NCERT QUESTIONS WITH SOLUTIONS

FIGURE IT OUT

2.4 RAY

1.

Rihan marked a point on a piece of paper. How many lines can he draw that pass through the point?

Sheetal marked two points on a piece of paper. How many different lines can she draw that pass through both of the points?

Can you help Rihan and Sheetal find their answers?

Sol. An infinite number of lines can be drawn to pass through a point in a plane. One and only one line can be drawn to pass through two points.

2. Name the line segments in figure 2.4 below. Which of the five marked points are on exactly one of the line segments? Which are on two of the line segments?

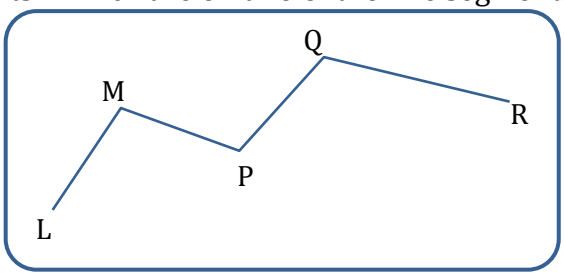


Fig. 2.4

Sol. Line segments in the given figure are LM, MP, PQ, and QR.

Points on exactly one line segment

L: It is an endpoint of line segment LM.

R: It is an endpoint of line segment QR.

Points on two line segments

M: It is a point where two line segments, LM and MP, meet.

P: It is a point where two line segments, MP and PQ meet

Q: It is a point where two line segments, PQ and QR, meet.

Result: Points on one line segment: L, R

Points on two line segments: M, P, Q

3. Name the rays shown in fig. 2.5 below. Is T the starting point of each of these rays?

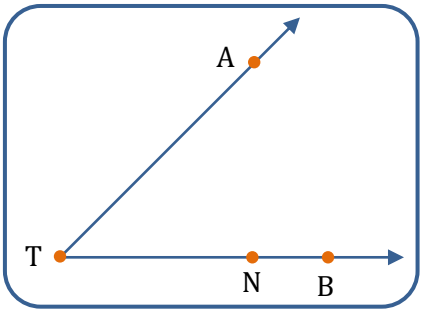


Fig. 2.5

Sol. In the given figure, there are two rays:

- Ray TA: This ray starts at point T and passes through point A, extending infinitely beyond A.
- Ray TB: This ray also starts at point T and passes through point B, extending infinitely beyond B.

So yes, T is the starting point of both rays.

4. Draw a rough figure and write labels appropriately to illustrate each of the following:

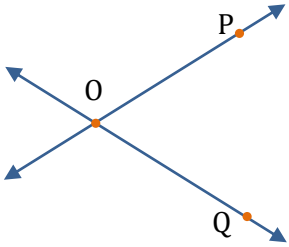
(a) $\overleftrightarrow{OP}$ and $\overleftrightarrow{OQ}$ meet at O.

(b) $\overleftrightarrow{XY}$ and $\overleftrightarrow{PQ}$ intersect at point M.

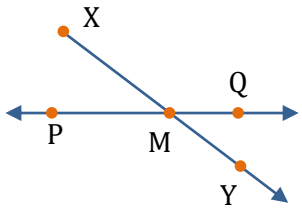
(c) Line ℓ contains points E and F but not point D.

(d) Point P lies on AB.

Sol. (a)

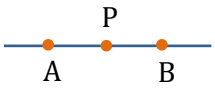


(b)



(c)

(d)



5. In Fig. 2.6, name:

(a) Five points (b) A line (c) Four rays (d) Five line segments

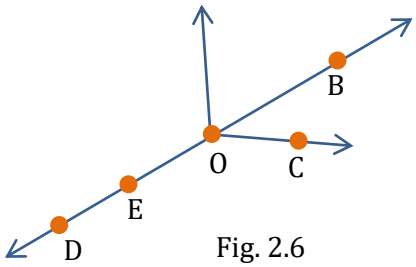


Fig. 2.6

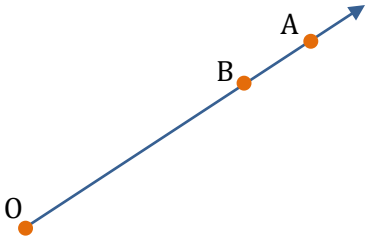
Sol. (a) Five points: D, E, O, C and B.

(b) A line: $\overleftrightarrow{BD}$

(c) Four rays: $\overrightarrow{OD}$, $\overrightarrow{OB}$, $\overrightarrow{OC}$ and $\overrightarrow{ED}$.

(d) Five line segments: $\overline{DE}$, $\overline{EO}$, $\overline{OC}$, $\overline{BO}$ and $\overline{DO}$.

6. Here is a ray $\overrightarrow{OA}$. It starts at O and passes through the point A. It also passes through the point B.



(a) Can you also name it as $\overrightarrow{OB}$? Why?

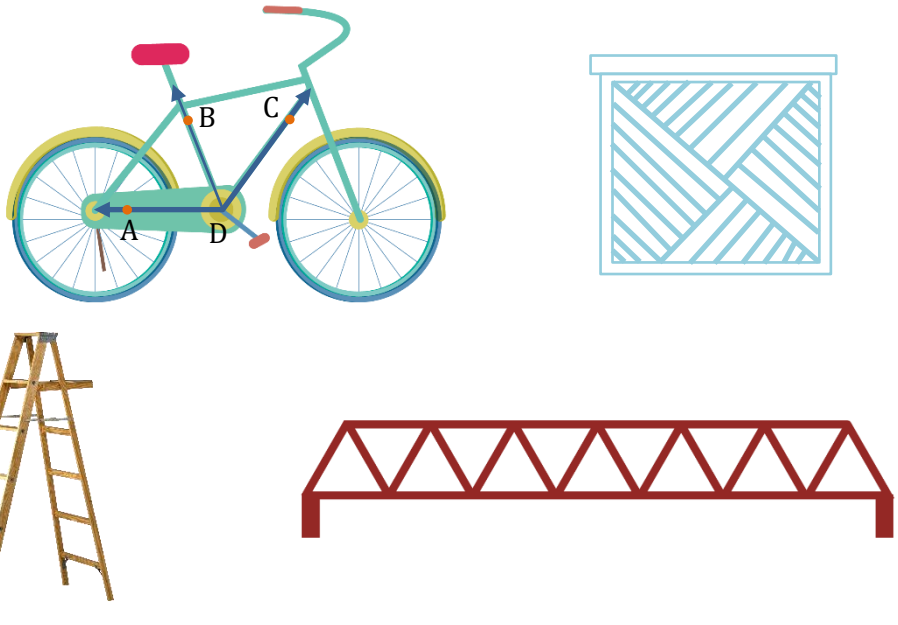
(b) Can we write $\overrightarrow{OA}$ as $\overrightarrow{AO}$? Why or why not?

Sol. (a) Yes, the ray can also be named $\overrightarrow{OB}$ because the ray $\overrightarrow{OA}$ passes through point B as well. Rays are named starting from the initial point and passing through any other point on the ray. Since the ray starts at O and passes through both B and A, it can be named $\overrightarrow{OB}$.

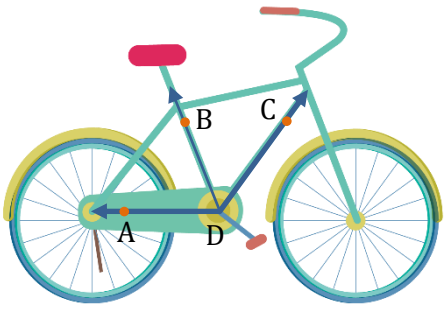
(b) No, we cannot write $\overrightarrow{OA}$ as $\overrightarrow{AO}$ because rays are directional. The ray starts at point O and extends through A, so $\overrightarrow{OA}$ indicates the direction from O to A. Writing it as $\overrightarrow{AO}$ would imply the ray starts at A and goes towards O, which is incorrect in this context because O is the starting point.

