Carole Greenes

Sophie Boxwala

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Practice, Research & Innovation in Mathematics Education (PRIME) Group

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Table of Contents

Author Bios

Carole Greenes, Ed.D. is Professor Emerita, Mathematics Education at Arizona State University. While at ASU, she served as Associate Vice President for STEM Education, Dean of the School of Educational Innovation and Teacher Preparation, Director of the Practice Research and Innovation in Mathematics Education (PRIME) Center, Director of the Vertically Integrated Projects program that provides research experiences for undergraduate students, and Professor of Mathematics Education in the Ira A. Fulton Schools of Engineering, the College of Liberal Arts and Sciences, and the Mary Lou Fulton Teachers College. Prior to working at ASU, she was Professor of Mathematics Education at Boston University. Currently, she directs the PRIME Group that develops books of challenge problems and games for students, grades K – 12, and authors Carole's Corner for the Center for Mathematics and Teaching, Inc. in California. Carole is author of more than 350 books for students and teachers; 81 articles; six mathematical musicals; and two histories of mathematics in story and song. In 2003, Greenes was inducted into the Massachusetts Mathematics Educators' Hall of Fame. In 2011, she received the NCSM Ross Taylor/Glenn Gilbert National Leadership Award in Mathematics Education. In 2016, she received the Copper Apple Award for Leadership in Mathematics in Arizona, and in 2018 she received the National Council of Teachers of Mathematics Lifetime Achievement Award. Her 2021 - 2024 books/games include: *What's My Angle? Alge-Grid: What's the a?, Pattern Grid-unLocks, Play It Positively or Negatively!*, *Factor Max, Make It Proper, Shape Up, Function Frenzy,* and *What's My Angle?* - all of which have been co-authored by high school or college students, and are available at no cost at the Center for Mathematics and Teaching!.

Sophie Boxwala is a senior at La Jolla High School, graduating in Spring 2024. Her favorite subjects are Mathematics and History. Sophie is passionate about spreading her love for mathematics, and for helping other students develop that passion. To that end, she is working at her local library's *Math and Reading Buddies*, where she teaches children, ages 3-10, both mathematics and reading. At her high school, Sophie is President of the school's Mock Trial Club; Environmental Awareness Chairperson for the Parent Teacher Student Association (PTSA); and Treasurer of U-Touch the World, a club that raises money for the education of kids in Uganda. In her free time, Sophie loves to do photography, especially, pet/wildlife photography. She created the project, Pet Photos By Sophie, where she takes photographs of people's pets in exchange for donations to the Rancho Coastal Humane Society. Sophie joined the PRIME Group author team, and is pleased to be writing math puzzle books. After high school, Sophie plans to attend college, majoring in Applied Mathematics, followed by law school.

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What's My Angle?

Developing Geometric and Algebraic Reasoning

Goal: Reason algebraically to solve for values of angles in various types of polygons. This requires the following talents in geometry and algebra.

Geometry:

- Identify number of angles in triangles, quadrilaterals, pentagons, hexagons, heptagons, and octagons.
- Differentiate between convex and concave polygons.
- For triangles, know properties of equilateral, isosceles, and scalene triangles.

Algebra:

- Identify total angle measure of different types of polygons.
  Note: **Total angle measure** can be determined by applying this formula:
  180 (*n* - 2) degrees, where ***n* is the number of sides**
- Solve equations and systems of equations that show relationships among the number of degrees in the angles of polygons.

Definitions: Types of Polygons:

- **Convex:** Polygon with all interior angles less than 180 degrees, and all vertices point outward.
- **Concave:** Polygon with at least one interior angle greater than 180 degrees, and at least one of its vertices points inward.

Book Contents:

- **Problem Section:** There are 8 problems for each type of polygon. For each problem, there is a set of clues (all algebraic equations) that, when solved singly or in combination, provide the number of degrees for each angle.
- **Answer Section:** For each problem, along with the number of degrees for each angle, **Solution** steps are shown. Note that, for most problems, there are alternative solution strategies. The latter provides an opportunity for groups of solvers to justify their methods.

