CHAPTER 5

Understanding Elementary Shapes

Understanding the Lesson

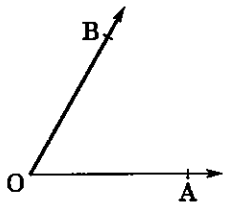
- Measure of a line segment.
- Comparison of two line segments
  — by observation
  — by tracing
  — using ruler and divider
- Measure of angles
  — acute, obtuse, right, straight, reflex, complete and zero angle.
- Measure of angles using protractor.
- Classification of triangles
  — scalene triangle, right angled triangle, isosceles triangle and equilateral triangle.
- Types of quadrilateral
  — rectangles, squares, parallelograms and trapezium
- Simple polygons (Regular and irregular both up to octagon).
- 3-D shapes; cubes, cuboids, cylinders, spheres, cones, prisms and pyramids.
- Elements of 3-D; faces, edges and vertices.
- Nets of cubes, cuboids, cylinders, cones and tetrahedron.

Conceptual Facts

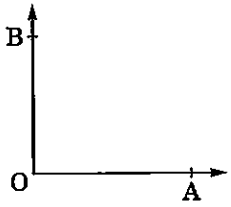
- The distance between the end points of a line segment is called its length.
- The length of a line segment is measured by graduated ruler.
- The length of two line segments is compared by the divider.
- An angle is formed by two arms (rays) with the same initial point.
- An angle is measured in 'degrees'.
- An angle is measured by 'protractor'.
- Measure of one complete angle is 360°.
- Measure of straight angle is 180°.
- Measure of right angle is 90°.
- An angle less than 90° is called acute angle.
- An angle more than 90° but less than 180° is called obtuse angle.
- An angle greater than straight angle is called 'reflex' angle.
- Two lines are said to be perpendicular to each other if the angle between them is 90°.
- Two lines are parallel if they do not intersect each other even on producing to any extent.
- Types of triangle on the basis of sides:
  — Scalene: all the three sides are unequal in length.
  — Isosceles: any two sides are equal in length.
  — Equilateral: all the three sides are equal in length.

- Types of triangle on the basis of angles:
  - — Acute triangle: each angles is less than 90° (acute)
  - — Right angled triangle: one of the three angles is (90°)
  - — Obtuse angled triangle : one of the three angle is more than 90°.
- Polygon is a closed figure bounded by a certain number of line segments:
  - — Triangle: bounded by 3 sides.
  - — Quadrilateral: bounded by 4 sides.
  - — Pentagon: bounded by 5 sides.
  - — Hexagon: bounded by 6 sides.
  - — Heptagon: bounded by 7 sides.
  - — Octagon: bounded by 8 sides.
- Types of quadrilateral:
  - — Parallelogram: Pair of opposite sides are equal and parallel.
  - — Square: each angle is 90° and all sides are equal.
  - — Rectangle: each angle is 90° and opposite sides are equal.
  - — Rhombus: a parallelogram with all equal sides.
  - — Trapezium: a pair of opposite sides are parallel.
  - — 3-D shapes: faces, edges and vertices are the elements of 3-D figures.

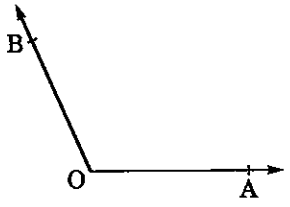
Some Important Figures



(*i*) Acute angle

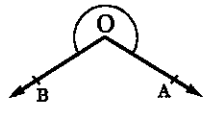


(*ii*) Right angle

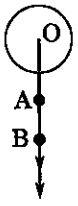


(*iii*) Obtuse angle

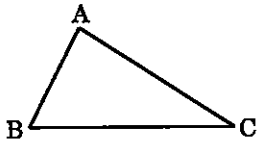
(*iv*) Straight angle



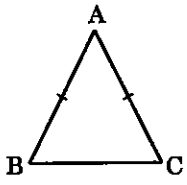
(*v*) Reflex angle



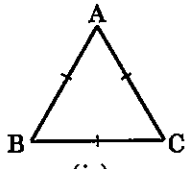
(*vi*) Complete angle



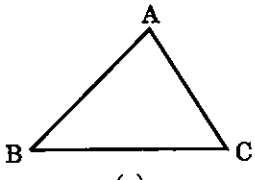
(*vii*) Scalene triangle



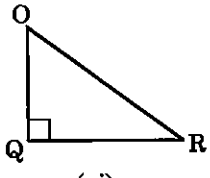
(*viii*) Isosceles triangle



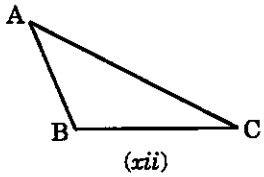
(*ix*) Equilateral triangle



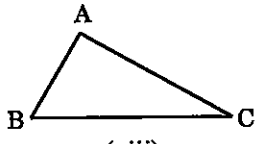
(*x*) Acute triangle



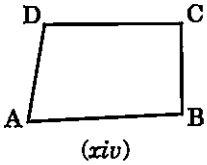
(*xi*) Right angled triangle



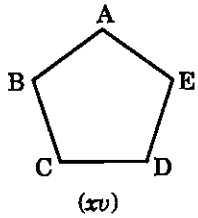
(*xii*) Obtuse angled triangle



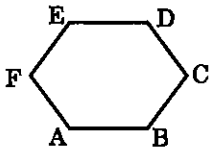
(*xiii*) 3-sided polygon



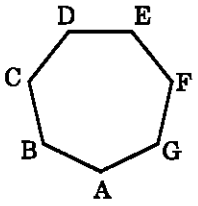
(*xiv*) Four sided polygon (quadrilateral)



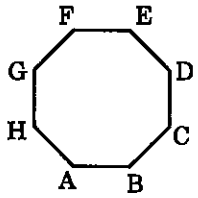
(*xv*) 5-sided polygon (pentagon)



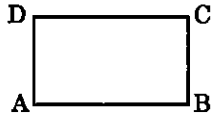
(*xvi*)
6-sided polygon
(hexagon)



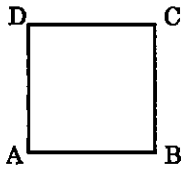
(*xvii*)
7-sided polygon
(septagon)



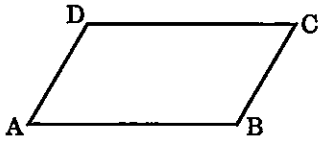
(*xviii*)
8-sided polygon
(octagon)



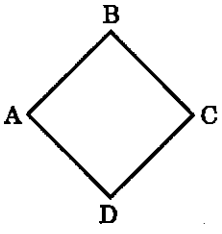
(*xix*)
Rectangle



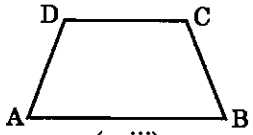
(*xx*)
Square



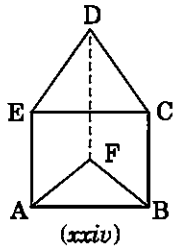
(*xxi*)
Parallelogram



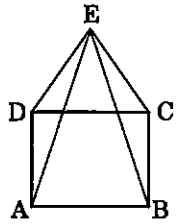
(*xxii*)
Rhombus



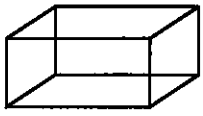
(*xxiii*)
Trapezium



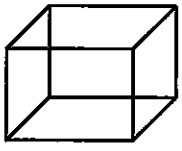
(*xxiv*)
Prism



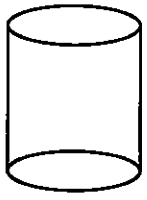
(*xxv*)
Pyramid



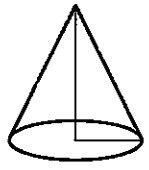
(*xxvi*)
Cuboid



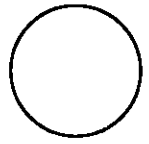
(*xxvii*)
Cube



(*xxviii*)
Cylinder



(*xxix*)
Cone



(*xxx*)
Sphere

TRY THESE (*PAGE 88*)

Q1. Take any post card. Use the above technique to measure its two adjacent sides.

Sol. We have a post card shown in the adjoining figure.

The measurement of its adjacent sides are 6.7 cm and 4.8 cm.

Q2. Select any three objects having a flat top. Measure all sides of the top using a divider and ruler.

Sol. We have taken the following figure with flat top.

(*i*) Mathematics Book: 24 cm, 14 cm.

(*ii*) TV table: 78 cm, 40 cm.

(*iii*) Mobile phone: 12 cm, 5 cm.

EXERCISE 5.1

Q1. What is the disadvantage in comparing line segment by metre observation?

Sol. Comparing the lengths of two line segments simply by 'observation' may not be accurate. So we use divider to compare the length of the given line segments.

Q2. Why is it better to use a divider than a ruler, while measuring the length of a line segment?

Sol. Measuring the length of a line segment using a ruler, we may have the following errors:

(*i*) Thickness of the ruler

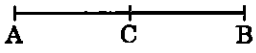
(*ii*) Angular viewing

These errors can be eradicated by using the divider. So, it is better to use a divider than a ruler, while measuring the length of a line segment.

Q3. Draw any line segment, say $\overline{AB}$. Take any point C lying in between A and B. Measure the lengths of AB, BC and AC. Is AB = AC + CB?

[**Note:** If A, B, C are any three points on a line such AC + CB = AB, then we can be sure that C lies between A and B]

Sol. Let us consider



A, B and C such that C lies between A and B and AB = 7 cm.

AC = 3 cm, CB = 4 cm.

$\therefore$ AC + CB = 3 cm + 4 cm = 7 cm.

But, AB = 7 cm.

So, AB = AC + CB.

