

Master Lesson Plan
for
Linear Equations in Two Variables

Board	Standard	Subject	Chapter	Language
NCERT	STD IX	Mathematics	Linear Equations in Two Variables	English

CURRICULAR GOALS	CG-3: Discovers and proves algebraic identities and models real-life situations in the form of equations to solve them
COMPETENCIES AS PER NCF/NIPUN BHARAT	C-3.2: Models and solves contextualised problems using equations (e.g., simultaneous linear equations in two variables or single linear equation in two variables) and draws conclusions about a situation being modelled
SDG(Sustainable Development Goals)	SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Technology aids	PPT
Cross-Cutting Themes	Educational Technology - PPTs for every component Values and Dispositions - VC_Art of Balancing

MS_Objective_Linear Equations in Two Variables

[**Notes to the teacher:** This asset lays down the proposed plan for transacting this chapter. It states the asset objectives of the MLP. This asset is for the teacher's reference and need not be taught to the students.]

Students will be able to –

- explore the need for linear equations in two variables
- define the standard form of a linear equation in two variables
- write the given linear equation in its standard form
- find the solutions of linear equations in two variables, algebraically
- appreciate that academics and extracurricular activities can be balanced to achieve their goals
- solve linear equations in two variables algebraically
- relate the linear equations in two variables with day to day life
- Summerise the chapter Linear Equations in Two Variables.

Time to teach	Asset type	Theme	Sub Theme
5 minutes	Main Script	Equations	Linear equation in two variables

IQ_Exploring Two Variables

Objective: The student will be able to explore the need for linear equations in two variables.

Teaching Aids: PPT

Notes to the teacher: The teacher may pose the following questions to the students, allow them to think and come out with as many answers as possible before arriving at a conclusion. If there is any difficulty in getting the answers, the teacher can ask leading questions.

1) Kendy bought some pencils for ₹ 91. If the cost of each pencil is ₹7, how many pencils did he buy?



Boy with pencil: pixabay.com/vectors/boy-pencil-drawing-school-student-4220282/ - Attribution: souandresantana

Pencils: pixabay.com/photos/colored-pencil-color-pencil-3987167/ - Attribution: stux

Answers from the students.

Answer: Kendy bought 13 pencils.

In this situation, only one unknown quantity is involved, that is the number of pencils.

In class 8, you have learnt how to represent such situations as linear equations in one variable. If the number of pencils is expressed as a variable (unknown quantity) x , the equation to represent the given situation becomes $7x = 91$.

2) Give another example of a situation involving one unknown quantity.

Answers from the students.

Notes to the teacher: The teacher can give a few examples, if required.

Examples of situations involving one unknown quantity.

- i) The sum of a number and twice the number is 36. The number is the unknown quantity.

- ii) The age of the mother is 42 years. She is three times as old as her son. The unknown quantity is the age of the son.

Let us consider one more situation:

- 1) On a school's sports day, the students of class IX won some gold and silver medals. They won a total of 10 medals. How many gold medals are won and how many silver medals?



Gold Medal: pixabay.com/illustrations/medal-gold-design-2163345/ -

Attribution: Alexey_Hulsov

Medal Design: pixabay.com/illustrations/medal-gradient-gold-silhouette-2163457/

Attribution: Alexey_Hulsov

Silver medal: cdn.pixabay.com/photo/2017/03/21/21/05/medal-2163349_960_720.png

Attribution: Alexey_Hulsov

Some answers from the students.

[**Notes to the teacher:** The teacher can fill different correct answers of the students in a table to show the students that there is more than one solution to this problem.]

	
1	9
2	8
3	7
4	6

5	5
6	4
7	3
8	2
9	1

So there are two variables in this situation, the number of gold medals and the number of silver medals. There are 10 solutions to this problem.

One more situation:

- 2) A sweet shop owner prepares special sweet boxes for festivals. Every box contains 10 *gulab jamuns* (an Indian sweet) of ₹ 15 each and any number of one other sweet of the customer's choice. The shopkeeper allows the customers to select any number of the other sweets of ₹ 20 each for the box. What is the cost of each box?



Gulab Jamun ₹15 each

Gulab jamun: pixabay.com/photos/indian-sweet-gulab-jamun-indian-371357/ - Attribution: ikon

Indian sweets: commons.wikimedia.org/wiki/File:Diwali_sweets_india_2009.jpg - Attribution: robertsharp



Other sweets ₹20 each

Some answers from the students.

Answer: The cost of the box depends on the number of other sweets in the box. The cost of the box will change for different numbers of other sweets in the box. In this situation, the total cost of *gulab jamun* is known to be ₹ 15 x 10 = ₹ 150.

The two unknown quantities are, the cost of the box and the number of other sweets of the customer's choice, added in the box.

3) Give another example of a situation involving two unknown quantities.

Answers by the students.

Answer: Situations involving ages, numbers, costs, etc. can involve two unknown quantities.

Examples:

i) The sum of the ages of two friends is 40 years. Two unknown quantities are the ages of two friends.

ii) The cost of 5 bananas and 4 oranges is ₹ 52. The cost of one banana and the cost of one orange are the unknown quantities.

Situations in real life, which involve two variables (unknown quantities) can easily be tackled by representing them as linear equations in two variables. Linear equations involving two variables are a very useful mathematical tool.

Time to teach	Asset type	Theme	Sub Theme
10 minutes	Inquisitive Questions	Equations	Linear equation in two variables

MS_Standard Form of Equations

Objective: The student will be able to define the standard form of a linear equation in two variables.

Teaching Aids: PPT

Notes to the teacher: The teacher may start with a brief revision of the concepts learnt by the students in class VIII.

What is a linear equation?

An equation where the highest power of the variable is 1, is called a linear equation.

The following are some examples of linear equations:

- $2x - 11y = 0$
- $3y = 12$

[**Notes to the teacher:** The teacher can help the students to observe that here the highest power of variable in each case is 1.]

What is a linear equation in one variable?

A linear equation which has only one variable is called a linear equation in one variable.

The following are examples of linear equations in one variable:

- $y + 2 = 0$
- $\sqrt{3}x = 0$
- $7p = 15$

Standard form of linear equation in one variable can be written in the form $ax + b = 0$ where x is a variable and a, b are real numbers such that $a \neq 0$.

[**Notes to the teacher:** The teacher may ask the students: Why $a \neq 0$?]

Some answers by the students:

Because then the equation becomes, $b = 0$, which is not true when $b \neq 0$.