2.5 ANGLE

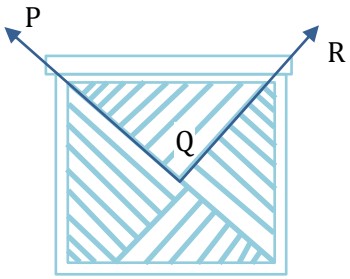
1. Can you find the angles in the given pictures? Draw the rays forming any one of the angles and name the vertex of the angle.



Sol. The name of the vertex of ∠BDC is D.

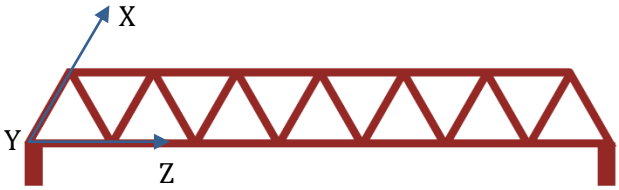


The name of the vertex of ∠PQR is Q.



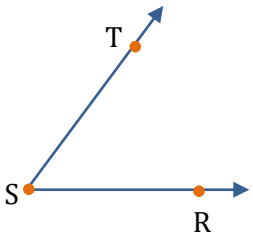
The name of the vertex of ∠LMN is M.

The name of the vertex of ∠XYZ is Y.

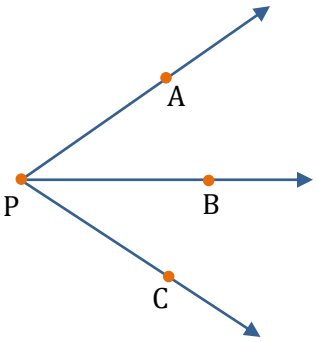


2. Draw and label an angle with arms ST and SR.

Sol.

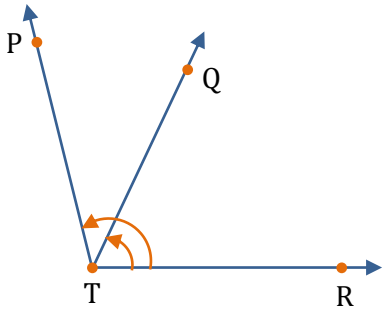


3. Explain why ∠APC cannot be labelled as ∠P.



Sol. There is more than one angle at P, that is ∠APB, ∠APC and ∠BPC That is why ∠APC can't be written as ∠P.

4. Name the angles marked in the given figure.



Sol. The angles marked in the given figure are ∠RTQ and ∠RTP.

5. Mark any three points on your paper that are not on one line. Label them A, B, C. Draw all possible lines going through pairs of these points. How many lines do you get? Name them. How many angles can you name using A, B, C? Write them down, and mark each of them with a curve as in Fig. 2.9.

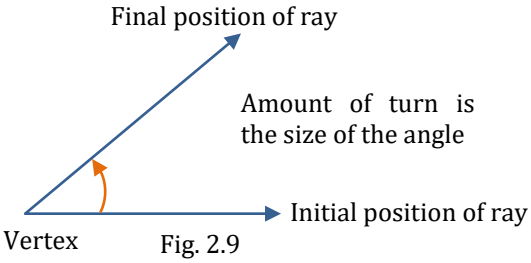
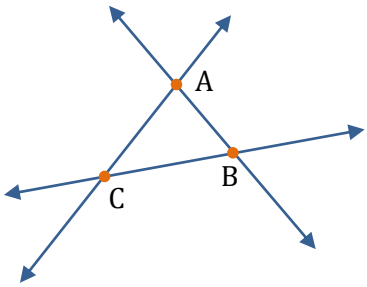


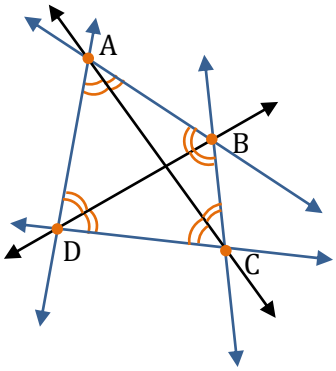
Fig. 2.9

Sol. We get three lines.
These are line AB, line BC and line CA.
Also, we get three angles.
These are ∠ABC, ∠BCA and ∠CAB.



6. Now mark any four points on your paper so that no three of them are on one line. Label them A, B, C, D. Draw all possible lines going through pairs of these points. How many lines do you get? Name them. How many angles can you name using A, B, C, D? Write them all down, and mark each of them with a curve as in Fig. 2.9.

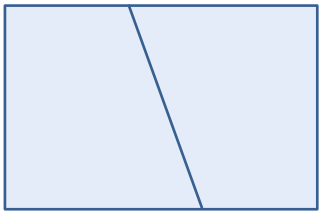
Sol.



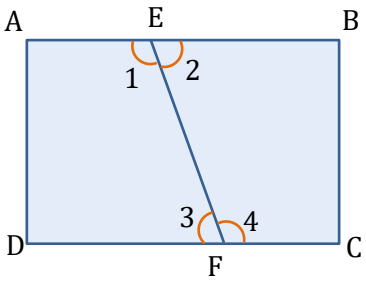
We get six lines. These are line AB, line BC, line CD, line DA, line AC and line BD.
Also, we get twelve angles. These are ∠BAC, ∠CAD, ∠BAD, ∠ABD, ∠DBC, ∠ABC, ∠BCA, ∠ACD, ∠BCD, ∠CDB, ∠CDA, ∠BDA.

2.6 COMPARING ANGLES

1. Fold a rectangular sheet of paper, then draw a line along the fold created. Name and compare the angles formed between the fold and the sides of the paper. Make different angles by folding a rectangular sheet of paper and compare the angles. Which is the largest and smallest angle you made?



Sol. The angles formed with the line along the fold created are (∠AEF), (∠BEF), (∠DFE), and (∠CFE), which are marked as 1, 2, 3, and 4. Out of these angles, (∠AEF) and (∠CFE) are the larger ones, whereas (BEF) and (∠DFE) are the smaller ones.



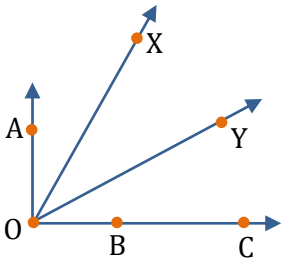
2. In each case, determine which angle is greater and why.

a. ∠AOB or ∠XOY

b. ∠AOB or ∠XOB

c. ∠XOB or ∠XOC

Discuss with your friends on how you decided which one is greater.

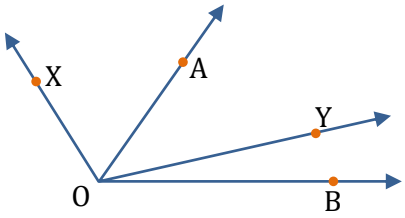


Sol. a. ∠AOB > ∠XOY because ∠XOY is contained within ∠AOB . It means ∠XOY is a part of ∠AOB.

b. ∠AOB > ∠XOB because ∠XOB is contained within ∠AOB. It means ∠XOB is a part of ∠AOB.

c. ∠XOB = ∠XOC, because both angles are formed with the same rays with common vertex O.

3. Which angle is greater: ∠XOB or ∠AOB? Give reasons.

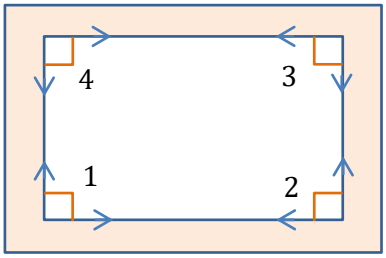


Sol. ∠XOB > ∠AOB because ∠AOB is contained within ∠XOB. It means ∠AOB is a part of ∠XOB.