Section 1: Problems
Triangles 1 – 8

Problem 1:

I am an isosceles right triangle.

Clues:

1) B + C = A

2) B = C

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

Problem 2:

I am a right triangle.

Clues:

1) A > B

2) B - C = 30

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

3. I am an obtuse triangle.

Clues:

1) A - B = 30

2) 3B = A

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

Problem 4:

I am a scalene triangle.

Clues:

1) **A > 90**
2) **B + C = 60**
3) **B – C = 20**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

Problem 5:

I am an isosceles obtuse triangle.

Clues:

1) B + 60 = 90

2) B + C = 60

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

Problem 6:

I am an isosceles acute triangle.

Clues:

1) A = B

2) 2A + 2 B = 280

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

Problem 7:

I am a scalene right triangle.

Clues:

1) A + C = 90

2) A – C = 22

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

Problem 8:

I am an acute triangle.

Clues:

1) A + B = 100

2) A – B = 20

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

Section 1: Problems
Quadrilaterals 1 – 8

1. I am a convex quadrilateral.

Clues

1) A = C

2) B = D

3) 2A – 30 = B

4) D/10 = 11

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

2. I am a convex quadrilateral.

Clues:

1) A = B + 10

2) A + B = 180

3) B = C

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

3. I am a convex quadrilateral.

Clues:

1) **2D = B**
2) **B + D= 180**
3) **B - 40 = C**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

4. I am a concave quadrilateral.

Clues:

1) 1/3 D = 10

2) B + D = 120

3) $(C - D)^2 = 100$

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

5. I am a convex quadrilateral.

Clues:

1) B = D

2) A – C = 30

3) A + C = 80

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

6. I am a concave quadrilateral.

Clues:

1) **A + B = 100**
2) **B + C = 120**
3) **D = 2(A+B) + 10**
4) **B = D/3**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

7. I am a convex quadrilateral.

Clues:

1) A = C

2) 2B + 10 = C

3) C = 13 x 100 ½

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

8. I am a convex quadrilateral.

Clues:

1) **D = D/2 + 5**
2) **360 – (A + B + D) = 120**
3) **C = 2B – 20**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

Section 1: Problems
Pentagons 1 – 8

1. I am a convex pentagon

Clues:

1) B = C

2) B + D = C + E

3) A + 30 = D

4) 2D = 180

5) 2A + 30 = B

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

2. I am a concave pentagon

Clues:

1) **B = A + C**
2) **C + 25 = B**
3) **E/D = 6**
4) **D + 40 = B**
5) **4B = 360**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

3. I am a concave pentagon

Clues:

1) **B + D + E = 440**
2) **A = C**
3) **D = 2A + 20**
4) **B = (D/2 – 10) x 4**
5) **D = E**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

4. I am a concave pentagon

Clues:

1) A = 3C
2) B + C = 140
3) B = 2E
4) C + 40 = B

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

5. I am a concave pentagon

Clues:

1) B = D
2) A = B + D
3) A + B + D = 180
4) 3A = C
5) E = A

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

6. I am a concave pentagon

Clues:

1) **B – E= 20**
2) **B + E = 440**
3) **$(A - C)^2 = 100$**
4) **D = C + 15**
5) **2C – 10 = 40**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

7. I am a concave pentagon

Clues:

1) **E/5 = 42**
2) **2C – 10 = D**
3) **E + 20 = B**
4) **C + D = 65**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

8. I am a convex pentagon.

Clues:
1) B + C = 230
2) B - C = 50
3) D = B – 50
4) 2E – 80 = 200

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

Section 1: Problems
Hexagons 1 – 8

Problem 1:

I am a concave hexagon.

Clues:

1) **A = 100 - 10**
2) **D = E**
3) **E = A + 20**
4) **2F - 30 = 2D - 110**
5) **3A - (30 x 2) = B**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

Problem 2:

I am a convex hexagon.

Clues:

1) **B + 20 = 140**
2) **3B/2 = E + 40**
3) **E = F**
4) **A + B – F = 110**
5) **B/2 + 40 + F = 3D**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

Problem 3:

I am a concave hexagon.

