



Master Lesson Plan

For

Mensuration

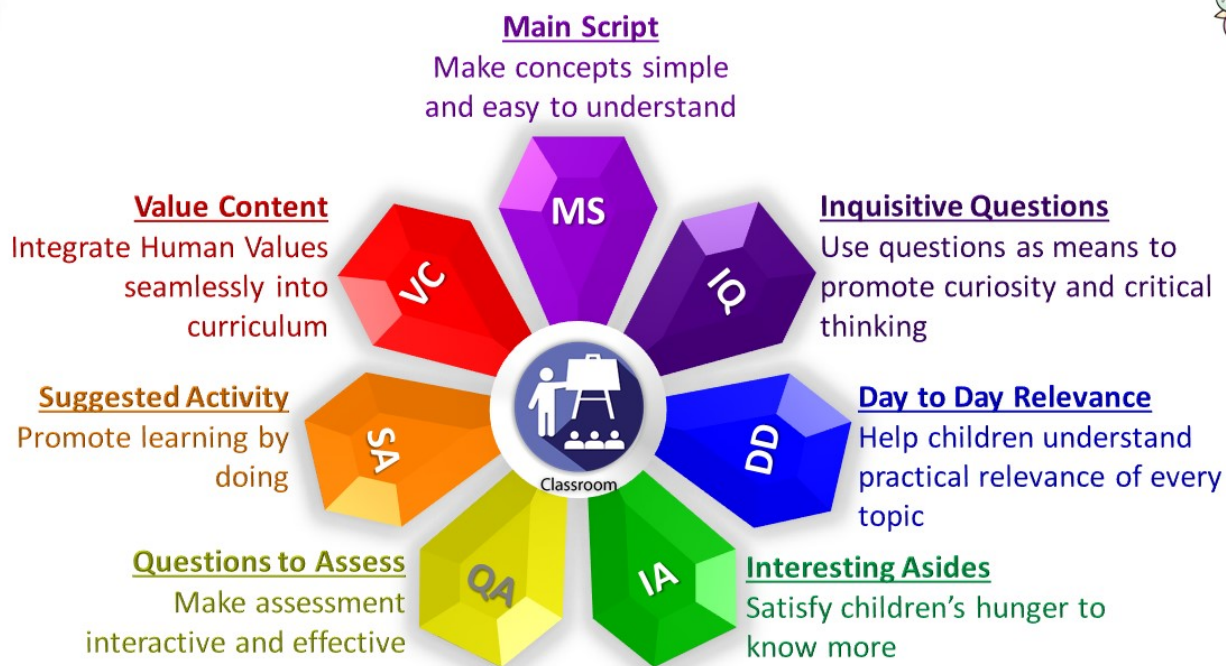
Board	Standard	Subject	Chapter	Language	Reference Link	Creation date
CBSE	STD VIII	Mathematics	Mensuration	English	Mensuration	2021-05-10 20:47:24

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Master Lesson Plan (MLP) - Covers the entire chapter with the help of these 7 asset types



For more information on how to use the lesson plan effectively, please scroll to the guidelines at the end of this document.

Mensuration

1. MS_Objectives-Mensuration

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 teacher's reference and need not be taught to the students.

Students will be able to

- discover the rectangular shapes around us
- explain the formulae to find perimeter and area of some known shapes
- explain the derivation of formula to find area of trapezium
- demonstrate the formula to find area of trapezium
- apply the formula of area of trapezium to do problems
- explain the area of general and special quadrilaterals like parallelogram, rhombus
- apply the formula of area of general and special quadrilaterals to do problems
- explain the method of finding area of a polygon

- list the uses of area and perimeter in day to day life
- explain different types of solid shapes
- demonstrate the formula to find total surface area of cuboid and cube
- evaluate surface area of cuboids formed by joining cubes with different combination
- become interested in the result among all solid shapes with given volume; the sphere has the smallest surface area
- explain the formulae to find curved surface area and total surface area of cylinder
- apply the results of surface area of cube, cuboid and cylinder to do problems
- explain the formulae to find volumes of cube, cuboid and cylinder
- apply the results of volumes of cube, cuboid and cylinder to do problems
- appreciate the importance of things needed to lead a meaningful life

Time to teach	Asset Type	Theme	SubTheme
3 Minutes	Main Script	Measurements	

2. IQ_General Quadrilaterals - An Introduction

Teacher: Observe the objects in our class room and identify the common quadrilateral shapes that we see here.

(Expected answers) Students: Board, floor, ceiling, top of table or desk, one side of a geometry box etc., are either in the shape of rectangle or square.

Teacher: What are the other quadrilaterals that you have come across in real life?

Students: Kite, parallelograms, rhombus and trapezium.

Teacher: Is any closed figure with four sides, that does not fit into any of the known shapes is still a quadrilateral?

Students: Yes

Teacher: Where do we see such shapes?

Students: Piece of land



Teacher: If two people own two different piece of land, how can we identify who can cultivate more crops?

Students: By comparing the area of each plot.

Teacher: Hence, we should know how to calculate the area of a general quadrilateral.

Image Source: <https://www.pexels.com/photo/bird-s-eye-view-of-farmland-636342/>

Time to teach	Asset Type	Theme	SubTheme
5 Minutes	Inquisitive Questions	Measurements	

3. MS_Introduction to Mensuration

A figure with 3 sides is called a triangle. Observe the following figures:



Can these two figures be classified as triangles?

No, these are not closed figures.

A closed figure with three sides is called a TRIANGLE and a closed figure with 4 sides is called a QUADRILATERAL.

What is perimeter?

Perimeter is the distance around the boundary of a closed figure.

What is area?

Area is the region covered by a closed figure.

Area is always expressed in square units like cm^2 , m^2 etc.

What is Mensuration?

The branch of Geometry that deals with the measurement of Length, Area and Volume is called Mensuration.