2.8 SPECIAL TYPES OF ANGLES

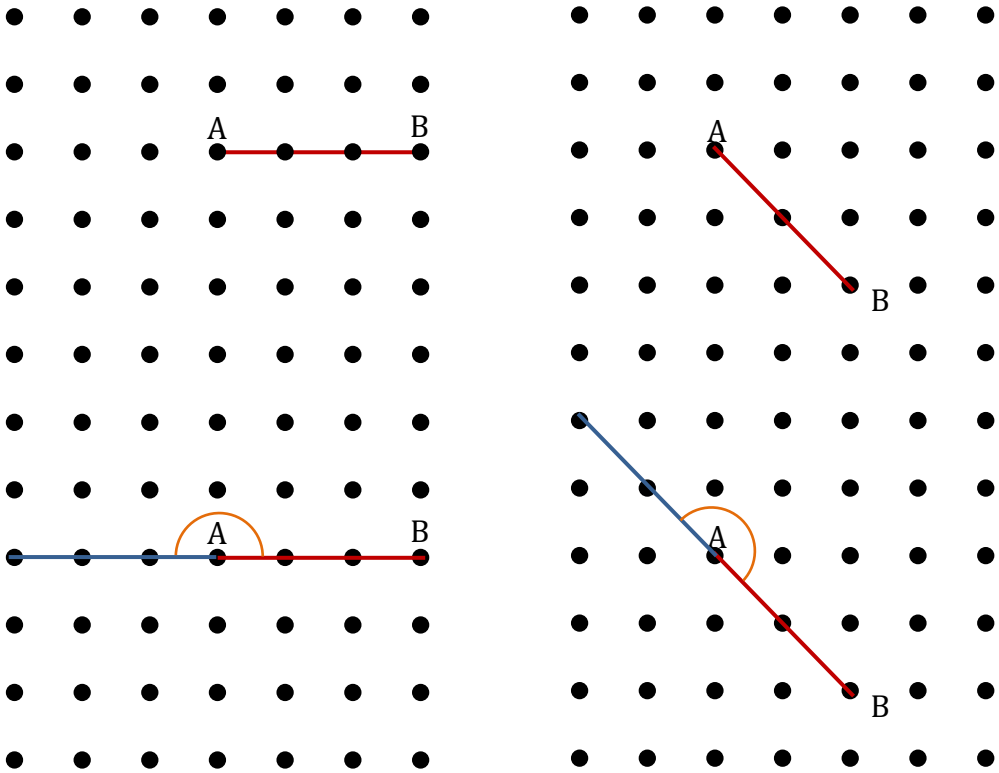
1. How many right angles do the windows of your classroom contain? Do you see other right angles in your classroom?

Sol. A window has 4 right angles. ∠1, ∠2, ∠3 and ∠4.
Yes, Other right angles can be found at the corners of door or at the corners of blackboard etc.

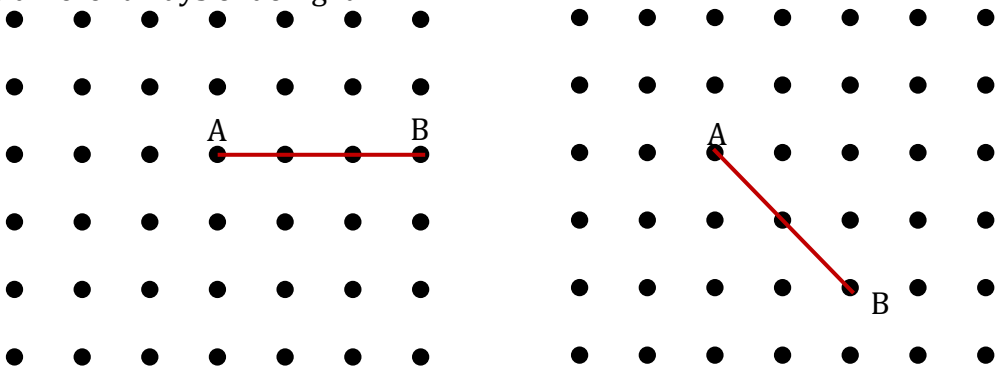


2. Join A to other grid points in the figure by a straight line to get a straight angle. What are all the different ways of doing it?

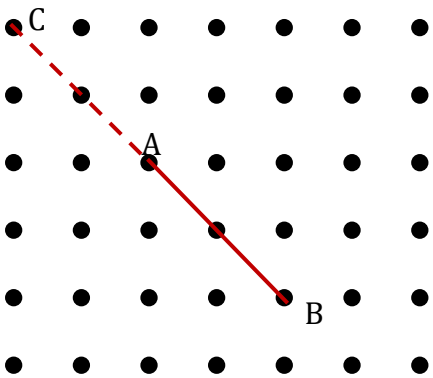
Sol.



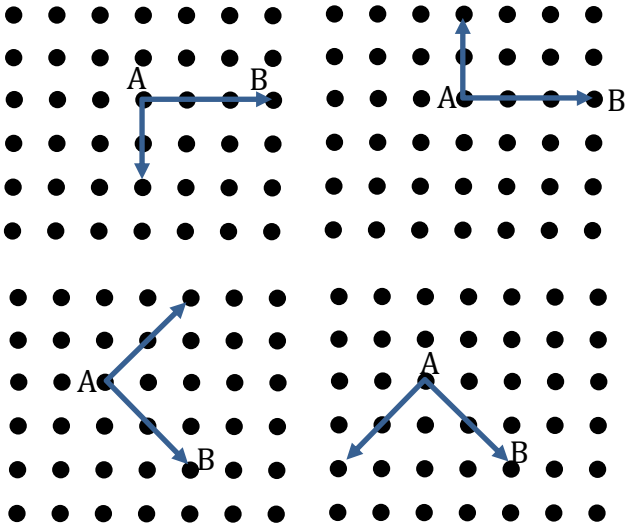
3. Now join A to other grid points in the figure by a straight line to get a right angle. What are all the different ways of doing it?



Hint: Extend the line further as shown in the figure below. To get a right angle at A, we need to draw a line through it that divides the straight angle CAB into two equal parts.



Sol.

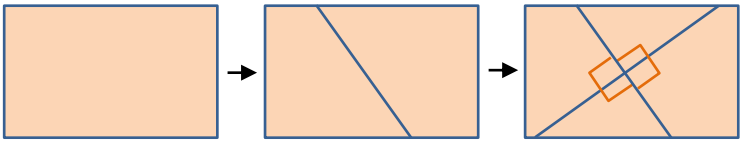


4. Get a slanting crease on the paper. Now, try to get another crease that is perpendicular to the slanting crease.

a. How many right angles do you have now? Justify why the angles are exact right angles.

b. Describe how you folded the paper so that any other person who doesn't know the process can simply follow your description to get the right angle.

Sol. We can fold the paper as shown in the figure.

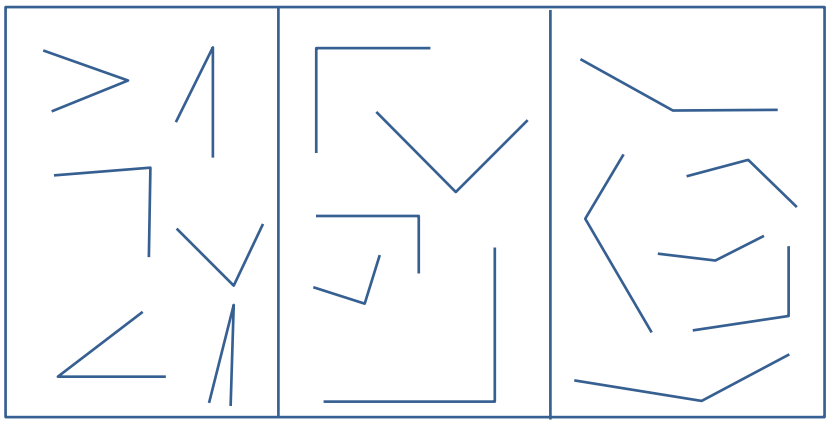


a. We get 4 right angles. Angle formed at any point and one side of a line is always a straight angle. The perpendicular drawn by the second crease through the vertex of a straight angle bisect it into two right angles.

b. We first fold the paper to get a slanting crease and then fold again the paper in such a way that a part of the slanting crease falls on the other part of itself. Doing it carefully, we get another slanting line which is perpendicular to the first one. Thus, we get 4 right angles at the meeting point of the two lines as shown in the figure.

