

Parallel and Intersecting Lines

Class 7 NCERT Solutions

Step-by-step answers for the 2026-27 NCERT Mathematics book

Chapter 5: Parallel and Intersecting Lines

This PDF solves Class 7 Mathematics (Part 1) Chapter 5 Parallel and Intersecting Lines. It covers intersecting lines, linear pairs, vertically opposite angles, perpendicular lines, parallel lines, transversals, corresponding angles, alternate angles and interior angle sums.

Also see for this chapter:

Chapter 5 Figure it Out Solutions

Q 5.1 Can two straight lines intersect at more than one point? What pattern do you observe among the four angles formed by intersecting lines?

SOLUTION

Concept used. Two distinct straight lines can have at most one common point. When two lines intersect, adjacent angles form linear pairs and opposite angles are vertically opposite angles.

Source anchor

NCERT Class 7 Mathematics (Part 1), Chapter 5, Parallel and Intersecting Lines, Reprint 2026-27.

Step 1. Two different straight lines cannot meet at two points. If they had two common points, the same straight line would pass through those two points.

Step 2. So two straight lines either do not meet or intersect at exactly one point.

Step 3. If the four angles around the intersection are a, b, c, d , then $a + b = 180^\circ$ and $b + c = 180^\circ$ because each pair makes a straight angle.

Step 4. From these relations, $a = c$ and $b = d$. These are the vertically opposite angle pairs.

Geometry check

Use reasoning before measuring. A rough drawing may measure as 119° and 121° , but the exact geometry gives equal vertically opposite angles.

Final Answer: No. Two straight lines intersect at at most one point. Also, $\angle a = \angle c$, $\angle b = \angle d$, and every linear pair adds to 180° .

EXPERT'S SOLUTION : Aarav Sharma, M.Sc Mathematics, IIT Bombay

Concept used. A straight line is fixed by two distinct points. Angle facts at an intersection come from the straight angle measure, 180° .

Step 1. Suppose two different lines met at two points. Then both lines would be the unique line through those two points.

Step 2. That would make them the same line, not two different intersecting lines.

Step 3. Therefore, two distinct straight lines can share only one intersection point.

Step 4. Around that point, adjacent angles are linear pairs. So $a + b = 180^\circ$ and $a + d = 180^\circ$.

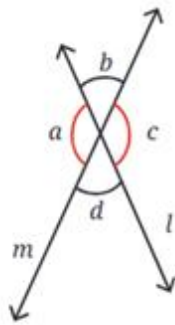
Step 5. Since both b and d are equal to $180^\circ - a$, we get $b = d$.

Step 6. In the same way, $a = c$ because each equals $180^\circ - b$.

This route proves the pattern instead of depending on a protractor. The proof also explains why small measurement errors do not change the exact result.

Final Answer: Two distinct straight lines cannot intersect at more than one point, and vertically opposite angles are equal.

Q 5.2 List all the linear pairs and vertically opposite angles you observe in Fig. 5.3.



Linear Pairs	$\angle a$ and $\angle b$, ...
Pairs of Vertically Opposite Angles	$\angle b$ and $\angle d$, ...

Fig. 5.3, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. A linear pair consists of adjacent angles on a straight line. Vertically opposite angles lie opposite each other when two lines intersect.

Source anchor

The answer key lists the four linear pairs and two vertically opposite pairs for Fig. 5.3.

Step 1. $\angle a$ and $\angle b$ are adjacent and form a straight angle, so they are a linear pair.

Step 2. $\angle b$ and $\angle c$ form another straight angle.

Step 3. $\angle c$ and $\angle d$ form another straight angle.

Step 4. $\angle d$ and $\angle a$ also form a straight angle.

Step 5. Opposite angles are $\angle a$ and $\angle c$, and $\angle b$ and $\angle d$.

Quick test

For a linear pair, the two angles touch each other. For vertically opposite angles, they do not share an arm.

Final Answer: Linear pairs: (a, b) , (b, c) , (c, d) , (d, a) . Vertically opposite pairs: (a, c) and (b, d) .

EXPERT'S SOLUTION : Diya Nair, M.Sc Mathematics, ISI Kolkata

Concept used. Read the diagram by following each straight line through the intersection point.

Step 1. On one straight line, $\angle a$ and $\angle b$ sit side by side, so $a + b = 180^\circ$.

Step 2. Continuing around the point gives $b + c = 180^\circ$, $c + d = 180^\circ$, and $d + a = 180^\circ$.

Step 3. These four adjacent pairs are exactly the linear pairs.

Step 4. The angles across the intersection are not adjacent. They are vertically opposite.

Step 5. Thus a is opposite c , and b is opposite d .

This method avoids memorising the list. Moving around the intersection once gives every adjacent pair, and then the remaining across-the-point pairs are vertically opposite.

Final Answer: Linear pairs are $\angle a, \angle b$; $\angle b, \angle c$; $\angle c, \angle d$; $\angle d, \angle a$. Vertically opposite pairs are $\angle a, \angle c$ and $\angle b, \angle d$.

Q 5.3 Which pairs of lines appear to be parallel in Fig. 5.6?

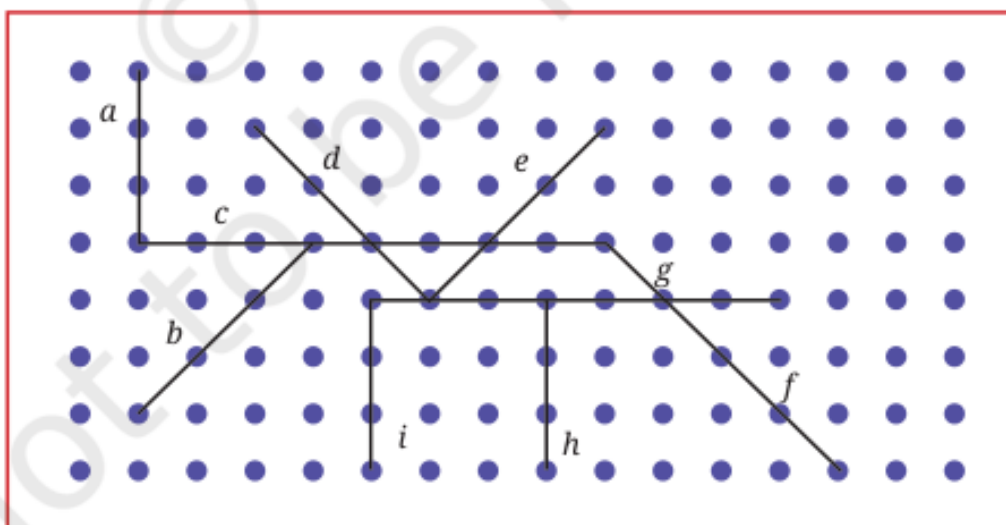


Fig. 5.6, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Parallel lines lie on the same plane and do not meet however far we extend them.