Q4. If A, B, C are three points on a line such that AB = 5 cm, BC = 3 cm and AC = 8 cm, which one of them lies between the other two?

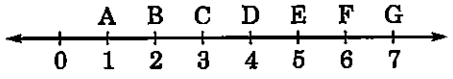
Sol. We have, AB = 5 cm; BC = 3 cm

$\therefore$ AB + BC = 5 + 3 = 8 cm

But, AC = 8 cm

Hence, B lies between A and C.

Q5. Verify, whether D is the mid point of $\overline{AG}$.



Sol. From the given figure, we have

AG = 7 cm − 1 cm = 6 cm

AD = 4 cm − 1 cm = 3 cm

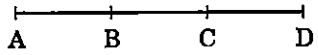
and DG = 7 cm − 4 cm = 3 cm

$\therefore$ AG = AD + DG.

Hence, D is the mid point of $\overline{AG}$.

Q6. If B is the mid point of $\overline{AC}$ and C is the mid point of $\overline{BD}$, where A, B, C, D lie on a straight line, say why AB = CD?

Sol. We have



B is the mid point of $\overline{AC}$.

$\therefore$ AB = BC ...(*i*)

C is the mid-point of $\overline{BD}$.

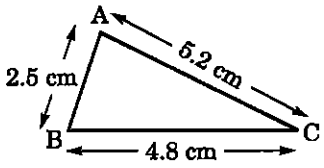
$\therefore$ BC = CD ...(*ii*)

From Eq. (*i*) and (*ii*), we have

AB = CD

Q7. Draw five triangles and measure their sides. Check in each case, if the sum of the length of any two sides is always less than the third side.

Sol. Case I. In ΔABC,



Let AB = 2.5 cm

BC = 4.8 cm

and AC = 5.2 cm

AB + BC = 2.5 cm + 4.8 cm

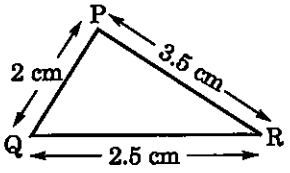
= 7.3 cm

Since, 7.3 > 5.2

So, AB + BC > AC

Hence, sum of any two sides of a triangle is greater than the third side.

Case II. In ΔPQR,



Let PQ = 2 cm

QR = 2.5 cm

and PR = 3.5 cm

PQ + QR = 2 cm + 2.5 cm

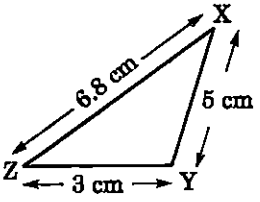
= 4.5 cm

Since, 4.5 > 3.5

So, PQ + QR > PR

Hence, sum of any two sides of a triangle is greater than the third side.

Case III. In ΔXYZ,



Let XY = 5 cm

YZ = 3 cm

and ZX = 6.8 cm

XY + YZ = 5 cm + 3 cm

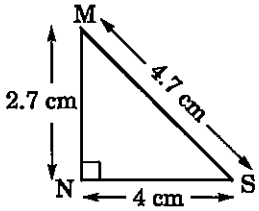
= 8 cm

Since, 8 > 6.8

So, XY + YZ > ZX

Hence, the sum of any two sides of a triangle is greater than the third side.

Case IV. In ΔMNS,



Let $MN = 2.7$ cm

$NS = 4$ cm

and $MS = 4.7$ cm

$MN + NS = 2.7 \text{ cm} + 4 \text{ cm}$

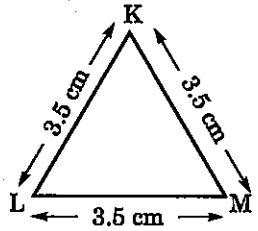
$= 6.7$ cm

Since, $6.7 > 4.7$

So, $MN + NS > MS$

Hence, the sum of any two sides of a triangle is greater than the third side.

Case V. In ΔKLM,



Let $KL = 3.5$ cm

$LM = 3.5$ cm

and $KM = 3.5$ cm

$KL + LM = 3.5 \text{ cm} + 3.5 \text{ cm} = 7 \text{ cm}$

Since, $7 \text{ cm} > 3.5 \text{ cm}$

So, $KL + LM > KM$

Hence, the sum of any two sides of a triangle is greater than the third side.

Hence, we conclude that the sum of any two sides of a triangle is never less than the third side.

Try These (*Page 91*)

Q1. What is the angle name for half a revolution?

Sol. We know that,

1 Complete angle *i.e.*, 2 straight angles = 1 revolution

$\therefore \quad \frac{1}{2}$ [2 straight angle]

$= \frac{1}{2} \times 1$ revolution

Hence, $\frac{1}{2}$ revolution = A straight angle.

Q2. What is the angle name for one-fourth revolution?

Sol. We know that

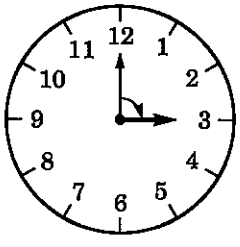
4 right angles = 1 revolution

$\therefore$ One right angle = $\frac{1}{4}$ revolution .

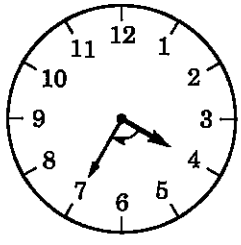
Hence $\frac{1}{4}$ revolution = one right angle.

Q3. Draw five other situation of one-fourth, half and three-fourth revolution on a clock.

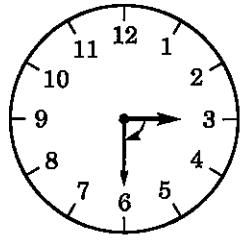
Sol. (*i*) For one-fourth revolution, we have



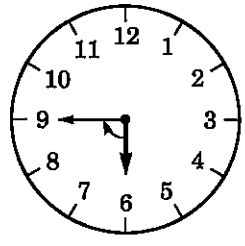
(*a*) From 12 to 3



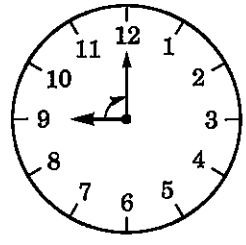
(*b*) From 4 to 7



(*c*) From 3 to 6

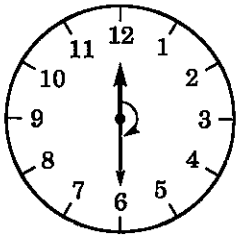


(*d*) From 6 to 9

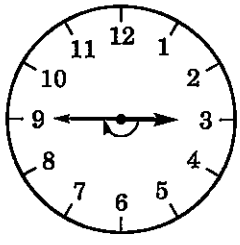


(*e*) From 9 to 12

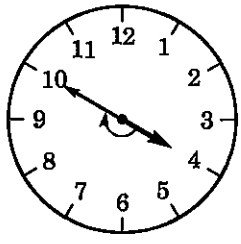
(*ii*) For half revolution, we have



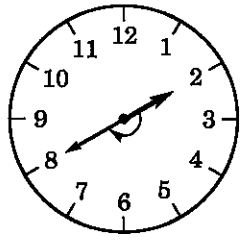
(*a*) From 12 to 6



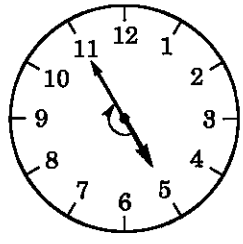
(*b*) From 3 to 9



(*c*) From 4 to 10

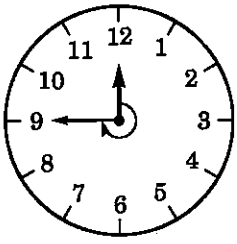


(*d*) From 2 to 8

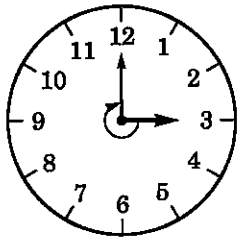


(*e*) From 5 to 11

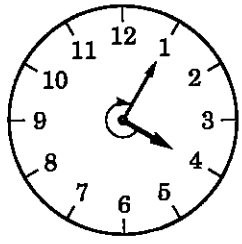
(*iii*) For three-fourth revolution, we have



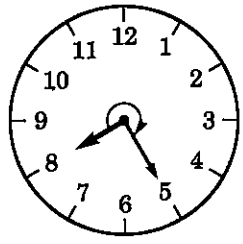
(*a*)
From 12 to 9



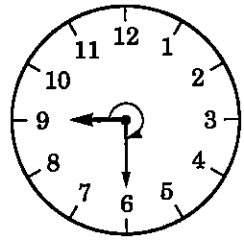
(*b*)
From 3 to 12



(*c*)
From 4 to 1



(*d*)
From 8 to 5



(*e*)
From 9 to 6

EXERCISE 5.2

Q1. What fraction of a clockwise revolution does the hour hand of a clock turn through, when it goes from

(*a*) 3 to 9 (*b*) 4 to 7 (*c*) 7 to 10

(*d*) 12 to 9 (*e*) 1 to 10 (*f*) 6 to 3

Sol. (*a*) 3 to 9

$9 - 3 = 6 \div 12 = \frac{1}{2}$ of a revolution

(*b*) 4 to 7

$7 - 4 = 3 \div 12 = \frac{1}{4}$ of a revolution

(*c*) 7 to 10

$10 - 7 = 3 \div 12 = \frac{1}{4}$ of a revolution

(*d*) 12 to 9 *i.e.*, 0 to 9

$9 - 0 = 9 \div 12 = \frac{3}{4}$ of a revolution

(*e*) 1 to 10

$10 - 1 = 9 \div 12 = \frac{3}{4}$ of a revolution

(*f*) 6 to 3 *i.e.*, 6 to 12 and then 12 to 3

6 to 12 = 12 – 6 = 6 and 12 to 3 = 0 to 3 = 3 – 0 = 3

$6 + 3 = 9 \div 12 = \frac{3}{4}$ of a revolution

Q2. Where will the hand of a clock stop if it

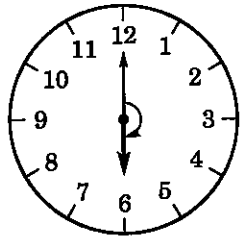
(*a*) starts at 12 and makes $\frac{1}{2}$ of a revolution, clockwise?