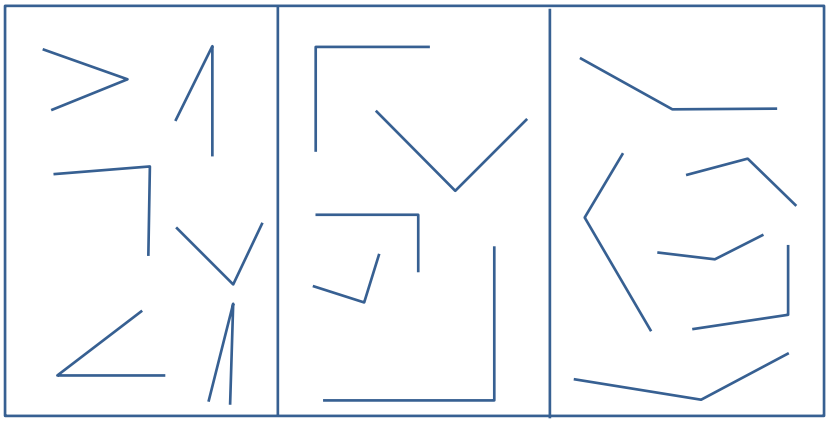
2.8 SPECIAL TYPES OF ANGLES

1.



Identify acute, right, obtuse and straight angles in the previous figures.

Sol. **Acute angle** **Right angle** **Obtuse angle**

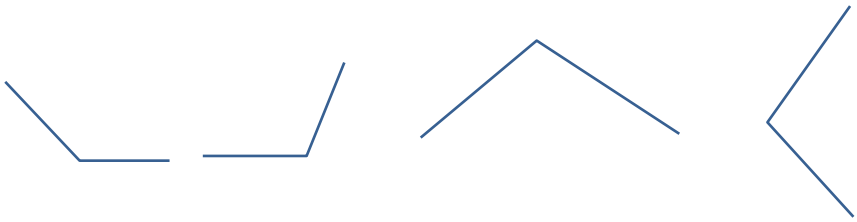


No straight angles are present in the given figures.

2. Make a few acute angles and a few obtuse angles. Draw them in different orientations.

Sol. Acute angles:

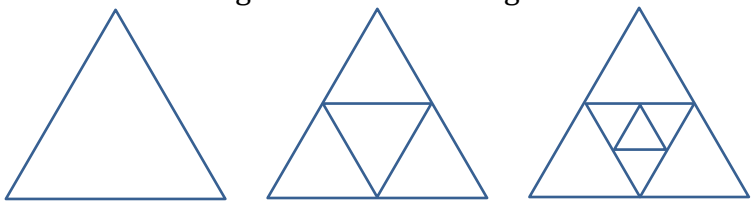
Obtuse angles:



3. Do you know what the words acute and obtuse mean? Acute means sharp and obtuse means blunt. Why do you think these words have been chosen?

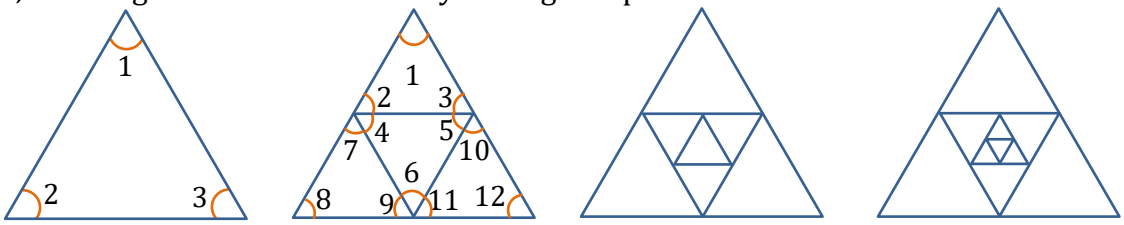
Sol. Acute means 'very sharp' . These angles are less than a right angle. At the vertex, the arms form a narrow, sharp opening resembling a pointed tip. Hence, "acute" (sharp) is used.
Obtuse means not sharp or dull. These angles are greater than a right angle. At the vertex, the arms form a wide, blunt opening, resembling a dull edge. Hence, "Obtuse" (blunt) is used.

4. Find out the number of acute angles in each of the figures below.



What will be the next figure and how many acute angles will it have? Do you notice any pattern in the numbers?

Sol. Yes, there is a pattern in numbers. That there is difference of 9 in two consecutives numbers. So, we can get the next number by adding 9 to previous number.



3 acute angles | 12 acute angles | 21 acute angles | 30 acute angles

2.9 MEASURING ANGLES

1. Write the measures of the following angles:

(a) ∠KAL,

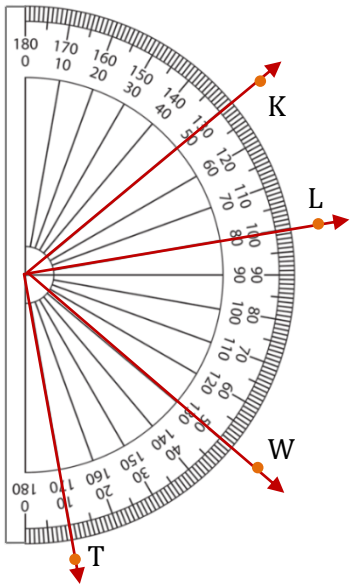
Notice that the vertex of this angle coincides with the centre of the protractor. So the number of units of 1 degree angle between KA and AL gives the measure of ∠KAL.

By counting, we get ∠KAL = 30°.

Making use of the medium sized and large sized marks, is it possible to count the number of units in 5s or 10s?

(b) ∠WAL

(c) ∠TAK



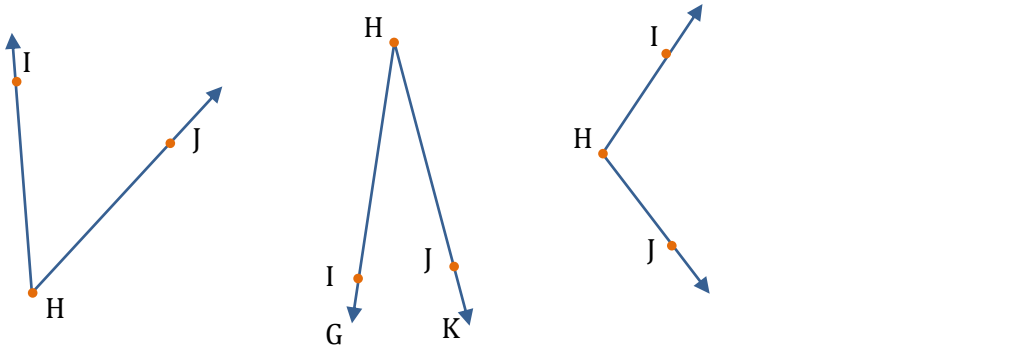
Sol. (a) ∠KAL = 3 × 10° = 30°

(b) ∠WAL = 5 × 10° = 50°

(c) ∠TAK = 12 × 10° = 120°

2.9 MEASURING ANGLES

1. Find the degree measures of the following angles using your protractor.

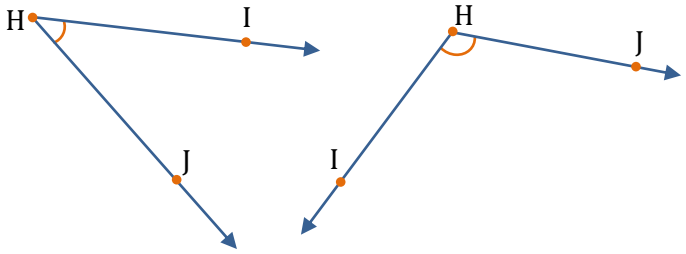


Sol. (a) ∠IHJ = 47°
(b) ∠IHJ = 24°
(c) ∠IHJ = 110°

2. Find the degree measures of different angles in your classroom using your protractor.

Sol. Angle formed at corner of blackboard = 90°, Angle formed at corner of desk = 90°

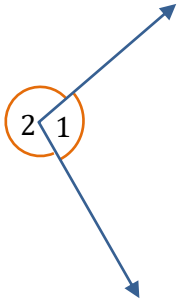
3. Find the degree measures for the angles given below. Check if your paper protractor can be used here!