Source anchor

The NCERT answer key identifies the apparent parallel sets in Fig. 5.6.

Step 1. Lines a , i and h are drawn in the same vertical direction, so they appear parallel.

Step 2. Lines c and g are both horizontal, so they appear parallel.

Step 3. Lines d and f have the same slant, so they appear parallel.

Step 4. Lines e and b also have the same slant, so they appear parallel.

Visual check

On dot paper, compare direction and spacing. Lines with the same tilt and steady distance are likely parallel.

Final Answer: a, i, h ; c, g ; d, f ; and e, b appear to be parallel.

EXPERT'S SOLUTION : Vivaan Patel, M.Sc Applied Mathematics, IIT Kanpur

Concept used. Parallelism is about direction on the same plane, not about length.

Step 1. First group the vertical-looking lines. The lines a , i and h share one direction.

Step 2. Next group the horizontal-looking lines. The lines c and g share one direction.

Step 3. For slanting lines, compare the rise and run between dots. Lines d and f match.

Step 4. The other matching slant is shown by lines e and b .

Step 5. Different lengths do not matter, because a line segment can be extended.

The dot grid helps us compare slopes informally. Equal slope means the extended lines stay equally spaced, so they do not meet.

Final Answer: a, i, h ; c, g ; d, f ; and e, b .

Q 5.4 In Activity 2 with paper folding in Fig. 5.7, fill the blanks and describe the pattern of parallel lines formed by repeated horizontal folds.

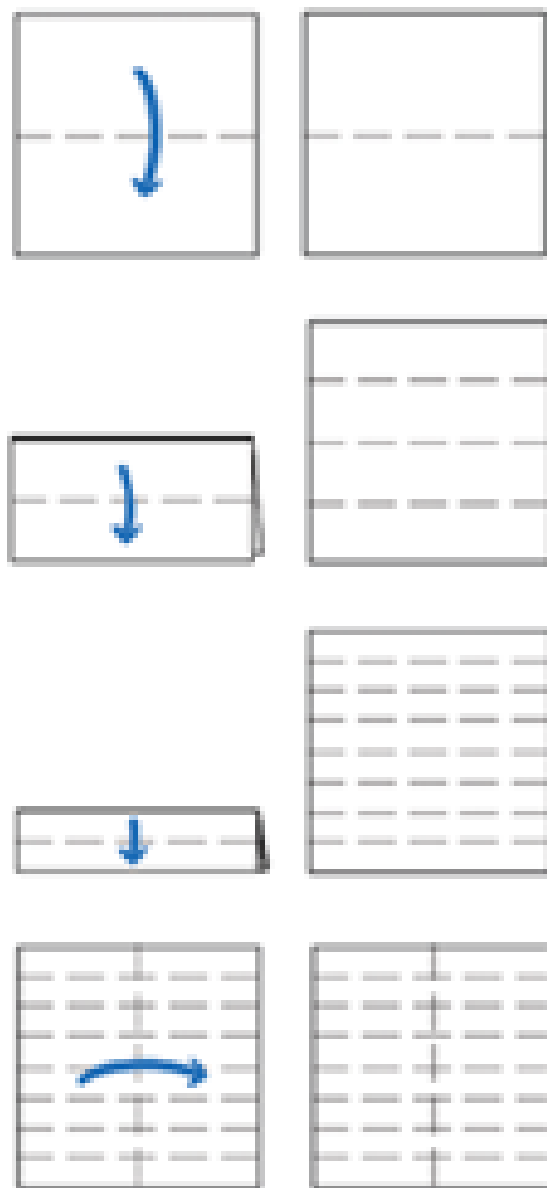


Fig. 5.7, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Opposite edges of a square sheet are parallel. Adjacent edges are perpendicular because they meet at right angles.

Source anchor

The answer key gives the fold counts as 3, 5 and 9 visible parallel lines for the first three horizontal fold stages.

Step 1. The opposite edges of the square sheet are parallel to each other.

Step 2. The adjacent edges are perpendicular to each other because they meet at right angles.

Step 3. After one horizontal fold, the two horizontal edges and the crease are parallel. So we see 3 parallel horizontal lines.

Step 4. After one more horizontal fold, the visible horizontal lines become 5.

Step 5. After another horizontal fold, the visible horizontal lines become 9.

Step 6. A vertical fold is perpendicular to the previous horizontal fold lines.

Step 7. A fold parallel to a diagonal can be made by aligning the fold with the same diagonal direction.

Pattern

Each new folding stage can create more creases between the same parallel edges.

Final Answer: Opposite edges are parallel. Adjacent edges are perpendicular. The first horizontal fold gives 3 parallel lines, the next gives 5, then 9. A vertical fold is perpendicular to the horizontal folds.

EXPERT'S SOLUTION : Sneha Iyer, Ph.D Mathematics, IIT Delhi

Concept used. A fold line behaves like a straight line on the same plane of paper.

Step 1. A square has two pairs of opposite sides. Each opposite pair does not meet on the sheet, so they are parallel.

Step 2. Adjacent sides meet at a corner and form 90° , so they are perpendicular.

Step 3. A horizontal half fold creates a crease parallel to the top and bottom edges.

Step 4. Counting the two original horizontal edges plus this crease gives 3 lines.

Step 5. Folding again creates new horizontal creases, raising the visible count to 5, and the next stage gives 9.

Step 6. A vertical crease cuts all horizontal creases at right angles, so it is perpendicular to them.