(*b*) starts at 2 and makes $\frac{1}{2}$ of a revolution, clockwise?

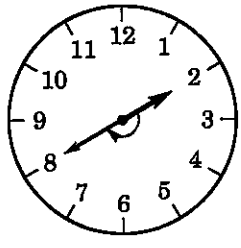
(*c*) starts at 5 and makes $\frac{1}{4}$ of a revolution, clockwise?

(*d*) starts at 5 and makes $\frac{3}{4}$ of a revolution, clockwise?

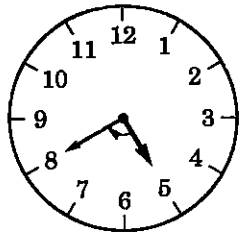
Sol. (*a*) Starting from 12 and making $\frac{1}{2}$ of a revolution, the clock hand stops at 6.



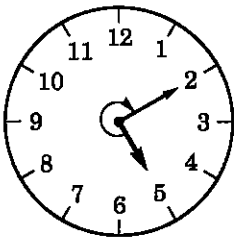
(*b*) Starting from 2 and making $\frac{1}{2}$ of a revolution, the clock hand stops at 8.



(*c*) Starting from 5 and making $\frac{1}{4}$ of a revolution, the clock hand stops at 8.



(*d*) Starting from 5 and making $\frac{3}{4}$ of a revolution, the clock hand stops at 2.



Q3. Which direction will you face if you start facing

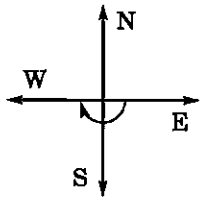
(*a*) east and make $\frac{1}{2}$ of a revolution clockwise?

(*b*) east and make $1\frac{1}{2}$ of a revolution clockwise?

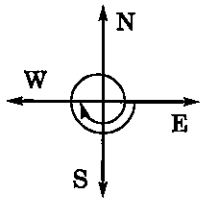
(*c*) west and make $\frac{3}{4}$ of a revolution anticlockwise?

(*d*) south and make one full revolution?
(Should we specify clockwise or anticlockwise for this last question? Why not?)

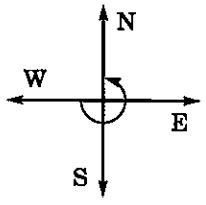
Sol.



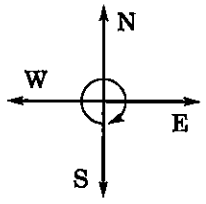
West
(*a*)



West
(*b*)



North
(*c*)



South
(*d*)

Taking one full revolution we will reach back to the original (starting) position. Therefore, it make no difference whether we turn clockwise or anticlockwise.

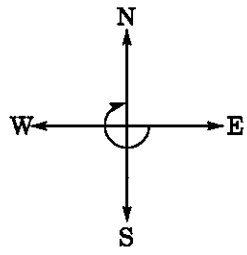
Q4. What part of a revolution have you turned through if you stand facing

(*a*) east and turn clockwise to face north?

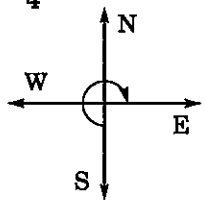
(*b*) south and turn clockwise to face east?

(*c*) west and turn clockwise to face east?

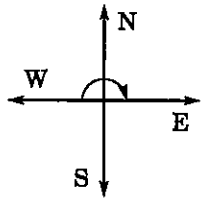
Sol. (*a*) If we start from east and reach at north (turning clockwise) $\frac{3}{4}$ of a revolution is required.



(*b*) If we start from south turning clockwise to face east, $\frac{3}{4}$ of a revolution is required.



(*c*) If we start from west turning clockwise to face east, $\frac{1}{2}$ of a revolution is required.



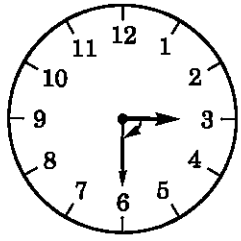
Q5. Find the number of right angles turned through by the hour hand of a clock when it goes from

(*a*) 3 to 6 (*b*) 2 to 8

(*c*) 5 to 11 (*d*) 10 to 1

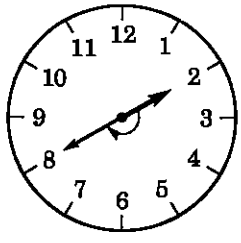
(*e*) 12 to 9 (*f*) 12 to 6

Sol. (*a*) 3 to 6



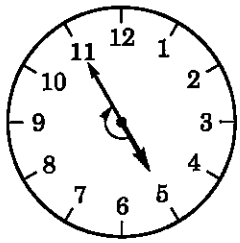
Starting from 3 to 6, the hour hand turns through 1 right angle.

(*b*) 2 to 8



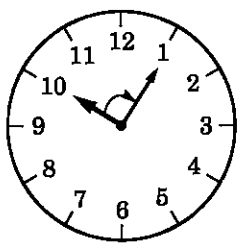
Starting from 2 to 8, the hour hand turns through 2 right angles.

(*c*) 5 to 11



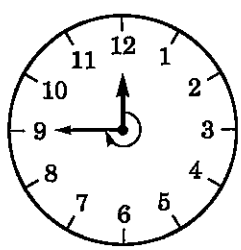
Starting from 5 to 11, the hour hand turns through 2 right angles.

(*d*) 10 to 1



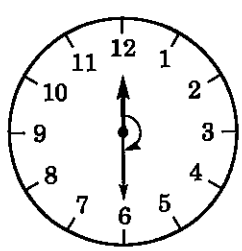
Starting from 10 to 1, the hour hand turns through 1 right angle.

(*e*) 12 to 9



Starting from 12 to 9, the hour hand turns through 3 right angles.

(*f*) 12 to 6



Starting from 12 to 6, the hour hand turns through 2 right angles.

Q6. How many right angles do you make if you start facing

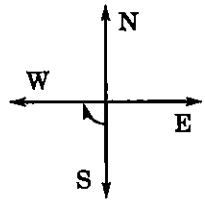
(*a*) south and turn clockwise to west?

(*b*) north and turn anticlockwise to east?

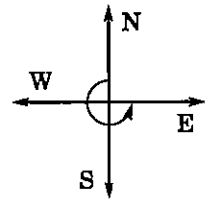
(*c*) west and turn to west?

(*d*) south and turn to north?

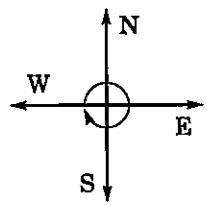
Sol.



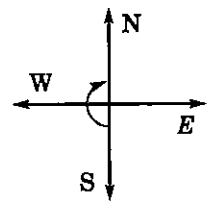
(*a*)
(1 Right angle)



(*b*)
(3 Right angles)



(*c*)
(4 Right angles)



(*d*)
(2 Right angles)

Q7. Where will the hour hand of a clock stop if it starts

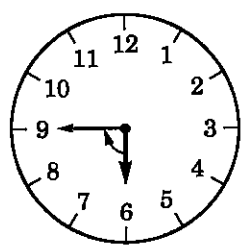
(*a*) from 6 and turns through 1 right angle?

(*b*) from 8 and turns through 2 right angles?

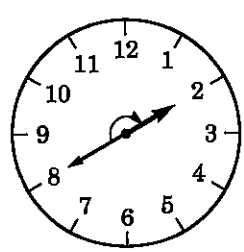
(*c*) from 10 and turns through 3 right angles?

(*d*) from 7 and turns through 2 straight angles?

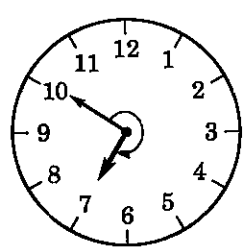
Sol. (*a*) Starting from 6 and turning through 1 right angle, the hour hand stops at 9.



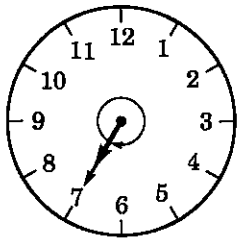
(*b*) Starting from 8 and turning through 2 right angles, the hour hand stops at 2.



(*c*) Starting from 10 and turning through 3 right angles, the hour hand stops at 7.



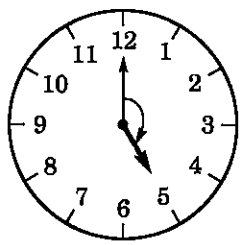
(*d*) Starting from 7 and turning through 2 straight angles, the hour hand stops at 7.



TRY THESE (*PAGE 93*)

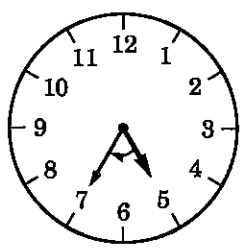
Q1. The hour hand of a clock moves from 12 to 5. Is the revolution of the hour hand more than 1 right angle?

Sol. Yes, the revolution of the hour hand in this case is more than 1 right angle.



Q2. What does the angle made by the hour hand of the clock look like when it moves from 5 to 7. Is the angle moved more than 1 right angle?

Sol. The angle made by the hour hand in moving from 5 to 7 looks like an acute angle. No, the angle is not more than 1 right angle.



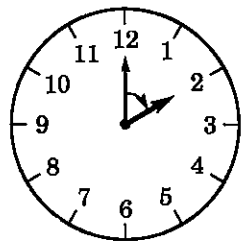
Q3. Draw the following and check the angle with your RA tester.