Clues:

1) **2B = 240**
2) **F - 10 = B**
3) **C = D**
4) **3C - 40 = E**
5) **2C = F + 30**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

Problem 4:

I am a convex hexagon.

Clues:

1) **B = (30 + 40) x 2**
2) **E = F**
3) **3A - 60 = 2B**
4) **A + B + E + F = 470**
5) **2C = 100 + 9 x 9 - 1**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

Problem 5:

I am a convex hexagon.

Clues:

1) 2E = B + 15

2) B = 2A - 35

3) 70 = E - 20

4) C = D - 35

5) A + B + C + E = 490

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

Problem 6:

I am a concave hexagon.

Clues:

1) B + C = A

2) B = E

3) 2F = 2B - 20

4) A/2 - 30 = F

5) 2E - 10 = 150

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

Problem 7:

I am a concave hexagon.

Clues:

1) **B = C**
2) **3D + 60 = 300**
3) **2D + 2F = 380**
4) **E - 60 = A/2 - 15**
5) **2F - 30 = A**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

Problem 8:

I am a convex hexagon.

Clues:

1) **A + B + D + F = 500**
2) **C = E**
3) **3E = 3A - 60**
4) **2A = B/2 + 2C - 20**
5) **(D+ E)/3 = B/2 + 20**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

Section 1: Problems
Heptagons 1 – 8

1. **I am a convex heptagon.**

   Clues:

   1) A = E

   2) B/2 = 120/2 – 5

   3) 2C – B = G

   4) G + 20 = B

   5) A + B + C + E = 490

   6) D = A + 10

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

2. I am a concave heptagon.

Clues:

1) B = C

2) 3D = 2C + 10

3) F + G = 220

4) 2(A – B) = G + 5

5) 2B = 300 – 10

6) D + G = 205

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

3. I am a convex heptagon.

Clues:

1) A – F = 10

2) C = (A -1) ½

3) A + F = 280

4) D + E = 220

5) 2A + 2B = 580

6) 115 – D = 10

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

4. I am a concave heptagon.

Clues:

1) B + C + D + E = 360

2) B = C

3) A – 30 = G

4) A + G = 240

5) 4D – F = 60

6) A – D = 45

7) B = (F + 60)/4

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

5. I am a concave heptagon

Clues:

1) A + B = 230

2) 3A – 2B = 140

3) 2E – B = 2A – 10

4) D/2 = G + 5

5) E + 20 = D

6) 2C - 10 = 3G

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____degrees

E = _____degrees

F = _____degrees

G = _____degrees

6. I am a convex heptagon.

Clues:

1) B + C – 100 = A

2) D + G = 280

3) A – 15 = B

4) C + 25 = G

5) 2E = 2F

6) F = C + 15

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

7. I am a convex heptagon.

Clues:

1) D = E

2) F – G = 30

3) 2F + G = 450

4) C + 20 = G

5) C + D + E = 390

6) 2D + A = 380

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____degrees

E = _____degrees

F = _____degrees

G = _____degrees

8. I am a concave heptagon.

Clues:

1) 2A + 20 = D

2) C/ 10^2 = 2

3) A + 30 = ½ C

4) G/7 = D/16

5) F – B = 20

6) B + F = 230

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

Section 1: Problems
Octagons 1 – 8

Problem 1:

I am a concave octagon.

Clues:

1) A = E

2) 2B – A = F

3) E + (100/2) = 150

4) F – A = 60

5) B/2 = C/2 - 35

6) C – G = G - A

7) H = B - 10

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

H = _____ degrees

Problem 2:

I am a convex octagon.

Clues:

1) 2F = 2H -10

2) 2H = 300 – D/2

3) D/10 = 14

4) F + 40 = E

5) A = E

6) 3A – 3G = 75

7) B = G + 35

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

H = _____ degrees

Problem 3:

I am a convex octagon.

Clues:

1) $10^2 + 1/4B - 10 = G$

2) G + F – 100 = B

3) A + B = 2A

4) F – G = 0

5) D = E

6) D + E = 310

7) A + 40 = 200

8) C – H = 0

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

H = _____ degrees

Problem 4:

I am a concave octagon.