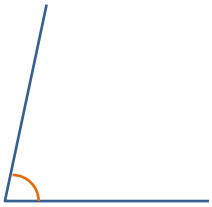
Sol. (a) ∠IHJ = 42°
(b) ∠IHJ = 116°

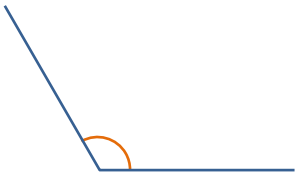
4. How can you find the degree measure of the angle given below using a protractor?

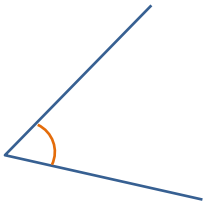
Sol. We can measure ∠1 = 100° using protractor and subtract it from 360° to find the the measure of ∠2 = 360° – 100° = 260°

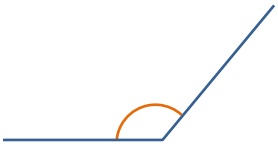


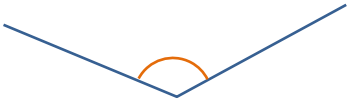
5. Measure and write the degree measures for each of the following angles:

a. 

b. 

c. 

d. 

e. 

f. 

Sol. (a) Measure of given angle is 80°

(b) Measure of given angle is 120°

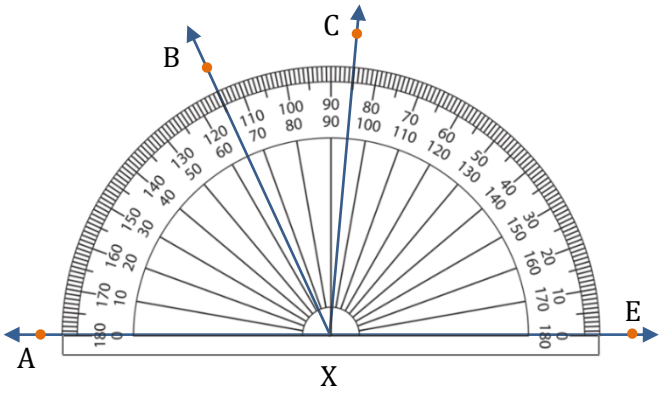
(c) Measure of given angle is 60°

(d) Measure of given angle is 130°

(e) Measure of given angle is 128°

(f) Measure of given angle is 61°

6. Find the degree measures of ∠BXE, ∠CXE, ∠AXB and ∠BXC.



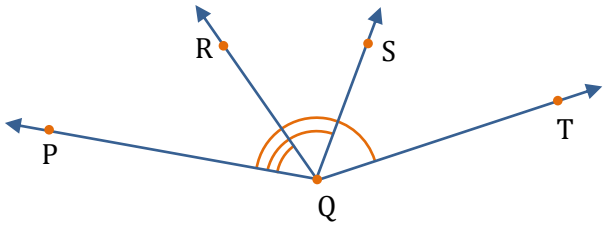
Sol. (a) ∠BXE = 115°

(b) ∠CXE = 85°

(c) ∠AXB = 65°

(d) ∠BXC = 30°

7. Find the degree measures of ∠PQR, ∠PQS and ∠PQT.

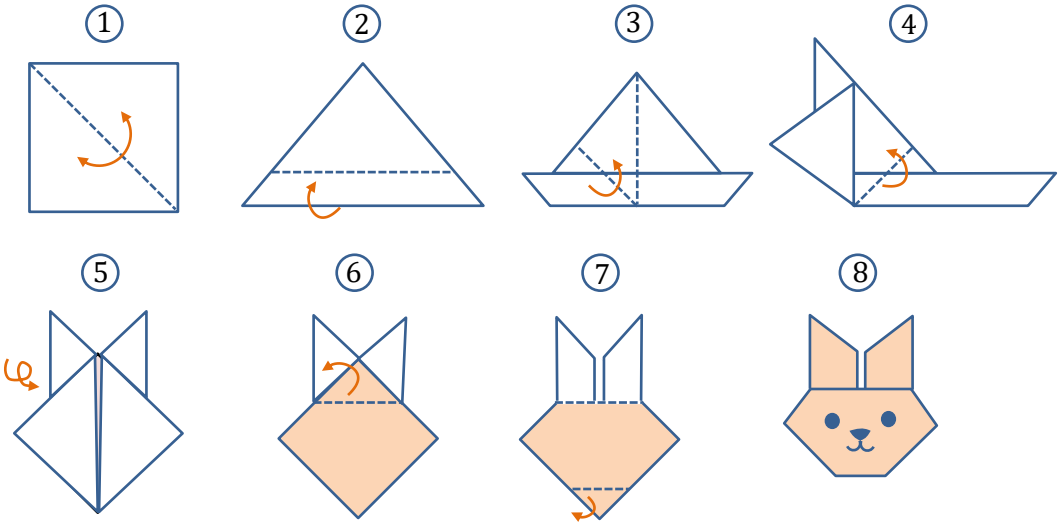


Sol. (a) ∠PQR = 45°

(b) ∠PQS = 100°

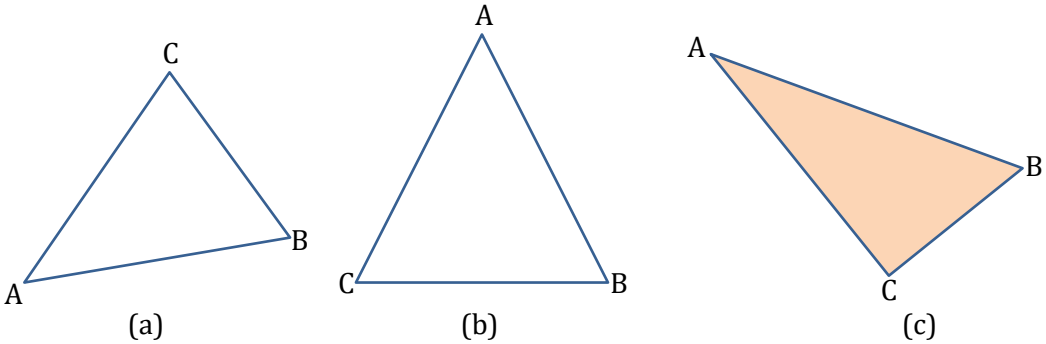
(c) ∠PQT = 150°

8. Make the paper craft as per the given instructions. Then, unfold and open the paper fully. Draw lines on the creases made and measure the angles formed.

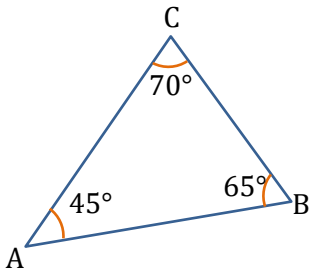


Sol. Do it yourself

9. Measure all three angles of the triangle shown in Fig. 2.21 (a), and write the measures down near the respective angles. Now add up the three measures. What do you get? Do the same for the triangles in Fig. 2.21 (b) and (c). Try it for other triangles as well, and then make a conjecture for what happens in general! We will come back to why this happens in a later year.

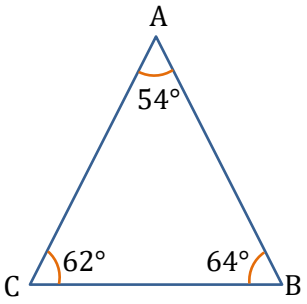


Sol. **(a)**



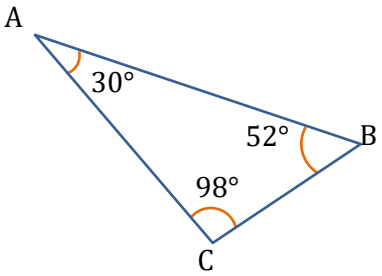
$45° + 65° + 70° = 180°$

(b)



$54° + 62° + 64° = 180°$

(c)



$30° + 52° + 98° = 180°$

In general, we observe that sum of all angles of a triangle is 180°.

