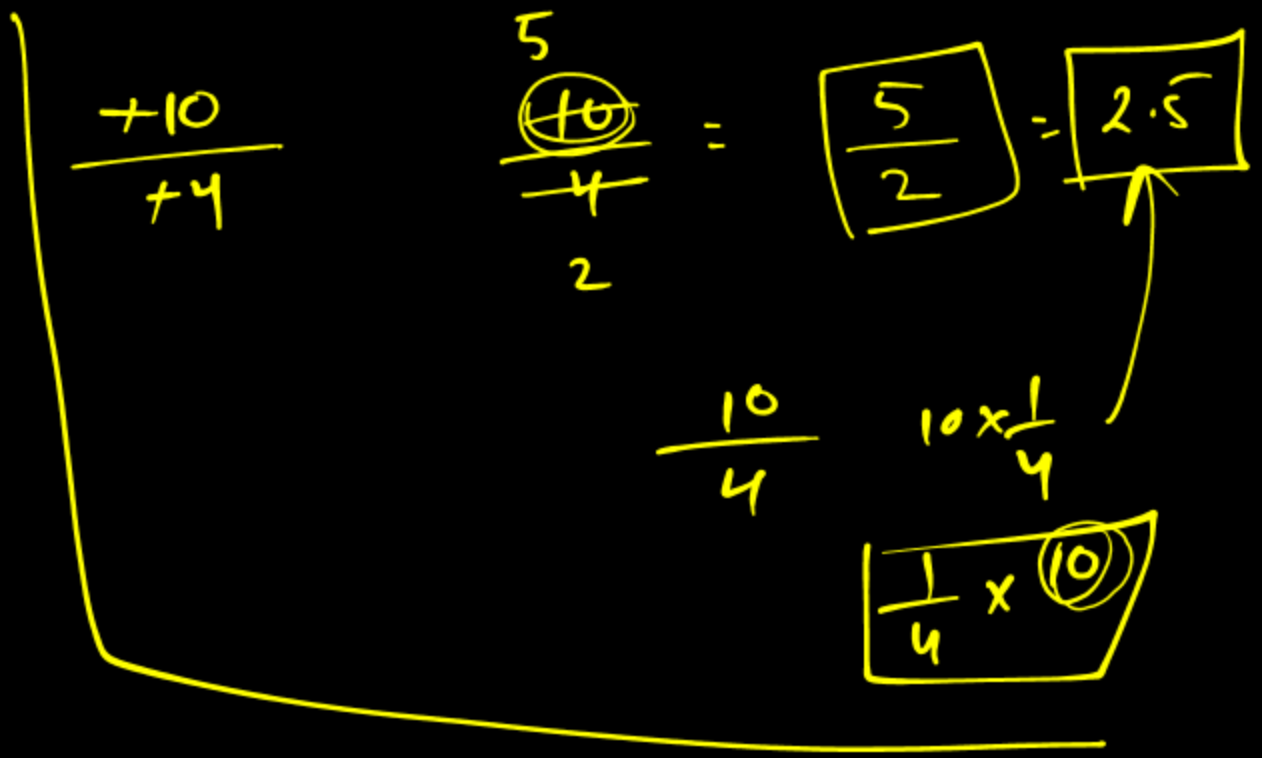
↑

variable

Linear equation : An equation in which the highest power of the variables involved is 1, is a linear equation.

eg: $x + 3 = 1$ equation ✓

$2x^2 + 3x + 9 = x + 15$ Linear equation ✗ (Quadratic equation)



eg. $2x + 3y + z = 13$ → equation ✓
→ Linear eq. ✓
→ Linear eq. in three variables.

$2x + 3y = 9 + z$ → eq. ✓
→ linear eq ✓
→ Linear eq. in 2 variables.

$2x + 9 = 5x + 7$ Linear eq. in 1 variable

↓

$2y + 7 = 14$ Linear eq. in 1 variable.

Q1: $\frac{x}{3} + 2 = 6$ ✓

Solving Linear equations in one variable

$4 = 4$

$+2 \quad +2$

$6 \neq 4$

eg: $x - 10 = 7$

L.H.S = $x - 10$

R.H.S = 7

$x - 10 = 7$

$+10 \quad +10$

$x - 10 + 10 = 7 + 10$

$x = 7 + 10$

$\boxed{x = 17}$

Q2

$$\frac{x}{3} + 2 = 6$$

$$-2 \qquad -2$$

$$\frac{x}{3} + 2 - 2 = 6 - 2$$

$$\frac{x}{3} = 4$$

$$\times 3 \qquad \times 3$$

$$\frac{x}{3} \times 3 = 4 \times 3$$

$$x = 4 \times 3$$

$$\boxed{x = 12}$$

Systemetic Method.

