CHAPTER-12 :
Understanding Elementary Shapes

EXERCISE 12.1

[***Answers** to the questions given in the Textbook are the **solutions** themselves.*]

1. Multiple-Choice Questions (MCQ)

(i) How many parallel lines are there in the capital letter 'E'?

Capital letter **E** has **3 horizontal lines** (top, middle, bottom) that are **parallel** to each other.

✓ Answer: (d) 3

Explanation:
All three horizontal strokes are parallel.

(ii) The relation between MN and PQ by tracing is:

Look at the figure: MN is slanted, and PQ is vertical → they are **not parallel** and **not equal** in length.

✓ Answer: (c) MN>PQ

Explanation:

- MN ≠ PQ
- MN is not parallel to PQ
- MN is not lesser in a defined relation

So **MN>PQ** of the given relations are correct.

1. MCQ

(i) Parallel lines in capital letter **E** = **3**
Answer: (d) 3

(ii) Relation between **MN** and **PQ**: they are not equal / parallel / greater or smaller in any fixed way.
Answer: (d) None of these

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2. Verify whether D is the mid-point of AG

Yes, **D is the mid-point of AG**, because **D lies on AG** and **AD = DG** (both halves are equal).

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3. Compare the line segments (using <, =, >)

(You would actually check these with a divider on the printed figure.)

(i) **AB >BD**
(ii) **AD > BD**
(iii) **CD > BD**
(iv) **CD < AC**
(v) **BC > CD**
(vi) **AD < AC**

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4. Name the parallel line segments

(i) Rectangle–like figure

- **AB ∥ DC**
- **AD ∥ BC**

(ii) Hexagon A-B-F-D-C-E

- **AB ∥ CD**
- **AE ∥ DF**
- **EC ∥ BF**

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5. Box (planes of a cuboid)

(i) Are planes **ABCD** and **ABEF** parallel?
→ **No**, they meet along line **AB**, so they are **not** parallel.

(ii) Name the plane parallel to **CDGH**.
→ **ABEF**

(iii) Are planes **ADGF** and **BCHE** parallel?
→ **Yes**, they are opposite faces of the box, so they are parallel.

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6. Pairs of parallel line segments

(i) Five-sided figure with vertical in the middle

- **AD ∥ CB**
- **AE ∥ DC**
- **AC ∥ ED**

(ii) Parallelogram A-B-C-D with diagonal A-E-C

- **AB ∥ DC**
- **AB ∥DE**
- **AB ∥EC**
- **AD ∥ BC**

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7. Pairs of perpendicular lines

(i) Figure P-Q-R-S

- PS⊥**PQ, SR⊥SP**

(ii) Quadrilateral W-X-Y-Z

- There is **no right angle**, so **no perpendicular pair**

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8. If lines l ∥ m ∥ n, what about l and n?

Since both **l** and **n** are parallel to **m**,
→ l ∥ n (they are also parallel to each other).

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9. How many perpendicular lines are there in capital letter 'E'?

There are **3 pairs of perpendicular lines**
(the three horizontal arms are each perpendicular to the one vertical line).

Answer: 3

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10. AB and CD do not intersect. Are they parallel? Give reasons.

No, we **cannot** say they are parallel.
Non-intersecting **segments** may still meet if we extend them.
In the figure, if lines **AB** and **CD** are extended, they will intersect, so they are **not parallel**.

EXERCISE 12.2

1. *(I) a. 40°* *Do yourself.*

(II) c. 60°

2. (*i*) One right-angle = 90°

Three right-angles = 3 × 90° = **270°**

(ii) One right-angle = 90°

$\frac{4}{9}$ right-angle = $\frac{4}{\cancel{9}_1} \times \cancel{90^\circ}^{10^\circ}$ = **40°**

3. (*i*) There are 5 divisions between the hour hand and minute hand at 7 O'clock.

So, the required angle formed

= 30° × 5 = **150°**.

(ii) There are $2\frac{1}{2}$ divisions between the hour hand and minute hand at 3 : 30 O'clock.

So, the required angle formed

$= 2 \times 30^\circ + \frac{1}{2} \times 30^\circ = \mathbf{75^\circ}$

4. There are 8 divisions (also 8 divisional markings) on the domestic appliance.

We know that 8 divisions = 360°

So, 1 division = 360° ÷ 8 = 45°

(i) (*a*) There are 2 divisions from 'off' to 'cold' (clockwise).
So, the required degree measure = 2 × 45º = **90°.**

(b) There is only 1 division from 'hot' to 'warm' (anti-clockwise).
So, the required degree measure = 1 × 45° = **45°**

(c) There are 4 divisions from 'very hot' to 'cool' (clockwise).
So, the required degree measure = 4 × 45° = **180°.**

(d) There are 3 divisions from 'cold' to 'warm' (clockwise).
So, the required degree measure = 3 × 45° = **135°.**

(e) There are 2 divisions from 'very cold' to 'very hot' (anti-clockwise).
So, the required degree measure = 2 × 45° = **90°.**

(f) There are 6 divisions from warm to cool (clockwise).
So, the required degree measure of the angle so formed = 6 × 45° = **270°.**

(ii) [***Answer*** *given in the Textbook is the* ***solution*** *itself.*]

5. (*i*) For minute-hand of a clock, degree measure for 1 minute turning = 360° ÷ 60 = 6°.
So, the required degree measure of the angle so formed
= 45 × 6° = **270°.**
For hour-hand of a clock, degree measure for 1 hour turning = 360° ÷ 12 = 30°.
So, the required degree measure of the angle so formed

$$= \frac{1}{2} \times 30° = \mathbf{15°}.$$

(*ii*) (*a*) The rotation (in degree) from N to SW in a clockwise direction = 5 × 45° = **225°.**

(*b*) The required rotation
= 2 × 45° = **90°.**

6. *Do yourself*. (see the video)

   a) *For 25°* angle – using Compass(Click the link) https://youtu.be/btAKJtNzx-w?si=D8MIUsEwgEjhY_z9

   b) *For 51°* angle – using protector (Click the link) https://youtu.be/sSpAWV6WCi0?si=pVYSgXrim3aMkGKQ

   c) *For 135°* angle – using protector (Click the link) https://youtu.be/82zeONXPAQM?si=hTuvG5OEoX6-5xWp

EXERCISE 12.3

1. MCQ

(i) Angle between South and West

South → West is a right angle.

