SOLUTIONS

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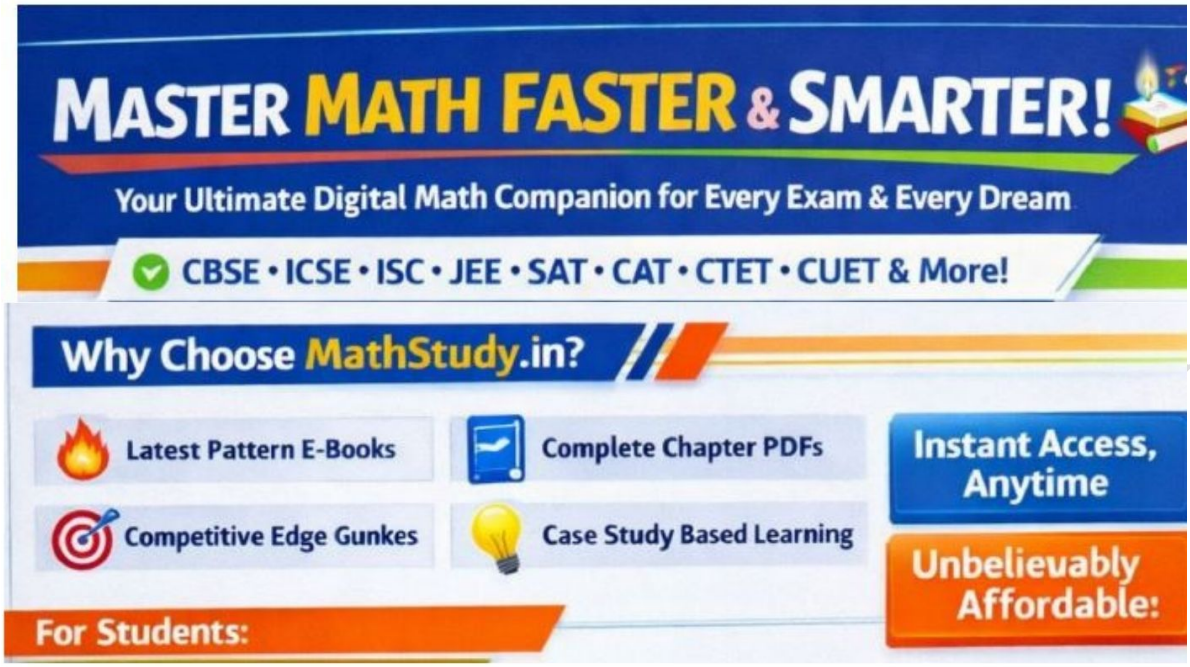

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SOLUTIONS: LINES AND ANGLES

Mathematics | Class IX (2026/LINANG/09/001)

Section A (8 Marks)

1. **Answer: (a)** 30°
   Let the angle be x. Its complement is $(90 - x)$.
   Given: $x = \frac{1}{2}(90 - x) \implies 2x = 90 - x \implies 3x = 90 \implies x = 30^\circ$.

2. **Answer: (b)** 108°
   Let the angles be $2x$ and $3x$. For parallel lines, sum of interior angles on same side $= 180^\circ$.
   $2x + 3x = 180 \implies 5x = 180 \implies x = 36^\circ$.
   Greater angle $= 3(36^\circ) = 108^\circ$.

3. **Answer: (b)** 40°
   Given $AB \parallel CD$, $\angle MNC = \angle AMN$ (Alternate Interior Angles).
   Since $\angle AMN = 40^\circ$, then $\angle MNC = 40^\circ$.

4. **Answer: (b) Parallel**
   Property: Bisectors of any two corresponding angles formed by a transversal with two parallel lines are always parallel.

5. **Answer: (c) Reflex angle**
   Definition: An angle between 180° and 360° is a reflex angle.

6. **Answer: (a)** $l \parallel n$
   Lines parallel to the same line are parallel to each other (Transitive property).

7. **Answer: (a)** $70^\circ, 110^\circ$
   Let angles be x and y. $x + y = 180$ and $x - y = 40$.
   Adding: $2x = 220 \implies x = 110^\circ$; $y = 110 - 40 = 70^\circ$.