Solve for x, $\boxed{x - 3 = 5}$

$+3 \qquad +3$

$x - 3 + 3 = 5 + 3$

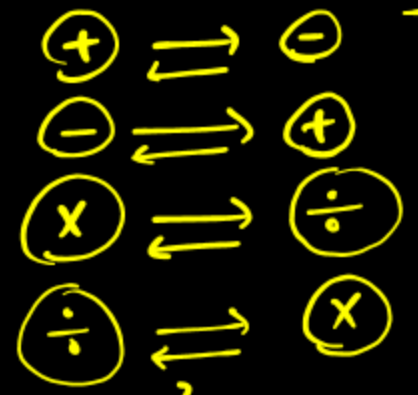
$\boxed{x = 8}$

Transposition method

Change the sign of the term and carry it to the other side of the equation

eg: $3(x-1) = 2x-11$

Solve for x.



Solve: We have $3(x-1) = 2x-11$

{ Simplify any bracket present in the e.q. }

$\Rightarrow 3x-3 = 2x-11$

{ Transfer all the variable terms to L.H.S. and constant terms to R.H.S. {⇒ while transfering remember to change the sign. } }

$3x-2x = -11+3$

$\boxed{x = -8}$

Thus, $x = -8$, is the solution of the given equation.

Q. Solve $3(x+3) - 2(x-1) = 5(x-5)$

Solution: We have,

$$3(x+3) - 2(x-1) = 5(x-5)$$

$$\Rightarrow 3x + 9 - 2x + 2 = 5x - 25$$

$$\Rightarrow 3x - 2x + 11 = 5x - 25$$

$$\Rightarrow x + 11 = 5x - 25$$

$$\Rightarrow x - 5x = -25 - 11$$

$$\Rightarrow -4x = -36$$

$$\Rightarrow 4x = 36$$

$$\Rightarrow x = \frac{36}{4}$$

$$\boxed{x = 9}$$

Q. Solve: $\frac{x}{2} - 1 = \frac{x}{3} + 4$

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

$\Rightarrow \frac{3x - 2x}{6} = 5$

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

$\Rightarrow x = 5 \times 6$

$\boxed{x = 30}$

$\frac{1}{2} - \frac{1}{3}$

$\Rightarrow \frac{3\times1 - 2\times1}{2\times3}$

$\Rightarrow \frac{3-2}{6}$

$\Rightarrow \frac{1}{6}$

Q. $\frac{2x-1}{3} + 1 = \frac{x-2}{3} + 2$ Solve for x and check the result.

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

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

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

$$\frac{x+1}{3} = 1$$

$$x+1 = 1 \times 3$$

$$x+1 = 3$$

$$x = 3-1$$

$$\boxed{x = 2}$$

Q. Solve: $\frac{3x}{10} + \frac{2x}{5} = \frac{7x}{25} + \frac{29}{25}$

Solution: We have $\frac{3x}{10} + \frac{2x}{5} = \frac{7x}{25} + \frac{29}{25}$

Multiply both side by 50.

$$50\left(\frac{3x}{10} + \frac{2x}{5}\right) = 50\left(\frac{7x}{25} + \frac{29}{25}\right)$$

$$\Rightarrow \frac{\cancel{50}^{5}}{\cancel{10}_{1}} \times 3x + \frac{\cancel{50}^{10}}{\cancel{5}_{1}} \times 2x = \frac{\cancel{50}^{2}}{\cancel{25}_{1}} \times 7x + \frac{\cancel{50}^{2}}{\cancel{25}_{1}} \times 29$$

$$\Rightarrow 5 \times 3x + 10 \times 2x = 2 \times 7x + 2 \times 29$$

$$\Rightarrow 15x + 20x = 14x + 58$$

$$\Rightarrow 35x - 14x = 58$$

$$\Rightarrow 21x = 58$$

$$\boxed{x = \frac{58}{21}}$$

Q. $\frac{12}{7}(x-5) = 24+8x$ Solve for x and check your result.

$\frac{12}{7}(x-5) = 24+8x$

$\Rightarrow 12(x-5) = 7(24+8x)$

$\Rightarrow 12x - 60 = 168 + 56x$

$\Rightarrow 12x - 56x = 168 + 60$

$-44x = 228$

$x = \frac{228}{-44}$

$x = -\frac{\cancel{228}^{114}}{\cancel{44}_{22}} = -\frac{\cancel{114}^{57}}{\cancel{22}_{11}}$

$x = -\frac{57}{11}$

2

$\Rightarrow -44x = 228$

$x = \frac{228}{-44}$

Solve: $\frac{(y-8)}{3} \quad \frac{(7-4y)}{7}$

(cross multiplication method.)

