SOLUTIONS

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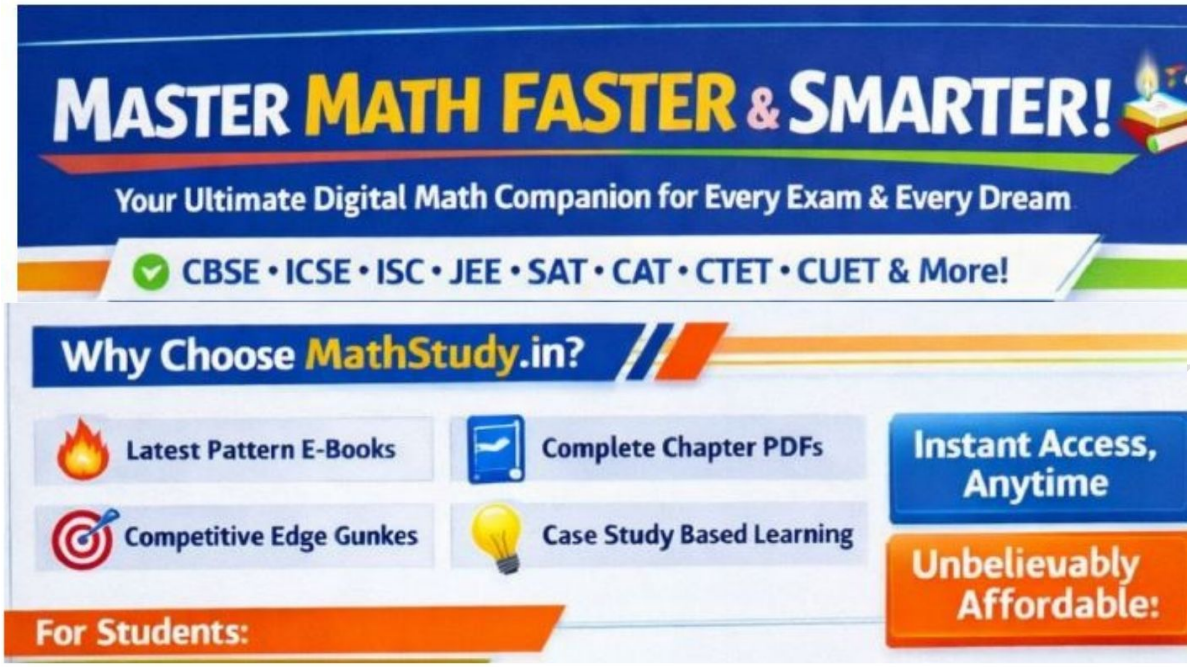

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SOLUTIONS: LINES AND ANGLES

Mathematics | Class IX (2026/LINANG/09/002)

SECTION A

1. **Answer: (ii)** 55°
   Let the angle be x. Complement is $(90 - x)$.
   $x = (90 - x) + 20 \implies 2x = 110 \implies x = 55^\circ$.

2. **Answer: (ii)** 108°
   Co-interior angles sum to 180°. Let angles be $2k$ and $3k$.
   $2k + 3k = 180 \implies 5k = 180 \implies k = 36$.
   Larger angle $= 3 \times 36 = 108^\circ$.

3. **Answer: (iii)** 285°
   Draw a line through O parallel to AB. The interior angle $x_{int} = 35^\circ + 40^\circ = 75^\circ$ (Alternate Interior Angles).
   The reflex angle $x = 360^\circ - 75^\circ = 285^\circ$.

4. **Answer: (iii) Rectangle**
   The bisectors of internal angles of a transversal with parallel lines always form a rectangle because adjacent angles are supplementary (bisectors meet at 90°) and opposite sides are parallel.

5. **Answer: (ii) Parallel to each other**
   If $L_1 \perp P$ and $L_2 \perp P$, then $L_1 \parallel L_2$.

6. **Answer: (a)** 45°
   $(180 - x) = 3(90 - x) \implies 180 - x = 270 - 3x \implies 2x = 90 \implies x = 45^\circ$.

7. **Answer: (iii)** 30°
   $4x + 2x = 180$ (Linear pair) $\implies 6x = 180 \implies x = 30^\circ$.