Let us recall the properties and formula for area and perimeter of a few known shapes,

Parallelogram:



A Parallelogram is a quadrilateral in which opposite sides are parallel & equal. In a parallelogram, the diagonals bisect each other.

Rectangle:

A rectangle is a parallelogram with each of its angle being right angle.

Can we say every rectangle is a parallelogram?

Yes, because opposite sides are parallel & equal in a rectangle.

Can we say that every parallelogram is a rectangle? No. In a parallelogram angles need not be right angles.

Rhombus:

A rhombus is a parallelogram in which all the sides are equal. 2 diagonals can be drawn for a rhombus.



The property of diagonals of a rhombus is that they bisect at right angles.

Square

A square is a parallelogram with all the sides equal and all angles equal to 90°

E.g. consider the perimeter and area of some known figures.

1) Rectangle of length 'a' and breadth 'b'

$$\text{Perimeter} = 2(a + b)$$

$$\text{Area} = ab$$

2) Square of side 'a'

$$\text{Perimeter} = 4a$$

$$\text{Area} = a^2$$

3) Triangle with sides a, b, c

Perimeter $a + b + c$

Area = $\frac{1}{2}bh$ where b is the base and h is the height.

4) Parallelogram with two adjacent sides a, b

Perimeter = $2(a + b)$ Area = bh where b is the base and h is the height

5) Circle of radius r , perimeter is nothing but circumference of a circle.

Perimeter = $2\pi r$ Area = πr^2

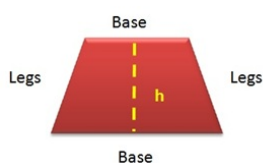
Image source:

All images drawn using MM tools

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Main Script	Perimeter and Area	

4. MS_Formula to find area of a trapezium

Formula to find area of Trapezium

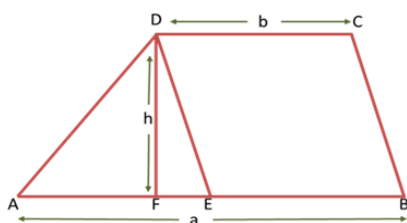


In a quadrilateral, if only one pair of opposite sides are parallel, then the quadrilateral is called Trapezium.

Derivation of Formula to find area of trapezium

In the Trapezium ABCD, let the lengths of parallel sides be, $AB = a$ and $CD = b$. Let $a > b$.

Divide the trapezium into a triangle and a parallelogram as follows.



Draw DE parallel to CB and DF perpendicular to AE.

Then $EB = b$.

Let $DF = h$.

Now $AE = AB - EB = a - b$

Area of triangle AED = $\frac{1}{2} \times AE \times DF = \frac{1}{2} \times (a - b) \times h$

Area of parallelogram EBCD = $EB \times DF = b \times h$

Area of Trapezium = Area of triangle AED + Area of parallelogram EBCD

$$= \frac{1}{2} \times (a - b) \times h + bh$$

$$= \frac{1}{2} \times (ah - bh + 2bh)$$

$$= \frac{1}{2} \times (ah + bh) = \frac{1}{2} \times (a + b)h$$

So, Area of a Trapezium = $\frac{1}{2} \times \text{sum of parallel sides} \times \text{height}$

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Main Script	Perimeter and Area	

5. SA_Activity to find area of a Trapezium

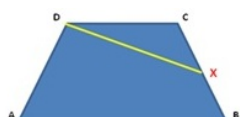
Aim - To verify the formula of area of a Trapezium

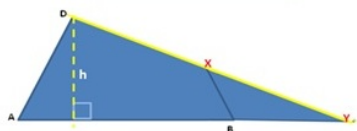
Materials required - Chart paper, ruler, pencil and a pair of scissors

Type of the activity: Individual / group

Setting of the activity: Classroom

Procedure - Students are divided into smaller groups and each group is given a chart paper, ruler, pencil, and a pair of scissors.





Step 1: Draw a trapezium ABCD on the chart paper and cut it from the chart paper.

Mark the side and $AB = a$ and $CD = b$.

Let the distance between AB and CD be h.

Step 2: Fold the side BC and find its midpoint X.

Step 3: Join D and X.

Step 4: Cut the triangle DXC from the trapezium and join the edge CX along XB as shown in the figure.

The piece DXC is now YXB in which,

$D = Y$, $X = X$ and $C = B$

In the new figure, $BY = CD = b$

Now we have a triangle.

The area of this triangle will be equal to the area of the trapezium. The length of the base of the triangle is $a + b$ and its altitude is 'h'.

Hence the formula to find area of the triangle = $\frac{1}{2} \times \text{base} \times \text{height}$, which is equal to $\frac{1}{2} \times (a + b) \times h$.

So, the Area of Trapezium = $\frac{1}{2} \times (a + b) \times h$.

Conclusion: Hence, verified that Area of a trapezium = $\frac{1}{2} \times (a + b) \times h$.

Time to teach	Asset Type	Theme	SubTheme
15 Minutes	Suggested Activity	Measurements	

6. QA_Find Area of Trapezium

I. Find the area of the trapezium for the given values (in cm).

Sl.No	'a'	'b'	'h'	'A'
1.	8.2	4.6	5	?
2.	5.6	10.4	6.2	?
3.	9	7	4	?
4.	11	4	8	?