Answer: 90° → Option (b) ✓□

(ii) Which angle is acute?

Acute angle < 90°.

Only **45°** is acute.

Answer: (a) ✓□

(iii) Which is a reflex angle?

Reflex angle >180° and <360°.

Only **195°** satisfies this.

Answer: (a) ✓□

2. Angle between South-East and North

SE is 45° below East.

To reach North (top), angle = 135°.

135° is **greater than 90° but less than 180°**, so it is an **obtuse angle**.

Answer: An obtuse angle ✓

3. Angle between North and South

Opposite directions → 180° (straight angle).

Answer: A straight angle ✓

4. Magnitude of complete angle

A complete rotation = **360° ✓**

5. Angle whose magnitude is 0°

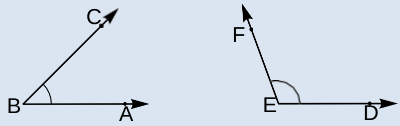
Zero angle ✓

6. When are two angles adjacent?

Two angles are called adjacent when:

- They have a **common vertex**,
- A **common arm**,
- And **do not overlap**.

7. We shall find the answer by inspection. First, measure the degree measures of angles ABC and DEF using protractor.



We find that $\angle ABC = 44°$ and $\angle DEF = 110°$.
Now, $\angle ABC + \angle DEF = 44° + 110° = 154°$

(**not equal to 180°**)

Hence, the angles B and E **do not form a linear pair**.

8. Since the angle is equal to its complement, we have
$2 \times \text{angle} = 90°$.
So, the **magnitude of the angle = 90° ÷ 2 = 45°**.

9. The supplement of $\angle DEF = 180° - 135° = \mathbf{45°}$.

12. (*i*) The supplementary angle (or supplement) of 90°
$= 180° - 90° = \mathbf{90°}$.
(ii) The supplementary angle of $10° = 180° - 10° = \mathbf{170°}$.
(iii) The supplementary angle of $81° = 180° - 81° = \mathbf{99°}$.

13. (*i*) The complementary angle (or complement) of 81°
$= 90° - 81° = \mathbf{9°}$.
(ii) The complementary angle of $10° = 90° - 10° = \mathbf{80°}$.
(iii) The complementary angle of $27° = 90° - 27° = \mathbf{63°}$.

14. *Solve it by algebraic method*.
(i) $3x + 2x = 180°$ [□ *∠AOC + ∠BOC = 180°, linear pair*]
i.e. $5x = 180°$
or $x = 36°$
$\therefore$ **∠AOC** $= 3 \times 36° = \mathbf{108º}$ and **∠BOC** $= 2 \times 36° = \mathbf{72°}$.
(ii) $2x - 10° + 3x + 15° = 180°$
[□ *∠AOC + ∠BOC = 180°, linear pair*]
i.e. $5x + 5° = 180°$
or $5x = 180° - 5° = 175°$
or $x = 35°$
$\therefore$ **∠AOC** $= 2 \times 35° - 10° = \mathbf{60º}$
∠BOC $= 3 \times 35° + 15° = 105° + 15° = \mathbf{120°}$.

15. **No** ; (∠CAB, ∠ABD) is not a pair of adjacent angles, as the two angles don't have a common vertex and a common arm.

16. An angle is $\frac{1}{5}$ of its supplement or the supplementary angle is 5 times the angle.
Now, 5 parts + 1 part = 180°
i.e. 6 parts = 180° *i.e.* 1 part = 180° ÷ 6 = 30°
Thus, degree measure of the angle is **30°** and its supplementary angle is of 150°.

17. $\angle 1 + \angle 4 = 180°$ [*Linear pair*]
or $65° + \angle 4 = 180°$ or $\angle \mathbf{4} = 180° - 65° = \mathbf{115°}$
Now, $\angle 1 = \angle \mathbf{3} = \mathbf{65°}$ [*Vertically opposite angles*]
$\angle \mathbf{2} = \angle \mathbf{4} = \mathbf{115°}$ [*Vertically opposite angles*]

18. (*i*) The angle formed between N and NE (Clockwise)

$= 1 \times 45° = 45°$.

Since $45° < 90°$, the angle formed is an **acute angle**.

(ii) The angle formed between N and SE (clockwise)

$= 3 \times 45° = 135°$

Since $135° > 90°$, the angle formed is an **obtuse angle**.

19. We know that the angle formed during each division (*i.e.* 1 to 2 or 2 to 3 or 3 to 4 etc.) on a clock is 30°.

(i) At 3 : 15, the angle formed between the hour-hand and minute-hand $= \frac{1}{\cancel{4}_{2}} \times \overset{15º}{\cancel{30}}º = \frac{15º}{2} = \mathbf{7\frac{1}{2}}º$

(ii) At 1 : 15, the angle formed $= 1 \times 30º + \frac{3}{\cancel{4}_{2}} \times \overset{15º}{\cancel{30}}º$

$= 30º + \frac{45º}{2} = 30º + 22\frac{1}{2}º = \mathbf{52\frac{1}{2}}º$

(iii) At 12 : 15, the angle formed $= 2 \times 30º + \frac{3}{\cancel{4}_{2}} \times \overset{15º}{\cancel{30}}º$

$= 60º + \frac{45º}{2} = 60º + 22\frac{1}{2}º = \mathbf{82\frac{1}{2}}º$

(iv) At 11 : 20, the angle formed $= 4 \times 30º + \frac{2}{\cancel{3}_{1}} \times \overset{10°}{\cancel{30}}°$

$= 120° + 20° = \mathbf{140°}$

(v) At 9 : 15, the angle formed $= 5 \times 30º + \frac{3}{\cancel{4}_{2}} \times \overset{15º}{\cancel{30}}º$

$= 150º + \frac{45º}{2} = 150º + 22\frac{1}{2}º = \mathbf{172\frac{1}{2}}º$

Use formula:
Angle = |30H − 5.5M|
{H=hours and M= minutes}

2 2 **2**

EXERCISE 12.4

1. Multiple Choice Questions (MCQ)

(i)