Let us consider a situation.

A) A postman delivered a total of 50 posts on a certain day. Of these 50 posts, some were parcels and the remaining were letters.

This situation involves two unknown quantities, the number of parcels and the number of letters delivered.



Postman: openclipart.org/detail/306425/postman

Attribution: buggywindows

Letters: pixabay.com/illustrations/inbox-letter-brief-email-mailbox-3495027

Attribution: kreatikar

Parcels: pixabay.com/vectors/gift-package-parcel-box-311970/

Attribution: Clker-Free-Vector-Images

If we denote the number of parcels as 'p' and the number of letters as 'q', how can we express the given situation as an equation?

$$p + q = 50$$

Here the number of variables used is two and the highest power of the variables is 1. So we have formed a linear equation in two variables.

If a linear equation involves two variables then it is called a linear equation in two variables.

This equation can be written as:

$$p + q - 50 = 0$$

This is called the **standard form** of representing the given equation.

B) In another situation, two friends Chikoo and Beenu want to buy some balloons for decorating their classroom on New Year day. Chikoo likes the blue-coloured balloons and Beenu wants the green ones. The cost of the blue balloon is ₹ 2 each and the green ones cost ₹ 4 each. How many balloons of each colour can they buy, if they have only ₹ 40 to spend on the balloons?



Boy: pixabay.com/vectors/boys-cartoon-children-comic-2026930/

Attribution: OpenClipart-Vectors

Girl: pixabay.com/vectors/girl-character-people-person-152498/

Attribution: OpenClipart-Vectors

Green balloon: pixabay.com/vectors/balloon-green-shiny-helium-happy-25735/

Attribution: Clker-Free-Vector-Images

Blue balloon: pixabay.com/vectors/balloon-birthday-balloon-25734/

Attribution: Clker-Free-Vector-Images

The number of blue balloons and the number of green balloons are the two unknown quantities.



Green & Blue Balloons: pixabay.com/illustrations/balloons-party-blue-balloon-4750548/ - Attribution: lena42787

Expressing the number of blue balloons as 's' and the number of green balloons as 't', what is the equation formed?

The cost of blue balloons is ₹ 2 and the cost of green balloons is ₹ 4.

The total cost of balloons = $2s + 4t$

The equation for this situation is $2s + 4t = 40$

Its standard form: $2s + 4t - 40 = 0$

Definition of the standard form or the general form, of linear equation in two variables:

The general form or standard form of linear equation in two variables x, y is $ax + by + c = 0$, where a, b, c are real numbers, and a, b are not simultaneously zero.

If a and b are both simultaneously 0, then the equation becomes $c = 0$, which is not true if $c \neq 0$.

What will happen if either $a = 0$ or $b = 0$?

It becomes a linear equation in one variable, **$by + c = 0$ or $ax + c = 0$** .

The standard form of an equation in two variables is written by transposing all the terms of the equation to one side of the equation, either to the left hand side or to the right hand and expressing it in the form $ax + by + c = 0$, where x and y are variable, and a, b, c are real numbers and a, b are not simultaneously zero.

It is customary to denote the variables in equations by x and y, but other letters like p, q, u, v, s, t, etc. may also be used.

The teacher takes a few examples and elicits the answers from the students.

[Notes to the teacher: The teacher can use black/white board to show how the terms of an equation are transposed to write the standard form.]

Examples:

- I) Express the following equations in the standard form **$ax + by + c = 0$** and indicate the value of a, b and c.

S.No	Equation	Standard Form $ax + by + c = 0$	a	b	c
1	$2x + 5y = 7$	$2x + 5y - 7 = 0$	2	5	-7
2	$\frac{4}{5} = x - 3y$	$x - 3y - \frac{4}{5} = 0$	1	-3	$-\frac{4}{5}$
3	$5x - 4 = 3y$	$5x - 3y - 4 = 0$	5	-3	-4
4	$\sqrt{2}x = y$	$\sqrt{2}x - y + 0 = 0$	$\sqrt{2}$	-1	0

Equations in one variable, of the type $ax + b = 0$ can also be expressed as a linear equation in two variables as $ax + 0y + c = 0$.

- II) Express the following equations as linear equations in two variables and write them in

the standard form. Also, indicate the value of a, b and c.

S.No.	Equation	Standard Form $ax + by + c = 0$	a	b	c
1	$x = -7$	$x + 0y + 7 = 0$	1	0	7
2	$4x = 3$	$4x + 0y - 3 = 0$	4	0	-3
3	$2 = 3x$	$3x + 0y - 2 = 0$	3	0	-2

The teacher encourages the students to think of more situations where the information can be represented as a linear equation in two variables and assists the students to form a correct equation.

[Notes to the teacher: For a few correct responses from the students, the equations formed for the situation may be represented in the standard form on the black/white board.]

Examples of such situations:

- i) The sum of a number and twice of another is 69.
- ii) The difference between the age of mother and her child is 27 years.
- iii) In a school cricket match, the number of runs made by a class IX team is 5 runs less than twice the number of runs made by a class X team.

Answer:

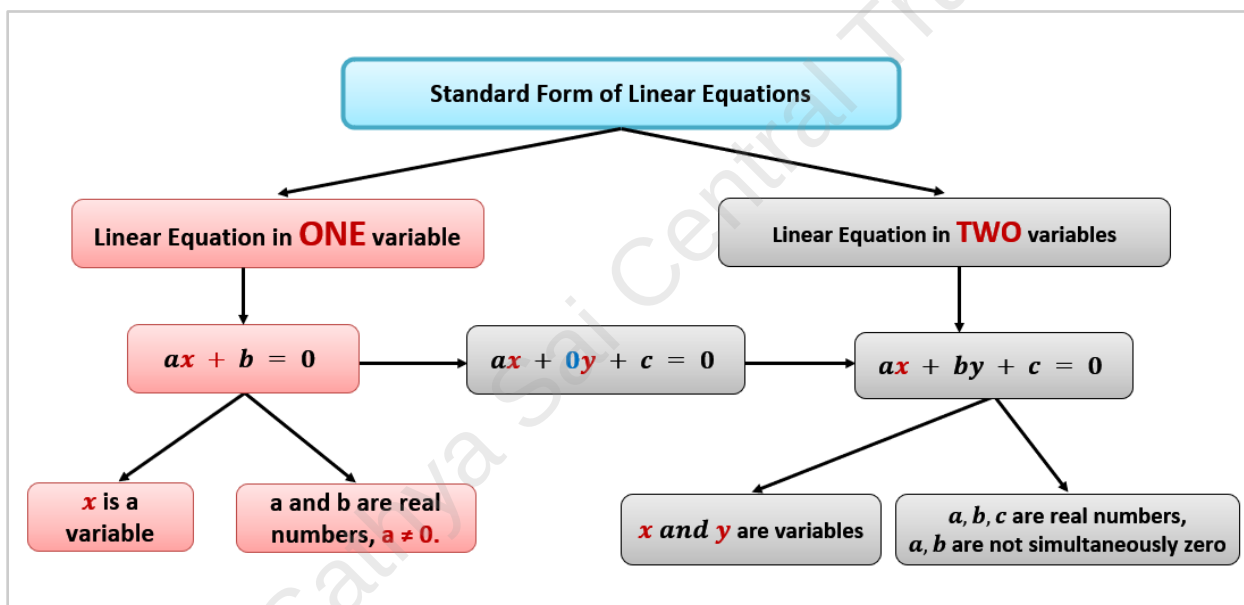
The equations:

- i) $x + 2y = 69$, such that one number is 'x' and the other is 'y'.
- ii) $m - n = 27$, such that the age of the mother is 'm' and that of the child is 'n'.



$p = 2q - 5$, such that the number of runs made by the class IX team is 'p' and the number of runs made by the class X team is 'q'.

[Notes to the teacher: The teacher may use the following image to summarise the topic.]



Graphic Organiser-Standard Form of Linear Equations: Original Creation

Time to teach	Asset type	Theme	Sub Theme
15 minutes	Main Script	Equations	Linear equation in one variable Linear equation in two variables

QA_Practising Standard Form

Objective: The student will be able to write the given linear equation in its standard form.

Teaching Aids: PPT and Worksheet

Notes to the teacher: Teacher may present the questions and allow the students to write or say the answers before revealing them to the students.

I Choose the correct option/options:

1. The standard form of equation $-5x = 3y - 4$:

a) $-5x - 3y - 4 = 0$

b) $-5x - 3y + 4 = 0$

c) $-3y + 4 + 5x = 0$

d) $5x + 3y - 4 = 0$

Answer:

b) $-5x - 3y + 4 = 0$

d) $5x + 3y - 4 = 0$ (multiplying the above equation by -1)

2. When the equation $-\frac{x}{5} = 3$ is expressed as a linear equation in two variables in the standard form $ax + by + c = 0$, the value of a, b and c respectively are:

a) $a = -\frac{1}{5}$, $b = 1$ and $c = -3$

b) $a = -\frac{1}{5}$, $b = 0$ and $c = 3$

c) $a = -\frac{1}{5}$, $b = 0$ and $c = -3$

d) $a = -5$, $b = 0$ and $c = -3$

Answer: c) $a = -\frac{1}{5}$, $b = 0$ and $c = -3$

3. A number is 7 less than twice the other. If one number is denoted as ' p ' and the other number as ' q ', this situation can be represented as a linear equation in two variables as:

a) $2p = q - 7$

b) $p - 7 = 2q$

c) $p = 2q - 7$

d) $2q + p = 7$

Answer: c) $p = 2q - 7$

4. The standard form of an equation in variables ' x ' and ' y ', in which the coefficients of ' x ' is $\sqrt{5}$, the coefficient of ' y ' is -3 and the constant term is -7 :

a) $\sqrt{5}x - 3y = 7$

b) $\sqrt{5}x - 3y = -7$

c) $\sqrt{5}x - 3y - 7 = 0$

d) $\sqrt{5}x + 3y + 7 = 0$

Answer: c) $\sqrt{5}x - 3y - 7 = 0$

II. Express each of the following statements as a linear equation in two variables. Write the equation in the standard form.

a. Two friends have read a total of 9 storybooks during a month.



Girl Reading: pixabay.com/illustrations/cute-girl-reading-a-book-education-5817645/ - Attribution: azmeyart-design
Boy Reading: pixabay.com/illustrations/student-boy-reading-book-studying-5730767 - Attribution: Felixmh

Suggested Answer:

Let the number of storybooks read by the two friends be ' l ' and ' m ' respectively.

Equation: $l + m = 9$

Standard form: $l + m - 9 = 0$

b)



Srinivas Ramanujan:
Attribution: Unknown author

commons.wikimedia.org/wiki/File:Srinivasa_Ramanujan_-_OPC_-_1.jpg
(Source: Oberwolfach Photo Collection)

On National Mathematics Day, 22nd December, celebrated in the honour of the Indian Mathematician genius Srinivasa Ramanujan, a school wants to give a school bag as a prize to every student who scored 100% marks in Mathematics in class X board exam that year and a pen drive as a consolation prize to those who scored above 95%. The cost of a school bag is ₹ 550 and the cost of a pen drive is ₹ 450. The school can spend a total of ₹ 7500 on the purchase of the prizes.



School Bag: pixabay.com/vectors/backpack-bag-baggage-luggage-159417/ - Attribution: OpenClipart-Vectors
Pen Drive: pixabay.com/vectors/pen-drive-usb-stick-portable-memory-5838536/ - Attribution: Shafin_Prodic

Suggested Answer:

Let the number of school bags to be bought be 's' and the number of pen drives be 't'

Equation: $550s + 450t = 7500$

Standard form: $550s + 450t - 7500 = 0$

Or $11s + 9t - 150 = 0$ (Dividing the equation throughout by 50)

III. Frame a situation for each of the following equations. Also write them in the standard form.

a) $3x + 4y = 96$

Suggested Answer:



Banana: pixabay.com/vectors/bananas-fruit-food-yellow-fruit-575773/ - Attribution: OpenClipart-Vectors

Guava: pixabay.com/illustrations/guavas-fruits-food-dew-drops-6370689/ - Attribution: Ronnysefria

A man spent ₹96 to buy some bananas and guavas. The cost of one banana is ₹3 and the cost of a guava is ₹4. Here, ' x ' stands for the number of bananas and ' y ' for the number of guavas.

Standard form: $3x + 4y - 96 = 0$

b. $w - z = 25$

Suggested Answer:



Cricket Bat Ball: pixabay.com/vectors/cricket-cricket-bat-bat-ball-155965/ - Attribution: OpenClipart-Vectors

The difference between the number of runs made by two cricketers in a test match is 25. So, ' w ' and ' z ' denotes the number of runs made by the two cricketers respectively.