Solution:

- 1) $\text{Area} = \frac{a+b}{2} \times h = \frac{8.2+4.6}{2} \times 5 = \frac{12.8}{2} \times 5 = 32 \text{ cm}^2$
- 2) $\text{Area} = \frac{a+b}{2} \times h = \frac{5.6+10.4}{2} \times 6.2 = \frac{16}{2} \times 6.2 = 49.6 \text{ cm}^2$
- 3) $\text{Area} = \frac{a+b}{2} \times h = \frac{9+7}{2} \times 4 = \frac{16}{2} \times 4 = 32 \text{ cm}^2$
- 4) $\text{Area} = \frac{a+b}{2} \times h = \frac{11+4}{2} \times 8 = \frac{15}{2} \times 8 = 60 \text{ cm}^2$

II. Find the one of the parallel sides of the trapezium given the following values a, b, h in cm and area in sq.cm

Sl. No	'a'	'b'	'h'	'A'
1.	10	?	6	45
2.	?	12.4	8.5	153
3.	6.2	?	12.5	105
4.	?	7.8	21	168

Solution:

- 1) $b = \frac{2A}{h} - a = \frac{2 \times 45}{6} - 10 = 5 \text{ cm}$
- 2) $a = \frac{2A}{h} - b = \frac{2 \times 153}{8.5} - 12.4 = 36 - 12.4 = 23.6 \text{ cm}$
- 3) $b = \frac{2A}{h} - a = \frac{2 \times 105}{12.5} - 6.2 = 16.8 - 6.2 = 10.6 \text{ cm}$
- 4) $a = \frac{2A}{h} - b = \frac{2 \times 168}{21} - 7.8 = 16 - 7.8 = 8.2 \text{ cm}$

III. Find the height of the trapezium given the following values a, b, in cm and area in sq. cm

Solution:

- 1) $h = \frac{2A}{a+b} = \frac{2 \times 60}{12+4} = \frac{120}{16} = 7.5 \text{ cm}$
- 2) $h = \frac{2A}{a+b} = \frac{2 \times 69.3}{14.5+7.5} = \frac{138.6}{22} = 6.3 \text{ cm}$
- 3) $h = \frac{2A}{a+b} = \frac{2 \times 58.5}{7+11} = \frac{117}{18} = 6.5 \text{ cm}$
- 4) $h = \frac{2A}{a+b} = \frac{2 \times 82}{8.3+12.2} = \frac{164}{20.5} = 8 \text{ cm}$

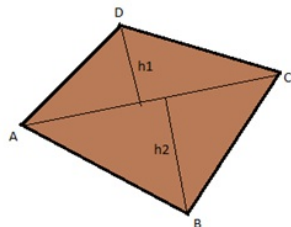
Time to teach	Asset Type	Theme	SubTheme
15 Minutes	Assessments	Measurements	

7. MS_Area of General and Special quadrilateral

Derivation of formula to find area of general quadrilateral:

Consider a quadrilateral ABCD. Join its diagonal AC. Then quadrilateral will get divided into two triangles.

This is called ‘Triangulation’. The area of the quadrilateral is equal to the sum of the areas of the two triangles.



Draw perpendiculars from B and D on the diagonal AC. Let the lengths of perpendiculars be h_1 and h_2 .

Base of both the triangles is AC and the area of triangle ADC is $\frac{1}{2} \times AC \times h_1$

The area of triangle ABC is $\frac{1}{2} \times AC \times h_2$.

So, the sum of the areas of the two triangles is

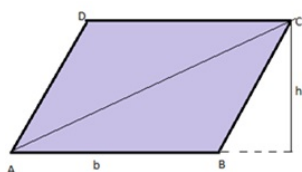
$$\frac{1}{2} \times AC \times h_1 + \frac{1}{2} \times AC \times h_2$$

By taking out common factor $\frac{1}{2} AC$, we get

$\frac{1}{2} AC (h_1 + h_2) = \frac{1}{2} d (h_1 + h_2)$ where d is the diagonal, h_1, h_2 are the lengths of the perpendiculars drawn from the opposite vertices on the diagonal.

Area of Parallelogram by triangulation method:

Consider a parallelogram with base = b, height = h.



Draw a diagonal and it divides the parallelogram into two triangles of equal area. Area of parallelogram is twice the area of the triangle.

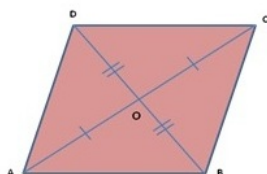
Area of each triangle is $\frac{1}{2} \times b \times h$.

So the Area of parallelogram = $2 \times \frac{1}{2} \times b \times h = b \times h$

Area of a rhombus by the method of triangulation:

We know that the diagonals of a rhombus bisect at right angles.

Consider the diagonal AC. BO and DO are the perpendiculars from the vertices B & D on AC



Area of rhombus:

Area of Rhombus ABCD = Area of triangle ACD + Area of triangle ABC

$$= \frac{1}{2} \times AC \times OD + \frac{1}{2} \times AC \times OB$$

$$= \frac{1}{2} \times AC (OD + OB)$$

$$= \frac{1}{2} \times AC \times BD = \frac{1}{2} \times d_1 \times d_2$$

where $d_1 = AC$ and $d_2 = BD$.

Thus Area of Rhombus = $\frac{1}{2} \times$ Product of diagonals

Image Source: saithri@yahoo.co.in

Time to teach	Asset Type	Theme	SubTheme
15 Minutes	Main Script	Measurements	

8. QA_Find area of General and Special quadrilaterals

Answer the following questions

1) In a quadrilateral, the diagonal is 125 cm and the two perpendiculars on it from the other

two vertices are 19 cm and 25 cm respectively. Find its area.

2) A swimming pool is in the form of an isosceles trapezium. The lengths of its parallel banks are 72 m and 45 m and the perpendicular distance between them is 60 m. Find the area of its water surface. Find the number of tiles required to line its bottom if dimension of each tile is $1.5 \text{ m} \times 1.5 \text{ m}$.

3) Find the area of a parallelogram whose base and height are 24 cm and 13 cm respectively.

4) Find the area of the Rhombus whose diagonals are:

a) 40 m and 70 m

b) 24.5 m and 48 m

5) The diagonals of a rhombus are 80 cm and 60 cm. Find its area and length of each side.