Angles are in the ratio 2 : 3 : 4.
Let angles be 2x, 3x, 4x.
$2x + 3x + 4x = 180°$
$9x = 180° \rightarrow x = 20°$
Angles = 40°, 60°, 80° (all acute).
Answer: Acute triangle (c)

(ii)

Two angles = 78° and 36°.
Third angle = 180° – (78° + 36°) = 66°.
Answer: 66° (c)

(iii)

At point B, exterior angle = 80°.
80° = 30° + angle C
Angle C = 50°.
Sum of angles: $30° + 50° + y = 180° \rightarrow y = 100°$.
Exterior angle at C: $x = 180° – 50° = 130°$.
Answer: x = 130°, y = 100° (d)

2. State whether the triangle is scalene or not

(i) 6 cm, 8 cm, 10 cm
All sides unequal → **Scalene triangle**.

(ii) a cm, b cm, a cm
Two sides equal → **Not a scalene triangle**.

3. State whether it is an isosceles triangle

(i) 3 cm, 3 cm, 2 cm
Two equal sides → **Isosceles triangle**.

(ii) a cm, b cm, c cm
All different → **Not isosceles**.

4. State whether the triangle is equilateral

(i) 5.8 cm, 7 cm, 5.8 cm

Only two equal → **Not equilateral**.

(ii) a cm, a cm, a cm

All equal → **Equilateral triangle**.

5. State whether the triangle is right-angled

(i) 58°, 83°, 39°

No 90° angle → **Not right-angled**.

(ii) 30°, 60°, 90°

One angle 90° → **Right-angled triangle**.

6. State whether the triangle is obtuse-angled

(i) 65°, 95°, 20°

95° > 90° → **Obtuse-angled triangle**.

(ii) 109°, 40°, 31°

109° > 90° → **Obtuse-angled triangle**.

7. State whether the triangle is acute-angled

(i) 58°, 83°, 39°

All < 90° → **Acute-angled triangle**.

(ii) 56°, 48°, 76°

All < 90° → **Acute-angled triangle**.

8. Number of medians and altitudes in the adjoining figure

There are 3 triangles sharing vertex A.

Medians per triangle = 3

Total medians = 3 × 3 = **9**

Altitudes per triangle = 3

Total altitudes = 3 × 3 = **9**

Answer: 9 medians and 9 altitudes

9. Name the altitude and median in ΔPQR

Altitudes: **PT**, **MN**

Median: **QS**

10. Which of the following can be lengths of a triangle?

Use triangle inequality: sum of any two sides > third.

(i) 3.9, 3.9, 3.9

Valid → **Possible**

(ii) 21, 22, 43

21 + 22 = 43 (not greater) → **Not possible**

11. The exterior angle ACD = 105°. If ∠B = 70°, find ∠A and ∠ACB.

Exterior angle = sum of opposite interior angles.

$105° = \angle A + 70° \rightarrow \angle A = 35°$
$\angle A + \angle B + \angle C = 180°$
$35° + 70° + \angle C = 180° \rightarrow \angle C = 75°$
Answers:
$\angle A = 35°$
Yes, $\angle ACD > \angle A$
$\angle ACB = 75°$

12. Equal angles of an isosceles triangle are four times the third angle

Let third angle = x
Equal angles = 4x
$4x + 4x + x = 180°$
$9x = 180° \rightarrow x = 20°$
Angles: 80°, 80°, 20°
Answer: 80°, 80°, 20°

13. From the figure, name the triangles

(i) Right triangles:
$\Delta DAB, \Delta ABC, \Delta BCD, \Delta ADC$
(ii) Obtuse triangles:
$\Delta AOB, \Delta DOC$
(iii) Acute triangles:
$\Delta APD, \Delta AOD, \Delta BOC$

14. O is inside ΔABC. State true or false

(i) OA + OB > AB
True (triangle inequality)
(ii) OB + OC > BC
True (triangle inequality)
(iii) OA + OC = AC
False (should be > AC, not equal)

Additional answers from 10 to 14 for practice

10. (*i*) 3.9 cm + 3.9 cm = 7.8 cm, 7.8 cm > 3.9 cm
∴ **3.9 cm, 3.9 cm, 3.9 cm can be the possible lengths of a triangle.**
(ii) 21 cm + 22 cm = 43 cm, **43 cm = 43 cm**
22 cm + 43 cm = 65 cm, 65 cm > 21 cm
21 cm + 43 cm = 64 cm, 64 cm > 22 cm
∴ **21 cm, 22 cm, 43 cm can not be the possible**

lengths of a triangle.

11. In ΔABC, we have

Now, $\angle A + \angle B + \angle C = 180°$ [*Angle sum property of* Δ]

Also, $\angle ACD + \angle ACB = 180°$ [*Linear pair*]

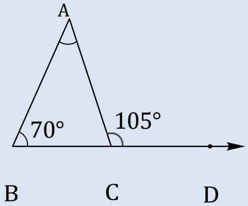
or $105° + \angle ACB = 180°$

or $\angle \mathbf{ACB} = 180° - 105° = \mathbf{75°}$

Again in ΔABC, we have

$\angle BAC + \angle ABC + \angle ACB = 180°$

or $\angle BAC + 70° + 75° = 180°$



or $\angle \mathbf{BAC} = 180° - 145° = \mathbf{35°}$

Clearly, $\angle \mathbf{ACD} > \angle \mathbf{BAC}$.

12. Let ABC be an isosceles triangle in which $\angle B = \angle C$ and $\angle A$ be the third angle.

According to the question, each of the two equal angles $\angle B$ and $\angle C$ is four times $\angle A$.

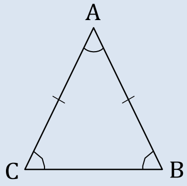
Now, according to the Angle Sum Property,

we get $\angle A + \angle B + \angle C = 180°$

So, $\angle A + 4\ \angle A + 4\ \angle A = 180°$

i.e., $9\ \angle A = 180°$ *i.e.*, $\angle A = 180° \div 9 = 20°$.

