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SOLUTIONS: LINES AND ANGLES

Mathematics | Class IX (2026/LINANG/09/003)

SECTION A (8 Marks)

1. **Answer: (i)** 150°

Let the angle be x . Supplement is $(180 - x)$.

$$x = 5(180 - x) \implies x = 900 - 5x \implies 6x = 900 \implies x = 150^\circ.$$

2. **Answer: (ii)** 38°

Since $l \parallel m$, alternate interior angles are equal.

$$2y + 10 = 3y - 20 \implies y = 30^\circ.$$

(Note: Based on the diagram placement, if they are co-interior, $5y - 10 = 180 \implies y = 38^\circ$. Usually, in this layout, they are treated as co-interior.)

3. **Answer: (ii)** $55^\circ, 35^\circ$

$$x + y = 90 \text{ and } x - y = 20. \text{ Adding gives } 2x = 110 \implies x = 55^\circ. y = 35^\circ.$$

4. **Answer: (iii)** 90°

$$\angle AOC + \angle COB + \angle BOD + \angle DOA = 360^\circ.$$

$$270^\circ + \angle DOA = 360^\circ \implies \angle DOA = 90^\circ.$$

5. **Answer: (ii)** 90°

$$x = 180 - x \implies 2x = 180 \implies x = 90^\circ.$$

6. **Answer: (ii) Intersect on the side where sum is 179°**

By Euclid's fifth postulate, lines intersect on the side where the sum of interior angles is less than 180° .

7. **Answer: (a)** 120°

$$A + B = 180 \text{ and } A - B = 60. \text{ Adding gives } 2A = 240 \implies A = 120^\circ.$$

8. **Answer: (ii) One**

A unique line segment exists between two distinct points.

SECTION B (8 Marks)

1. Draw line $XY \parallel OP$ through Q . Then $XY \parallel RS$.

$$\angle OPQ + \angle PQX = 180^\circ \text{ (Co-interior)} \implies \angle PQX = 180 - 110 = 70^\circ.$$

$$\angle RSQ + \angle SQX = 180^\circ \text{ (Co-interior)} \implies \angle SQX = 180 - 130 = 50^\circ.$$

$$\angle PQR = \angle PQX + \angle SQX = 70^\circ + 50^\circ = 120^\circ.$$

2. **Axiom:** If a ray stands on a line, then the sum of two adjacent angles so formed is 180° .

3. Let adjacent angles be $\angle AOB$ and $\angle BOC$. Let OX and OY be bisectors.

$$\text{Given } \angle XOY = 90^\circ. \frac{1}{2}\angle AOB + \frac{1}{2}\angle BOC = 90^\circ.$$

$\angle AOB + \angle BOC = 180^\circ$. This forms a linear pair, so AOC is a straight line.

4. Draw a line parallel to AB through the vertex of x .

Upper part of $x = 45^\circ$ (Alternate Interior).

Lower part of $x = 30^\circ$ (Alternate Interior).

$$x = 45^\circ + 30^\circ = 75^\circ.$$

SECTION C (9 Marks)

- Let $AB \parallel CD$ and transversal t intersect them at G and H .
 $\angle AGH = \angle GHD$ (Alt. Int. Angles).
 $\frac{1}{2}\angle AGH = \frac{1}{2}\angle GHD \implies \angle MGH = \angle NHG$ (where GM, HN are bisectors).
Since alternate angles for lines GM and HN are equal, $GM \parallel HN$.
- $\angle PQS + \angle PQR = 180^\circ$ and $\angle PRT + \angle PRQ = 180^\circ$ (Linear Pairs).
Since $\angle PQR = \angle PRQ$, then $180^\circ - \angle PQS = 180^\circ - \angle PRT$.
 $\implies \angle PQS = \angle PRT$.
- Assume transversal t cuts l, m such that $\angle 1 = \angle 2$ (Alt. Int.).
 $\angle 1 = \angle 3$ (Vertically Opposite).
Therefore, $\angle 3 = \angle 2$. Since corresponding angles are equal, $l \parallel m$.

SECTION D (10 Marks)

- Extend BC to intersect ED at G .
Since $BA \parallel ED$, $\angle ABC = \angle DGC$ (Corresponding angles).
Since $BC \parallel EF$, $\angle DGC = \angle DEF$ (Corresponding angles).
Therefore, $\angle ABC = \angle DEF$.
- Proof:** Let $l \parallel m$. Corresponding angles are equal ($\angle 1 = \angle 2$).
 $\angle 1 + \angle 3 = 180^\circ$ (Linear pair). Substitute $\angle 1$: $\angle 2 + \angle 3 = 180^\circ$.
Application: In a parallelogram, adjacent angles are co-interior between parallel sides.
If $\angle A = 75^\circ$, then $\angle B = 180 - 75 = 105^\circ$.
Angles are $75^\circ, 105^\circ, 75^\circ, 105^\circ$.

SECTION E (5 Marks)

- $5x - 30 = 2x + 60$ (Alt. Int. Angles) $\implies 3x = 90 \implies x = 30$.
- $5(30) - 30 = 120^\circ$.
- Co-interior angle $= 180 - 120 = 60^\circ$.
- No. If $x = 40$, $\angle 1 = 170^\circ$ and $\angle 2 = 140^\circ$. Since $170 \neq 140$, lines are not parallel.
- Sum $= 180^\circ$ (Property of parallel lines).

*** End of Solutions ***