6) The area of a rhombus is equal to the area of a square of side 40 m. If one of the diagonals of the rhombus is 80 m. Find the length of the other diagonal.

7) In a rhombus ABCD, if the diagonals AC and BD intersect at O. If $AO = 4 \text{ cm}$, $BO = 3 \text{ cm}$, find the area of the rhombus.

Solutions:

$$1) \text{ Area} = \frac{1}{2} d(h_1 + h_2) = \frac{1}{2} \times 125 \times (19 + 25) = \frac{1}{2} \times 125 \times 44 = 2750 \text{ sq. cm}$$

2) The lengths of parallel sides, $a = 72 \text{ m}$, $b = 45 \text{ m}$.

Perpendicular distance between parallel sides = $h = 60 \text{ m}$.

$$\text{Area of the swimming pool} = \frac{1}{2} h(a + b) = \frac{1}{2} \times 60 \times (72 + 45) = 3510 \text{ sq. m.}$$

If number of tiles required is n ,

$$1.5 \times 1.5 \times n = 3510$$

$$n = 3510 / (1.5 \times 1.5) = 1560$$

3) Base $b = 24$ cm, height $h = 13$ cm

$$\text{Area of the parallelogram} = b \times h = 24 \times 13 = 312 \text{ sq. cm}$$

4) Area = $\frac{1}{2} \times d_1 \times d_2$ where d_1, d_2 are lengths of diagonals

a) $d_1 = 40$ m, $d_2 = 70$ m

$$\text{Area} = \frac{1}{2} \times 40 \times 70 = 1400 \text{ sq. m}$$

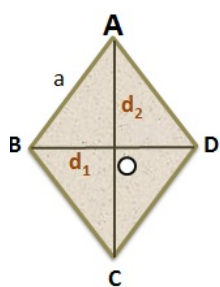
b) $d_1 = 24.5$ m, $d_2 = 48$ m

$$\text{Area} = \frac{1}{2} \times 24.5 \times 48 = 588 \text{ sq. m}$$

5) Area = $\frac{1}{2} \times d_1 \times d_2$ where d_1, d_2 are lengths of diagonals

$d_1 = 80$ cm and $d_2 = 60$ cm

$$\text{Area} = \frac{1}{2} \times 80 \times 60 = 2400 \text{ sq. cm}$$



In the fig. $AO = 80/2 = 40$ cm and $OB = 60/2 = 30$ cm

Let the side = a

$$a^2 = AO^2 + BO^2 = 40^2 + 30^2 = 1600 + 900 = 2500 = 50^2$$

$$a = 50 \text{ cm}$$

6) Area of the square of side 40 m is $40^2 = 1600 \text{ m}^2$

Let one diagonal of the rhombus be d_1

The other diagonal $d_2 = 80 \text{ m}$

Area of the rhombus = Area of the square.

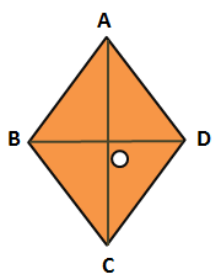
$$\frac{1}{2} \times d_1 \times d_2 = 1600$$

$$\frac{1}{2} \times d_1 \times 80 = 1600$$

$$40 \times d_1 = 1600$$

$$d_1 = 1600/40 = 40 \text{ m}$$

7) We have $AO = 4 \text{ cm}$, $BO = 3 \text{ cm}$



$$\text{Diagonal AC} = 2 \times 4 = 8 \text{ cm} = d_1$$

$$\text{Diagonal BD} = 2 \times 3 = 6 \text{ cm} = d_2$$

$$\text{Area} = \frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 8 \times 6 = 24 \text{ sq.cm}$$

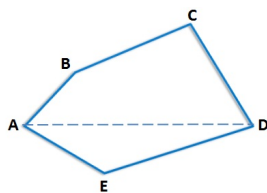
Image Source: saithri@yahoo.co.in

Time to teach	Asset Type	Theme	SubTheme
15 Minutes	Assessments	Measurements	

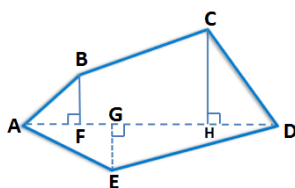
9. MS_Finding area of a Polygon

We can find the area of a polygon by splitting into right triangles and trapeziums in convenient way.

Consider the pentagon ABCDE.



Let us draw perpendiculars BF, CH and EG on the diagonal AD.



Now the polygon is divided into 3 triangles AFB, HDC, AED and one trapezium FHCB.

We can find the area of the polygon, by finding the areas of the three triangles and the trapezium and adding them up.

Suppose, we have the following values:

$AD = 12\text{cm}$, $AH = 8\text{cm}$, $AG = 6\text{cm}$, $AF = 3\text{cm}$ and perpendiculars $BF = 2\text{cm}$, $CH = 4\text{cm}$, $EG = 2.5\text{cm}$, find the area of the polygon.

Solution:

$$\text{Area of triangle AFB} = \frac{1}{2} \times AF \times BF = \frac{1}{2} \times 3 \times 2 = 3 \text{ cm}^2$$

$$\text{Area of trapezium FHCB} = \frac{1}{2} (FB + CH) \times FH$$

(Because FB and CH are parallel sides)

$$= \frac{1}{2} (2 + 4) \times 5 = 15 \text{ cm}^2 \text{ (as } FH = AH - AF = 8 - 3 = 5 \text{)}$$

$$\text{Area of triangle HDC} = \frac{1}{2} \times HD \times HC$$

$$= \frac{1}{2} \times 4 \times 4 = 8 \text{ cm}^2$$

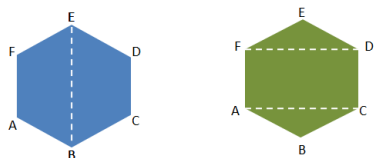
(Because $HD = AD - AH = 12 - 8 = 4$)

$$\text{Area of triangle ADE} = \frac{1}{2} \times AD \times EG = \frac{1}{2} \times 12 \times 2.5 = 15 \text{ cm}^2$$

$$\text{Thus area of pentagon ABCDE} = 3 + 15 + 8 + 15 = 41 \text{ cm}^2$$

Dividing a polygon in different ways:

We can divide a polygon in different ways and find its area. For example,



Here we have a regular Hexagon, ABCDEF. By joining the diagonal BE, we get two congruent trapeziums ABEF and BCDE.