(*a*) going from 12 to 2 (*b*) from 6 to 7

(*c*) from 4 to 8 (*d*) from 2 to 5

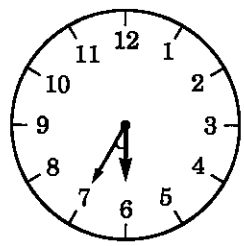
Sol. (*a*) From 12 to 2:

The angle made by hour hand is going from 12 to 2 is shown in the figure alongside. When we check by RA tester, it is formed to be less than a right angle.



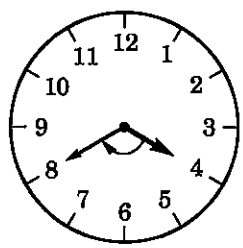
(*b*) From 6 to 7:

The angle made by hour hand in moving from 6 to 7 is less than 90° (using RA test)



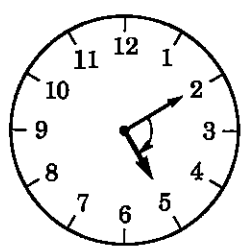
(*c*) From 4 to 8:

The angle made by the hour hand in moving from 4 to 8 is more than right angle (Using RA test)

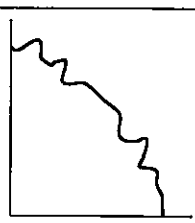
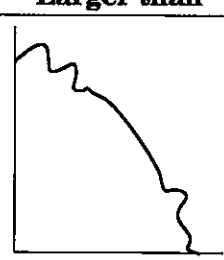


(*d*) From 2 to 5:

The angle made by hour hand in moving from 2 to 5 is a right angle (Using RA test)



Q4. Take five different shapes with corners. Name the corners. Examine them with your tester and tabulate your results for each case.

Corner	Smaller than	Larger than
		

A	.....	.....
B	.....	.....
C	.....	.....
D	.....	.....
E	.....	.....
F	.....	.....

Sol. It is an activity. So, the students have to do it themselves.

TRY THESE (*PAGE 94*)

Q1. Look around you and identify edges meeting at corners to produce angles. List ten such situations.

Sol. It is an activity. So, try yourself.

Q2. List ten situations where the angles made are acute.

Sol. It is an activity. So, try yourself.

Q3. List ten situations where the angles made are right angles.

Sol. It is an activity. So, try yourself.

Q4. Find five situations where obtuse angles are made.

Sol. It is an activity. So, try yourself.

Q5. List five other situations where reflex angles may be seen.

Sol. It is an activity. So, try yourself.

EXERCISE 5.3

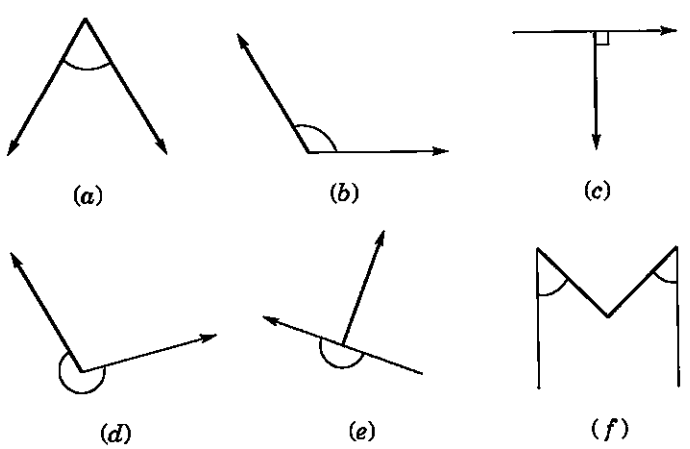
Q1. Match the following:

(*i*) Straight angle
(*ii*) Right angle
(*iii*) Acute angle
(*iv*) Obtuse angle
(*v*) Reflex angle

(*a*) Less than one-fourth of a revolution.
(*b*) More than half a revolution.
(*c*) Half of a revolution.
(*d*) One-fourth of a revolution.
(*e*) Between $\frac{1}{4}$ and $\frac{1}{2}$ of a revolution.
(*f*) One complete revolution.

Sol. (*i*) Straight angle ↔ (*c*) Half of a revolution.
(*ii*) Right angle ↔ (*d*) One-fourth of a revolution.
(*iii*) Acute angle ↔ (*a*) Less than one-fourth of a revolution.
(*iv*) Obtuse angle ↔ (*e*) Between $\frac{1}{4}$ and $\frac{1}{2}$ of a revolution.
(*v*) Reflex angle ↔ (*f*) One complete revolution.

Q2. Classify each one of the following angles as right, acute, obtuse or reflex.



Sol. (*a*) Acute angle (*b*) Obtuse angle
(*c*) Right angle (*d*) Reflex angle
(*e*) Straight angle (*f*) Acute angle

EXERCISE 5.4

Q1. What is the measure of (*i*) a right angle (*ii*) a straight angle?

Sol. (*i*) Measure of a right angle = 90°
(*ii*) Measure of a straight angle = 180°

Q2. Say True or False:
(*a*) The measure of an acute angle < 90°
(*b*) The measure of an obtuse angle < 90°
(*c*) The measure of a reflex angle > 180°
(*d*) The measure of one complete revolution = 360°
(*e*) If $m\angle A = 53°$ and $\angle B = 35°$, then $m\angle A > m\angle B$.

Sol. (*a*) True (*b*) False (*c*) True
(*d*) True (*e*) True

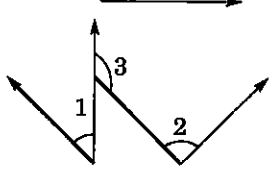
Q3. Write down the measures of
(*a*) some acute angles
(*b*) some obtuse angles

Sol. (*a*) 25°, 63° and 72° are acute angles.
(*b*) 105°, 120° and 135° are obtuse angles.

Q4. Measure the angles given below using the protractor and write down the measure.

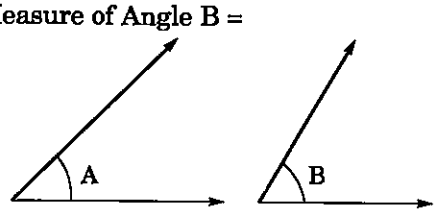
(*a*) (*b*)

(*c*) (*d*)



Sol. (*a*) 45° (*b*) 125° (*c*) 90°
(*d*) $\angle 1 = 60°$, $\angle 2 = 90°$, $\angle 3 = 125°$

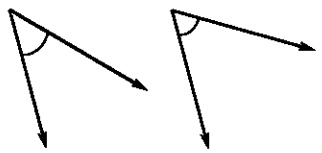
Q5. Which angle has a large measure? First estimate and then measure.
Measure of Angle A =
Measure of Angle B =



Sol. Measure of Angle A = 40°
Measure of Angle B = 60°.

Q6. From these two angles which has large measure? Estimate and then confirm by measuring them.

Sol. The opening of angle (*b*) is more than angle (*a*).



(*a*) (*b*)

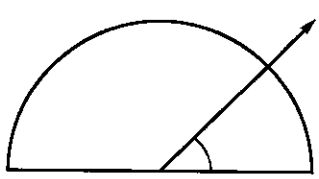
$\therefore$ Measure of angle (*a*) = 45°
and the measure of angle (*b*) = 60°

Q7. Fill in the blanks with acute, obtuse, right or straight:
(*a*) An angle whose measure is less than that of a right angle is ..... .
(*b*) An angle whose measure is greater than that of a right angle is ..... .
(*c*) An angle whose measure is the sum of the measures of two right angles is ..... .
(*d*) When the sum of the measures of two angles is that of a right angle, then each one of them is ..... .
(*e*) When the sum of the measures of two angles is that of a straight angle and if one of them is acute then the other should be ..... .

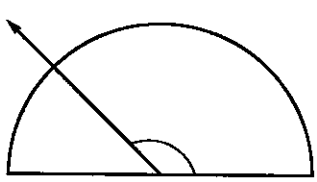
Sol. (*a*) acute (*b*) obtuse (*c*) straight
(*d*) acute (*e*) obtuse

Q8. Find the measure of the angle shown in each figure. (First estimate with your eyes and than find the actual measure with a protractor).

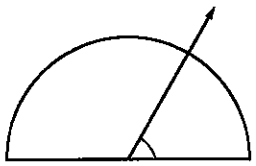
(*a*)



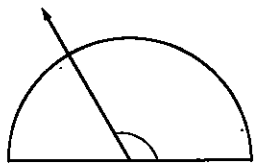
(*b*)



(c)



(d)



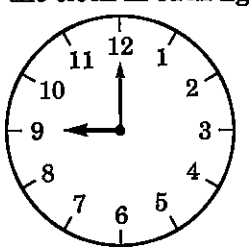
Sol. (a) Measure of the angle = 40°

(b) Measure of the angle = 130°

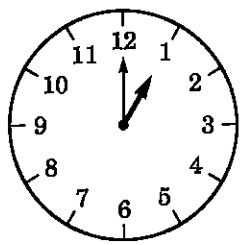
(c) Measure of the angle = 65°

(d) Measure of the angle = 135°.

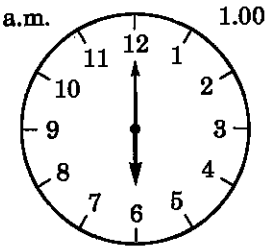
Q9. Find the angle measure between the hands of the clock in each figure:



9.00 a.m.



1.00 p.m.



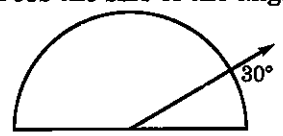
6.00 p.m.