Standard form: $w - z - 25 = 0$

Time to teach	Asset type	Theme	Sub Theme
10 minutes	Questions to Assess	Equations	Linear equation in two variables

MS_Solution of Linear Equation

Objective: The student will be able to find the solutions of linear equations in two variables, algebraically.

Teaching Aids: PPT

Notes to the teacher: The teacher may start with a brief revision of the solution of linear equations in one variable.

In class VIII, you have learnt to solve linear equations in one variable.

Do you remember how many solutions they have?

Let us solve a few simple equations.

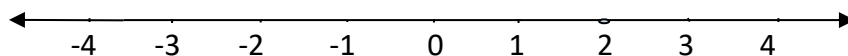
$$5x - 10 = 0$$

$$\Rightarrow 5x = 10$$

$$\Rightarrow x = \frac{10}{5}$$

$$\Rightarrow x = 2$$

So the solution or the root of the equation is 2, which can be represented on the number line.



$x = 2 \uparrow$ is the solution

Similarly, solving another linear equation in one variable:

$$3(x + 1) = 15$$

$$\Rightarrow 3x + 3 = 15$$

$$\Rightarrow 3x = 15 - 3$$

$$\Rightarrow x = \frac{12}{3}$$

$$\Rightarrow x = 4$$

We get the solution of the equation as 4, which again can be represented on the number line.

Since a linear equation has only one variable, solving an equation means finding the value of the variable. **Every linear equation in one variable has one and only one solution i.e. it has a unique solution.**

You have also learnt that:

While solving linear equations, we should keep in mind that the solution of a linear equation does not get affected when:

- 1) the same number is added to (or subtracted from) both the sides of the equation.**
- 2) both the sides of the equation are multiplied or divided by the same non-zero number.**

What can you say about the solution of a linear equation involving two variables?

Can it have only one solution or does it have more than one solution?

Let us consider a linear equation in two variables.

$$3x + 2y = 8$$

Let us assume that $x = 2$ is a solution of this equation. Substituting $x = 2$ in the equation we get:

$$3(2) + 2y = 8$$

$$\Rightarrow 6 + 2y = 8$$

But the value of y is still not found. If we solve the equation further, we get:

$$\Rightarrow 2y = 8 - 6$$

$$\Rightarrow 2y = 2$$

$$\Rightarrow y = \frac{2}{2}$$

$$\Rightarrow y = 1$$

The values of x and y which satisfy the equation $3x + 2y = 8$ are $x = 2$ and $y = 1$, written as $(2, 1)$.

So, as there are two variables in the equation, its solution means a pair of values, one for x and the other for y , which satisfy the given equation.

Any pair of values of the variables 'x' and 'y' which satisfy the linear equation in two variables is called its solution.

The solution is written as an ordered pair (x, y) , writing the value for x first and then the value for y .

Let us check if there are any other solutions of the equation $3x + 2y = 8$.

Taking any value of x , say $x = 5$ and substituting it in the equation $3x + 2y = 8$, we get:

$$3(5) + 2y = 8$$

$$\Rightarrow 15 + 2y = 8$$

This is an equation in one variable, which can be solved further.

$$\Rightarrow 2y = 8 - 15$$

$$\Rightarrow 2y = -7$$

$$\Rightarrow y = \frac{-7}{2}$$

So, $(5, \frac{-7}{2})$ is another solution of the equation.

We can get many solutions this way, that is, by picking any value for x , substituting it in the equation to reduce it to a linear equation in one variable and then solving it to obtain the value of the other variable.

A linear equation in two variables has more than one or infinitely many solutions.

Here is an easy way to find two of the solutions of a linear equation in two variables:

Step I: Put $x = 0$ and get the corresponding value of 'y'.

Step II: Put $y = 0$ and obtain the corresponding value of 'x'.

For finding more solutions, choose a value of any one variable and get a corresponding value of the other variable.

Let us solve a few linear equations in two variables.

Examples:

- Find three solutions for each of the following equations.

a) $x + 4y = 11$

Suggested Answer:

Variable of choice	x	y	x
Value of the variable	0	0	1
Substituting the value of the variable of choice in the equation, to get the value of the other variable.	$x + 4y = 11$ $0 + 4y = 11$ $4y = 11$ $y = \frac{11}{4}$	$x + 4y = 11$ $x + 4(0) = 11$ $x + 0 = 11$ $x = 11$	$x + 4y = 11$ $1 + 4y = 11$ $4y = 11 - 1$ $4y = 10$ $y = \frac{10}{4}$
Solution	(0, $\frac{11}{4}$)	(11, 0)	(1, $\frac{10}{4}$)

b) $5x = 4y$

Suggested Answer:

Variable of choice	x	y	y	y
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Value of the variable	0	0	1	-1
Substituting the value of the variable of choice in the equation, to get the value of the other variable.	$5x = 4y$ $5(0) = 4y$ $y = \frac{0}{4} = 0$	$5x = 4y$ $5x = 4(0)$ $5x = 0$ $x = \frac{0}{5} = 0$	$5x = 4y$ $5x = 4(1)$ $5x = 4$ $x = \frac{4}{5}$	$5x = 4y$ $5x = 4(-1)$ $5x = -4$
Solution	(0,0)	(0,0)	$(\frac{4}{5}, 1)$	$(\frac{-4}{5}, -1)$

↑ is repeated, so take another value of x or y.

c) $2x - 7 = 0$

Suggested Answer:

Express the equation as a linear equation in two variables $2x + 0y - 7 = 0$

Solving the equation $2x - 7 = 0$ gives:

$$2x = 7$$

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

[Notes to the teacher: The teacher may explain here that the value of x is already known to be $\frac{7}{2}$, it will not change for any value of y.]

Let us take $y = 1$

Substituting $y = 1$ in equation $2x + 0y - 7 = 0$

$$\Rightarrow 2x - 0(1) - 7 = 0$$

$$\Rightarrow 2x - 0 - 7 = 0$$

$$\Rightarrow 2x = 7$$

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

Similarly for any other value of y , the value of $x = \frac{7}{2}$.

[Notes to the teacher: The teacher may explain by taking up more values of the variable y , if required.]

Taking the values, $y = 0, 1$ and 2 ,

The three solutions for the equation $2x - 7 = 0$ can be:

$$(\frac{7}{2}, 0), (\frac{7}{2}, 1) \text{ and } (\frac{7}{2}, 2)$$

$$\text{d) } 3y = 5$$

Suggested Answer:

Express the equation as a linear equation in two variables $0x + 3y - 5 = 0$

Solving the equation $3y = 5$ gives:

$$y = \frac{5}{3}$$

Similarly for any other value of x , the value of $y = \frac{5}{3}$.