The activity turns definitions into a physical model. Parallel means same direction on the paper; perpendicular means a right-angle meeting.

Final Answer: Parallel; perpendicular; 3, 5, then 9 parallel horizontal lines; the vertical fold is perpendicular.

Q 5.5 In the paper-folding activity shown in Fig. 5.8, are a , b and c parallel to p , q and r respectively? Why?

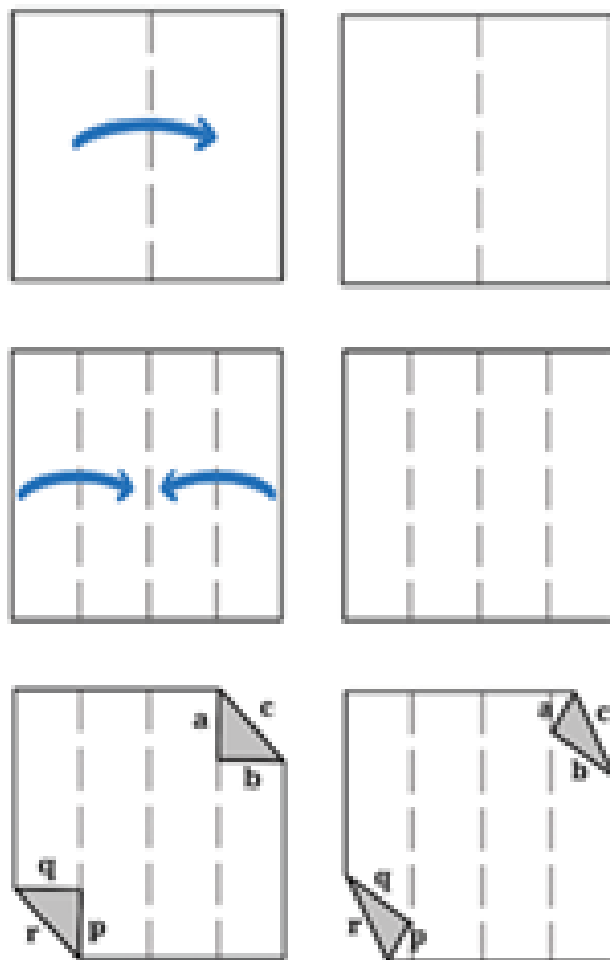


Fig. 5.8, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. If two lines are made by the same folding direction, or if both are perpendicular to the same line, they are parallel.

Step 1. Line segment a and line segment p lie along the same fold direction, so they are parallel.

Step 2. Line segment b and line segment q are both formed in matching positions with respect to the central crease.

Step 3. Since their directions match, $b \parallel q$.

Step 4. The triangular folds create c and r along matching diagonal directions.

Step 5. Hence $c \parallel r$ as well.

Reasoning cue

Parallel lines need not be the same length. The direction is what matters.

Final Answer: Yes. $a \parallel p$, $b \parallel q$, and $c \parallel r$.

EXPERT'S SOLUTION : *Pranav Rao, M.Sc Mathematics, IIT Bombay*

Concept used. Paper folds preserve alignment. Creases made by matching folds give lines with matching direction.

Step 1. Compare a with p : both come from corresponding crease directions, so they remain equally spaced.

Step 2. Compare b with q : both are positioned by folds toward the same centre line, so their directions are the same.

Step 3. Compare c with r : both diagonal fold edges are created symmetrically.

Step 4. If extended, each matched pair would not meet on the paper plane.

Step 5. Therefore, each matched pair is parallel.

This solution uses the definition of parallel lines rather than only visual appearance. The folded construction gives a reason for the equal direction.

Final Answer: a , b and c are parallel to p , q and r respectively.

Q 5.6 Solve the dot-paper and notation questions in Fig. 5.10, Fig. 5.11, Fig. 5.12 and Fig. 5.13.



Fig. 5.10, NCERT Class 7 Mathematics (Part 1), Chapter 5.

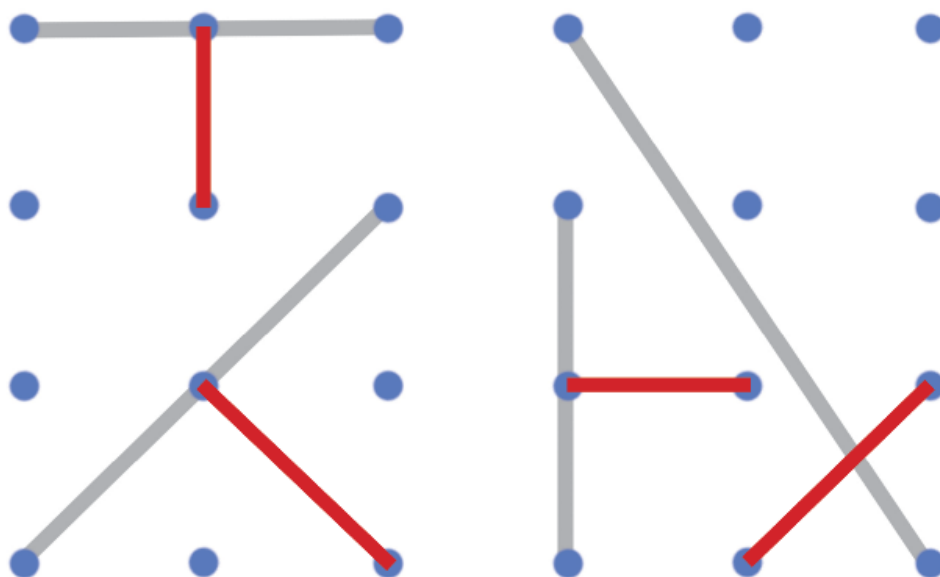


Fig. 5.11, NCERT Class 7 Mathematics (Part 1), Chapter 5.