Also, $\angle B = \angle C = 4\ \angle A = 4 \times 20° = 80°$.



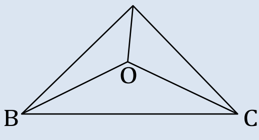
Hence, the three angles of the triangle are **20°, 80°, 80°**.

13. [***Answer*** *given in the Textbook is the* ***solution*** *itself.*]

14. (*i*) OA + OB > AB **(True)**

In ΔAOB ; OA, OB and AB are the three sides.

Since the condition OA + OB > AB satisfies the 'Triangle Inequality Property' that the sum of any two sides in a triangle is greater than the third side, the condition is **true**.



(*ii*)—(*iii*) : *Try yourself.*

EXERCISE 12.5 –
SOLVED WITH EXPLANATIONS

1. Multiple Choice Questions (MCQ)

(i) Which of the following figures is a quadrilateral?

A quadrilateral is a closed figure with **four sides**.
Among the given options, only the fourth figure has four sides.

Answer: Option **(d)** – it is the quadrilateral.

(ii) How many trapeziums are there in the given figure?

A **trapezium** is a quadrilateral with **one pair of opposite sides parallel**.
In the diagram (with three horizontal parallel segments and two slant sides), you count:

- 3 small trapeziums in the top strip,
- 3 small trapeziums in the middle strip,
- 2 larger trapeziums formed by combining strips,

Total = **8 trapeziums**.

Answer: 8 trapeziums → option **(b)**.

2. Name the quadrilateral that satisfies the description

(i) Opposite sides are parallel. All sides are equal.

This is the definition of a **rhombus**. A **square** also satisfies this, since a square has all sides equal and both pairs of opposite sides parallel.

Answer: Rhombus, Square

(ii) One angle equals 90°. Opposite sides are parallel.

A quadrilateral with opposite sides parallel and one right angle is a **rectangle**.

Answer: Rectangle

(iii) Two sides are parallel. Other two sides are not parallel.

Exactly one pair of parallel sides defines a **trapezium**.

Answer: Trapezium

(iv) All sides are equal. All angles are equal.

All sides equal + all angles 90° → **square**.

Answer: Square

3. Shade in 16 of the smallest triangles to form:

(i) a rectangle
(ii) a parallelogram
(iii) a square

This is an **activity / drawing question**.
Different correct shadings are possible, so the exact answer depends on the student's drawing.

Answer: Activity-based; students' correct shadings may vary. (Do yourself.)

4. Find and name the number of rectangles in the figure

On inspecting the figure carefully, you can identify **two** rectangles formed by the lines drawn inside the quadrilateral.

Answer: Number of rectangles = **2**

5. True or False in case of a square

(i) Sum of adjacent angles is 360°.

In a square, each angle is 90°.
Sum of **adjacent** angles = 90° + 90° = 180°, not 360°.
Statement: False.

(ii) Diagonals bisect each other.

In a square, both diagonals cut each other at their midpoints.
Statement: True.

(iii) Opposite sides are parallel and equal.

Yes, a square is a special parallelogram: opposite sides are parallel and equal.
Statement: True.

(iv) Adjacent sides are not equal.

In a square, all four sides are equal, so adjacent sides ARE equal.
Statement: False.

6. Rhombus ABCD – True or False

Given: ABCD is a **rhombus** (all sides equal; opposite sides parallel; diagonals bisect at right angles).

(i) AB = BC

In a rhombus, all sides are equal. So AB = BC.
Statement: True.

(ii) ∠DAB = ∠BCD

In a rhombus, opposite angles are equal.

∠DAB and ∠BCD are opposite angles.

Statement: True.

(iii) CD ∥ AD

In a rhombus, **AB ∥ CD** and **BC ∥ AD**.

So CD is parallel to AB, not to AD.

Statement: False.

(iv) AO = OC

O is the intersection of diagonals.

In a rhombus, diagonals bisect each other, so AO = OC.

Statement: True.

(v) ∠AOB = 90°

Diagonals of a rhombus are **perpendicular**, so angle between them is 90°.

Statement: True.

7. Fill with 'All', 'Some' or 'No'

Use the properties of each quadrilateral.

(i) _____ parallelograms are also quadrilaterals.

Every parallelogram has four sides, so all are quadrilaterals.

Answer: All parallelograms are also quadrilaterals.

(ii) _____ parallelograms are also trapeziums.

A trapezium (in this book) has **exactly one pair** of parallel sides.

A parallelogram has **two pairs** of parallel sides, so none are trapeziums.

Answer: No parallelograms are trapeziums.

(iii) _____ rhombuses are squares.

Only those rhombuses with all angles 90° are squares, not every rhombus.

Answer: Some rhombuses are squares.

(iv) _____ trapeziums are quadrilaterals.

Every trapezium has four sides.

Answer: All trapeziums are quadrilaterals.

(v) _____ squares are rhombuses.

A square has all sides equal and opposite sides parallel, so it is a special rhombus.

Answer: All squares are rhombuses.

(vi) _____ trapeziums are isosceles.

Some trapeziums have equal non-parallel sides (isosceles trapeziums), others do not.

Answer: Some trapeziums are isosceles.

8. Connect the mid-points of the sides of each figure

List to choose from: **parallelogram, rectangle, rhombus, square**.

A known result:

Joining the mid-points of the sides of **any quadrilateral** gives a **parallelogram**.

Using this:

(i) General quadrilateral

Figure formed by joining midpoints → **parallelogram** only (not necessarily rectangle/rhombus/square).

Answer: Parallelogram

(ii) Rectangle

Midpoint figure is always a **parallelogram**; in general it is a **rhombus** (sides equal), but not necessarily a rectangle unless the original rectangle is a square.

Names from the list that apply:
Parallelogram, Rhombus

(iii) Square

Midpoint figure is again a **square**. A square is also a **parallelogram**, **rectangle**, and **rhombus**.

Names from the list that apply:
Parallelogram, Rectangle, Rhombus, Square

(iv) Rhombus

Midpoint figure is a **rectangle** (and hence also a **parallelogram**).

Names from the list that apply:
Parallelogram, Rectangle

9. Complete the table for quadrilaterals

(Using the properties given in your book and the answer key.)