So, the three solutions for the equation $3y = 5$ can be:

$$(0, \frac{5}{3}), (2, \frac{5}{3}) \text{ and } (-1, \frac{5}{3})$$

An equation of the type $ax + b = 0$, when expressed as a linear equation in two variables x and y as $ax + 0y + b = 0$, such that a, b are real numbers, the value of x remains the same for any value of y . That is to say, $x = -b/a$ for any value of y .

Similarly, for the equation $by + c = 0$, the value of $y = -c/b$, for any value of x .

2. Check which of the following are solutions of the equation $5x + 2y = 10$.

$$\text{a) } (2, 5)$$

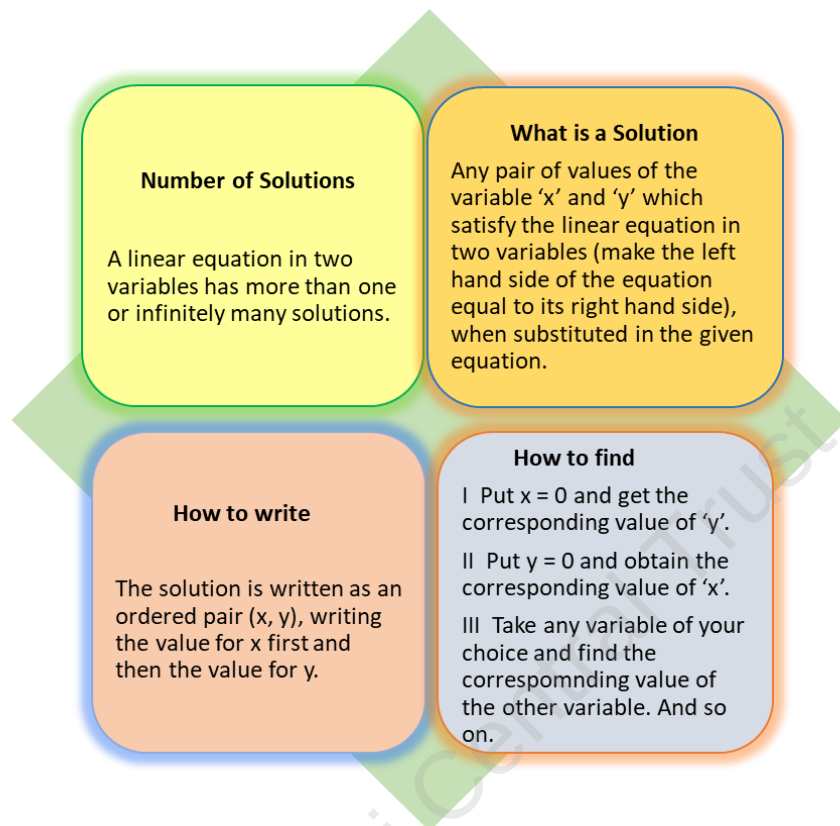
$$\text{b) } (4, -5)$$

Given values of the variables	(2, 5)		(4, -5)	
Substituting in the equation	LHS	RHS	LHS	RHS
	$ \begin{aligned} 5x + 2y &= 5(2) + 2(5) \\ &= 10 + 10 \\ &= 20 \end{aligned} $	10	$ \begin{aligned} 5x + 2y &= 5(4) + 2(-5) \\ &= 20 - 10 \\ &= 10 \end{aligned} $	10
Comparing the LHS and RHS	LHS $\neq$ RHS		LHS = RHS	
Conclusion	(2, 5) is not a solution		(4, -5) is a solution	

The pair of values of the two variables which make the left-hand side (LHS) of the equation equal to its right-hand side (RHS), when substituted in the given equation, is a solution of the equation.

[Notes to the teacher: The teacher may use the following graphic organiser to revise the topic.]

The solutions of a Linear Equation in Two Variables



Time to teach	Asset type	Theme	Sub Theme
15 minutes	Main Script	Equations	Solution of linear equations

VC_Art of Balancing

Objective: Students will be able to appreciate that academics and extracurricular activities can be balanced to achieve their goals.

Teaching Aids: PPT

Notes to the teacher: The teacher may introduce the concept as follows

Concept- Value Connection:

Consider a situation:

The total number of pink and red roses is 15.

We can represent this data as a linear equation in two variables $x + y = 15$ where variables x , y represent the number of pink and red roses respectively.

From the equation, we have $y = 9$ when $x = 6$, $x = 11$ when $y = 4$, etc.

Thus, the value of x depends on the value of y or vice versa

The equation $x + y = 15$, balances their values

Similarly, the two important variables in any student's life are academics on the one side and extracurricular activities on the other, and there is a need to balance them. To achieve best results, it is necessary to keep your goals in focus and adjust your priorities so that the equation of life is balanced.

The teacher continues:

Students! Let us consider that you are good at studies and also a passionate singer / sports person / an artist.

Do you think you need to compromise on one to excel in the other?

Let us debate now.

Activity - Debate

Notes to the teacher:

1. The teacher forms 2 groups and selects the topic — “Academics OR Extracurricular — which is more important?”
2. One group speaks for Academics and the other group speaks for Extracurricular activities
3. The two groups discuss and choose their leader.
4. The speakers of both the teams need to present only 3 points on their topic
5. The groups can be given 3 minutes to discuss and 1 minute to present

Possible Points for Academics:

- Increases your employment opportunities and to earn a steady income
- Develops self-confidence to deal with problems in life
- You are less likely to engage in anti-social activities

Possible Points for Extracurricular activities:

- All work and no play makes Jack a dull boy
- Helps to develop social skills and learn how to work in a team to achieve a shared goal
- Increases self-confidence and builds leadership skills