↓

⇒ (Butterfly method)

$\Rightarrow 7(y-8) = 3(7-4y)$

$\Rightarrow 7y - 56 = 21 - 12y$

$\Rightarrow 7y + 12y = 21 + 56$

$\Rightarrow 19y = 77$

$y = \frac{77}{19}$

Solve: $\left[\left(\frac{x-6}{4}\right) - \left(\frac{x-4}{6}\right) = 1 - \frac{x}{10}\right] \times 60$

$\frac{x}{10} \times \frac{12}{1}$

LHS $\times 12$ = RHS $\times 12$

$3x - 18 - (2x - 8) = \frac{12}{1} - \frac{12x}{10}$

$3x - 18 - 2x + 8 = 12 - \frac{12x}{10}$

$\left(x - 10 = 12 - \frac{12x}{10}\right) \times 10$

$10x - 100 = 120 - 12x$

$10x + 12x = 120 + 100$

$22x = 220$

$x = \frac{220}{22}$

$\boxed{x = 10}$

Solve $(0.3x + 0.4x = 0.28x + 1.16)\,100$

$30x + 40x = 28x + 116$

$42x = 116$

$x = \frac{116}{142} \quad \frac{58}{21} = \boxed{\frac{58}{21}}$

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

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

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

H.W.

Solve: $\frac{3}{4}(7x-1) - \left(2x - \frac{1-x}{2}\right) = \frac{x}{} + \frac{3}{2}$

+	−

$\Rightarrow$ Multiply both side by 4.

$4 \times (LHS) = (RHS)\,4$

$$4\left[\frac{3}{4}(7x-1) - \left(2x - \frac{1-x}{2}\right)\right] = 4\left(\frac{x}{} + \frac{3}{2}\right)$$

I term — II term

$2x - 4y + 7$

$\frac{x}{2} - 5y + \frac{3}{2}$

$$\Rightarrow \quad 4\left[\frac{3}{4}(7x-1)\right] - 4\left[2x - \frac{1-x}{2}\right] = 4x + \frac{2}{\cancel{4}} \times \frac{3}{\cancel{2}_1}$$

$$\Rightarrow \quad \cancel{4} \times \frac{3}{\cancel{4}}(7x-1) - 4(2x) + \overset{2}{\cancel{4}}\left(\frac{1-x}{\cancel{2}_1}\right) = 4x + 6$$

$$3(7x-1) - 8x + 2(1-x) = 4x + 6$$

$$21x - 3 - 8x + 2 - 2x = 4x + 6$$

$$21x - 8x - 2x - 4x = 6$$

$$7x = 6 + 3 - 2$$

$$7x = 7$$

$$\boxed{x = 1}$$

$$m - \frac{m-1}{2} = 1 - \frac{m-2}{3}$$

$$\frac{2m}{2} - \frac{m-1}{2} = \frac{3}{3} - \frac{m-2}{3}$$

$$\cancel{6}^{3}\left(\frac{2m}{\cancel{2}}\right) - \cancel{6}^{2}\left(\frac{m-1}{\cancel{2}}\right) = \cancel{6}^{2}\cdot\frac{3}{\cancel{3}} - \cancel{6}^{2}\left(\frac{m-2}{\cancel{3}}\right)$$

$$3(2m) - 3(m-1) = 2(3) - 2(m-2)$$

$$6m - 3m + 3 = 6 - 2m + 4$$

$$3m + 2m = 10 - 3$$

$$5m = 7$$

$$\boxed{m = \frac{7}{5}}$$ ✓

Q. Find the number which when divided by 9 gives 4.

Sol. Let the required no. be x.