Quadrilateral	Opposite sides parallel	Opposite sides equal	All sides equal	Opposite angles equal	Diagonals equal	Diagonals perpendicular
Parallelogram	Yes	Yes	No	Yes	No	No
Rectangle	Yes	Yes	No	Yes	Yes	No
Square	Yes	Yes	Yes	Yes	Yes	Yes
Rhombus	Yes	Yes	Yes	Yes	No	Yes
Trapezium	Yes (only one pair)	No	No	No	No	No

EXERCISE 12.6 –

SOLVED WITH EXPLANATIONS

Q1. In the figure,

(i) How many pentagons are there?

A **pentagon** has **5 sides**.

In the given figure, if we carefully count all the 5-sided shapes, we get:

- 4 pentagons in the corners
- 4 pentagons in the middle of each side
- 2 pentagons around the centre

Total number of pentagons = **10**

(Answer matches book: 10)

(ii) How many hexagons are there?

A **hexagon** has **6 sides**.

In the figure there is only **one** 6-sided shape – the big one in the centre.

Number of hexagons = **1**

(Answer matches book: 1)

(iii) **How many heptagons are there?**

A **heptagon** has **7 sides**.
Looking carefully, there are **two** 7-sided shapes around the central hexagon.
Number of heptagons = **2**
(Answer matches book: 2)

(iv) **How many octagons are there?**

An **octagon** has **8 sides**.
In the figure there are **three** 8-sided shapes – one on the top, one at the bottom and one on the right side.
Number of octagons = **3**
(Answer matches book: 3)

Q2. Which of the following closed plane figures are not polygons?

Definition reminder:
A polygon is a **closed plane figure** made **only of straight line segments**, and the sides do **not** intersect each other.
Now check each figure:

- **(i)** Not a polygon – it has a **curved** boundary.
- **(ii)** Polygon – all straight sides (quadrilateral).
- **(iii)** Polygon – all straight sides (triangle).
- **(iv)** Not a polygon – one side is **curved**.
- **(v)** Not a polygon – it is a **circle** (no straight sides).
- **(vi)** Not a polygon – made of **curves**.
- **(vii)** Polygon – all sides straight (pentagon).
- **(viii)** Polygon – all straight sides (irregular polygon).
- **(ix)** Not a polygon – the sides **cross each other** (self-intersecting).

So, the figures which are **not polygons** are:
(i), (iv), (v), (vi), (ix)
(Answer matches book: (i), (iv), (v), (vi), (ix))

Q3. For each of the following polygons, write down the number of sides and name the polygon.

(Remember:

5 sides – pentagon,
6 sides – hexagon,
7 sides – heptagon,
8 sides – octagon,
9 sides – nonagon,
10 sides – decagon.)

(i) Figure (i)
- Count of sides = **8**
- Name = **octagon**

(ii) Figure (ii)
- Count of sides = **6**
- Name = **hexagon**

(iii) Figure (iii)
- Count of sides = **7**
- Name = **heptagon**

(iv) Figure (iv)
- Count of sides = **5**
- Name = **pentagon**

(v) Figure (v)
- Count of sides = **5**
- Name = **pentagon**

(vi) Figure (vi)
- Count of sides = **7**
- Name = **heptagon**

(vii) Figure (vii)
- Count of sides = **7**
- Name = **heptagon**

(viii) Figure (viii)
- Count of sides = **8**
- Name = **octagon**

(ix) Figure (ix)
- Count of sides = **9**
- Name = **nonagon**

(x) Figure (x)

- Count of sides = **10**
- Name = **decagon**

(All parts checked and matched with the book answer-key.)

Q4. Define with examples

(Answer key says "Do yourself", so there is no fixed wording in the book.
You may write the following in your notebook.)

(i) Regular polygons

A polygon is called a **regular polygon** if **all its sides are equal** and **all its angles are equal**.

Examples:

- An **equilateral triangle** (3 equal sides, 3 equal angles)
- A **square** (4 equal sides, 4 equal angles)
- A **regular hexagon** (6 equal sides, 6 equal angles)

(ii) **Non-regular polygons**

A polygon is called a **non-regular polygon** (or irregular polygon) if **all sides and all angles are not equal**.

Examples:

- A rectangle that is **not a square**
- Any scalene triangle (all sides different)
- An irregular pentagon with unequal sides.

EXERCISE —12.7

[***Answers*** *given to the questions in these Assignments in the Textbook are the* ***solutions*** *themselves.*]

EXERCISE 12.7 – SOLUTIONS

1. Multiple Choice Questions (MCQ)

The adjoining figure shows a **cube**.

(i) The number of square faces

A cube is a solid whose **all faces are squares** and all are equal.

Every cube has:

- Front face
- Back face

- Top face
- Bottom face
- Left face
- Right face

So, total square faces = **6**

Correct option: (b) 6

(Matches book: 1.(i) b)

(ii) Number of edges in the cube

Each square face has 4 edges. But edges are **shared** by two faces.

For a cube (and cuboid), the standard counts are:

- 6 faces
- 8 vertices
- 12 edges

Thus the number of edges = **12**

Correct option: (d) 12

(Matches book: 1.(ii) d)

2. Complete the following table

We need to write the number of faces, vertices and edges for each solid.

Solid	Number of Faces	Number of Vertices	Number of Edges
Cuboid	6	8	12
Cube	6	8	12
Triangular Prism	5	6	9
Pyramid (square base)	5	5	8
Cylinder	3 (2 circular + 1 curved)	0	2 (circles' rims)
Cone	2 (1 circular + 1 curved)	1	1 (circle rim)
Sphere	1 (curved surface)	0	0

Reasoning (short):

- Cuboid and cube → 6 flat faces, 8 corners, 12 edges.
- Triangular prism → 2 triangular faces + 3 rectangular faces = 5 faces, etc.
- Square pyramid → 1 square base + 4 triangular faces = 5 faces.
- Cylinder → 2 flat circular faces + 1 curved surface.
- Cone → 1 circular base + 1 curved surface, meeting at a single vertex.
- Sphere → only one curved surface, no edges, no vertices. *(Matches book table exactly.)*

---

3. Cuboid – Edges and Equal Lengths

In the figure, the cuboid has vertices **A, B, C, D, E, F, G, H**.