Clues:

1) **G/4 + 100 = E**
2) **G + 10 = A**
3) **A + B = 180**
4) **C = H**
5) **(C + 5)/ 3 = A**
6) **A + B + F = 280**
7) **H – F = 165**
8) **E – 20 = F**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

H = _____ degrees

Problem 5:

I am a concave octagon.

Clues:

1) D + E = 320

2) D – E = 86

3) 2C = D + 37

4) C + E = 2B - 33

5) 2H = F - 10

6) F – G = 60

7) B + (B – 100) = F

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

H = _____ degrees

Problem 6:

I am a concave octagon.

Clues:

1) **A + C + E = 120**
2) **H + 50 = F**
3) **A + C + E + G = 185**
4) **G + 5 = 1/4F**
5) **A + E = 75**
6) **B – H = 5**
7) **C – 10 = E**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

H = _____ degrees

Problem 7:

I am a convex octagon.

Clues:

1) **G = H – 25**
2) **A + B = D + E**
3) **B + D = 265**
4) **H/15 = 10**
5) **B – D = 25**
6) **C + E+ F + G = 545**
7) **F – C = 5**
8) **C + F = 275**

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

H = _____ degrees

Problem 8:

I am a convex octagon.

Clues:

1) D = E

2) $B^2/4 = G^2/4 + 625$

3) 3G = 2H + 10

4) G + H = 295

5) H – 25 = E

6) 2B – E = F

7) A = F – 5

My angles are:

A = _____ degrees

B = _____ degrees

C = _____ degrees

D = _____ degrees

E = _____ degrees

F = _____ degrees

G = _____ degrees

H = _____ degrees

Section 2: Solutions
Triangles 1 – 8

Problem 1:

I am an isosceles right triangle.

Clues:

1) **B + C = A**
2) **B = C**

My angles are:

A = 90 degrees

B = 45 degrees

C = 45 degrees

Solution

Clue 1: B + C = A. Since A is the sum, it is greater than both B and C. Because this is an isosceles right triangle, A = 90 degrees.

Clue 2: B = C. Since A is 90 degrees, B + C must equal 180 – 90, or 90 degrees. Since B = C, then B = 45 degrees and C = 45 degrees.

From A to C, angle measures:

90 + 45 + 45 = 180

Problem 2:

I am a right triangle.

Clues:

1) **A > B**
2) **B - C = 30**

My angles are:

A = 90 degrees

B = 60 degrees

C = 30 degrees

Solution

Clue 1: A > B So, A is greater than B.

Clue 2: B – C = 30. Since A is greater than B, and B is greater than C, then A is greater than both B and C. Since this is a right triangle, A = 90 degrees.

Clue 2: B – C = 30. Since A = 90, then B + C = 90. So, B = 60 degrees and C = 30 degrees.

From A to C, angle measures:

90 + 60 + 30 = 180 degrees

Problem 3:

I am a scalene triangle.

Clues:
1) A > 90
2) B + C = 60
3) B – C = 20

My angles are:

A = 120 degrees

B = 40 degrees

C = 20 degrees

Solution

Both Clue 2:B + C = 60 and Clue 3: B – C = 20 contain B and C. So, add those equations. Then, B + C + B – C = 60 + 20. So, 2B = 80, and B = 40 degrees.

Clue 2: B + C = 60. Replace B with 40. Then 40 + C = 60, and C = 20 degrees.

There are 180 degrees in a triangle. B + C = 60. So, A must be 180 – 60 = 120.
So, A = 120 degrees, and that matches Clue 1.

From A to C, angle measures:

120 + 40 + 20 = 180 degrees

Problem 4:

I am an isosceles obtuse triangle.

Clues:

1) **B + 60 = 90**
2) **B + C = 60**

My angles are:

A = 120 degrees

B = 30 degrees

C = 30 degrees

Solution

Clue 1: B + 60 = 90. So, B = 30 degrees.

