Geometry: Solving Parallelograms Using Properties

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DIRECTIONS *In parallelogram ABCD, E is the intersection of the diagonals. Use parallelogram properties to solve for x and find missing measurements. Show all work.*

1 Find x and all side lengths. Perimeter = 26:

$AB = 2x + 3, \quad BC = x + 1$

Answer: _____

2 Consecutive Angles — Find x and both angle measures:

$\angle A = (2x + 10)^\circ, \quad \angle B = (3x - 10)^\circ$

Answer: _____

3 Diagonals Bisect — Find x and AC:

$AE = 2x + 1, \quad CE = 3x - 4$

Answer: _____

4 Find x and the perimeter. BC = AD = 7:

$AB = 3x - 2, \quad CD = x + 10$

Answer: _____

5 Find m∠B, m∠C, and m∠D:

$m\angle A = 65^\circ$

Answer: _____

6 Diagonals Bisect — Find x and BD:

$BE = 4x + 3, \quad DE = 6x - 5$

Answer: _____

7 Opposite Angles — Find x and all four angles:

$\angle A = (4x - 8)^\circ, \quad \angle C = (2x + 16)^\circ$

Answer: _____

8 Opposite Sides — Solve for x and y:

$AB = 2x + y = 11, \quad BC = x + 2y = 7$

Answer: _____

9 Diagonals Bisect — Find x and AC:

$AE = 3x - 1, \quad EC = x + 9$

Answer: _____

10 Consecutive Angles — Solve for x and find both angles:

$\angle C = (5x + 3)^\circ, \quad \angle D = (3x + 17)^\circ$

Answer: _____

11 Find x and both side lengths. Perimeter = 50:

$AB = 2x + 3, \quad BC = x + 7$

Answer: _____

12 Diagonals Bisect — Find x, y, AC, and BD:

$AE = 2x + 3,\ CE = 4x - 5,\ BE = y + 8,\ DE = 3y - 4$

Answer: _____

Answer Key & Solutions

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TEACHER NOTES *P1: Opp. sides equal. P2: Opp. angles equal. P3: Consecutive angles sum to 180°. P4: Diagonals bisect each other (AE=CE, BE=DE). Perimeter = 2(AB+BC).*

1 Find x and all side lengths. Perimeter = 26:

$AB = 2x + 3, \quad BC = x + 1$

= $x = 3,\ AB = CD = 9,\ BC = AD = 4$

2(AB+BC)=26 → AB+BC=13. (2x+3)+(x+1)=13 → 3x=9 → x=3.

2 Consecutive Angles — Find x and both angle measures:

$\angle A = (2x + 10)^\circ, \quad \angle B = (3x - 10)^\circ$

= $x = 36,\ \angle A = 82^\circ,\ \angle B = 98^\circ$

∠A+∠B=180°: (2x+10)+(3x–10)=180 → 5x=180 → x=36.

3 Diagonals Bisect — Find x and AC:

$AE = 2x + 1, \quad CE = 3x - 4$

= $x = 5, \quad AC = 22$

AE=CE: 2x+1=3x–4 → x=5. AE=11, so AC=2(11)=22.

4 Find x and the perimeter. BC = AD = 7:

$AB = 3x - 2, \quad CD = x + 10$

= $x = 6, \quad P = 46$

AB=CD: 3x–2=x+10 → x=6, AB=16. P=2(16+7)=46.

5 Find m∠B, m∠C, and m∠D:

$m\angle A = 65^\circ$

= $m\angle B = 115^\circ,\ m\angle C = 65^\circ,\ m\angle D = 115^\circ$

∠C=∠A=65° (opposite). ∠B=∠D=180°–65°=115° (consecutive).

6 Diagonals Bisect — Find x and BD:

$BE = 4x + 3, \quad DE = 6x - 5$

= $x = 4, \quad BD = 38$

BE=DE: 4x+3=6x–5 → 8=2x → x=4. BE=19, so BD=2(19)=38.

7 Opposite Angles — Find x and all four angles:

$\angle A = (4x - 8)^\circ, \quad \angle C = (2x + 16)^\circ$

= $x = 12,\ \angle A = \angle C = 40^\circ,\ \angle B = \angle D = 140^\circ$

∠A=∠C: 4x–8=2x+16 → x=12. ∠A=40°. ∠B=180°–40°=140°.

8 Opposite Sides — Solve for x and y:

$AB = 2x + y = 11, \quad BC = x + 2y = 7$

= $x = 5, \quad y = 1$

y=11–2x; sub: x+2(11–2x)=7 → –3x=–15 → x=5, y=1.

9 Diagonals Bisect — Find x and AC:

$AE = 3x - 1, \quad EC = x + 9$

= $x = 5, \quad AC = 28$

AE=EC: 3x–1=x+9 → 2x=10 → x=5. AE=14, so AC=2(14)=28.

10 Consecutive Angles — Solve for x and find both angles:

$\angle C = (5x + 3)^\circ, \quad \angle D = (3x + 17)^\circ$

= $x = 20,\ \angle C = 103^\circ,\ \angle D = 77^\circ$

∠C+∠D=180°: (5x+3)+(3x+17)=180 → 8x+20=180 → x=20.

11 Find x and both side lengths. Perimeter = 50:

$AB = 2x + 3, \quad BC = x + 7$

= $x = 5,\ AB = CD = 13,\ BC = AD = 12$

2(AB+BC)=50 → AB+BC=25. (2x+3)+(x+7)=25 → 3x=15 → x=5.

12 Diagonals Bisect — Find x, y, AC, and BD:

$AE = 2x + 3,\ CE = 4x - 5,\ BE = y + 8,\ DE = 3y - 4$

= $x = 4,\ y = 6,\ AC = 22,\ BD = 28$

AE=CE → x=4, AE=11, AC=22. BE=DE → y=6, BE=14, BD=28.