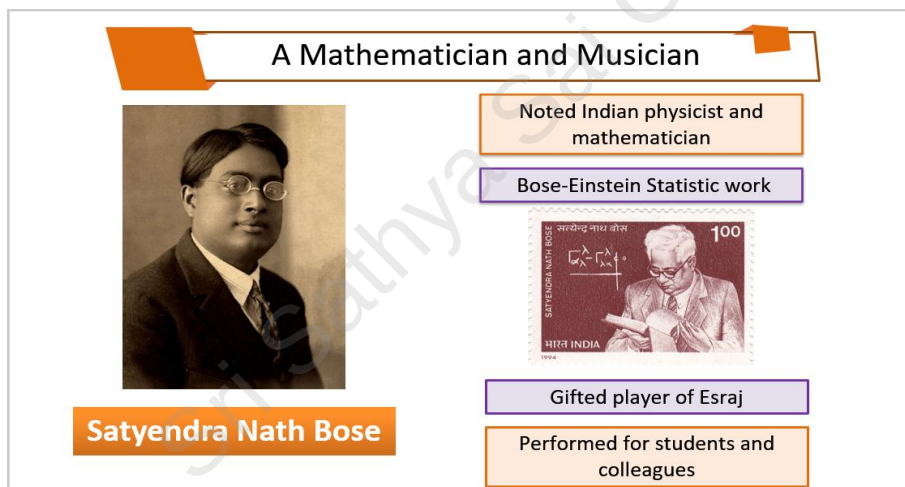
Discussion Points:

The teacher continues:

Children! There is no need to compromise on one to excel in the other. Both these factors can co-exist. In reality, both factors develop self-confidence.

Here are examples of few great scientists who passionately followed their favourite pastimes.

- Nobel Laureate Albert Einstein was a great violin player and performer. He was introduced to violin at an early age by his mother. In his lifetime he owned around ten violins. He often indicated that if he hadn't worked as a scientist, he would have become a musician.
- Noted Indian physicist and mathematician Satyendra Nath Bose, known for his work called Bose-Einstein statistics in collaboration with Albert Einstein, was a gifted player of Esraj, an Indian stringed instrument, similar to violin. He used to perform for his students and colleagues.



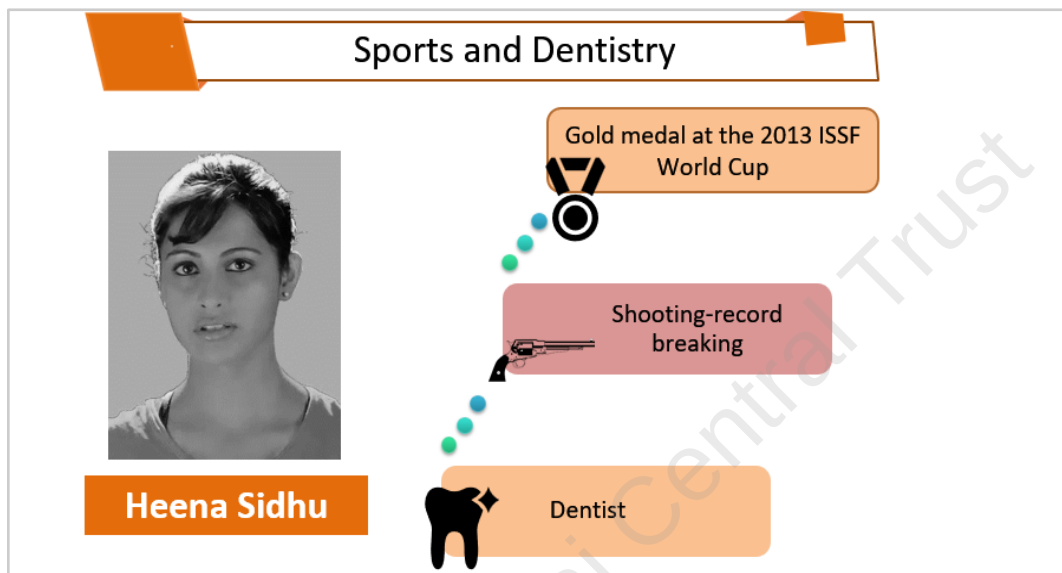
1. **Satyendra Nath Bose:** en.wikipedia.org/wiki/Satyendra_Nath_Bose#/media/File:SatyenBose1925.jpg - Attribution: Unknown Author

2. **Stamp:** en.wikipedia.org/wiki/File:Satyendranath_Bose_1994_stamp_of_India.jpg - Attribution: India Post, Government of India (GODL)

Here are examples of few famous sports personalities who excelled in academics

- Do you know that all these cricketers are engineers by profession? The highest wicket-taker for India, Anil Kumble, has a BE degree in Mechanical Engineering; India's best fast bowler, Javagal Srinath holds a BE degree in Instrumentation Technology; off-spinner Ravichandran has a B.Tech degree in Information Technology; yesteryears batsman, Krishnamachari Srikanth is an Electrical Engineer
- Ace shooter Heena Sidhu is a dentist who turned her shooting hobby into a record-

breaking profession. She won a gold medal at the 2013 ISSF World Cup in Munich and has many awards to her credits. While making her name in the shooting world, she was also studying dentistry. She received a Bachelor of Dental Surgery in 2013



1. **Tooth:** PPT Icon
 2. **Medal:** PPT Icon
 3. **Heena Sidhu:** commons.wikimedia.org/wiki/File:Heena_Sidhu,_promo_for_2014_CWG.jpg – Attribution: Ten Sports
 4. **Pistol:** pixabay.com/vectors/revolver-remington-pistol-wild-west-158673/ - Attribution: OpenClipart-Vectors

Points to Ponder/reflect

- You may feel clubbing academics with extra activities like sports/art/music is a tough task in life.
- Going by the experience of these people, it does not seem so.
- As you grow older, you may reach a crossroad where you have to choose one as a primary career.
- Choose diligently, guided by the elders, and go by your passion.
- Ensure that whichever is your secondary career, it does not interfere with your primary career but complements it.
- The key lies in balancing

Anecdotes adapted from:

Cricketers: sportskeeda.com/cricket/6-indian-cricketers-hold-engineering-degree

Einstein and others: nobelprize.org/symphony-of-science/Heena_Sidhu-- kreedon.com/heena-sidhu-biography/ & thebridge.in/featured/top-highly-educated-indian-sportspersons/

Satyendranath Bose: wondersofphysics.com/2020/09/five-physicists-who-were-musically.html & britannica.com/biography/Satyendra-Nath-Bose

Time to teach	Asset type	Theme	Sub Theme
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15 minutes	Value Content	Right Action	Goals
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QA_Solving Linear Equations

Objective: The students will be able to solve linear equations in two variables, algebraically.

Teaching Aids: PPT and Worksheet.

Notes to the teacher: Teacher may present the questions and allow the students to write or say the answers before revealing them to the students.

I) Choose the correct option/options:

1) The linear equation $3x - y = 10$ has:

- a. a unique solution
- b. no solution
- c. infinitely many solutions
- d. two solutions.