Sol. (i) The angle between hour hand and minute hand of a clock at 9.00 a.m = 90°

(ii) The angle between the hour hand and minute hand of a clock at 1.00 p.m = 30°

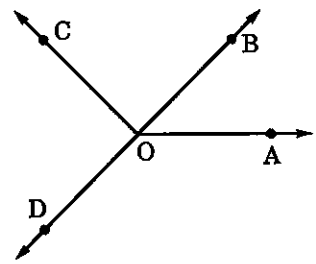
(iii) The angle between the hour hand and minute hand of a clock at 6.00 p.m = 180°.

Q10. Investigate: In the given figure, the angle measures 30°. Look at the same figure through a magnifying glass. Does the angle becomes larger? Does the size of the angle change?



Sol. It is an activity. So try it yourself.

Q11. Measure and classify each angle:



Angle	Measure	Type
∠AOB		
∠AOC		
∠BOC		
∠DOC		
∠DOA		
∠DOB		

Sol.

Angle	Measure	Type
∠AOB	40°	Acute angle
∠AOC	125°	Obtuse angle
∠BOC	85°	Acute angle
∠DOC	95°	Obtuse angle
∠DOA	140°	Obtuse angle
∠DOB	180°	Straight angle

EXERCISE 5.5

Q1. Which of the following are models for perpendicular lines:

(a) The adjacent edges of a table top.

(b) The lines of a railway track.

(c) The line segments forming a letter 'L'.

(d) The letter V.

Sol. (a) Yes, the adjacent edges of a table top are the models of perpendicular lines.

(b) No, the lines of a railway tracks are parallel to each other. So they are not a model for perpendicular lines.

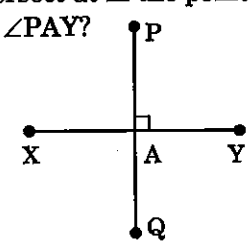
(c) Yes, the two line segments of 'L' are the model for perpendicular lines.

(d) No, the two line segments of 'V' are not a model for perpendicular lines.

Q2. Let $\overline{PQ}$ be the perpendicular to the line segment $\overline{XY}$. Let $\overline{PQ}$ and $\overline{XY}$ intersect at in the point A. What is the measure of ∠PAY?

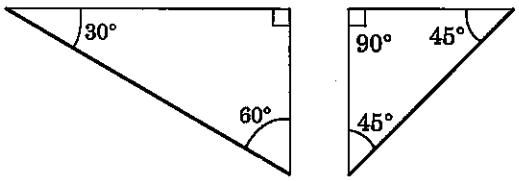
Sol. Since $\overline{PQ} \perp XY$

$\therefore$ ∠PAY = 90°



Q3. There are two set-squares in your box. What are the measures of the angles that are formed at their corners? Do they have any angle measure that is common?

Sol. The figures of the two set-squares are given below:



(*a*) (*b*)

The measure angles of triangle (*a*) are : 30°, 60° and 90°.

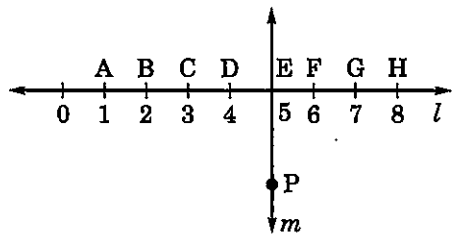
The measure angles of triangle (*b*) are 45°, 45° and 90°.

Yes, they have a common angle of measure 90°.

Q4. Study the diagram. The line l is perpendicular to line m.

(*a*) Is CE = EG?

(*b*) Does PE bisects CG?



(*c*) Identify any two line segments for which PE is the perpendicular bisector.

(*d*) Are these true?

(*i*) AC > FG (*ii*) CD = GH

(*iii*) BC < EH

Sol. (*a*) Yes,

Since, CE = 2 units and EG = 2 units

Hence, CE = EG.

(*b*) Yes, PE bisects CG

(*c*) Required line segments for which PE is perpendicular bisector are: $\overline{BG}$ and $\overline{DF}$

(*d*) (*i*) True (*ii*) True (*iii*) True

EXERCISE 5.6

Q1. Name the types of following triangles:

(*a*) Triangle with lengths of sides 7 cm, 8 cm and 9 cm.

(*b*) ΔABC with AB = 8.7 cm, AC = 7 cm and BC = 6 cm.

(*c*) ΔPQR such that PQ = QR = PR = 5 cm.

(*d*) ΔDEF with m∠D = 90°

(*e*) ΔXYZ with m∠Y = 90° and XY = YZ.

(*f*) ΔLMN with m∠L = 30° m∠M = 70° and m∠N = 80°.

Sol. (*a*) Lengths of the sides of a triangle are given as: 7 cm, 8 cm and 9 cm.

Since, all sides of the given triangle are different.

Hence, it is a Scalene triangle.

(*b*) Given that: AB = 8.7 cm, AC = 7 cm and BC = 6 cm

Here AB ≠ AC ≠ BC

Hence, ΔABC is Scalene triangle.

(*c*) Given that: PQ = QR = PR = 5 cm

Since all sides are equal.

Hence, it is an equilateral triangle.

(*d*) Given that: In ΔDEF, $m\angle D = 90°$

Hence it is a right angled triangle.

(*e*) Given that: In ΔXYZ, $m\angle Y = 90°$ and XY = YZ

Hence it is a right angled triangle.

(*f*) Given that: ΔLMN, $m\angle L = 30°$, $m\angle M = 70°$ and $m\angle N = 80°$.

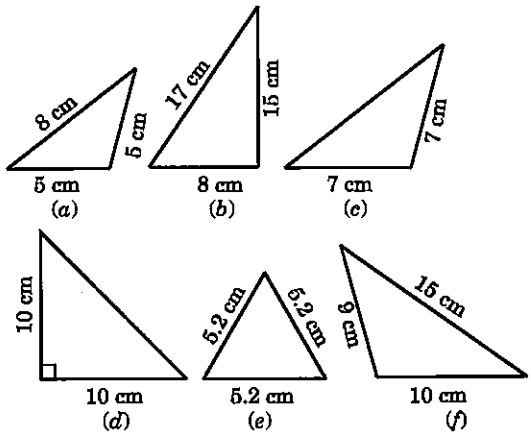
Hence it is an acute angled triangle.

Q2. Match the following:

Measure of triangle	*Type of triangle*
(*i*) 3 sides of equal length	(*a*) Scalene
(*ii*) 2 sides of equal length	(*b*) Isosceles right angled
(*iii*) All sides are of different length	(*c*) Obtuse angled
(*iv*) 3 acute angles	(*d*) Right angled
(*v*) 1 right angle	(*e*) Equilateral
(*vi*) 1 obtuse angle	(*f*) Acute angled
(*vii*) 1 right angle with two sides of equal length	(*g*) Isosceles

Sol. (*i*) ↔ (*e*) (*ii*) ↔ (*g*) (*iii*) ↔ (*a*) (*iv*) ↔ (*f*) (*v*) ↔ (*d*)
(*vi*) ↔ (*c*) (*vii*) ↔ (*b*)

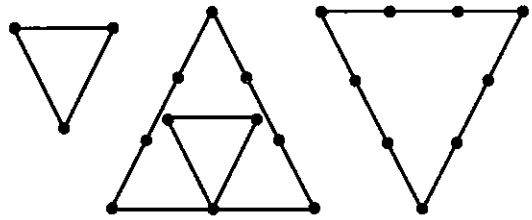
Q3. Name each of the following triangles in two different ways: (You may judge the nature of the angle by observation)



Sol. (*a*) (*i*) Acute angled triangle
(*ii*) Isosceles triangle
(*b*) (*i*) Right angled triangle
(*ii*) Scalene triangle
(*c*) (*i*) Obtuse angled triangle
(*ii*) Isosceles triangle
(*d*) (*i*) Right angled triangle
(*ii*) Isosceles triangle
(*e*) (*i*) Acute angled triangle
(*ii*) Equilateral triangle
(*f*) (*i*) Obtuse angled triangle
(*ii*) Scalene triangle.

Q4. Try to construct triangles using matchsticks. Some are shown here. Can you make a triangle with

(*a*) 3 matchsticks? (*b*) 4 matchsticks?
(*c*) 5 matchsticks? (*d*) 6 matchsticks?

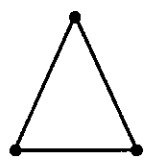


(Remember you have to use all the available matchsticks in each case)

Name the type of triangle in each case.

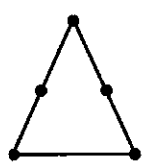
If you cannot make a triangle, give of reasons for it.

Sol. (*a*) Yes, we can make an equilateral triangle with 3 matchsticks.

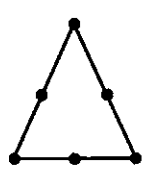


(*b*) No, we cannot make a triangle with 4 matchsticks.

(*c*) Yes, we can make an isosceles triangle with five matchsticks.



(*d*) Yes, we can make an equilateral triangle with 6 matchsticks.



EXERCISE 5.7

Q1. Say True or False:

(*a*) Each angle of a rectangle is a right angle.
(*b*) The opposite sides of a rectangle are equal in length.
(*c*) The diagonals of a square are perpendicular to one another.
(*d*) All the sides of a rhombus are of equal length.
(*e*) All the sides of a parallelogram are of equal length.
(*f*) The opposite sides of a trapezium are parallel.

Sol. (*a*) True (*b*) True (*c*) True
(*d*) True (*e*) False (*f*) False

Q2. Give reasons for the following:

(*a*) A square can be thought of as a special rectangle.
(*b*) A rectangle can be thought of as a special parallelogram.
(*c*) A square can be thought of as a special rhombus.
(*d*) Square, rectangles, parallelograms are all quadrilaterals.
(*e*) Square is also a parallelogram.