Clue 2: B + C = 60. Replace B with 30. Then 30 + C = 60, and C = 30 degrees.

So, 180 – 60 = 120, and A = 120 degrees.

From A to C, angle measures:

120 + 30 + 30 = 180 degrees

Problem 5:

I am an isosceles acute triangle.

Clues:

1) A = B

2) 2A + 2 B = 280

My angles are:

A = 70 degrees

B = 70 degrees

C = 40 degrees

Solution

Clue 2: 2A + 2B = 280. So, A + B = 140.

Clue 1: A = B. Since, A + B = 140, then A = 70 degrees and B = 70 degrees.

Since the total number of degrees in is 180, then C = 180 – 140, and C = 40 degrees.

From A to C, angle measures:

70 + 70 + 40 = 180 degrees

Problem 6:

I am a scalene right triangle.

Clues:

1) A + C = 90

2) A – C = 22

My angles are:

A = 56 degrees

B = 90 degrees

C = 34 degrees

Solution

Both Clue 1: A + C = 90 and Clue 2 A – C = 22 contain A and C. So, add those equations. A + C + A – C = 90 + 22. So, 2A = 112, and A = 56 degrees.

Clue 1: A + C = 90 Replace A with 56. Then 56 + C = 90, and C = 34 degrees.

Since the total number of degrees is 180, then B = 180 – 90, and B = 90 degrees.
So, B is the right angle.

From A to C, angle measures:

56 + 90 + 34 = 180 degrees

Problem 7:

I am an acute triangle.

Clues:

1) A + B = 100

2) A – B = 20

My angles are:

A = 60 degrees

B = 40 degrees

C = 80 degrees

Solution

Both Clue 1: A + B = 100 and Clue 2: A – B = 20 have A and B. Add those equations. A + B + A – B = 100 + 20. So, 2A = 120, and A = 60 degrees.

Clue 1: A + B = 100. Replace A with 60. Then 60 + B = 100, and B = 40 degrees.

Since the total number of degrees is 180, then C = 180 – 100. So, C = 80 degrees.

From A to C, angle measures:

60 + 40 + 80 = 180 degrees

Problem 8:

I am an obtuse triangle.

Clues:

1) A - B = 30

2) 3B = A

My angles are:

A = 45 degrees

B = 15 degrees

C = 120 degrees

Solution

Clue 2: 3B = A. In Clue 1: A – B = 30, replace A with 3B. Then 3 B – B = 30. So, 2B = 30, and B = 15 degrees.

Clue 2: 3B = A. Replace B with 15. Then A = 3 x 15, and A = 45 degrees.

Since the total number of degrees is 180, then 180 – 45 – 15 = 120, and C = 120 degrees.

From A to C, angle measures:

45 + 15 + 120 = 180 degrees

Section 2: Solutions
Quadrilaterals 1 – 8

1. I am a convex quadrilateral.

Clues:

1) **A = C**
2) **B = D**
3) **2 A – 30 = B**
4) **D/10 = 11**

My angles are:

A = 70 degrees

B = 110 degrees

C = 70 degrees

D = 110 degrees

Solution

Clue 4: D/10 = 11. So, D = 10 x 11, and D = 110 degrees.

Clue 2: B = D. Since D = 110, then B = 110 degrees.

Clue 3: 2A – 30 = B. Replace B with 110. Then, 2A – 30 = 110.
So, 2A = 140, and A = 70 degrees.

Clue 1: A = C. Since A = 70, then C = 70 degrees.

From A to D, angle measures:

70 + 110 + 70 + 110 = 360 degtrees

2. I am a convex quadrilateral.

Clues:

1) A = B + 10
2) A + B = 180
3) B = C

My angles are:

A= 95 degrees

B = 85 degrees

C = 85 degrees

D = 95 degrees

Solution

Clue 1: A = B + 10. Clue 2: A + B = 180. In Clue 2, replace A with B + 10 from Clue 1. Then, B + B + 10 = 180, and 2B + 10 = 180. So, 2B = 170, and B = 85 degrees.

Clue 3: B = C. Since B = 85, then C = 85 degrees.