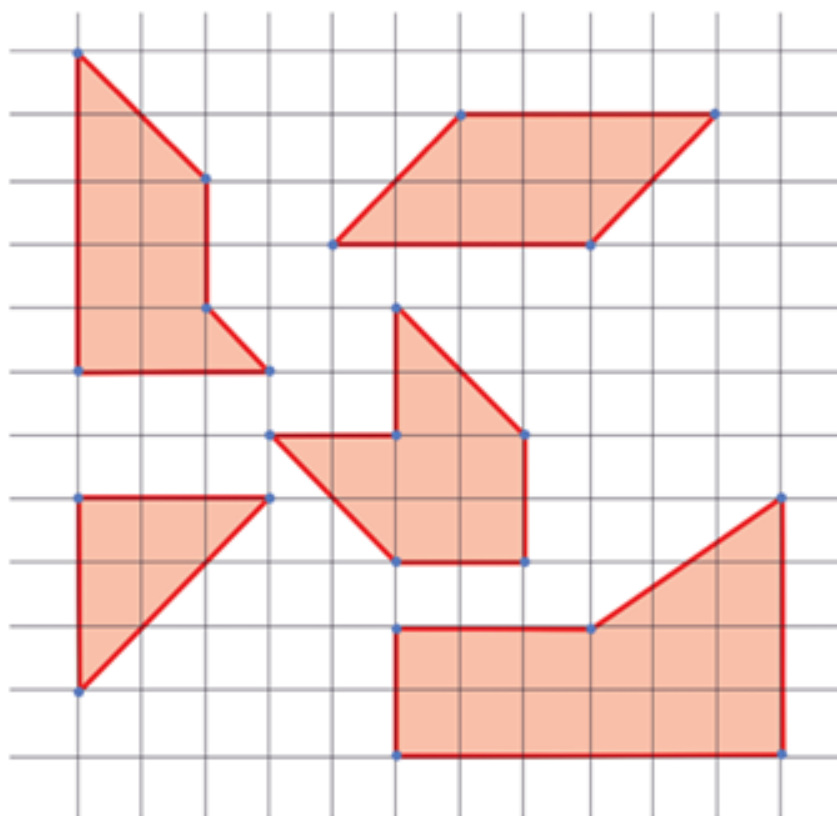


Fig. 5.12, NCERT Class 7 Mathematics (Part 1), Chapter 5.

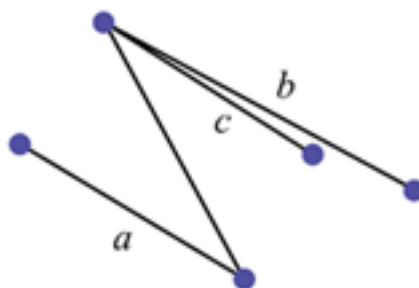


Fig. 5.13, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Perpendicular lines meet at 90° . Parallel lines keep the same direction and distance when extended.

Step 1. In Fig. 5.10, draw each required perpendicular by making a right angle with the given line segment on the dot paper.

Step 2. In Fig. 5.11, mark perpendicular lines where a vertical-looking line meets a horizontal-looking line at a right angle.

Step 3. Mark parallel lines in Fig. 5.11 by using the same arrow notation for lines with the same direction.

Step 4. In Fig. 5.12, draw each parallel through dot endpoints by keeping the same tilt as the given line segment.

Step 5. The more difficult ones are usually e , f , g and h , because they are not simple horizontal or vertical segments.

Step 6. In Fig. 5.13, line c is parallel to line a , not line b .

 Construction tip

Use the dots as equal spacing markers. A parallel copy should repeat the same rise and run.

Final Answer: Draw right-angle lines in Fig. 5.10; mark grid right angles and same-direction lines in Fig. 5.11; draw equal-tilt copies in Fig. 5.12; and in Fig. 5.13, $c \parallel a$.

EXPERT'S SOLUTION : Aanya Desai, M.Sc Mathematics, ISI Kolkata

Concept used. On dot paper, slope can be checked by counting horizontal and vertical moves between endpoints.

Step 1. To draw a perpendicular, choose a direction that turns the given segment by 90° .

Step 2. On a square grid, horizontal and vertical directions are perpendicular.

Step 3. Lines with identical rise and run are parallel because they have the same direction.

Step 4. For slanting segments in Fig. 5.12, copy the same dot-to-dot movement elsewhere on the grid.

Step 5. In Fig. 5.13, c keeps the same direction and spacing as a .

Step 6. Line b cuts across that direction, so it is not parallel to a .

This approach works even when visual judgement is unsure. Counting the dot movement makes the decision about parallel lines more reliable.

Final Answer: c is parallel to a in Fig. 5.13, and the other figures are completed by right-angle and same-slope constructions.

Q 5.7 In Fig. 5.14, a transversal intersects two lines and forms eight angles. Can all eight angles have different measurements? What about five angles: 6, 5, 4, 3 and 2?

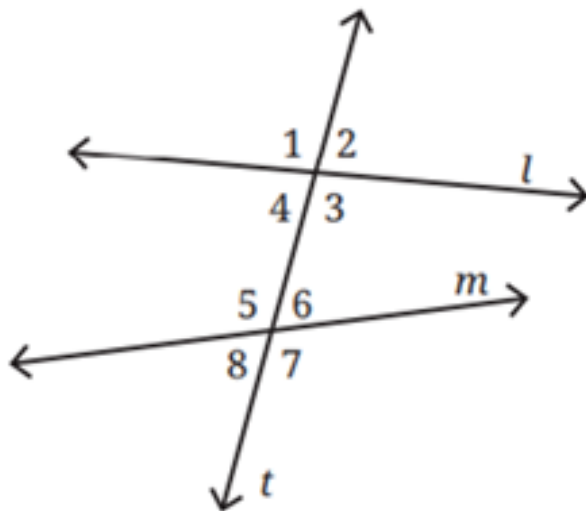


Fig. 5.14, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Vertically opposite angles are equal whenever two lines intersect.

Step 1. At the upper intersection, $\angle 1 = \angle 3$ and $\angle 2 = \angle 4$.

Step 2. At the lower intersection, $\angle 5 = \angle 7$ and $\angle 6 = \angle 8$.

Step 3. Since at least these pairs are equal, all eight angles cannot have different measurements.

Step 4. Among angles 6, 5, 4, 3, 2, the pair $\angle 2$ and $\angle 4$ is equal.

Step 5. Therefore those five angles also cannot all be different.