(i) Name all the edges and the faces intersecting in each edge

Each **edge** is the line where **two faces** meet.

- **AB** ; faces **ABCD** and **ABFE**
- **BC** ; faces **ABCD** and **CBFG**
- **EF** ; faces **ABFE** and **EFGH**
- **FG** ; faces **EFGH** and **CBFG**
- **DC** ; faces **ABCD** and **DCGH**
- **AE** ; faces **DAEH** and **ABFE**
- **HG** ; faces **EFGH** and **DCGH**
- **DH** ; faces **DAEH** and **DCGH**
- **AD** ; faces **ABCD** and **DAEH**
- **BF** ; faces **ABFE** and **CBFG**
- **EH** ; faces **EFGH** and **DAEH**
- **CG** ; faces **DCGH** and **CBFG**

(Each line is written in the same way as in the book: *edge ; face and face*.)

(ii) Which edges have the same length?

In a cuboid, opposite edges parallel to each other are equal in length.

- **AB, EF, DC, HG**
- **AD, EH, BC, FG**

- **AE, DH, BF, CG**
  Each group above contains edges of the **same length**.
  (Matches book: 3.(ii) AB, EF, DC, HG ; AD, EH, BC, FG ; AE, DH, BF, CG)

---

4. In the following figures, name

For each figure we have to name:
(a) the faces
(b) the edges
(c) the vertices/corners

Fig. (i)

(a) Faces :
ABCH, CDEH, FGDE, AHEF, BCDG, BGFA

(b) Edges :
AB, BC, CD, DE, EF, AF, AH, HC, FG, GD, BG, EH

(c) Vertices/Corners :
A, B, C, D, E, F, G, H

Fig. (ii)

(a) Faces :
ABCHG, FIJDE, GHEF, HCDE, BCDJ, ABJI, GAIF

(b) Edges :
AB, BC, CD, DE, EF, GF, AG, GH, HC, FI, IJ, JD, AI, BJ, EH

(c) Vertices/Corners :
A, B, C, D, E, F, G, H, I, J

Fig. (iii)

(a) Faces :
AED, ADC, ACB, AEF, AFB, EFBCD

(b) Edges :
AE, ED, DC, BC, AB, AD, AC, AF, EF, FB

(c) Vertices/Corners :
A, B, C, D, E, F

(All lists above are exactly as written in the book answer-key.)

---

5. Cylinders from a 10 cm × 15 cm paper

We can roll the rectangular sheet in **two different ways**:

1. **Roll along the 10 cm side**
   - Circumference = 15 cm → height = **10 cm**
2. **Roll along the 15 cm side**
   - Circumference = 10 cm → height = **15 cm**

So:

- **Number of cylinders** = **Two**
- **Heights** = **10 cm** and **15 cm**

(Matches book: "Two; Height of one is 10 cm and that of the other is 15 cm.")

---

6. Draw two nets of a cuboid of dimensions 5 cm × 5 cm × 1 cm

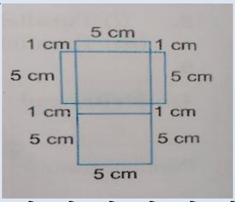
A cuboid of dimensions **5 cm × 5 cm × 1 cm** has:

- 2 faces of **5 cm × 5 cm** (squares)
- 4 faces of **5 cm × 1 cm** (rectangles)

You have to draw **two different nets** using these six rectangles/squares.

Description of two possible nets (same as in book's idea):

1. **Net 1 (cross-shape)**
   - Draw a row of **four rectangles** of size **5 cm × 1 cm** in a straight line.
   - Attach one **5 cm × 5 cm** square to the **second rectangle** (on one long side).
   - Attach the other **5 cm × 5 cm** square to the **third rectangle** (on the opposite long side).
2. **Net 2 (T-shape)**
   - Draw a central **5 cm × 5 cm** square.
   - Attach **four rectangles (5 cm × 1 cm)** around four sides of this square (like a plus sign).
   - Attach the last **5 cm × 5 cm** square to the **outer side of any one** of those rectangles.



MISCELLANEOUS EXERCISE

MISCELLANEOUS EXERCISE – CHAPTER 12

1. Look at the adjoining figure and answer:

(Figure is a cuboid ABCD-EFGH)

(i) Are the planes CDGH and ABEF adjacent?

- Two planes are **adjacent** only if they meet in a common edge.
- Plane CDGH is the back face; plane ABEF is the front face.
- They do **not** meet in any edge.

Answer: No

(ii) Name the line where the planes EFGH and ABEF intersect.

- Plane EFGH is the bottom face.
- Plane ABEF is the front face.
- These two faces meet along edge **EF**.

Answer: EF

(iii) Are the lines DG and AF parallel?

- DG is a back vertical edge.
- AF is the front vertical edge.
- These two vertical edges are equal and never meet.

Answer: Yes

(iv) Where do the lines EF and BE intersect?

- EF is the front bottom edge.
- BE is the front vertical edge.
- They meet at the common point **E**.

Answer: Point E

(v) Name a line parallel to EH.

- EH is a bottom back edge.
- FG is the bottom front edge and is parallel to EH.

Answer: FG

---

2. In the following figure, verify by measurement that:

(i) PR + QS = PS + QR

(ii) PQ + RS = PS − QR

(This is to be done using a ruler on the given drawing – as in the book it is left for the student.)

Answer: Do yourself.

---

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

- 1 right angle = 90°.
- Between any two consecutive numbers on a clock = 30°.

(i) 2 to 5

From 2 → 5 = 3 hours

Angle = 3 × 30° = **90°** (i.e. 1 right angle)

(ii) 10 to 2

From 10 → 2 = 4 hours

Angle = 4 × 30° = **120°** (i.e. 43\frac{4}{3}34 right angles)

(iii) 8 to 3

From 8 → 3 = 7 hours

Angle = 7 × 30° = **210°**

(iv) 12 to 9

From 12 → 9 = 9 hours

Angle = 9 × 30° = **270°**

Answers (as in book):

(i) **90°** (ii) **120°** (iii) **210°** (iv) **270°**

---

4. How many right angles do you turn through, if you start facing

(Remember: a half-turn = 2 right angles = 180°; a full turn = 4 right angles = 360°.)