Sol. (*a*) A square has all the properties as that of rectangle. So, it is a special rectangle.
(*b*) A rectangle has the same properties as that of parallelogram. So, it is a special parallelogram.
(*c*) A square has the same properties as that of a rhombus. So, it is a special rhombus.
(*d*) Square, rectangles and parallelogram are all quadrilateral as they are all enclosed by four sides.

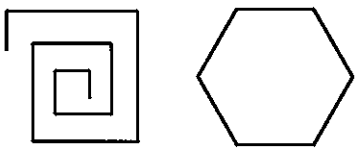
Q3. A figure is said to be regular if its sides are equal in length and angles are equal in measure. Can you identify the regular quadrilateral?

Sol. Square is only the regular quadrilateral with equal sides and equal angles.

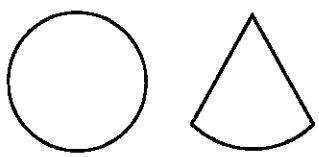
Therefore, square is a regular quadrilateral.

EXERCISE 5.8

Q1. Examine whether the following are polygons. If any one among them is not, say why?



(*a*) (*b*)



(*c*) (*d*)

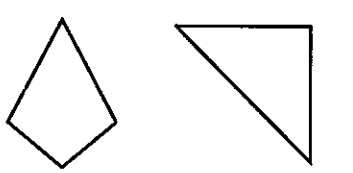
Sol. (*a*) The given figure is not closed. Therefore, it is not a polygon.

(*b*) The given figure is a polygon.

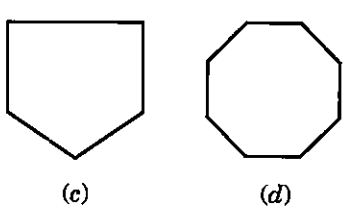
(*c*) The given figure is not a polygon because every polygon is enclosed with line segments.

(*d*) The given figure is not a polygon because it is enclosed by an arc and two line segments.

Q2. Name each polygon.



(*a*) (*b*)

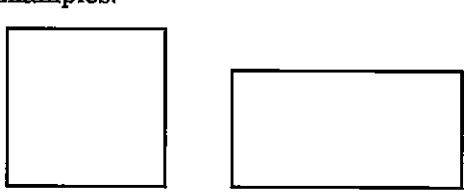


(*c*) (*d*)

Make two more examples of each of these.

Sol. (*a*) A quadrilateral

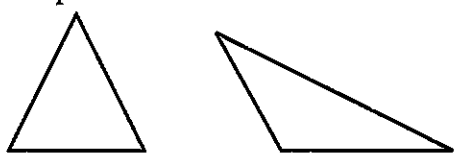
Examples:



(*i*) (*ii*)

(*b*) A triangle

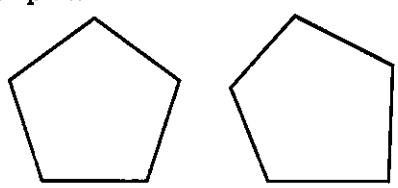
Examples:



(*i*) (*ii*)

(*c*) A pentagon

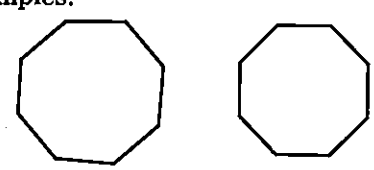
Examples:



(*i*) (*ii*)

(*d*) An octagon

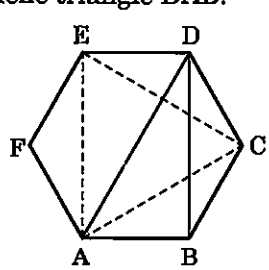
Examples:



(*i*) (*ii*)

Q3. Draw a rough sketch of a regular hexagon. Connecting any three of its vertices, draw a triangle. Identify the type of the triangle you have drawn.

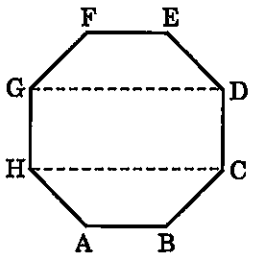
Sol. ABCDEF is a rough sketch of a regular hexagon. If we join any three vertices like D, A and B, we get a scalene triangle DAB.



But if we join the alternate vertices, we get an equilateral triangle EAC.

Q4. Draw a rough sketch of a regular octagon. (Using squared paper if you wish). Draw a rectangle by joining exactly four of the vertices of the octagon.

Sol. ABCDEFGH is a rough sketch of regular octagon. GHCD is the rectangle formed by joining the four vertices of the given octagon.

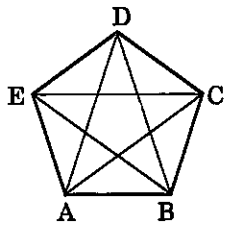


Q5. A diagonal is a line segment that joins any two vertices of the polygon and is not a side of the polygon. Draw a rough sketch of a pentagon and draw its diagonals.

Sol. A B C D E is the rough sketch of a pentagon.

By joining its any two vertices, we get, the following diagonals.

$\overline{AD}$, $\overline{AC}$, $\overline{BE}$, $\overline{BD}$ and $\overline{CE}$



EXERCISE 5.9

1. Match the following:

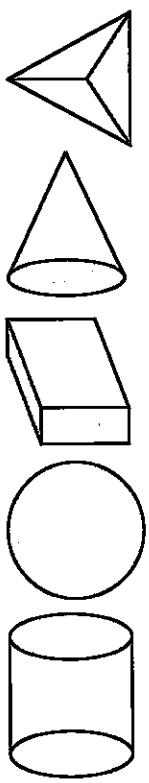
(*a*) Cone (*i*)

(*b*) Sphere (*ii*)

(*c*) Cylinder (*iii*)

(*d*) Cuboid (*iv*)

(*e*) Pyramid (*v*)



Give two examples of each shape.

Sol. (*a*) ↔ (*ii*)

Examples: (*i*) An ice-cream cone

(*ii*) Birthday cap

(*b*) ↔ (*iv*)

Examples: (*i*) Tennis ball

(*ii*) Cricket ball

(*c*) ↔ (*v*)

Examples: (*i*) A road roller

(*ii*) A lawn roller

(*d*) ↔ (*iii*)

Examples: (*i*) Math book

(*ii*) A brick

(*e*) ↔ (*i*)

Examples: (*i*) A diamond

(*ii*) Egypt-Pyramids

Q2. What shape is

(*a*) Your instrument box?

(*b*) A brick?

(*b*) A matchbox?

(*d*) A road-roller?

(*e*) A sweet laddu?

Sol. (*a*) Shape of instrument box is cuboid.

(*b*) Shape of a brick is cuboid.

(*c*) Shape of a matchbox is cuboid.

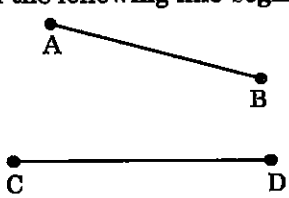
(*d*) Shape of a road-roller is cylinder.

(*e*) Shape of a sweet laddu is sphere.

Learning More Q & A

I. Very Short Answer (VSA) Questions

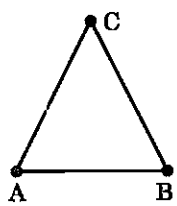
Q1. Which of the following line-segments is longer?



Sol. By using divider, $\overline{CD}$ seems to be longer than $\overline{AB}$.

Q2. How many line segments are used in making a triangle?

Sol. Three line segments are used to make a triangle.



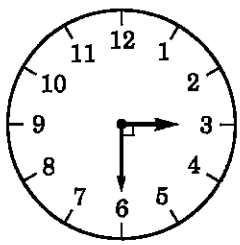
Q3. What is the measure of straight angle?

Sol. The measure of straight angle is 180°.

Q4. What is complete angle?

Sol. The angle for one revolution is called a complete angle.

Q5. Find the number of right angle turned through by the hour hand of a clock when it goes from 3 to 6.



Sol. When the hour hand of a clock goes from 3 to 6, it turns through a right angle.

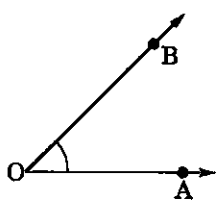
Q6. Draw the rough sketch of the following:

(*a*) Acute angle

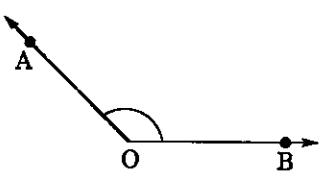
(*b*) Obtuse angle

(*c*) Reflex angle

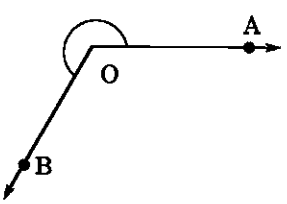
Sol.



(*a*) Acute angle



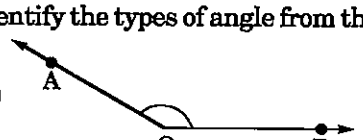
(*b*) Obtuse angle



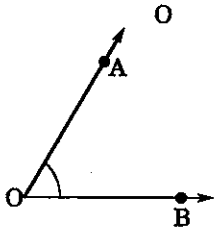
(*c*) Reflex angle

Q7. Identify the types of angle from the given figures:

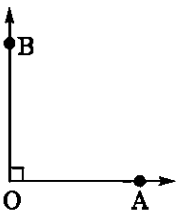
(*a*)



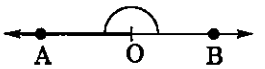
(*b*)



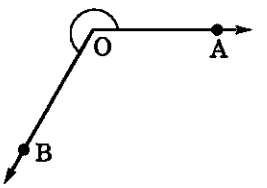
(*c*)



(*d*)



(*e*)



Sol. (*a*) Obtuse angle (*b*) Acute angle

(*c*) Right angle (*d*) Straight angle

(*e*) Reflex angle

Q8. What are the degree measures of the following angles?