Counting idea

A transversal makes eight labelled angles, but equal opposite pairs reduce the number of possible different measures.

Final Answer: No. All eight cannot be different, and the five angles 6, 5, 4, 3, 2 cannot all be different because $\angle 2 = \angle 4$.

EXPERT'S SOLUTION : *Karan Singh, B.Tech CSE, IIT Roorkee*

Concept used. A transversal creates two separate intersections, and each intersection has vertically opposite angle pairs.

Step 1. Look first at line t crossing line l .

Step 2. The vertically opposite pairs at this point are $(1, 3)$ and $(2, 4)$.

Step 3. Since each pair is equal, four upper angles can have at most two different measures.

Step 4. Look next at line t crossing line m .

Step 5. The vertically opposite pairs at this point are $(5, 7)$ and $(6, 8)$.

Step 6. Therefore eight fully different angle measures are impossible.

For the smaller set 6, 5, 4, 3, 2, the equality $\angle 2 = \angle 4$ is already enough to rule out five different measurements.

Final Answer: No in both cases. Vertically opposite angles force equality.

Q 5.8 Can you draw a line parallel to l that goes through point A in Fig. 5.23? Describe the geometry-box method. Also explain why the paper-folding construction in Fig. 5.24 gives a parallel line.

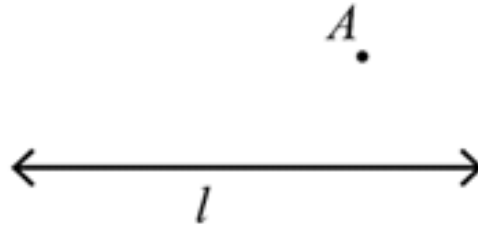


Fig. 5.23, NCERT Class 7 Mathematics (Part 1), Chapter 5.

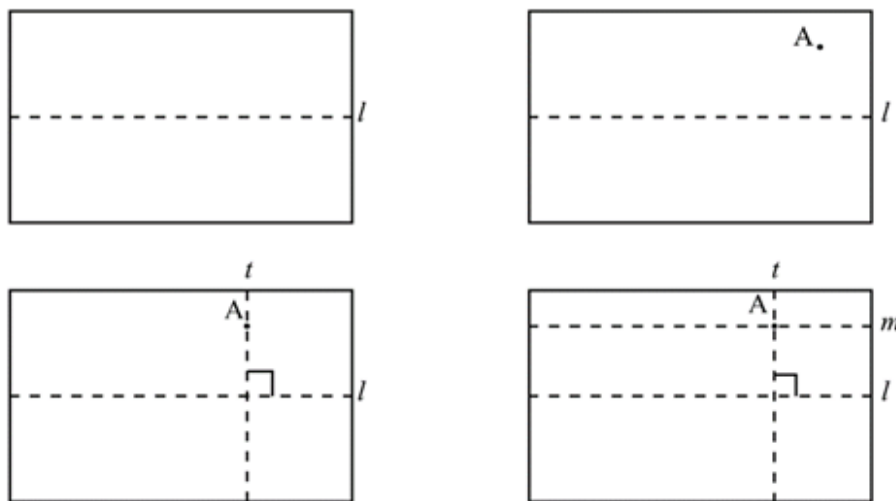


Fig. 5.24, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. If two lines are perpendicular to the same line, they are parallel to each other.

Step 1. Place one side of a set square along line l .

Step 2. Hold a ruler against another side of the set square so the ruler stays fixed.

Step 3. Slide the set square along the ruler until its drawing edge passes through point A .

Step 4. Draw the line through A . This line is parallel to l because the set square keeps the same angle while sliding.

Step 5. In paper folding, first fold a crease t perpendicular to l through A .

Step 6. Then fold another crease m perpendicular to t through A .

Step 7. Since l and m are both perpendicular to t , they are parallel.

 Tool rule

Sliding a set square preserves direction. That is why the copied line stays parallel.

Final Answer: Yes. Use a ruler and set square to copy the direction of l through A . In folding, $l \perp t$ and $m \perp t$, hence $l \parallel m$.

EXPERT'S SOLUTION : Neha Banerjee, Ph.D Mathematics, IIT Delhi

Concept used. Equal corresponding angles imply parallel lines.

Step 1. The set-square method keeps the angle made with the ruler unchanged while the set square slides.

Step 2. Therefore the new line through A makes the same corresponding angle as line l .

Step 3. Equal corresponding angles guarantee that the two lines are parallel.

Step 4. In the folding method, t is drawn perpendicular to l , so the angle is 90° .

Step 5. The line m is also perpendicular to t , so it also makes 90° with t .

Step 6. These equal corresponding angles show $l \parallel m$.

The construction is reliable because it does not depend on eye judgement. It copies either a direction or a right angle relation.

Final Answer: The line through A is drawn by sliding the set square. The folding construction works because two lines perpendicular to the same line are parallel.

Q 5.9 Find the angles marked a to j in Fig. 5.30.