2.9 MEASURING ANGLES

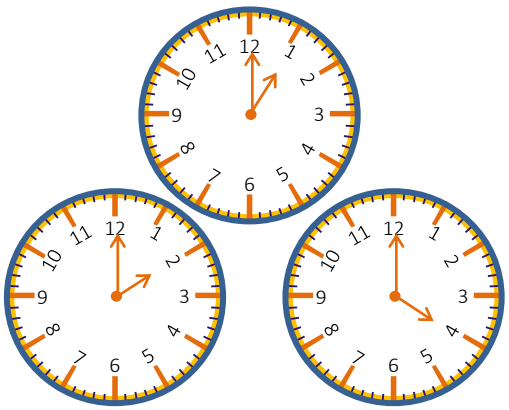
Where are the angles?

1. Angles in a clock:

a. The hands of a clock make different angles at different times. At 1 o'clock, the angle between the hands is 30°. Why?

b. What will be the angle at 2 o'clock? And at 4 o'clock? 6 o'clock?

c. Explore other angles made by the hands of a clock.



Sol. a. There are 12 numbers on a clock representing 12 hours. The total angle covered in 12 hours is 360° .

So, the angle between two successive numbers = $\frac{360°}{12}$ = 30°

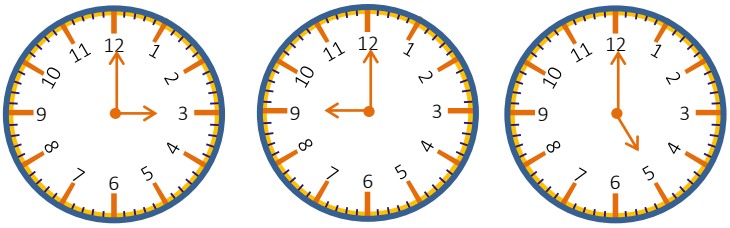
That is why at 1 o'clock, the angle between the hands is 30°.

b. The angle at 2 o'clock = 2 × 30° = 60°

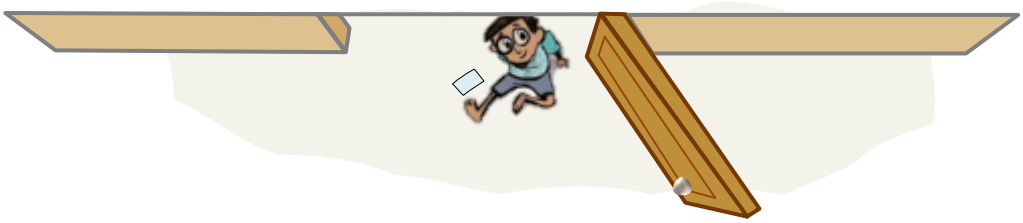
The angle at 4 o'clock = 4 × 30° = 120°

The angle at 6 o'clock = 6 × 30° = 180°

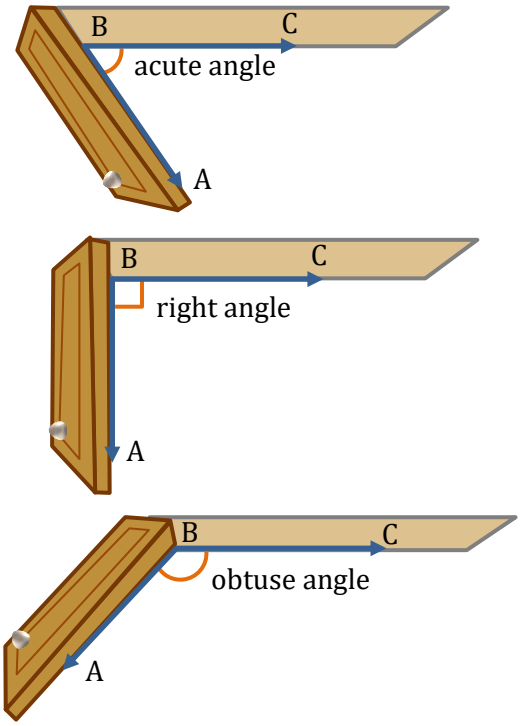
c. The other angle made by hands



2. The angle of a door: Is it possible to express the amount by which a door is opened using an angle? What will be the vertex of the angle and what will be the arms of the angle?



Sol. Yes, It is Possible.



Here, vertex is B and arms are BA and BC.

3. Vidya is enjoying her time on the swing. She notices that the greater the angle with which she starts the swinging, the greater is the speed she achieves on her swing. But where is the angle? Are you able to see any angle?

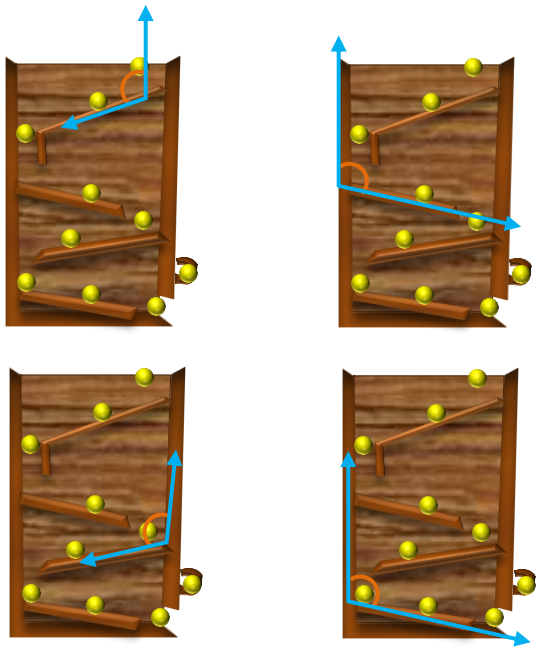
Sol. Yes, an angle can be seen.

4. Here is a toy with slanting slabs attached to its sides; the greater the angles or slopes of the slabs, the faster the balls roll. Can angles be used to describe the slopes of the slabs? What are the arms of each angle? Which arm is visible and which is not?

Sol. Yes, angles can be used to describe the slope of the slabs.

Greater the angle, Greater the slope.

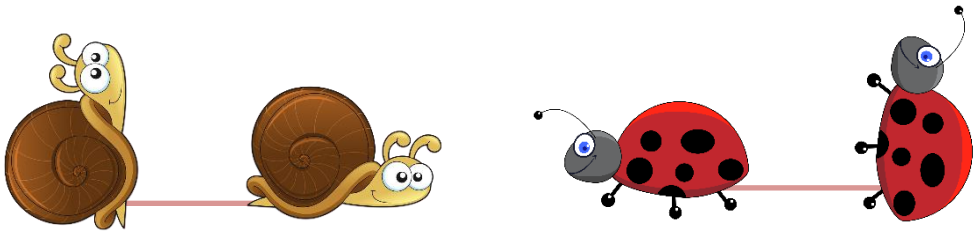
For Each angle one arm is a side and one arm is the slope.



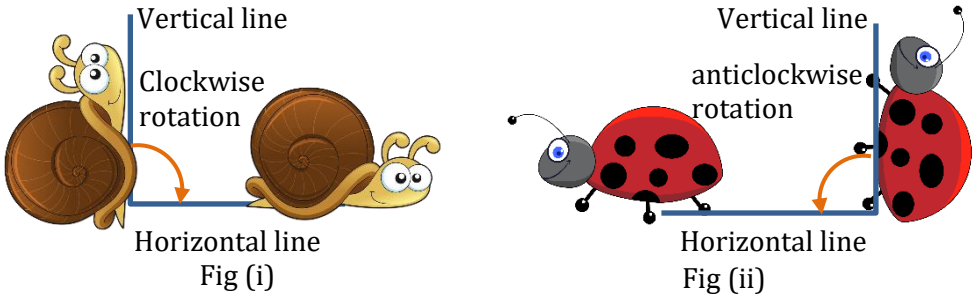
The vertical arm is not visible whereas the other arm is visible.

5. Observe the images below where there is an insect and its rotated version. Can angles be used to describe the amount of rotation? How? What will be the arms of the angle and the vertex?