Clue 1: A = B + 10. Replace B with 85. Then, A = 85 + 10, and A = 95 degrees.

Since the total number of degrees is 360, to solve for D:
360 – (95 + 85 + 85) = 95. So, D = 95 degrees.

From A to D, angle measures:

95 + 85 + 85 + 95 = 360 degrees

3. I am a convex quadrilateral.

Clues:

1) **2D = B**
2) **B + D= 180**
3) **B - 40 = C**

My angles are:

A = 100 degrees

B = 120 degrees

C = 80 degrees

D = 60 degrees

Solution

Clue 1: 2D = B. In Clue 2: B + D = 180, replace B with 2D from Clue 1. Then 2D + D = 180, and 3D = 180.So, D = 60 degrees.

Clue 1: 2D = B. Replace D with 60. Then 2 x 60 = B, and B = 120 degrees.

Clue 3: B – 40 = C. Replace B with 120. Then 120 – 40 = C, and C = 80 degrees.

Since the total number of degrees is 360, to solve for A:
360 – (120 + 80 + 60) = 100. So, A = 100 degrees.

From A to D, angle measures:

100 + 120 + 80 + 60 = 360 degrees

4. I am a concave quadrilateral.

Clues:

1) **1/3 D = 10**
2) **B + D = 120**
3) **$(C - D)^2 = 100$**

My angles are:

A = 200 degrees

B = 90 degrees

C = 40 degrees

D = 30 degrees

Solution

Clue 1: 1/3 D = 10. So D = 30 degrees.

Clue 2: B + D = 120. Replace D with 30. Then, B + 30 = 120, and B = 90 degrees.

Clue 3: $(C - D)^2 = 100$. Replace D with 30. Then $(C - 30)^2 = 100$, and C = 40 degrees.

Since the total number of degrees is 360, to solve for A:
360 – (90 + 40 + 30) = 200 So, A = 200 degrees.

From A to D, angle measures:

200 + 90 + 40 + 30 = 360 degrees

5. I am a convex quadrilateral.

Clues

1) **B = D**
2) **A – C = 30**
3) **A + C = 80**

My angles are:

A = 55 degrees

B = 140 degrees

C = 25 degrees

D = 140 degrees

Solution

Clue 2: A – C = 30 and Clue 3: A + C = 80. Since both clues contain A and C, add the equations: A - C + A + C = 110. So, 2A = 110, and A = 55 degrees.

Clue 3: A + C = 80. Replace A with 55. Then, 55 + C = 80, and C = 25 degrees.

Clue 1: B = D. Since the total number of degrees is 360, and A = 55 and C = 25, then 360 – (55 + 25), or 280 degrees for B + D.

Clue 1: Since B = D, then B = 140 degrees and D = 140 degrees.

From A to D, angle measures:

55 + 140 + 25+ 140 = 360 degrees

6. **I am a concave quadrilateral.**
   Clues:
   1) **A + B = 100**
   2) **B + C = 120**
   3) **D = 2(A+B) + 10**
   4) **B = D/3**

My angles are:

A = 30 degrees

B = 70 degrees

C = 50 degrees

D = 210 degrees

Solution

Clue 1: A + B = 100. Clue 3: D = 2(A+B) + 10. In Clue 3, replace A + B with 100 from Clue 1. Then, D = 2 x 100 + 10, and D = 210 degrees.

Clue 4: B = D/3. Replace D with 210. Then B = 210/3, and B = 70 degrees.

Clue 1: A + B = 100. Replace B with 70. Then A + 70 = 100, and A = 30 degrees.

Clue 2: B + C = 120. Replace B with 70. Then 70 + C = 120, and C = 50 degrees.

From A to D, angle measures:

30 + 70 + 50 + 210 = 360 degrees

7. I am a convex quadrilateral.

Clues:

1) **A = C**
2) **2B + 10 = C**
3) **C = 13 x 100 ½**

My angles are:

A = 130 degrees

B = 60 degrees

C = 130 degrees

D = 40 degrees

Solution

Clue 3: C = 13 x 100 ½. So, C = 13 x 10, and C = 130 degrees.