(*a*) Right angle (*b*) A complete angle

(*c*) Straight angle

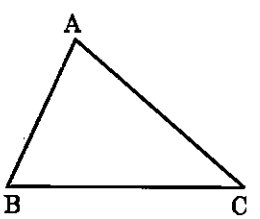
Sol. (*a*) Degree measure of a right angle is 90°.

(*b*) Degree measure of a complete angle is 360°.

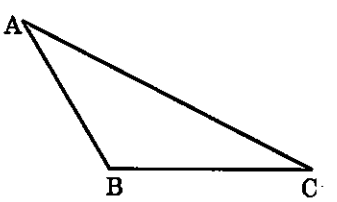
(*c*) Degree measure of a straight angle is 180°.

Q9. What are the types of the given triangles on the basis of angles?

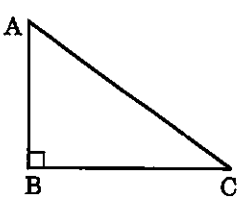
(*a*)



(*b*)



(*c*)

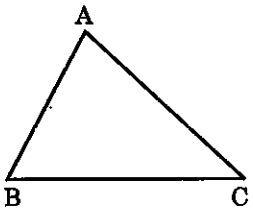


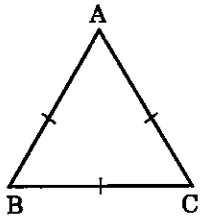
Sol. (*a*) Acute angled triangle.

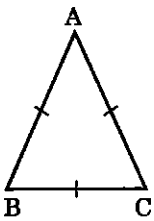
(*b*) Obtuse angled triangle.

(*c*) Right angled triangle.

Q10. What are the types of the following triangles on the basis of sides?

(a) 

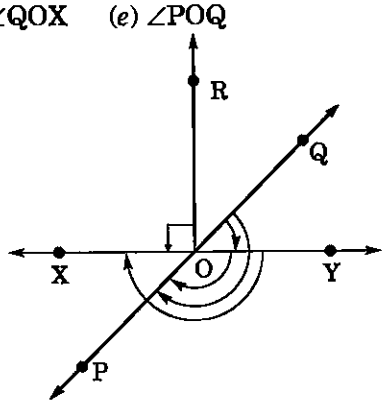
(b) 

(c) 

Sol. (*a*) Scalene triangle.
(*b*) Equilateral triangle.
(*c*) Isosceles triangle.

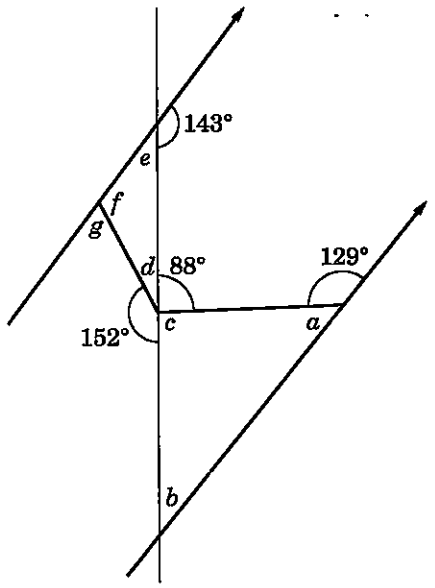
II. Short Answer (SA) Questions

Q11. In the given figure, name the following angles as acute, obtuse, right, straight or reflex.
(*a*) ∠QOY (*b*) ∠YOP (*c*) ∠ROX
(*d*) ∠QOX (*e*) ∠POQ



Sol. (*a*) ∠QOY = acute angle.
(*b*) ∠YOP = obtuse angle.
(*c*) ∠ROX = right angle.
(*d*) ∠QOX = reflex angle.
(*e*) ∠POQ = straight angle.

Q12. In the given figure, find the measure of the angles marked with *a*, *b*, *c*, *d*, *e* and *f*.



Sol. $\angle a = 180° - 129° = 51°$

$\angle b = 180° - (51° + 92°)$

$= 180° - 143° = 37°$

$\angle c = 180° - 88° = 92°$

$\angle d = 180° - 152° = 28°$

$\angle e = 180° - 143° = 37°$

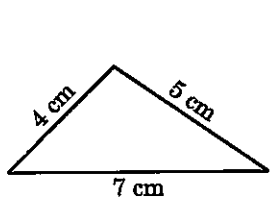
$\angle f = 180° - (\angle e + \angle d)$

$= 180° - (37° + 28°)$

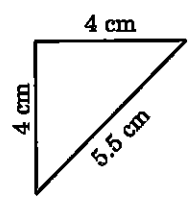
$= 180° - 65° = 115°$

$\angle g = 180° - \angle f = 180° - 115° = 65°$

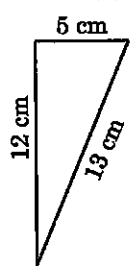
Q13. Classify the given triangles whose sides are indicated on them.



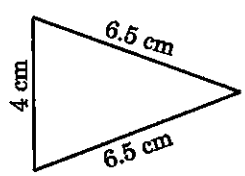
(*a*)



(*b*)



(*c*)



(*d*)

Sol. (*a*) All sides are different. So, it is a scalene triangle.
(*b*) Lengths of two sides of the triangle are same. So, it is an isosceles triangle.
(*c*) All sides are unequal and one angle is right angle. So it is scalene right angled triangle.
(*d*) Two sides of this triangle are equal. So, it is an isosceles triangle.

Q14. Complete each of the following, so as to make a true statement:
(*a*) A _____ is a rectangle with a pair of adjacent sides equal.
(*b*) A parallelogram with a pair of adjacent sides equal is called a _____.

(c) A quadrilateral having exactly one pair of parallel sides is called a _____.

(d) A quadrilateral having both pairs of opposite sides parallel, is called a _____.

(e) A parallelogram whose each angle is a right angle is called a _____.

Sol. (a) Square (b) Rhombus

(c) Trapezium (d) Parallelogram

(e) Rectangle.

III. Long Answer (LA) Questions

Q15. Verify the 'Euler's formula' V + F = E + 2 for the given figures.

(a) A triangular prism having 5 faces, 9 edges and 6 vertices.

(b) A rectangular prism with 6 faces, 12 edges and 8 vertices.

(c) A pentagonal prism with 7 faces, 15 edges and 10 vertices.

(d) A tetrahedron with 4 faces, 6 edges and 4 vertices.

Sol. (a) Here, F = 5, E = 9 and V = 6

$\therefore$ V + F = E + 2 $\Rightarrow$ 6 + 5 = 9 + 2

$\Rightarrow$ 11 = 11

Hence, verified.

(b) Here, F = 6, E = 12 and V = 8

$\therefore$ V + F = E + 2 $\Rightarrow$ 8 + 6 = 12 + 2

$\Rightarrow$ 14 = 14

Hence, verified.

(c) Here, F = 7, E = 15 and V = 10

$\therefore$ V + F = E + 2 $\Rightarrow$ 10 + 7 = 15 + 2

$\Rightarrow$ 17 = 17

Hence, verified.

(d) Here, F = 4, E = 6 and V = 4

$\therefore$ V + F = E + 2 $\Rightarrow$ 4 + 4 = 6 + 2

$\Rightarrow$ 8 = 8

Hence, verified.

Q16. Complete the given table for prisms:

Prism	Number of faces	Number of edges	Number of vertices
Triangular	_____	_____	_____
Quadrilateral	_____	_____	_____
Pentagonal	_____	_____	_____
Hexagonal	_____	_____	_____
Octagonal	_____	_____	_____
Decagonal	_____	_____	_____

Sol.

Prism	Number of faces	Number of edges	Number of vertices
Triangular	5	9	6
Quadrilateral	6	12	8
Pentagonal	7	15	10
Hexagonal	8	18	12
Octagonal	10	24	16
Decagonal	12	30	20

IV. Multiple Choice Questions (MCQs)

Q17. Number of right angles turned by the hour hand of a clock when it goes from 3 to 6.

(a) 1 (b) 2 (c) 3 (d) 4

Sol. Correct option is (a).

Q18. A quadrilateral having a pair of unequal opposite sides is called

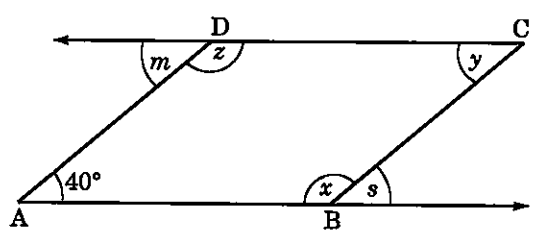
(a) Parallelogram (b) Square

(c) Rectangle (d) Trapezium

Sol. The correct option is (d).

V. Higher Order Thinking Skills (HOTS) Questions

Q19. In the given figure, find the values of x, y, z, s and m.