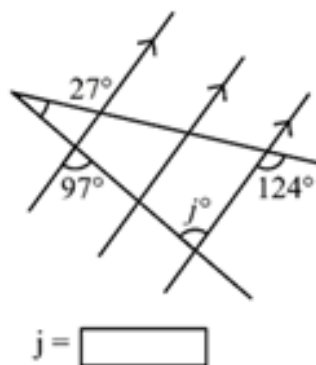
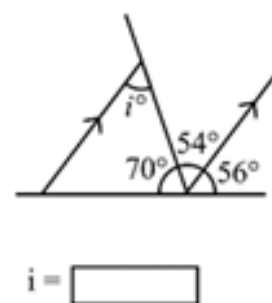
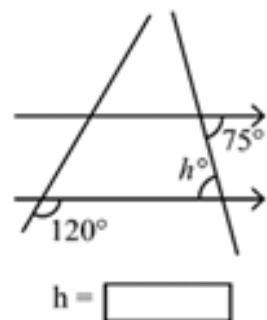
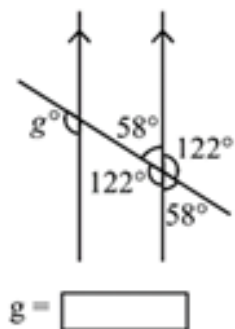
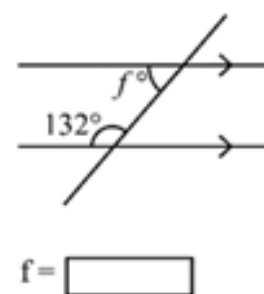
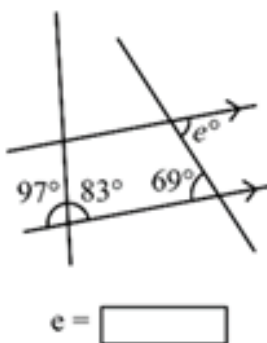
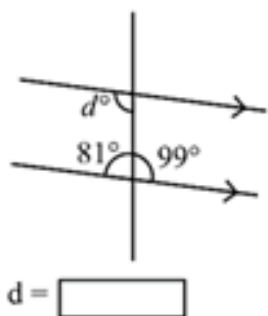
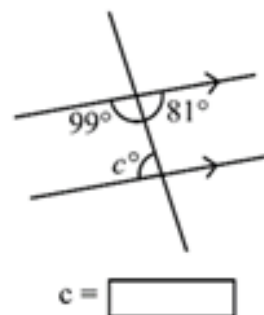
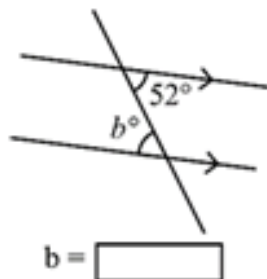
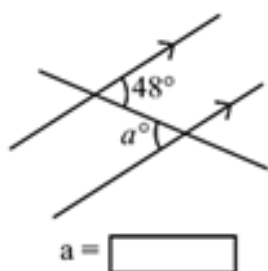


Fig. 5.30, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Use vertically opposite angles, linear pairs, corresponding angles and same-side interior angle sums.

Step 1. In the first small figure, $a = 48^\circ$ by vertically opposite angles.

Step 2. In the second, $b = 52^\circ$ by the corresponding or equal angle relation shown.

Step 3. In the third, $c = 81^\circ$ because the given 99° and 81° form a straight angle pair.

Step 4. In the fourth, $d = 99^\circ$ by vertically opposite or corresponding angle equality.

Step 5. In the fifth, $e = 69^\circ$ by the equal angle relation in the parallel-line setup.

Step 6. In the sixth, $f = 48^\circ$ because it is supplementary to 132° .

Step 7. In the seventh, $g = 122^\circ$ by corresponding or vertically opposite equality.

Step 8. In the eighth, $h = 75^\circ$ by the marked parallel-line angle relation.

Step 9. In the ninth, $i = 54^\circ$.

Step 10. In the tenth, $j = 97^\circ$.

Angle strategy

When stuck, first check for a straight line sum of 180° . Then check for equal opposite or corresponding angles.

Final Answer: $a = 48^\circ$, $b = 52^\circ$, $c = 81^\circ$, $d = 99^\circ$, $e = 69^\circ$, $f = 48^\circ$, $g = 122^\circ$, $h = 75^\circ$, $i = 54^\circ$, $j = 97^\circ$.

EXPERT'S SOLUTION : Yash Pillai, M.Sc Applied Mathematics, IIT Kanpur

Concept used. Each marked value comes from one of two rules: equal angle pairs or supplementary linear pairs.

Step 1. Equal pairs give $a = 48^\circ$, $b = 52^\circ$, $d = 99^\circ$, $e = 69^\circ$, $g = 122^\circ$, $h = 75^\circ$, $i = 54^\circ$ and $j = 97^\circ$.

Step 2. For c , the adjacent straight-line angle is 99° , so $c = 180^\circ - 99^\circ = 81^\circ$.

Step 3. For f , the adjacent angle is 132° , so $f = 180^\circ - 132^\circ = 48^\circ$.

Step 4. All values are checked against either a straight-line sum or an equality rule.

This gives a quick verification path. Any answer larger than 180° or not matching an equal or supplementary partner would signal an error.

Final Answer: $48^\circ, 52^\circ, 81^\circ, 99^\circ, 69^\circ, 48^\circ, 122^\circ, 75^\circ, 54^\circ, 97^\circ$ in order from a to j .

Q 5.10 Find the angle represented by a in each diagram of Fig. 5.31.

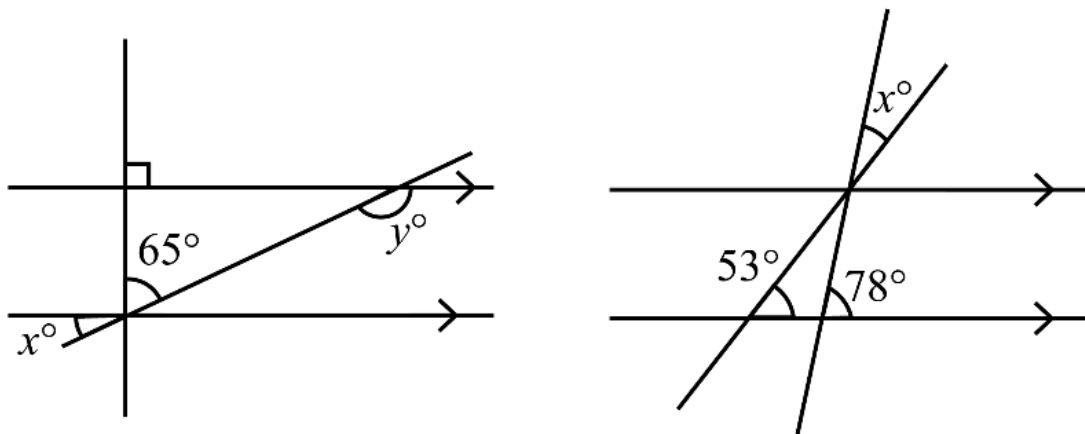


Fig. 5.31, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Around parallel lines and transversals, use supplementary linear pairs and equal corresponding or alternate angles.

Step 1. In the first diagram, the marked angle related to 42° gives

$$a = 180^\circ - 42^\circ = 138^\circ.$$

Step 2. In the second diagram, the corresponding setup gives $a = 180^\circ - 62^\circ = 118^\circ$.