Answer: c) Infinitely many solutions.

2) The solution of a linear equation in two variables is:

- a. a number which satisfies the given equation
- b. a number which is the value of both the variables and satisfies the given equation
- c. a pair of values of the variables
- d. An ordered pair (x, y) of values of the variables, which satisfies the given linear equation in variables x, y

Answer: d) An ordered pair (x, y) of values of the variables, which satisfies the given linear equation in variables x, y

3) The ordered pair (l, m) is a solution of the equation $ax + by + c = 0$ if

- a. $am + bl + c = 0$
- b. $c = 0$
- c. $al + bm + c = 0$
- d. $al + bm = c$

Answer: c) $al + bm + c = 0$

4) Which of the following are the solutions of the equation $y + 4x = 3$?

- a) $(0, 1)$
- b) $(1, -1)$
- c) $(5, 0)$
- d) $(2, -5)$

Answer: b) and d)

Substituting the value of the variables in the equation makes the two sides of the equation equal.

Given equation $y + 4x = 3$	
substituting $x = 1$ and $y = -1$	substituting $x = 2$ and $y = -5$
$(-1) + 4(1)$ $= (-1) + (4)$ $= 3$ $\Rightarrow LHS = RHS$	$(-5) + 4(2)$ $= (-5) + (8)$ $= 3$ $\Rightarrow LHS = RHS$
$(1, -1)$ is a solution.	$(2, -5)$ is a solution

II) Give a few solutions of the equation $x - y = 15$

Answer: $(0, -15), (1, -14), (18, 3), (2, -13), (16, 1)$, etc.

III) If $(4, -6)$ is a solution of the equation $y = kx + 6$, what is the value of k ?

Suggested Answer:

$(-6) = k(4) + 6$ (Substituting $x = 4, y = -6$ in the given equation)

$$\Rightarrow (-6) = 4k + 6$$

$$\Rightarrow -6 - 6 = 4k$$

$$\Rightarrow -12 = 4k$$

$$\Rightarrow \frac{-12}{4} = k$$

$$\Rightarrow k = -3$$

IV)



Factory: pixabay.com/illustrations/factory-industry-warehouse-3550551/ - Attribution: ArtsyBee

Factory worker: pixabay.com/vectors/human-person-man-male-people-4554842/ - Attribution: UnifiArt

A factory pays its workers on a daily basis. Each worker is paid a fixed amount of ₹ 600 and ₹ 80 per hour for overtime. So the daily wages are calculated on the basis of extra hours put in by each worker.

- a) Form an equation using the daily wage of a worker as x and the number of extra hours put in by the worker as y .
- b) Find the wage of a worker who has put 3 hours extra as overtime.
- c) Find the number of extra hours put in by a worker whose wage is ₹ 1000.

Suggested Answer:

a) Equation: $x = 600 + 80y$

b) The extra hours put in by the worker is 3, so $y = 3$

$$\Rightarrow x = 600 + 80(3)$$

$$\Rightarrow x = 600 + 240$$

$$\Rightarrow x = 840$$

Daily wages of the worker = ₹840



Wages: pixabay.com/illustrations/rupees-giving-giving-money-donating-4698727/ - Attribution: shatadip7

c) $x = 600 + 80y$

Wage of the worker $x = ₹ 1000$

$$\Rightarrow 1000 = 600 + 80y$$

$$\Rightarrow 1000 - 600 = 80y$$

$$\Rightarrow 400 = 80y$$

$$\Rightarrow \frac{400}{80} = y$$

$\Rightarrow y = 5$. The number of extra hours put in by a worker whose wages are ₹ 1000



Hour glass :pixabay.com/photos/time-hour-hourglass-clock-timer-3961758/ - Attribution: mrbobdobolina

V) Form a linear equation in two variables, one of whose solution is (7, 3). How many equations can be formed with (7,3) as a solution?

Suggested Answer:

Some of the equations that can be formed by observing the value of the two variables, are:

$$x + y = 10$$

$$x - y = 4$$

$$2x - 3y = 5 \text{ etc.}$$

Infinitely many equations can be formed.

VI) Give a situation which can be represented as the equation $x = 5y$ and explain it using one of its solutions.

Suggested Answer:



- The number of red rose plants in a garden is five times the number of yellow rose plants.

If $(15, 3)$ is a solution of the equation, then the number of yellow rose plants is 3 and the number of red rose plants is 15.

- Similarly, situations involving cost, age, numbers, etc. can be used to write the situation representing the given linear equation.

Time to teach	Asset type	Theme	Sub Theme
15 minutes	Questions to Assess	Equations	Solution of linear equations

DD_Use of Linear Equations

Objective:

The students will be able to relate the linear equations in two variables with day to day life.

Teaching Aids: PPT

Example -1

Sukriti went on a vacation tour. She hired a taxi for sightseeing. The taxi service charges were Rs.600 from her hotel as a fixed charge and Rs.50 per km for the trip. She sets up a linear equation that can be used to find the cost of any taxi service she takes on her trip.



Image source:

Hotel: [freepress.org/hotel](https://www.freepress.org/hotel) - Attribution: j4p4n

Taxi: [pixabay.com/illustrations/taxi-taxi-driver-auto-car-5937177/](https://www.pixabay.com/illustrations/taxi-taxi-driver-auto-car-5937177/) - Attribution: lolilavendr

Girl: [pixabay.com/vectors/cartoon-child-comic-characters-face-2026702/](https://www.pixabay.com/vectors/cartoon-child-comic-characters-face-2026702/) - Attribution: OpenClipart-Vectors

If variable x represents the kilometres and y represents the cost incurred on the taxi trip, then the linear equation will be

$$y = 600 + 50x$$

With this equation, we can easily calculate the cost of the taxi trip of any destination(distance) of travel.

Suppose you visit a place at a distance of 100km, then

$$\text{Cost of taxi trip} = 600 + 50(100)$$

$$= 600 + 5000$$

$$= \text{Rs. } 5600$$

Example - 2

David sold a cellular smartphone with a postpaid connection. The monthly invoice of the postpaid connection accommodates a set rental of Rs.200. All the outgoing calls are charged with an identical amount of Rs 0.60.

We can write a linear equation that can be used to find the bill for a given number of calls.