Clue 1: A = C. Since C = 130, then A = 130 degrees.

Clue 2: 2B + 10 = C. Replace C with 130. Then 2B + 10 = 130, and 2B = 120. So, B = 60 degrees.

Since the total number of degrees is 360, to solve for D:
360 – (130 + 60 + 130) = 40. So, D = 40 degrees.

From A to D, angle measures:

130+ 60 + 130 + 40 = 360 degrees.

8. I am a convex quadrilateral.

Clues:

1) **D = D/2 + 5**
2) **360 – (A + B + D) = 120**
3) **C = 2B – 20**

My angles are:

A = 160 degrees

B = 70 degrees

C = 120 degrees

D = 10 degrees

Solution

Clue 2: 360 – (A + B + D) = 120. So, C =120 degrees.

Clue 3: C = 2B – 20. Replace C with 120. Then, 120 = 2B – 20.
So, 140 = 2B, and B = 70 degrees.

Clue 1: D = D/2 + 5. Multiply both sides of the equation by 2. Then 2D = D + 10, and D = 10 degrees.

Clue 2: 360 – (A + B + D) = 120. Replace B with 70 and D with 10.
Then, 360 – (A + 70 + 10) = 120. So, 360 – A - 80 = 120. Then, 280 – A = 120, and A = 160 degrees.

From A to D, angle measures:

160 + 70 + 120 + 10 = 360 degrees.

Section 2: Solutions
Pentagons 1 – 8

Problem 1:

I am a convex pentagon.

Clues:

1) **B = C**
2) **B + D = C + E**
3) **A + 30 = D**
4) **2D = 180**
5) **2A + 30 = B**

My angles are:

A = 60 degrees

B = 150 degrees

C = 150 degrees

D = 90 degrees

E = 90 degrees

Solution

Clue 4: 2D = 180. So, D = 90 degrees.

Clue 3: A + 30 = D. Replace D with 90. Then, A + 30 = 90, and A = 60 degrees.

Clue 5: 2A + 30 = B. Replace A with 60. Then, 2 x 60 + 30 = B, and B = 150 deegrees.

Clue 1: B = C. Replace B with 150. Then, C = 150 degrees.

Clue 2: B + D = C + E. Replacee B with 150, D with 90, and C with 150.
Then, 150 + 90 = 150 + E, and E = 90 degrees.

From A to E, angle measures:

60 + 150 + 150 + 90 + 90 = 540 degrees

Problem 2:

I am a concave pentagon.

Clues:

1) **B = A + C**
2) **C + 25 = B**
3) **E/D = 6**
4) **D + 40 = B**
5) **4B = 360**

My angles are:

A = 35 degrees

B = 90 degrees

C = 65 degrees

D = 50 degrees

E = 300 degrees

Solution

Clue 5: 4B = 360, so B = 90 degrees.

Clue 2: C + 25 = B. Replace B with 90. Then, C + 25 = 90, and C = 65 degrees.

Clue 4: D + 40 = B. Replace the B with 90. Then ,D + 40 = 90, and D = 50 degrees.

Clue 1: B = A + C. Replace B with 90 and C with 65.
Then, 90 = A + 65, and A = 35 degrees.

Clue 2: E/D = 6. Replace D with 50. Then, E/50 = 6, and E = 300 degrees.

From A to E, angle measures:

35 + 90 + 65 + 50 + 300 = 540 degrees

Problem 3:

I am a concave pentagon.

Clues:

1) **B + D + E = 440**
2) **A = C**
3) **D = 2A + 20**
4) **B = (D/2 – 10) x 4**
5) **D = E**

My angles are:

A = 50 degrees

B = 200 degrees

C = 50 degrees

D = 120 degrees

E = 120 degrees

Solution:

Clue 1: B + D + E = 440. So, A + C = 540 - 440, or 100.

Clue 2: A = C. Since A+ C = 100, then A = 50 degrees and C = 50 degrees.

Clue 3: D = 2A + 20. Replace A with 50. Then, 2 x 50 + 20 = 120, and D = 120 degrees.