So the area of the hexagon is sum of the area of the two trapeziums.

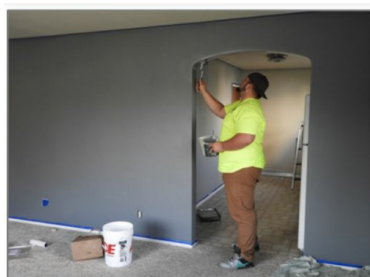
We can also divide it into two congruent triangles ABC and DEF and rectangle ACDF.

Image Source: Original contribution by saithri@yahoo.co.in

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Main Script	Measurements	

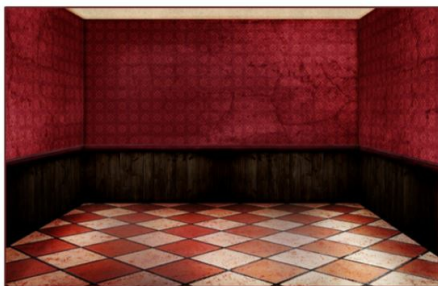
10. DD_Area and Perimeter - Applications

1. If the cost of painting a wall is given as Rs. 50 per m^2 , then the total cost of painting is the area of wall multiplied with the given cost.



2. We can find the number of tiles required to cover a room by dividing the area of the room

by area of a tile.



3. The total cost for a plot or a house is calculated by multiplying the area of the plot with cost per unit square.

4. Carpenters calculate the amount of plywood required to design a cot or cupboard by calculating the area of each face of the required furniture.



5. The amount of barbed wire required to fence a field is decided by calculating perimeter of a field.

6. Cost of fencing a house is calculated by considering the perimeter of the house.

7. In embroidery work done around a piece of cloth, perimeter is used to find amount of lace or ribbon required.

The above examples are just a few of the applications of area and perimeter.

Image Source:

<https://pixabay.com/illustrations/room-empty-interior-floor-tiles-2185942/>

<https://pixabay.com/photos/painter-paint-house-indoor-2247395/>

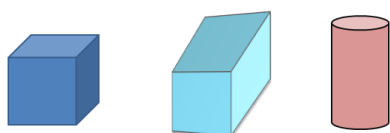
<https://pxhere.com/en/photo/197205> by author Alan Levine

Time to teach	Asset Type	Theme	SubTheme
5 Minutes	Day-to-day Relevance	Measurements	

11. MS_Solid shapes

Objects which have three dimensions viz., length, breadth and height are called solids.

Examples of some solids which are found around us are book, box, water bottle, pencil, duster, gas cylinder etc.



Cuboid: A cuboid is a solid shape with six rectangular faces or it's a solid shape with 3 pairs of identical, rectangular faces.

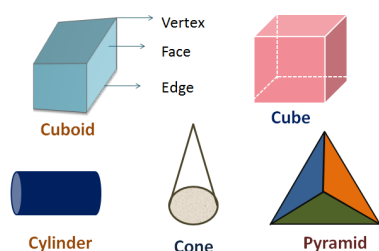
Examples of cuboid: Brick, duster, box, text book etc.

Cube: If all six faces of a cuboid are squares then it is called a cube. E. g. Dice, Ice cube

Cylinder: A cylinder has a pair of identical circular faces and a curved surface.

E.g. Tooth paste tube, Over head water tank, gas cylinder, oil tanker, and tube light.

The faces of a solid are two dimensional, namely rectangles, squares, circles, triangles etc.



Generally any room is a cuboid. It has length, breadth and height. If we are required to paint a room, we can paint the four walls alone, or we can even paint the ceiling also.

Of course, we will not paint the floor!

Trucks transporting petrol, diesel and gas are cylindrical in shape.

If it is required to paint a gas tanker, we have to paint all the surfaces – the curved surface and the circular faces also.

Thus, we have areas called CURVED/LATERAL SURFACE AREA AND TOTAL SURFACE AREAS.

Image Source: Original Contribution by vallisairam9@gmail.com

Time to teach	Asset Type	Theme	SubTheme
7 Minutes	Main Script	Measurements	

12. SA_Activity to find Surface area of Cuboid and Cube

Set up: Individual activity, students should be instructed beforehand to get an empty soap box, tooth paste box or any other cuboidal shaped box.

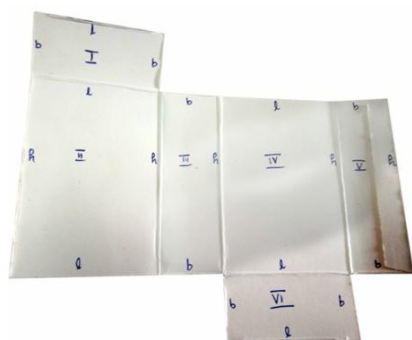
Aim: To derive the formula to find surface area of cuboid and cube.

Materials required: A pair of scissors, pencil, eraser and a paper.

Procedure:

Step 1: Take the empty soap box, open it on both sides and cut off the extra flaps.

Step 2. Cut along one long edge to obtain the net of a cuboid.



Step 3. Label each quadrilateral formed as I, II, III, IV, V and VI. Mark the longest lines as height(h), medium lines as length(l), and the shortest lines as breadth (b).