8. **Answer: (a)** $30^\circ, 150^\circ$
   $x + 5x = 180 \implies 6x = 180 \implies x = 30$. Angles are 30° and 150°.

SECTION B

1. **Proof:** Let lines AB and CD intersect at O. $\angle AOC + \angle COB = 180^\circ$ (Linear Pair). $\angle COB + \angle BOD = 180^\circ$ (Linear Pair).
   Thus, $\angle AOC + \angle COB = \angle COB + \angle BOD \implies \angle AOC = \angle BOD$.

2. Since $l \parallel m$, the angle corresponding to 120° on line m is 120°.
   Then, $x + 120^\circ = 180^\circ$ (Linear Pair) $\implies x = 60^\circ$.

3. Let the angle be x. $x = (90 - x) + 14 \implies 2x = 104 \implies x = 52^\circ$.

4. $\angle POY = 90^\circ \implies \angle POX = 90^\circ$ (Linear Pair).
   $a + b = 90^\circ$. Given $a : b = 2 : 3 \implies 5k = 90 \implies k = 18$.
   $a = 36^\circ, b = 54^\circ$.
   $b + c = 180^\circ$ (Linear pair on line MN) $\implies 54^\circ + c = 180^\circ \implies c = 126^\circ$.

SECTION C

1. Draw $MY \parallel PQ$ through M.
   $\angle XMQ + \angle MXQ = 180^\circ$ (Co-interior) $\implies \angle XMQ = 180 - 135 = 45^\circ$.
   $\angle YMR = \angle MYR = 40^\circ$ (Alternate Interior).
   $\angle XMY = \angle XMQ + \angle YMR = 45^\circ + 40^\circ = 85^\circ$.

2. In $\triangle PQR$, Ext $\angle PRS = \angle P + \angle Q$. In $\triangle TQR$, Ext $\angle TRS = \angle T + \angle TQR$.
   $2\angle TRS = \angle P + 2\angle TQR \implies 2(\angle T + \angle TQR) = \angle P + 2\angle TQR$.
   $2\angle T + 2\angle TQR = \angle P + 2\angle TQR \implies 2\angle T = \angle P \implies \angle QTR = \frac{1}{2}\angle QPR$.

3. Let transversal t intersect AB and CD. Let GM and HN be parallel bisectors of alternate angles $\angle AGH$ and $\angle GHD$.
   Since $GM \parallel HN$, $\angle MGH = \angle NHG$ (Alternate Interior).
   Since these are bisectors, $2\angle MGH = 2\angle NHG \implies \angle AGH = \angle GHD$.
   Since alternate interior angles are equal, $AB \parallel CD$.

SECTION D

1. $AB \parallel CD \parallel EF$.
   1. $y + 55^\circ = 180^\circ$ (Co-interior angles between CD and EF) $\implies y = 125^\circ$.
   2. $x = y = 125^\circ$ (Corresponding angles between AB and CD).
   3. In right $\triangle EAB$, $\angle BAE = 90^\circ$. $\angle FEB + \angle EBA = 180$ is not directly used.
   Instead, $\angle z + \angle y = 180$ is false. Use: $\angle EAB + \angle FEA = 180 \implies 90 + (z + 55) = 180 \implies z = 35^\circ$.

2. **(a)** Draw $XY \parallel BC$ through A. $\angle XAB = \angle B$ and $\angle YAC = \angle C$. Since XAY is a line, $\angle B + \angle A + \angle C = 180^\circ$.
   (b) Ext $\angle = 180 -$ adj Int $\angle$. Sum of Int $\angle s = 180 \implies$ Opp Int Sum $= 180 -$ adj Int $\angle$. Hence equal.

SECTION E: CASE STUDY

1. **Answer: (ii)** 75° ($\angle 2$ and $\angle 4$ are alternate interior angles).

2. **Answer: (iii)** $\angle 2$ and $\angle 3$ are on the same side of the transversal (co-interior).

3. **Answer: (i) 30** $((3x + 10) + (2x + 20) = 180 \implies 5x + 30 = 180 \implies 5x = 150 \implies x = 30)$.

4. **Answer: (ii) Parallel to each other** (Lines parallel to the same line are parallel).

5. **Answer: (iii) It must decrease by** 10° (To keep corresponding angles equal).

***** End of Solutions *****