Hint: Observe the horizontal line touching the insects.



Sol. Observe the vertical and horizontal lines touching the insects. The rotation from vertical to horizontal position makes an angle. We can imagine the meeting point of the two lines as the vertex, and these two lines as arms of the angle as shown in the picture.



In the figure (i) given above, the insect is rotated through an angle of 90° in the clockwise direction and in the figure (ii), the insect is rotated through an angle of 90° in the anti-clockwise direction.

2.10 DRAWING ANGLES

1. In Fig. 2.23, list all the angles possible. Did you find them all? Now, guess the measures of all the angles. Then, measure the angles with a protractor. Record all your numbers in a table. See how close your guesses are to the actual measures.

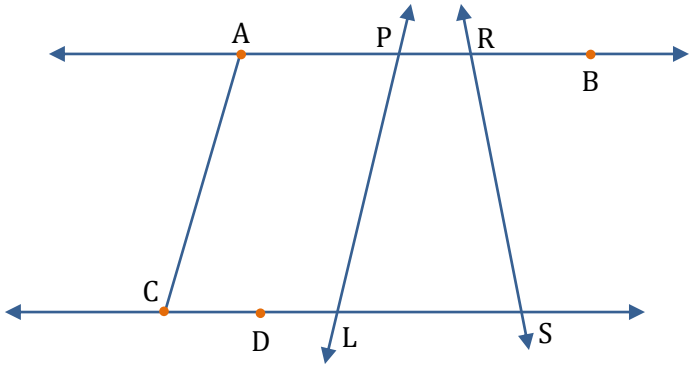


Fig. 2.23

Sol. **List of Angles:**

∠PAC, ∠ACD, ∠CDL, ∠DLP, ∠APL, ∠LPR, ∠PLS, ∠LSR, ∠PRS, ∠BRS

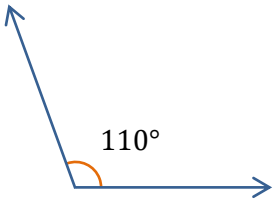
Name of Angles	Estimated measure of Angles	Actual measures of Angles
∠PAC	105°	107°
∠ACD	65°	72°
∠CDL	180°	180°
∠DLP	100°	98°
∠LPR	100°	98°
∠PLS	80°	82°
∠LSR	70°	79°
∠PRS	100°	101°
∠BRS	80°	79°
∠APL	75°	76°

2. Use a protractor to draw angles having the following degree measures:

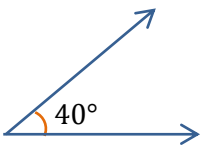
(a) 110° (b) 40° (c) 75° (d) 112°

(e) 134°

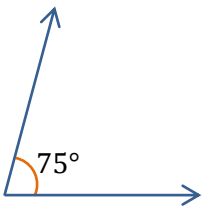
Sol. (a)



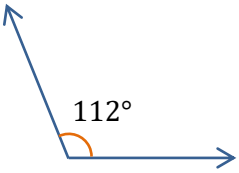
(b)



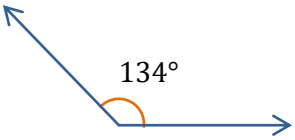
(c)



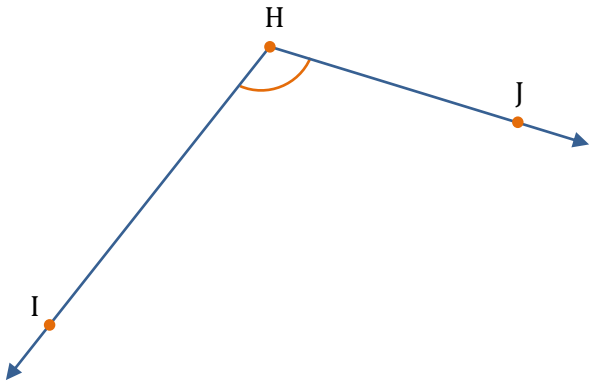
(d)



(e)



3. Draw an angle whose degree measure is the same as the angle given below:



Also, write down the steps you followed to draw the angle.

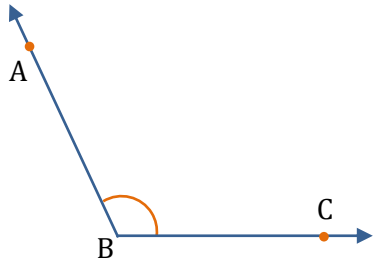
Sol. **Step 1:** Measure The Given Angle ($\angle IHJ = 115°$)

Step 2: Draw the horizontal ray $\overrightarrow{BC}$.

Step 3: Using protractor, place the centre of protractor on B and align $\overrightarrow{BC}$ to the zero line.

Step 4: Starting from 0° count up to 115° and mark a point A at the label 115°.

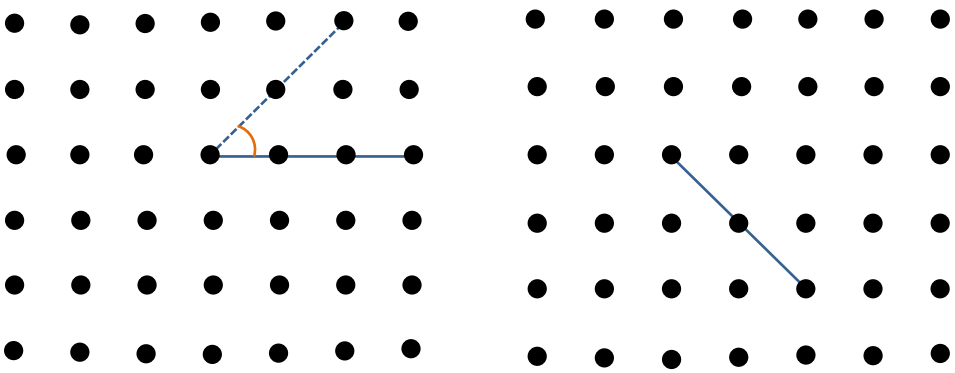
Step 5: Using a ruler join the point B and A Hence, $\angle ABC = 115°$.