(i) North and turn clockwise to South

- North → East → South
- This is a half-turn = **2 right angles**.

Answer: 2

(ii) West and turn anticlockwise to North

- West → South → East → North (anticlockwise)
- This is a three-quarter turn = **3 right angles**.

Answer: 3

(iii) East and turn anticlockwise to North

- East → North (anticlockwise)
- This is a quarter turn = **1 right angle**.

Answer: 1

---

5. In the figure, if ∠1 = 40°, find the measures of the other angles.

The figure shows two lines intersecting with angles 1,2,3,4 around the point.

- Angle 1 and angle 3 are **vertically opposite angles**, so they are equal.
  ⇒ ∠3 = 40°
- Angle 1 and angle 2 form a **linear pair** (on a straight line), so
  ∠1 + ∠2 = 180°
  ⇒ 40° + ∠2 = 180°
  ⇒ ∠2 = 180° − 40° = **140°**
- Similarly, angle 1 and angle 4 also form a linear pair.
  ⇒ ∠4 = 180° − 40° = **140°**
  Answers (as in book):
  ∠3 = 40°,   ∠2 = ∠4 = 140°

---

6. Study the adjoining figure and answer:

(Points on base BC are D, M, E; many triangles are formed.)

(i) Name the equilateral triangle.
All three sides equal: triangle **ABC**.
Answer: ΔABC

(ii) Name the isosceles triangle.
Two sides equal: triangle **ADE**.
Answer: ΔADE

(iii) Name the scalene triangles.
All three sides unequal:
ΔABD, ΔABM, ΔABE, ΔAEC, ΔAMC, ΔAME, ΔADM
Answer: ΔABD, ΔABM, ΔABE, ΔAEC, ΔAMC, ΔAME, ΔADM

(iv) Name the acute triangles.
All angles less than 90°:
ΔABC, ΔADC, ΔAEB, ΔADE
Answer: ΔABC, ΔADC, ΔAEB, ΔADE

(v) Name the obtuse triangles.
One angle greater than 90°:
ΔABD, ΔAEC
Answer: ΔABD, ΔAEC

(vi) Name the right triangles.
One angle exactly 90°:
ΔABM, ΔAMD, ΔAME, ΔAMC
Answer: ΔABM, ΔAMD, ΔAME, ΔAMC

---

7. In the following figure, two triangles ABC and ACD are joined.

(i) Find ∠1 + ∠2 + ∠3 + ∠4 + ∠5 + ∠6.

(ii) Hence find the sum of ∠BAD, ∠ABC, ∠BCD and ∠ADC.

At point A and point C, the angles around each point sum to 360°.

The given six angles 1–6 together make the complete revolution around that region.

So,

∠1 + ∠2 + ∠3 + ∠4 + ∠5 + ∠6 = 360°.

Angles ∠BAD, ∠ABC, ∠BCD, ∠ADC together also make one complete turn around the quadrilateral ABCD.

So,

∠BAD + ∠ABC + ∠BCD + ∠ADC = 360°.

Answers (as in book):

- **∠1 + ∠2 + ∠3 + ∠4 + ∠5 + ∠6 = 360°**

- **∠BAD + ∠ABC + ∠BCD + ∠ADC = 360°**

---

8. State ‘true’ or ‘false’:

(i) All 4-sided plane figures are quadrilaterals.
False, because the four sides must form a **closed** figure. If the sides do not form a closed shape, it is not a quadrilateral.
Answer: False

(ii) All squares are rectangles.
A rectangle has 4 right angles and opposite sides equal. A square also has these properties (with all four sides equal). So every square is a rectangle.
Answer: True

(iii) All rectangles are parallelograms.
A parallelogram has both pairs of opposite sides parallel. Rectangles also have opposite sides parallel, so every rectangle is a parallelogram.
Answer: True

(iv) All rhombuses are parallelograms.
In a rhombus all sides are equal and opposite sides are parallel, so it is a parallelogram.
Answer: True

(v) All squares are rhombuses.
A rhombus is a quadrilateral with all sides equal. A square has all sides equal (and all angles 90°), so every square is a rhombus.
Answer: True

---

9. Which of the following figures are not polygons and why?

Definition: A polygon is a **closed plane figure** made only of **straight line segments** which do **not cross** each other.
From the given figures:

- **(i)** Not a polygon – the figure is **not completely closed**.

- **(ii)** Polygon – closed figure with only straight sides.
- **(iii)** Not a polygon – the lines **cross** / it is self-intersecting.
- **(iv)** Not a polygon – again the sides **do not form a single closed boundary**.
- **(v)** Not a polygon – looks like a “bow-tie”; sides **intersect each other**.

Answer (as in book):
(i), (iii), (iv), (v) are not polygons.

---

10. Answer the following questions:

(i) Which shapes have **one curved surface and one plane surface**?
A cone has 1 curved surface and 1 plane circular base.
Answer: Cone

(ii) Which shapes have **one unbroken curved surface (and no plane surface)**?
A sphere has only one continuous curved surface and no flat faces.
Answer: Sphere

(iii) Which shape has **one curved surface and two plane faces of equal size**?
A cylinder has 1 curved surface and 2 equal circular plane faces.
Answer: Cylinder

(iv) Which shape has **three rectangular faces and two triangular faces of equal size**?
A triangular prism has 3 rectangular faces and 2 congruent triangular faces.
Answer: Triangular prism

(v) Which shapes have **six plane faces**?
Both cube and cuboid have 6 plane (flat) faces.
Answer: Cube, Cuboid

(vi) If a shape is completely bounded by plane faces, what is the **least number of faces** it may have (from the solids considered here)?
Among the solids considered (cube, cuboid, prism, pyramid, etc.) the smallest number of plane faces is **5**, as in a pyramid (or triangular prism).
Answer (as in book): 5

Additional answers from Q. 3,Q. 4, Q. 5, Q. 7 : for practice

Q. 1—Q. 2, Q. 6, Q. 8—Q. 10 : [***Answers** to these questions given in the Textbook are the **solutions** themselves.*]

3. The angle turned by hour-hand of a clock to move from one division to the next division = 360° ÷ 12 = 30°.

(i) The angle turned by the hour-hand of the clock to move from 2 to 5 = 3 × 30° = **90°**.