Sol. Given that $\angle A = 40°$

(i) $\angle DAB + \angle ABC = 180°$ (adjacent angles)

$40° + \angle ABC = 180°$

$\angle ABC = 180° - 40° = 140°$

Hence, $\angle x = 140°$

(ii) $\angle x + \angle y = 180°$ (adjacent angles)

$\Rightarrow$ $140° + \angle y = 180°$

$\Rightarrow$ $\angle y = 180° - 140° = 40°$

Hence, $\angle y = 40°$

(iii) $\angle y + \angle z = 180°$ (adjacent angles)

$\Rightarrow$ $40° + \angle z = 180°$

$\Rightarrow$ $\angle z = 180° - 40° = 140°$

Hence, $\angle z = 140°$

(iv) $\angle x + \angle s = 180°$ (straight angles)

$\Rightarrow$ $140° + \angle s = 180°$

$\Rightarrow$ $\angle s = 180° - 140° = 40°$

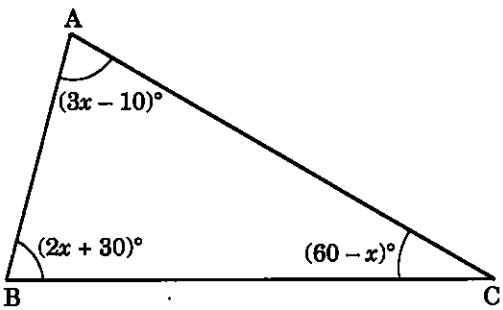
Hence, $\angle s = 40°$

(v) $\angle m + \angle z = 180°$ (straight angles)

$\Rightarrow$ $\angle m + 140° = 180°$

$\Rightarrow$ $\angle m = 180° - 140° = 40°$

Q20. Find the value of x from the given figure and hence find the measure of each angle of the triangle.



Sol. (i) Sum of the three angles of a triangle = 180°

$\therefore$ $2x + 30° + 60° - x + 3x - 10° = 180°$

$\Rightarrow$ $(2x - x + 3x) + (30° + 60° - 10°) = 180°$

$\Rightarrow$ $4x + 80° = 180°$

$\Rightarrow$ $4x = 180° - 80°$

$\Rightarrow$ $4x = 100°$

$\therefore$ $x = \frac{100°}{4} = 25°$

$\therefore$ Measure of the angles are:

(i) $(2x + 30)° = 2 \times 25° + 30° = 80°$

(ii) $(60 - x)° = 60° - 25° = 35°$

(iii) $(3x - 10)° = 3 \times 25° - 10° = 75° - 10° = 65°$

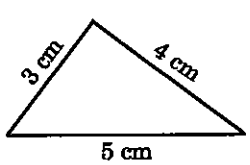
Hence, $x = 25°$ and the angles of the triangles are: 80°, 35° and 65°.

Test Yourself

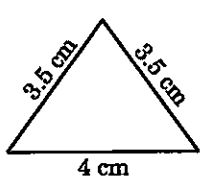
I. Very Short Answer (VSA) Questions

1. What is the measure of straight angle?
2. What is the sum of the measures of the three angles of a triangle?
3. What is the measure of each angle of an equilateral triangle?
4. How many end points are there in a line segment?
5. If you stand facing North, and take a right angle turn clockwise, which direction will your face?
6. What are the measures of the three angles of an isosceles right angled triangle?
7. Classify the following triangles on the basis of sides:

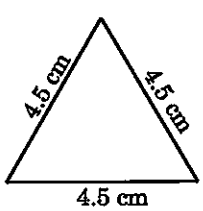
(a)



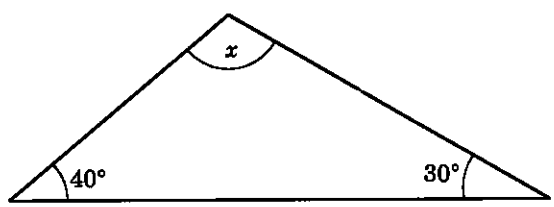
(b)



(c)



8. Find the value of x in the given figure:



9. What is the measure of a complete angle?
10. How many faces a cube has?

Short Answer (SA) Questions

11. What angle is formed when the minute hand moves
    (a) from 12 to 7 (b) from 12 to 9
    (c) from 12 to 6 (d) from 12 to 3.
12. Classify the angles whose measures are given below as acute, obtuse, zero, right, complete, straight or reflex.
    (a) 30° (b) 0° (c) 180° (d) 120°
    (e) 360° (f) 270° (g) 45° (h) 90°
13. Name the types of the following triangles:
    (a) ΔABC, with AB = 4.5, BC = 3.5 and AC = 6 cm
    (b) ΔPQR with $\angle Q = 90°$
    (c) ΔMNS with MN = 5.5 cm, NS = 5.5 cm and MS = 8 cm
    (d) ΔXYZ with XY = YZ = ZX = 7.5 cm.

14. If sum of all the interior angles of a polygon is equal to $(n - 2) \times 180°$, where n is the number of sides of the polygon, then find the sum of all the interior angles of the following.
(a) Pentagon (b) Hexagon
(c) Octagon (d) Decagon.

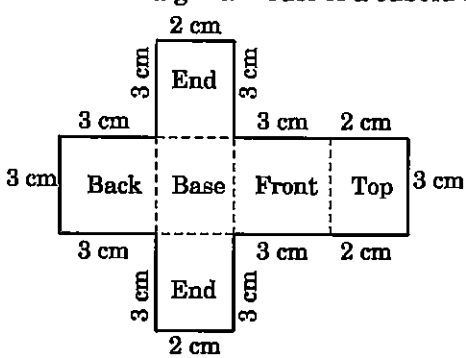
15. Fill in the blanks:
(a) There are _____ faces in a triangular prism.
(b) A reflex angle is _____ than a straight angle.
(c) A sphere has _____ vertices.
(d) The sum of any two sides of a triangle is _____ than the third side.
(e) A right angled triangle has _____ acute angles.
(f) One complete angle = 2 × _____.

ANSWERS

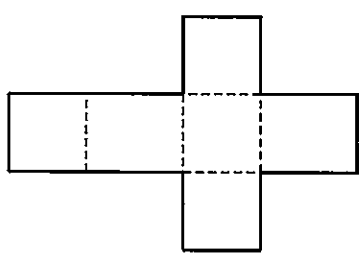
1. 180° 2. 180° 3. 60°
4. two 5. East 6. 90°, 45°, 45°
7. (a) Scalene triangle (b) Isosceles triangle (c) Equilateral triangle.
8. 110° 9. 360° 10. 6
11. (a) 210° (b) 270° (c) 180° (d) 90°
12. (a) acute (b) zero (c) straight (d) obtuse (e) complete (f) reflex (g) acute (h) right
13. (a) Scalene triangle (b) Right angled triangle (c) Isosceles triangle (d) Equilateral triangle
14. (a) 540° (b) 720° (c) 1080° (d) 1440°
15. (a) 5 (b) more (c) no (d) more (e) two (f) 180°

Internal Assessment

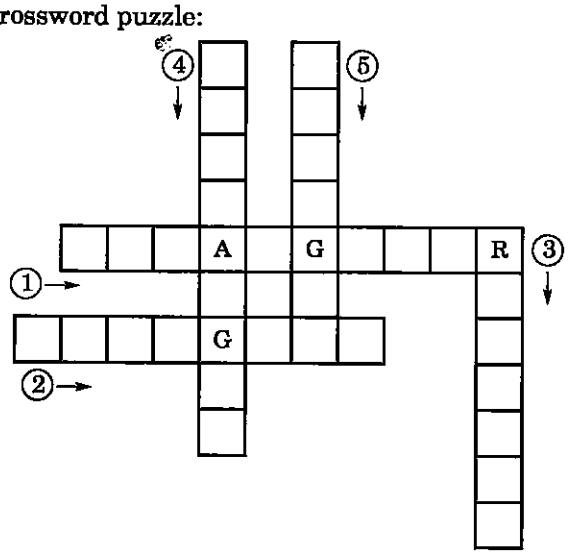
Activity: Take a sheet of paper. Draw on it, the following two diagrams. Cut each one and fold each along the dotted lines. You get a model of a cuboid and of a cube.



Net of cuboid


Net of cube

Q1. Complete the following crossword puzzle:



Directions:

Across: 1. A _____ prism has 5 faces.

2. Number of sides of all the _____ is at least 3.

Down: 3. A regular polygon bounded by four line segments is called a _____.

4. A parallelogram having its opposite sides equal is called _____.

5. A _____ having six sides is called a hexagon.

Q2. Fill in the blanks:

(*a*) $1\frac{1}{2}$ right angles = _____ degree.

(*b*) $\frac{1}{2}$ right angle = _____ degree.

(*c*) $1\frac{1}{3}$ right angles = _____ degree.

(*d*) 4 right angles = _____ degree.

(*e*) $\frac{5}{4}$ right angle = _____ degree.

Q3. State 'True' or 'False'.

(*a*) A triangle can have two obtuse angles.

(*b*) A triangle can have all the three angles acute.

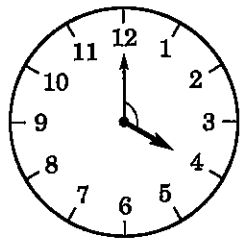
(*c*) The sum of three angles of a triangle is 180°.

(*d*) The sum of two sides of a triangle is greater than the third side.

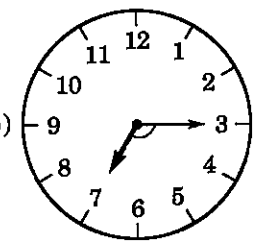
(*e*) A triangle can have a reflex angle.

Q4. What are the angles between minute hand and hour hand of a clock in the following?

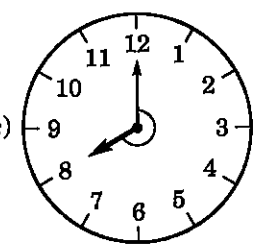
(*a*)



(*b*)



(*c*)



ANSWERS

1. 1. TRIANGULAR 2. POLYGONS
   3. RHOMBUS 4. RECTANGLE
   5. POLYGON
2. (*a*) 135 (*b*) 45 (*c*) 120
   (*d*) 360 (*e*) $112\frac{1}{2}$
3. (*a*) False (*b*) True (*c*) True
   (*d*) True (*e*) False
4. (*a*) 120° (*b*) 120° (*c*) 240°