Step 4: Take the paper, draw a table as given below and fill it with appropriate answers

Part	Area
I	lb
II	lh
III	bh
IV	lh
V	bh
VI	lb

Observation:

Area of I = Area of ____

Area of II = Area of ____

Area of III = Area of ____

Step 5: Add the areas of all the parts. This will give the total surface area of the cuboidal box

Total surface area = 2 Area of I + 2 Area of II + 2 Area of III

$$= 2(\text{Area of I} + \text{Area of II} + \text{Area of III})$$

$$= 2 (lb+lh+bh)$$

Step 5: Cut the parts I and VI, add the areas of the remaining parts.

This will give the lateral surface area of the cuboidal box. (Area excluding top and bottom)

Lateral surface area = Area of II + Area of III + Area of IV + Area of V

$$= lh + bh + lh + bh = 2lh + 2bh$$

$$= 2h (l + b)$$

Extension :

For a cube $l = b = h$

Thus, Total surface area of cube = $2 (l \times l + l \times l + l \times l) = 2 \times 3l^2 =$

$$6l^2$$

$$\text{Lateral surface area of cube} = 2l(l + l) = 4l^2$$

OR

$$\text{The area of each face in a cube} = l^2$$

$$\text{Total surface area of cube} = 6 \times \text{area of each face} = 6l^2$$

$$\text{Lateral surface area of cube} = 4 \times \text{area of each face} = 4l^2$$

Conclusion : Thus, we have derived the formula to find surface area of cuboid and cube.

Time to teach	Asset Type	Theme	SubTheme
20 Minutes	Suggested Activity	Measurements	

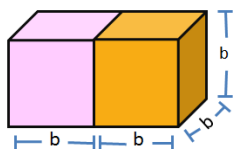
13. IQ_Think hard and do it

(1) a) Two cubes each with side b are joined to form a cuboid. What is the surface area of this cuboid?

(b) What is the surface area of cuboid formed by joining three such cubes? Why?

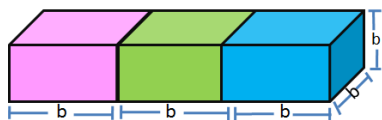
Solutions:

1 a)



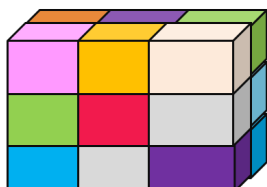
$$\text{Surface area of the resulting cuboid} = \text{Area of the pink cube} + \text{Area of the orange cube} = 5b^2 + 5b^2 = 10b^2$$

1 b)



Surface area of the resulting cuboid = Area of the pink cube + Area of the green cube + Area of the blue cube = $5b^2 + 4b^2 + 5b^2 = 14b^2$

(2) How will you arrange 18 cubes of equal length to form a cuboid of smallest surface area?



Solution:

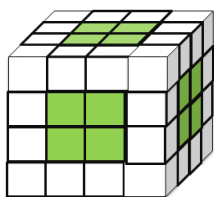
In the above arrangement the number of visible faces is minimum. Thus the surface area is the smallest

(3) After the surface area of a cube is painted, the cube is cut into 64 smaller cubes of same dimensions.

- How many have 1 face painted?
- 2 faces painted?
- 3 faces painted?
- No faces painted?

Solutions:

3 a)



From the figure it is clear that no of cubes with one face painted is

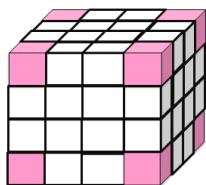
$$= 6 \times 4 = 24$$

3 b)

From the figure it is clear that no of cubes with two faces painted is

$$= 8 \times 3 = 24$$

3 c)



From the figure it is clear that no of cubes with three faces painted

$$= 4 + 4 = 8$$

3 d)

Total number of cubes = 64

Number of cubes with no faces painted = Total number of cubes - (number of cubes with 1 face painted + number of cubes with 2 faces painted + number of cubes with 3 faces painted)

$$= 64 - (24 + 24 + 8) = 64 - 56 = 8$$

Image Source: Original Contribution by vallisairam9@gmail.com

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Inquisitive Questions	Measurements	

14. IA_Surface area - Interesting Facts

The surface area of a spherical object is equal to four times the area of circle with same radius.

When we consider different objects with fixed volume, the sphere is the shape that has the smallest surface area.

For Example : Consider cube, cuboid and sphere with volume 216 cm^3

Cube : Side = $a = 6 \text{ cm}$

$$\text{Volume} = a^3 = 6 \times 6 \times 6 = 216 \text{ cm}^3$$

$$\text{Total surface Area} = 6 a^2 = 6 \times 36 = 216 \text{ cm}^2$$

Cuboid: $l = 3 \text{ cm}$, $b = 6 \text{ cm}$ and $h = 12 \text{ cm}$

$$\text{Volume} = l \times b \times h = 3 \times 6 \times 12 = 216 \text{ cm}^3$$

$$\text{Total Surface area} = 2(lb + lh + bh) = 2 \times (3 \times 6 + 3 \times 12 + 6 \times 12) = 2 \times 126 = 252 \text{ cm}^2$$

Sphere: radius = $r = 3.725 \text{ cm}$

$$\text{Volume} = V = \frac{4}{3} \times 3.14 \times r^3$$

$$= 216.4 \text{ cm}^3 \text{ (approximately)}$$

$$\text{Surface Area} = 4 \times 3.14 \times r^2 = 174.3 \text{ cm}^2 \text{ (approximately)}$$

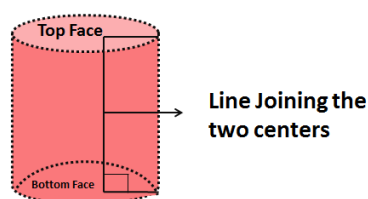
We observe that, sphere has the least surface area for a fixed volume.