If A is the bill amount, and n is the number of calls,

$$A = 200 + 0.60 \times n$$



Image source:

Mobile phone: pixabay.com/photos/iphone-phone-smartphone-mobile-2464968/ - Attribution: AI_Solution

Boy: pixabay.com/vectors/boy-child-kid-pointing-male-head-6724505/ - Attribution: biggerthanpluto

Calls: pixabay.com/vectors/phone-call-icon-cutout-contact-6662438/ - Attribution: inspire-studio

If he makes 600 calls per month,

$$\text{His bill amount } A = 200 + (0.60 \times 600)$$

$$= 200 + 360$$

$$= \text{Rs.}560$$

Example - 3

In a race, a student ran x number of laps and walked y number of laps. It takes 3 mins to run 1 lap and 5 minutes to walk 1 lap. What is the total time he takes to complete the race?

Total time he takes to complete = 65min

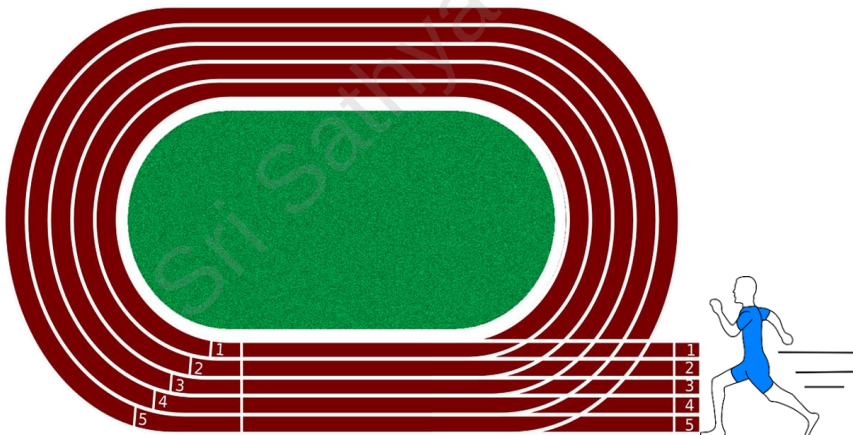


Image source :

Track: pixabay.com/vectors/running-track-running-track-run-1018587/ - Attribution: Kjrstie

Runner: pixabay.com/vectors/runner-drawing-isolated-sport-304236/ - Attribution: Clker-Free-Vector-Images

1 lap running : 3min

x laps : 3x

1 lap walking: 5min

y laps: 5y



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Annexure to Master Lesson Plan

What is the purpose of this Master lesson Plan?	This Master Lesson Plan (MLP) prepared by Sri Sathya Sai Vidya Vahini (SSSVV), covers the entire chapter for the given board. The MLP for the chapter given in the textbook is broken down into smaller modules known as assets. Any chapter can be taught using the 7 asset types in SSSVV methodology. Several different assets together complete the entire chapter. Depending on the requirement, each asset is supported by teaching aids such as animated presentation, audio, video, and learning aids such as worksheets. The MLP is for the teacher's preparation and the teaching aids are for use in the classroom.
How to use it?	You can prepare for your class with this MLP by following 3 simple steps: 1. Read your textbook; 2. Go through the information given in the assets (document & multimedia); 3. Prepare your teaching notes. Great! Now you are ready to transact the chapter.
Duration	Kindly note the duration given for each asset. Due care has been taken in planning the assets, to ensure the chapter is completed within the time specified by the Board. Note: Preparation time is not included in the asset duration. The teaching time depends on the duration of the teaching aids and is not impacted by the length of the MLP.
What is a 'Main Script' (MS) Asset?	The Main Script asset is there for explaining the main concepts of the chapter clearly. The information given in the textbook is simplified, organised and structured to give more clarity. Additionally, you may find a video or mnemonics or a graphic organiser to deepen the understanding of the concept.
How to teach using the MS asset?	Please use the blackboard, slides and interaction to develop the concept.
What is an 'Inquisitive Questions' (IQ) asset?	The Inquisitive Questions asset uses questions to promote higher order thinking like the n th why, what-if, new perspectives, cause-effect, and others, creating curiosity.
How to teach using the IQ asset?	You may use the questions to connect with the students, encourage exploration to engage them in the learning process. You may allow multiple responses and instead of rejecting any of the responses, ask why, before revealing the suggested answer or hints.
What is a 'Day to day Relevance' (DD) Asset?	The Day to Day Relevance asset helps students understand the practical relevance of every topic, making them eager participants in the classroom. If students connect the concepts to their environment, they would learn meaningfully without dislike or simply memorizing for exams.
How to teach using the DD	You may use the asset by asking questions about their experience and use it to establish why they are learning the topic. If necessary you may substitute with a

asset?	recent or local example.
What is an 'Interesting Aside' (IA) asset?	The Interesting Aside asset uses attention grabbing tidbits or anecdotes to bring joy and satisfy the child's hunger to know more. This is a quick/short asset intended to bring attention back to the main concept being taught.
How to teach using the IA asset?	You may use this asset to give a piece of interesting information relevant to the topic, without prolonged explanation/discussion. You may suggest appropriate books for further reading.
What is a 'Suggested Activity' (SA) Asset?	The Suggested Activity asset provides a detailed step by step procedure for the teacher to conduct a hands-on activity. This promotes Activity Based Learning.
How to teach using the SA asset?	You may use this asset to energise your students to learn by doing simple, fun-filled activities based on the topic. The asset includes - preparation, activity, and follow-up. You may engage the students in the preparation and follow-up stages to develop collaboration and responsibility. You could try it once, yourself, before the actual delivery to be more comfortable with it. Note: The duration mentioned in the asset is usually for the activity part only.
What is a 'Value Content' (VC) Asset?	The Value Content asset integrates Universal Human Values (such as empathy, inclusivity, respect for nature that translates into responsible behaviour) seamlessly into the curriculum, as the "End of education is character".
How to teach using the VC asset?	You may use this asset to engage with the students to bring out their innate values and connect with the intrinsic values in the topic/concept. The asset includes pointers on the specific pedagogical technique followed.
What is a 'Questions to Assess' (QA) asset?	The Questions to Assess asset uses an interactive approach to check learning of different types of learners, and provides feedback to the teacher for appropriate action. The questions cater to all the levels of Bloom's Taxonomy. Questions from 'Apply' level and above enable students to reflect on their learning.
How to teach using the QA asset?	You may go through the slides to understand its flow and know when to click for the answer (slides include suggested answers). While presenting in the class, you may display the question and encourage multiple responses, before revealing the answer. In some cases, this asset may include extra questions/worksheet that can be given as homework.