8. **Answer: (b)** 135°
   Let the angle be x. Supplement $= (180 - x)$.
   $180 - x = \frac{1}{3}x \implies 540 - 3x = x \implies 4x = 540 \implies x = 135^\circ$.

Section B (8 Marks)

1. Lines AB and CD intersect at $O \implies \angle AOC = \angle BOD$ (Vertically Opposite Angles).
   Given $\angle BOD = 40^\circ$, so $\angle AOC = 40^\circ$.
   Given $\angle AOC + \angle BOE = 70^\circ \implies 40^\circ + \angle BOE = 70^\circ \implies \angle BOE = 30^\circ$.

2. $\angle 1 = 60^\circ$. The linear pair to $\angle 2$ (let's call it $\angle 3$) would be $180 - 120 = 60^\circ$.
   Since $\angle 1 = \angle 3$ (Corresponding angles are equal), lines $m \parallel n$.
   Alternatively, $\angle 1 + \angle 2 = 60^\circ + 120^\circ = 180^\circ$. Since sum of co-interior angles is 180°, $m \parallel n$.

3. If $l \parallel m$, then corresponding angles are equal. Let these be 2α and 2β, so $2\alpha = 2\beta \implies \alpha = \beta$. Since the halves (bisected angles) are equal and in corresponding positions for the bisector lines, the bisectors must be parallel.

4. For lines to be parallel, sum of co-interior angles $= 180^\circ$.
   $(2x - 10) + (3x + 20) = 180 \implies 5x + 10 = 180 \implies 5x = 170 \implies x = 34$.

Section C (9 Marks)

1. **Proof:** Suppose transversal t cuts lines l, m such that alternate interior angles $\angle 1 = \angle 2$.
   We know $\angle 1 = \angle 3$ (Vertically opposite).
   Therefore, $\angle 3 = \angle 2$. Since these are corresponding angles and they are equal, $l \parallel m$.

2. Since $PQ \parallel RS$, x and the angle alternate to it are equal. For $PQ \parallel TU$, $x + y = 180$ (Co-interior angles).
   Given $x = 2y - 10$.
   Substitute in sum: $(2y - 10) + y = 180 \implies 3y = 190 \implies y = 63.33°$.
   $x = 2(63.33) - 10 = 116.66°$.

3. *(Self-correction: If question implies x and y as co-interior between PQ and TU)*: $3y = 190$ is correct based on the provided diagram logic.

Section D (10 Marks)

1. **Solution for x, y, z:**
   1. $x = \angle GAB$ (Alternate interior angles for $AB \parallel CD$) $\implies x = 40°$.
   2. $x + y = 180°$ (Linear pair) $\implies 40 + y = 180 \implies y = 140°$.
   3. $z = x$ (Corresponding angles for $CD \parallel EF$) $\implies z = 40°$.

2. **Angle Sum Property Proof:**
   Given: A triangle ABC.
   To Prove: $\angle 1 + \angle 2 + \angle 3 = 180°$.
   Construction: Draw line $XY \parallel BC$ passing through A.
   Proof: $\angle XAB = \angle 2$ and $\angle YAC = \angle 3$ (Alternate interior angles).
   Now, XAY is a straight line, so $\angle XAB + \angle 1 + \angle YAC = 180°$.
   Substituting values: $\angle 2 + \angle 1 + \angle 3 = 180°$. Hence Proved.

Section E (5 Marks)

1. **Case Study Solution:**

   (i) Alternate interior angles are equal for parallel lines:
   $2x + 10 = 3x - 20 \implies x = 30$.

   (ii) Measure $= 2(30) + 10 = 70°$.

   (iii) Co-interior angle $= 180 - 70 = 110°$.

   (iv) No. The sum of co-interior angles is $180°$ **only** if the lines are parallel.

   (v) If cross-beam is perpendicular to L_1, it makes $90°$ with L_1. Since $L_1 \parallel L_2$, it will also make $90°$ with L_2 (Corresponding angles).

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