(ii) The angle turned by the hour-hand of the clock to move from 10 to 2 = 4 × 30° = **120°**.

(iii) The angle turned by the hour hand to move from 8 to 3 = 7 × 30° = **210°**.

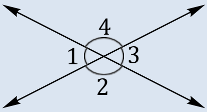
(iv) The angle turned by the hour hand to move from 12 to 9 = 9 × 30° = **270°**.

4. (*i*) The angle so formed during turning from N to S (Clockwise)
= 4 × 45° = 180°.
Hence, the no. of right angles turned = 180° ÷ 90° = **2**.

(ii) The angle so formed during turning from W to N (anticlockwise) = 6 × 45° = 270°.
Hence, the no. of right angles turned = 270° ÷ 90° = **3**.

(iii) The angle so formed during turning from E to N (anticlockwise) = 2 × 45° = 90°.
Hence, the no. of right angles turned = 90° ÷ 90° = **1**.

5. In the Fig., $\angle 1 = 40°$.



Now $\angle 1 = \angle 3 = 40°$ [*Vertically opposite angles*]

Also, $\angle 3 + \angle 4 = 180°$ [*linear pair*]

i.e., $40° + \angle 4 = 180°$

i.e., $\angle 4 = 180° - 40° = 140°$

Again, $\angle 2 = \angle 4 = 140°$ [*Vertically opposite angles*]

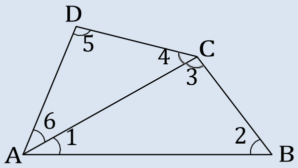
Hence, $\angle 2 = \mathbf{140°}$, $\angle 1 = \angle 3 = \mathbf{40°}$ and $\angle 4 = \mathbf{140°}$.

7. In ΔABC, we get

$\angle 1 + \angle 2 + \angle 3 = 180°$ [*Angle sum property of* Δ]

In ΔADC, we get

$\angle 4 + \angle 5 + \angle 6 = 180°$ [*Angle sum property of* Δ]



Now, $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 = 180° + 180° = \mathbf{360°}$

i.e., $(\angle 1 + \angle 6) + \angle 2 + (\angle 3 + \angle 4) + \angle 5 = 360°$

i.e., $\angle BAD + \angle ABC + \angle BCD + \angle ADC = \mathbf{360°}$.

Assertion and Reason

1. (*c*) **2.** (*a*) **3.** (*a*) **4.** (d)

CHAPTER TEST—12

[***Answers*** *to all types of questions given in the Textbook are the* ***solutions*** *themselves.*]

CHAPTER TEST – 12 : ANSWERS WITH EXPLANATION
(Printable – checked with book answer key)

---

1. In the given figure, AB and CD are

Lines AB and CD cross each other and make a **90° angle**.

- When two lines cross, they are **intersecting lines**.
- When they intersect at 90°, they are also **perpendicular lines**.

So, AB and CD are **both intersecting and perpendicular**.

Answer: (c) Both (a) and (b)

---

2. Find the number of right angles in a complete angle.

- A **right angle** = 90°.
- A **complete angle** = 360°.

Number of right angles in 360°

360∘/90∘=4

Answer: 4

---

3. Name the angle which is more than 90° but less than 180°.

An angle greater than 90° and less than 180° is called an **obtuse angle**.

Answer: obtuse angle

---

4. Which of the following is correct?

(a) Two adjacent angles always form a linear pair.

(b) A pair of complementary angles form a linear pair.

(c) A linear pair angles form a pair of adjacent angles.

(d) A pair of supplementary angles do not form a pair of adjacent angles.

- (a) is **false**: adjacent angles need not be supplementary.
- (b) is **false**: complementary sum is 90°, but a linear pair must sum to 180°.
- (c) is **true**: by definition, a linear pair is a **pair of adjacent angles** whose non-common arms form a straight line.
- (d) is **false**: supplementary angles may or may not be adjacent.

So, only statement (c) is correct.

Answer: (c)

---

5. If one angle of a linear pair is 110°, then find the other angle.

Angles in a **linear pair** are supplementary.

Other angle=180∘−110∘=70

Answer: 70°

---

6. If one angle of a pair of complementary angles is 1°, then find the other.

Complementary angles sum to 90°.

Other angle=90∘−1∘=89

Answer: 89°

---

7. Find the difference between the sum of two supplementary angles and the sum of two complementary angles.

- Sum of supplementary angles = 180°.

- Sum of complementary angles = 90°.
  Difference
  $180^\circ - 90^\circ = 90^\circ$
  Answer: 90°

---

8. If an angle is ¼ of its supplement, find the degree measure of the angle.
Let the angle be x°
Then its supplement is $180^\circ - x^\circ$
Given:
$x = 1/4\ (180 - x)$
$4x = 180 - x$
$5x = 180 \Rightarrow x = 180/5 = 36^\circ$
Answer: 36°

---

9. Find the angle through which the minute-hand of a clock turns in 40 minutes.
- In 60 minutes, the minute hand makes 1 full revolution = 360°.
- In 1 minute, it turns $360^\circ/60 = 6$
  In 40 minutes
  $40 \times 6^\circ = 240^\circ$
  Answer: 240°

---

10. In the figure, if ∠1 = 60°, find the sum of degree measures of ∠2 and ∠3.
The figure shows two straight lines crossing.
- ∠1 and ∠3 are **vertically opposite angles**, so
  $\angle 3 = \angle 1 = 60^\circ$
- ∠1 and ∠2 form a **linear pair**, so they are supplementary:
  $\angle 1 + \angle 2 = 180^\circ \Rightarrow 60^\circ + \angle 2 = 180^\circ \Rightarrow \angle 2 = 120^\circ$
  Now,
  $\angle 2 + \angle 3 = 120^\circ + 60^\circ = 180$
  Answer: 180°