Step 3. In the third diagram, combining the shown linear-pair relation gives $a = 105^\circ$.

Step 4. In the fourth diagram, the relevant difference in the angle chase gives

$$a = 23^\circ.$$

Check

Each result should fit the picture: obtuse-looking angles are above 90° , and the small acute angle is 23° .

Final Answer: The four values of a are 138° , 118° , 105° and 23° .

EXPERT'S SOLUTION : Sanya Chatterjee, Ph.D Pure Mathematics, IISc Bangalore

Concept used. Angle chasing means moving from a known angle to the required angle through equal or supplementary pairs.

Step 1. First diagram: the known 42° angle and a make a supplementary relation, so

$$a = 138^\circ.$$

Step 2. Second diagram: 62° is paired with a through a straight-angle relation, so $a = 118^\circ$.

Step 3. Third diagram: the lower marked angle chain gives an obtuse result, $a = 105^\circ$.

Step 4. Fourth diagram: the angle chase leaves the small acute gap $a = 23^\circ$.

Step 5. These match the NCERT answer key values.

The safest way is to annotate each equal angle first, then subtract only when a straight line or same-side interior pair is being used.

Final Answer: $a = 138^\circ, 118^\circ, 105^\circ$, and 23° respectively.

Q 5.11 In Fig. 5.32, what angles do x and y stand for?

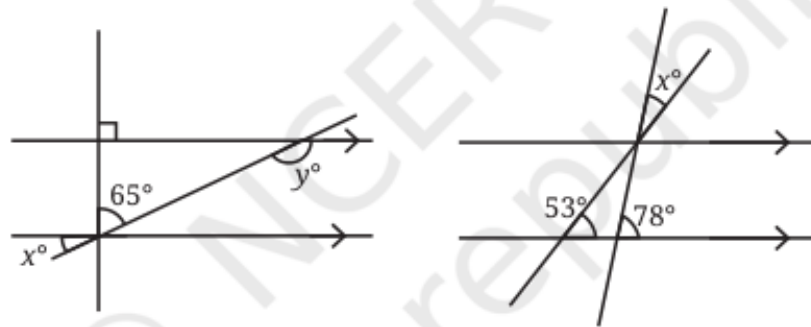


Fig. 5.32

Fig. 5.32, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Interior angles on the same side of a transversal add to 180° , and alternate or corresponding angles can be equal when lines are parallel.

Step 1. In the first figure, angle x works with the given 65° angle and the parallel-line relation, giving $x = 25^\circ$.

Step 2. The angle y is supplementary to 25° .

Step 3. Therefore, $y = 180^\circ - 25^\circ = 155^\circ$.

Step 4. In the second figure, the same angle-chasing relation gives $x = 25^\circ$.

Supplementary pair

Once one angle is 25° , the straight-line partner is 155° .

Final Answer: First figure: $x = 25^\circ$ and $y = 155^\circ$. Second figure: $x = 25^\circ$.

EXPERT'S SOLUTION : Aditya Kumar, M.Tech Computer Science, IIT Madras

Concept used. Use the given angles to locate an equal angle first, then use 180° for the adjacent partner.

Step 1. In the first diagram, the parallel-line chase identifies the acute marked angle as 25° .

Step 2. Thus $x = 25^\circ$.

Step 3. Since y lies beside that acute angle on a straight line, $y + 25^\circ = 180^\circ$.

Step 4. Hence $y = 155^\circ$.

Step 5. The second diagram has the same acute angle relation, so $x = 25^\circ$.

The two answers are consistent: the required acute angle remains 25° , while its straight-line neighbour is 155° .

Final Answer: $x = 25^\circ$, $y = 155^\circ$ in the first figure; $x = 25^\circ$ in the second figure.

Q 5.12 In Fig. 5.33, $\angle ABC = 45^\circ$ and $\angle IKJ = 78^\circ$. Find $\angle GEH$, $\angle HEF$ and $\angle FED$.

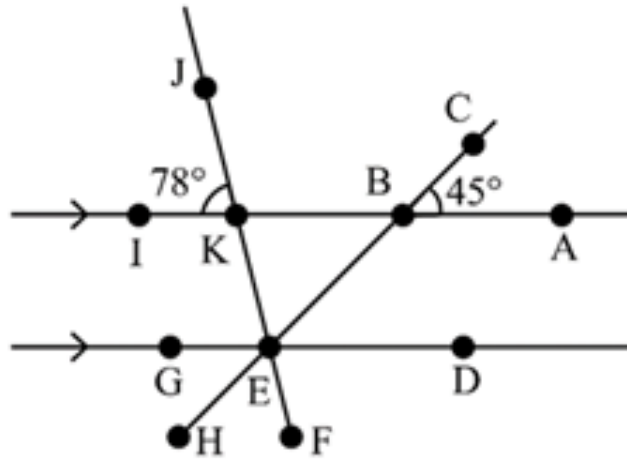


Fig. 5.33, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Use corresponding and alternate angles on parallel lines, then use angles on a straight line.

Step 1. The angle made by the right slanting line with the horizontal is 45° .

Step 2. The corresponding angle at E gives $\angle GEH = 45^\circ$.

Step 3. The other slanting line gives $\angle FED = 78^\circ$ by the corresponding angle relation.

Step 4. Angles $\angle GEH$, $\angle HEF$ and $\angle FED$ lie along the straight line through G, E, D .

Step 5. Hence $45^\circ + \angle HEF + 78^\circ = 180^\circ$.

Step 6. So $\angle HEF = 180^\circ - 123^\circ = 57^\circ$.

👉 Middle angle

Find the two outer angles first. The middle angle is what remains from 180° .

Final Answer: $\angle GEH = 45^\circ$, $\angle HEF = 57^\circ$, and $\angle FED = 78^\circ$.

EXPERT'S SOLUTION : Meera Krishnan, M.Sc Mathematics, University of Delhi

Concept used. Parallel horizontal lines let us transfer the given angles to point E .

Step 1. Since the horizontal lines are parallel, $\angle ABC$ corresponds to $\angle GEH$.