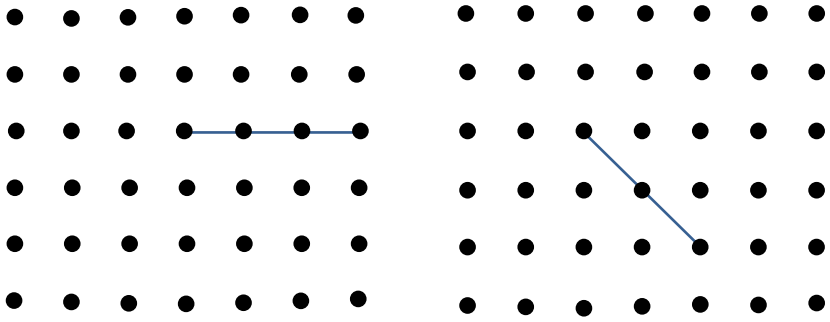
2.11 TYPES OF ANGLES AND THEIR MEASURES

1. In each of the below grids, join A to other grid points in the figure by a straight line to get:

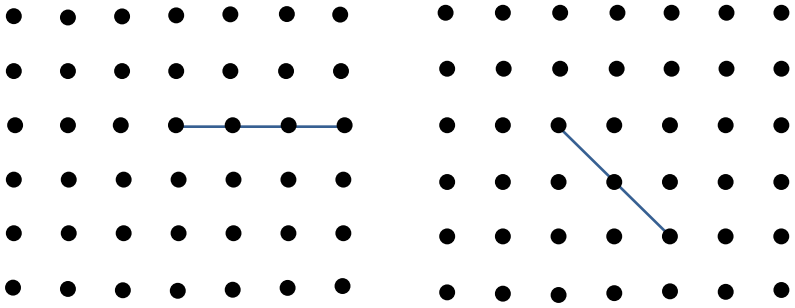
(a) An acute angle



(b) An obtuse angle

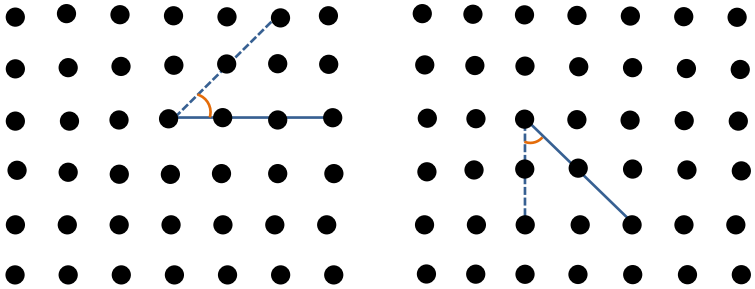


(c) A reflex angle

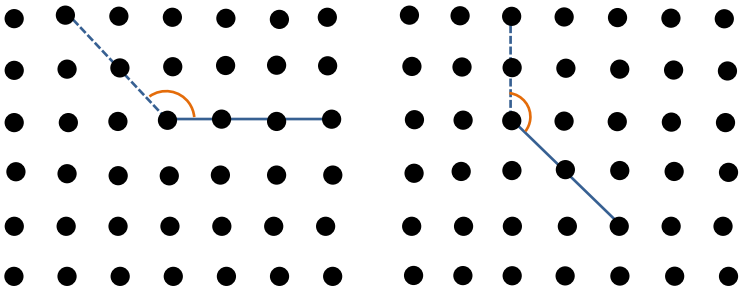


Mark the intended angles with curves to specify the angles. One has been done for you.

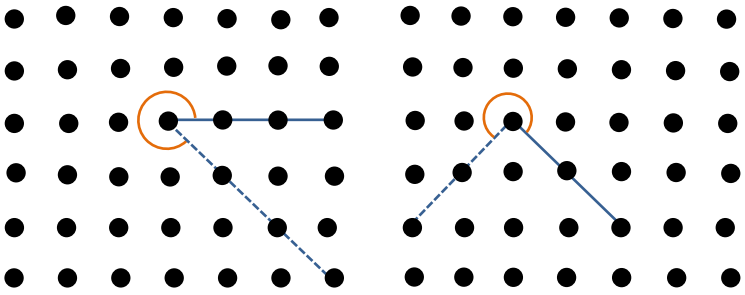
Sol. (a)



(b)

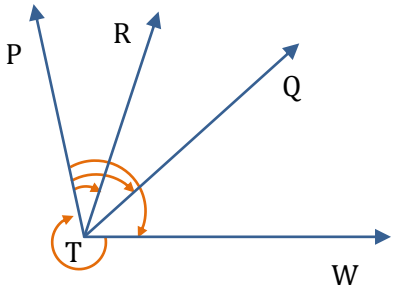


(c)



2. Use a protractor to find the measure of each angle. Then classify each angle as acute, obtuse, right, or reflex.

(a) ∠PTR (b) ∠PTQ (c) ∠PTW (d) ∠WTP



Sol. Using a protractor, we find the measure of each angle and then classify each angle as follows:

(a) ∠PTR = 31°, Acute angle

(b) ∠PTQ = 60°, Acute angle

(c) ∠PTW = 104°, Obtuse angle

(d) ∠WTP = 360° – 104° = 256°, Reflex angle.

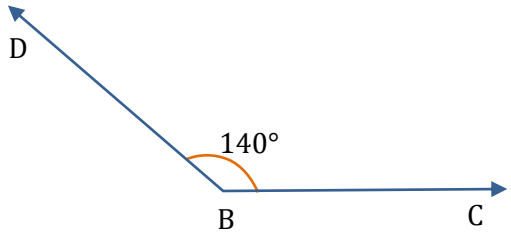
2.11 TYPES OF ANGLES AND THEIR MEASURES

1. Draw angles with the following degree measures:

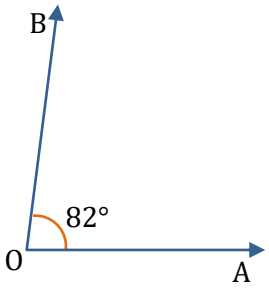
(a) 140° (b) 82° (c) 195° (d) 70°

(e) 35°

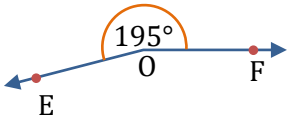
Sol. (a)



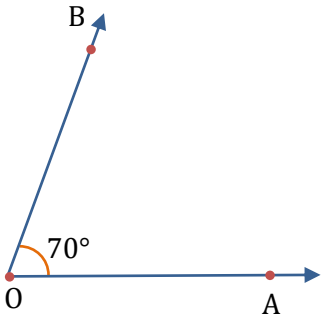
(b)



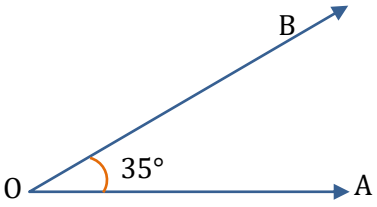
(c)



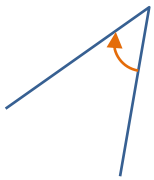
(d)

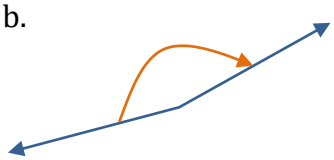


(e)

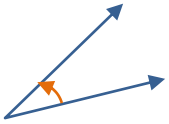


2. Estimate the size of each angle and then measure it with a protractor:

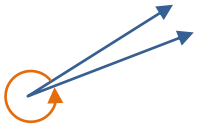
a. 

b. 

c. 

d. 

e. 

f. 

Classify these angles as acute, right, obtuse or reflex angles.

Sol. (a) 45° Acute angle

(b) 165° Obtuse angle

(c) 120° Obtuse angle

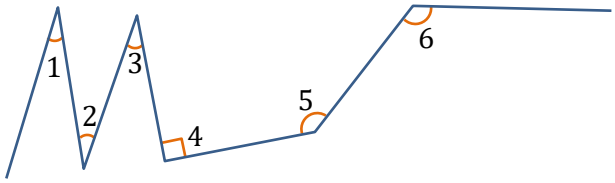
(d) 30° Acute angle

(e) 95° Obtuse angle

(f) 350° Reflex angle

3. Make any figure with three acute angles, one right angle and two obtuse angles.

Sol.

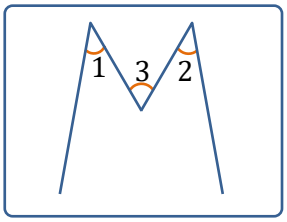


In the figure given above, angles marked as ∠1, ∠2 and ∠3 are acute angles (i.e. angles less than 90°) whereas angle marked as ∠4 is right angle.

Angles marked as ∠5 and ∠6 are obtuse angles (i.e. greater than 90°).

4. Draw the letter 'M' such that the angles on the sides are 40° each and the angle in the middle is 60°.

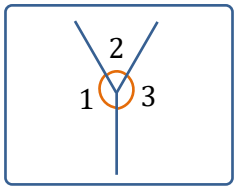
Sol.



∠1 = 40°, ∠2 = 40°, ∠3 = 60°

5. Draw the letter 'Y' such that the three angles formed are 150°, 60° and 150°.

Sol.



$\angle 1=150°, \angle 2=60°, \angle 3=150°$

6. The Ashoka Chakra has 24 spokes. What is the degree measure of the angle between two spokes next to each other? What is the largest acute angle formed between two spokes?

Sol. Angle between two consecutive spokes = $\frac{360°}{24}$ = 15°

Largest acute angle = 5 × 15° = 75°

7. Puzzle: I am an acute angle. If you double my measure, you get an acute angle. If you triple my measure, you will get an acute angle again. If you quadruple (four times) my measure, you will get an acute angle yet again! But if you multiply my measure by 5, you will get an obtuse angle measure. What are the possibilities for my measure?

Sol. As acute angle is the angle which is less than 90° whereas obtuse angle is the angle greater than 90°.

We have to find the acute angle such that:

4 times of angle < 90° and 5 times of angle > 90°

Angle can be: 19°, 20°, 21°, 22°