x is divided by 9 = 4

$$\frac{x}{9} = 4$$

$$x = 9 \times 4$$

$$x = 36$$

Q. The sum of two consecutive nos. is 53. Find the numbers.

$x + x+1$

⇒ Let one number be x and next no. be $(x+1)$

$\therefore$ $x + (x+1) = 53$

$2x + 1 = 53$

$2x = 53 - 1$

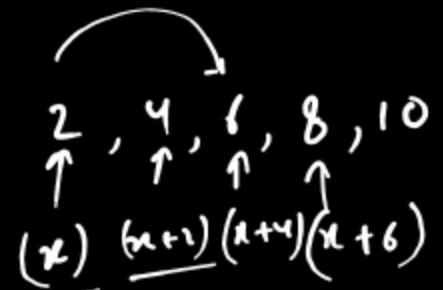
$2x = 52$

$x = \frac{52}{2}$

$x = 26$, $(x+1) = 27$

Numbers are : 26 and 27

Q. The sum of two consecutive even numbers is 86. Find the number.



Sol: Let one of the even nos. be x

$\therefore$ Next consecutive even no. $= (x+2)$

Now, as per the problem statement.

$$(x) + (x+2) = 86$$

$$2x + 2 = 86$$

$$2x = 86 - 2$$

$$2x = 84$$

$$x = 42$$

Answer: One of the even no $= 42$

Next consecutive even no. $= x + 2 = 42 + 2 = 44$

Q. Sum of two consecutive odd nos. is 68. Find the no numbers.

33 35

Q. Find two numbers such that one of them exceeds the other by 9 and their sum is 81.

Sol. Let first no. be x

and second no. $= x+9$

$\therefore \quad x + (x+9) = 81$

$2x = 81 - 9$

$2x = 72$

$\boxed{x = 36}$

$\begin{cases} \text{First no} = 36 \\ \text{Second no} = x+9 = 36+9 = 45 \end{cases}$

Q. Find a number which when multiplied by 5 is increased by 80.

Let the number be x.

$$x \times 5 = x + 80$$

$$5x = x + 80$$

$$5x - x = 80$$

$$4x = 80$$

$$x = \frac{80}{4}$$

$$\boxed{x = 20}$$

$$\boxed{3y^2 = 108}$$

$$y^2 = \frac{108}{3}$$

$$\boxed{y^2 = 36}$$

$$y = 6 \quad (-6)^2$$

Q. The sum of ages of father and his son is 75 years. If the age of son is 25 years find father's age.

Let father's age is x years.

$$x + 25 = 75$$

$$x = 50 \text{ years}$$

Q Rahim's father is three times as old as Rahim. If sum of their ages is 56, find their ages.

Sol: Let Rahim's age be x years

So, his father's age $= 3x$ years.

Now,

$$x + 3x = 56$$

$$4x = 56$$

$$x = \frac{56}{4}$$

$$\boxed{x = 14}$$

Rahim's age = 14 years

Father's age $= 3x = 3 \times 14 = 42$ years.

Q. Mona's father is thrice as old as Mona. After 12 years, he will be just twice his daughter. Find their present age.

Sol^{n}: Let present age of Mona be x years.]

Present age of father $= 3x$ years.]

After 12 years

Age of Mona $= (x + 12)$ years.

Age of father $= (3x + 12)$ years

Now, Father's age $=$ 2 x Mona's age.

$$3x + 12 = 2(x + 12)$$

$$3x + 12 = 2x + 24$$

$$x = 12$$

Present age of Mona = 12 years

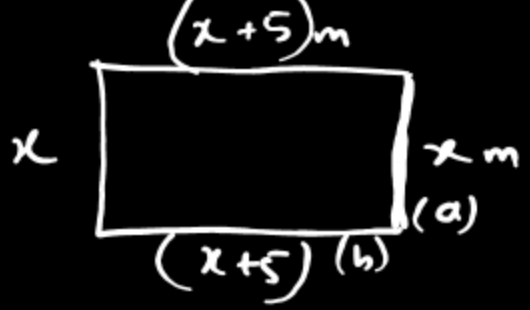
Present age of father : 3×12

$= 36$ years

Q. Ravish owns a plot of rectangular shape. He has fenced it with a wire of length 750 m. The length of the plot exceeds the breadth by 5 m. Find the length and breadth of plot.

=> Let the breadth of plot = x m

then, length of plot = (x + 5) m



$$x + (x+5) + x + (x+5) = 750$$

$$2(x + x + 5) = 750$$

$$4x + 10 = 750$$

$$4x = 740$$

$$x = \frac{740}{4} = 185 \text{ m}$$

Perimeter of rectangle = 2(a+b)

Breadth = 185 m

length = 185 + 5 = 190 m

End of the chapter