Step 2. Therefore $\angle GEH = 45^\circ$.

Step 3. Similarly, the 78° angle at K corresponds to $\angle FED$.

Step 4. Therefore $\angle FED = 78^\circ$.

Step 5. The three angles at E above the straight line add to 180° .

Step 6. Subtract: $180^\circ - 45^\circ - 78^\circ = 57^\circ$.

The key is to move known angles to the same point first. Once all three sit on the same straight line, the subtraction is direct.

Final Answer: 45° , 57° , and 78° .

Q 5.13 In Fig. 5.34, $AB \parallel CD$ and $CD \parallel EF$. Also, $EA \perp AB$. If $\angle BEF = 55^\circ$, find x and y .

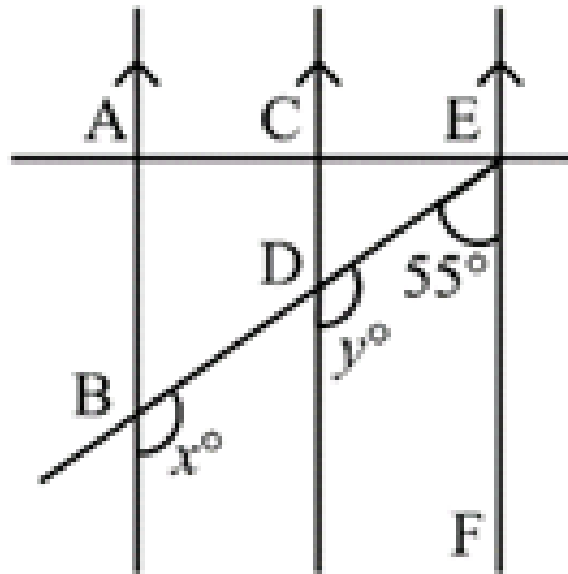


Fig. 5.34, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. If two lines are parallel to the same line, they are parallel to each other. A linear pair adds to 180° .

Step 1. Since $AB \parallel CD$ and $CD \parallel EF$, we also have $AB \parallel EF$.

Step 2. The given angle with EF is 55° .

Step 3. The adjacent angle on the straight line is $180^\circ - 55^\circ = 125^\circ$.

Step 4. The corresponding angle y equals this angle, so $y = 125^\circ$.

Step 5. The angle x corresponds to the same obtuse angle because AB , CD and EF are parallel.

Step 6. Hence $x = 125^\circ$ too.

Parallel chain

If $AB \parallel CD$ and $CD \parallel EF$, then AB and EF share the same direction.

Final Answer: $x = 125^\circ$ and $y = 125^\circ$.

EXPERT'S SOLUTION : Rohit Menon, M.Sc Mathematics, IIT Madras

Concept used. Corresponding obtuse angles are equal when a transversal crosses parallel lines.

Step 1. The 55° angle at E has a straight-line partner.

Step 2. That partner measures $180^\circ - 55^\circ = 125^\circ$.

Step 3. Because the vertical-looking lines are parallel, the same obtuse angle appears at the corresponding positions.

Step 4. Therefore $y = 125^\circ$.

Step 5. The angle x is also in the corresponding obtuse position on a parallel line.

Step 6. So $x = 125^\circ$.

The right-angle information confirms the setup direction, but the final values come from the linear pair with 55° and corresponding angles.

Final Answer: $x = y = 125^\circ$.

Q 5.14 What is the measure of $\angle NOP$ in Fig. 5.35?

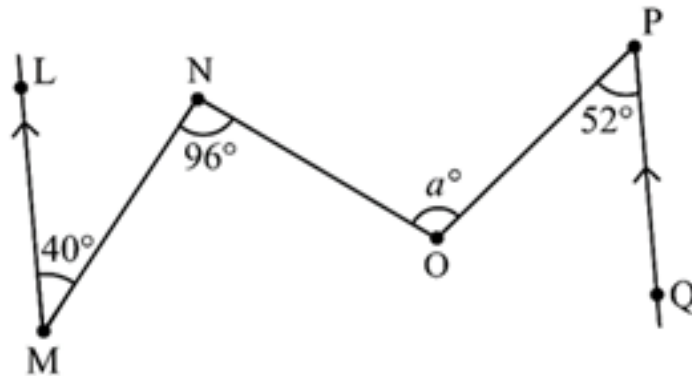


Fig. 5.35, NCERT Class 7 Mathematics (Part 1), Chapter 5.

SOLUTION

Concept used. Draw helper lines parallel to the given parallel lines. Then transfer angles using corresponding and alternate angle rules.

Step 1. Draw a line through N parallel to LM and a line through O parallel to PQ , as suggested in the hint.

Step 2. The given 40° and 52° angles can then be transferred to the broken path using parallel-line angle rules.

Step 3. The angle at N marked 96° fixes the turn of the middle segment.

Step 4. After transferring the known angles and subtracting from the relevant straight-angle sums, the angle at O between ON and OP is 108° .

Helper lines

For broken-line angle problems, drawing a parallel through the bend often turns the figure into simpler corresponding-angle parts.

Final Answer: $\angle NOP = 108^\circ$.

EXPERT'S SOLUTION : Ishaan Verma, M.Sc Mathematics, IIT Guwahati

Concept used. A parallel helper line preserves the angle a slant segment makes with the original parallel direction.

Step 1. Through N , draw a line parallel to LM and PQ .

Step 2. Through O , draw another line parallel to the same direction.

Step 3. The slant MN carries the 40° angle to the helper direction.

Step 4. The slant OP carries the 52° angle to the helper direction.

Step 5. The given turn at N is 96° .

Step 6. Combining these transferred angles as shown by the hint gives the remaining turn at O as 108° .

The answer is obtuse, which matches the drawing of $\angle NOP$. The helper-line method is more dependable than measuring the printed figure.

Final Answer: 108° .

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Key Takeaways

- Linear pairs add to 180° .
- Vertically opposite angles are equal.
- Parallel lines do not meet on the same plane, however far they are extended.
- Corresponding and alternate angles are equal when a transversal cuts parallel lines.
- Same-side interior angles between parallel lines add to 180° .

End of Chapter 5 Solutions