This could be the reason why sphere appears in nature as in rain drops, planets, bubbles etc.

Time to teach	Asset Type	Theme	SubTheme
5 Minutes	Interesting Asides	Measurements	

15. MS_Curved surface and Total surface area of cylinder

In addition to objects which are in the shape of cuboid and cube, we have objects which are cylindrical in shape.

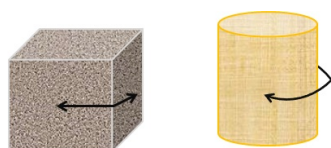


Generally, the cylindrical shaped objects have two congruent circles at the top and bottom.

If we join the centers of the top and bottom faces, the line will be perpendicular to the base. Such cylinders are called **right circular cylinders**.

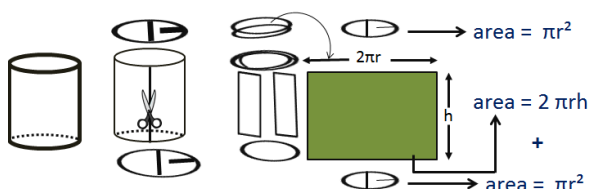
“All cylinders need not be right circular”

In case of a cuboid and a cube, the side surfaces or walls are flat surfaces. But in case of a cylinder, it is curved. So, we call its area as **curved surface area**.



Curved surface area and total surface area of a cylinder

Let the radius of the base circle of the cylinder be 'r' and the height of the cylinder be 'h'.



Cut and open the curved surface of the cylinder as shown in the figure.

It is a rectangle .

The length of the rectangle = l = perimeter or the circumference of the base circle

$$= 2\pi r$$

The breadth of the rectangle = b = height of the cylinder = h

Curved surface area of the cylinder = Area of the rectangle

$$= l \times b = 2\pi r \times h = 2\pi rh$$

Total surface area = Curved surface area + 2 (Area of the base circle)

$$= 2\pi rh + 2\pi r^2$$

$$= 2\pi r(r + h)$$

Image Source: Original Contribution by saithri@yahoo.co.in

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Main Script	Measurements	

16. QA_Find the Surface area

1) If six cubes of 10 cm edge are joined end to end, find the surface area of the cuboid formed.

2) Calculate the total surface area of an aquarium which is in cuboidal shape having dimensions 12 m × 10 m × 4 m.

3) In a marriage hall there are 18 cylindrical pillars. The radius of each pillar is 21 cm and height is 3.5 m.

Find the total cost of painting the curved surface area of all pillars at the rate of Rs 5 / m²

Solutions:

1) Total number of faces of 6 cubes = 36



But when they are joined end to end, 10 faces are not visible.

No. of visible faces = $36 - 10 = 26$

Area of each face = $10^2 = 100 \text{ cm}^2$

Total surface area of the cuboid = $26 \times 100 = 2600 \text{ cm}^2$

Alternate method:

When six cubes are joined end to end, the resulting cuboid has,

length $l = 60 \text{ cm}$, height $h = 10 \text{ cm}$ and breadth $b = 10 \text{ cm}$

Surface Area $S = 2 \times (lb + lh + bh) = 2(60 \times 10 + 60 \times 10 + 10 \times 10)$

$$= 2 \times (600 + 600 + 100)$$

$$= 2 \times (1300) = 2600 \text{ sq. cm.}$$

2) The dimensions of the cuboid are $l = 12 \text{ m}$, $b = 10 \text{ m}$ and $h = 4 \text{ m}$



Total surface area = $2 \times (lb + lh + bh) = 2(12 \times 10 + 12 \times 4 + 10 \times 4)$

$$= 2 \times (120 + 48 + 40) = 2 \times 208 = 416 \text{ sq. m}$$

3) Radius $r = 0.21$ m, height $h = 3.5$ m

Curved surface area of one pillar $= 2\pi rh = 2 \times (22/7) \times 0.21 \times 3.5 = 4.62 \text{ m}^2$

Curved surface area of 18 pillars $= 4.62 \times 18 \text{ m}^2$

Total cost of painting curved surface area of all pillars at the rate of Rs 5 per m^2

$$= \text{Rs. } 4.62 \times 18 \times 5 = \text{Rs. } 4.62 \times 90 = \text{Rs. } 415.80$$

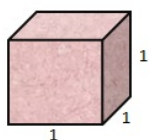
Image source:

<https://pixabay.com/photos/fresh-aquarium-fish-aquarium-plant-980406/>

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Assessments	Measurements	

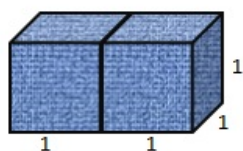
17. MS_Volume of Cube, Cuboid and Cylinder

The volume of three dimensional object is the amount of the space occupied by it.



The space occupied by a unit cube is called 1 cubic unit. That is, the volume of a cube of length 1 unit is 1 cubic unit.

If two such unit cubes are kept, then the total volume will be 2 cubic units.



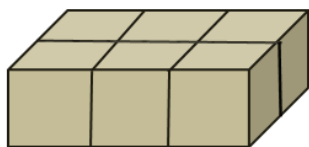
When 2 unit cubes are joined together, then it becomes a cuboid.

The length, breadth and height of the cuboid will then be,

Length = $l = 2$ units, breadth = $b = 1$ unit and height = $h = 1$ unit

So, the volume = 2 cubic units = $2 \times 1 \times 1 = l \times b \times h$

Now, 6 unit cubes be joined together in 2 rows as shown in the figure.



What will be the total volume? Its volume will be 6 cubic units.

It is a cuboid with dimensions, $l = 3$ units $b = 2$ units and $h = 1$ unit.

Therefore, volume of the cuboid = 6 cubic units = $3 \times 2 \times 1 = l \times b \times h$.

Thus, in these two cases, volume of the cuboid = $l \times b \times h$

We can also arrive at this result as follows.

Volume of a solid = Area of the base $\times$ height

Volume of a cuboid

For a cuboid, the base is a rectangle of length l and breadth b .

Area of the base = $l \times b$

Thus, volume of the cuboid = $l \times b \times h$.

Volume of a cube

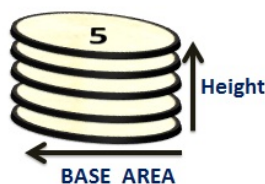
For a cube, of side l , the base is a square of side l . Its area = l^2

Volume of the cube = Area of the base $\times$ height = $l^2 \times l = l^3$

Volume of a cylinder

For a cylinder, the base is a circle. Let the radius of the base be r and height be h .

Volume of the cylinder can be derived by making a pile of coins of same size.



Volume = Base area $\times$ height

Area of the base = πr^2

Therefore, Its volume = $\pi r^2 h$

Image Source: Saithri@yahoo.co.in

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Main Script	Measurements	

18. QA_Find the volume

1) The volume of a cube is 1728 cm^3 . Find the length of its one edge and its surface area.

2) The length, breadth and height of a cuboid are 22 m, 15 m and 4 m respectively. Find its volume.

3) A concrete beam is to rest on two concrete pillars. The beam is a cuboid of length 3 m, breadth 0.4 m and height 0.5 m. The pillars have diameters 0.6 m and height 2 m. Calculate the total volume of the concrete needed to make the beam and pillars

Solutions

1) Let the length of one edge of the cuboid be 'a'.

$$\text{Its volume } a^3 = 1728 \text{ cm}^3 = 4^3 \times 3^3 = (4 \times 3)^3 = 12^3$$

$$a = 12 \text{ cm.}$$

$$\text{Surface area} = 6 a^2 = 6 \times 12 \times 12 = 864 \text{ cm}^2$$

2) $l = 22 \text{ m}$, $b = 15 \text{ m}$ and $h = 4 \text{ m}$.

$$\text{Volume} = V = l \times b \times h = 22 \times 15 \times 4 = 22 \times 60 = 1320 \text{ m}^3$$

3) Dimensions of the beam are $l = 3 \text{ m}$, $b = 0.4 \text{ m}$ and $h = 0.5 \text{ m}$.



Dimensions of the pillars are $r = 0.3 \text{ m}$ and $h = 2 \text{ m}$.

$$\text{Volume of the beam} = l \times b \times h = 3 \times 0.4 \times 0.5 = 0.6 \text{ m}^3$$

$$\text{Volume of 2 pillars} = 2 \times \pi r^2 h = 2 \times (22/7) \times 0.3 \times 0.3 \times 2 = 1.13 \text{ m}^3$$

$$\text{Volume of the concrete required to make the beam and 2 pillars} = 1.13 + 0.6 = 1.73 \text{ m}^3$$

Image source:

<https://pixabay.com/photos/architecture-pillar-monument-3128171/>

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Assessments	Measurements	

19. VC_Rocks in the Jar

Amount of space occupied by a three dimensional object is called its volume.

Simply put volume means capacity.

Here is an interesting story that will make us understand the importance of things in our life. A professor one day picked up a large empty jar and proceeded to fill it with small rocks. He then asked his students if the jar was full. They unanimously agreed that the jar was full.

The professor then picked up a box of pebbles and rolled them into the jar. He shook the jar lightly.

The pebbles, of course, moved into the open areas between the rocks.

He then asked his students again if the jar was full. Again, they unanimously agreed that the jar was full.

Then the professor picked up a box of sand and poured it into the jar. Of course, the sand filled up everything else.

Last he took some water and poured it in. The water occupied all the empty spaces and filled in neatly into the jar.

"Now," the professor said, "I want you to recognize that this jar represents our life.

The rocks are the important things like our family, our friends, our health, our character. Even if all else is lost and only these remained we can still lead a full life.

The pebbles stand for all things we acquire with our money and education like a house, a car etc.

The sand represents the unpleasant situations like those caused because of short temper, anger, revenge etc.

We must be careful not to fill the jar with these things as they will occupy a lot of volume and there will be no place for the rocks or pebbles.

If we spend all our time and energy on the small stuff, we will never have room for the things that are important to us.

But it is also important not to be content in living for oneself.

There is still some space left for the water, this represents the small acts of kindness or service that we can do whenever we get a chance.

This is how the jar of life should be filled to the brim, to occupy the entire volume of the jar.

The students learnt a very valuable lesson that day.

Time to teach	Value Type	Value Sub Type	Value Attribute
5 Minutes	Peace	Discipline	Stories

20. MS_Summary-Mensuration

- The rectangular shapes around us are listed
- The formulae to find perimeter and area of some known shapes are listed
- Derivation of formula to find area of trapezium is explained and demonstrated in an activity
- The formula to find area of trapezium is applied to do problems
- The formulae to find area of general and special quadrilaterals are explained and applied to do problems
- The method of finding area of a polygon is explained
- Uses of Area and perimeter in day to day life are listed
- The different types of solid shapes are explained

- The formula to find total surface area of cuboid and cube is demonstrated in an activity
- Total surface area of cuboids formed by joining cubes of different combinations are evaluated
- The result, among all solid shapes of given volume the sphere has the smallest surface area is explained
- The formulae to find curved surface area and total surface area of cylinder are derived and applied to do problems
- Formulae to find volume of cube, cuboid and cylinder are derived and applied to do problems
- The importance of things needed to lead a meaningful life are explained

Time to teach	Asset Type	Theme	SubTheme
3 Minutes	Main Script	Measurements	

Master Lesson Plan

Seven Asset Methodology for MLP

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 asset?	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 recent or local example.
What is an 'Interesting Aside' (IA) asset?	The Interesting Aside asset uses attention grabbing titbits 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.