Clue 5: D = E . Since D = 120, then E = 120 degrees.

Clue 4: B = (D/2 – 10) x 4. Replace D with 120. Then, B = (120/2 – 10) x 4.
So, B = 50 x 4, and B = 200 degrees.

From A to E, angle measures:

50 + 200 + 50 + 120 + 120 = 540 degrees

Problem 4:

I am a concave pentagon.

Clues:
1) A = 3C
2) B + C = 140
3) B = 2E
4) C + 40 = B

My angles are:

A = 150 degrees

B = 90 degrees

C = 50 degrees

D = 205 degrees

E = 45 degrees

Solution

Clue 2: B + C = 140. So, B = 140 – C.

Clue 4: C + 40 = B. Replace B = 140 – C. Then, C + 40 = 140 – C. So, 2C = 100, and C = 50 degrees.

Clue 2: B + C = 140. Replace C with 50, then Then, B + 50 = 140, and B = 90 degrees.

Clue 1: A = 3C. Replace C with 50. Then A = 3 x 50, and A = 150 degrees.

Clue 3: B = 2E. Replace B with 90. Then 90 = 2E, and E = 45 degrees.

To solve for D: 540 – (150 + 90 + 50 + 45) = 205. So, D = 205 degrees.

From A to E, angle measures:

150 + 90 + 50 +205 +45 = 540 degrees

Problem 5:

I am a concave pentagon.

Clues:

1) B = D

2) A = B + D

3) A + B + D = 180

4) 3A = C

5) E = A

My angles are:

A = 90 degrees

B = 45 degrees

C = 270 degrees

D = 45 degrees

E = 90 degrees

Solution

Clue 3: A + B + D = 180. In Clue 2, A = B + D. So, in Clue 3, replace B + D with A . Then , 2A = 180, and A = 90 degrees.

Clue 5: E = A. Since A = 90, then E = 90 degrees.

Clue 4: 3A = C. Replace A with 90. Then, 3 x 90 = C, and C = 270 degrees.

Clue 1: B = D. Clue 2: A = B + D. Since B = D, replace D with B in Clue 2.

Then, A = 2B. Replace A with 90. Then, 90 = 2B, and B = 45 degrees.
Since B = D, then D = 45 degrees.

From A to E, angle measures:

90 + 45 + 270 + 45 + 90 = 540 degrees

Problem 6:

I am a concave pentagon.

Clues:

1) **B – E= 20**
2) **B + E = 440**
3) **$(A - C)^2 = 100$**
4) **D = C + 15**
5) **2C – 10 = 40**

My angles are:

A = 35 degrees

B = 230 degrees

C = 25 degrees

D = 40 degrees

E = 210 degrees

Solution

Clue 5: 2C – 10 = 40. So 2C = 50, and C = 25 degrees.

Clue 4: D = C + 15. Replace C with 25. Then D = 25 + 15, and D = 40 degrees.

Clue 3: $(A - C)^2 = 100$. Replace C with 25. Then $(A - 25)^2 = 100$, and A = 35 degrees.

Clue 1: B – E = 20. Clue 2: B + E = 440. Since both equations have B and E, add the equations: B – E + B + E = 20 + 440. Then, 2B = 460, and B = 230 degrees.

Clue 2: B + E = 440. Replace B with 230. Then 230 + E = 440, and E = 210 degrees.

From A to E, angle measures:

35 + 230 + 25 + 40 + 210 = 540 degrees

Problem 7:

I am a concave pentagon.

Clues:

1) **E/5 = 42**
2) **2C – 10 = D**
3) **E + 20 = B**
4) **C + D = 65**

My angles are:

A = 35 degrees

B = 230 degrees

C = 25 degrees

D = 40 degrees

E = 210 degrees

Solution

Clue 1: E/5 = 42. So, E = 5 x 42 = 210, and E = 210 degrees.

Clue 3: E + 20 = B. Replace E with 210. Then, 210 + 20 = B, and B = 230 degrees.

Clue 4: C + D = 65. So, D = 65 – C.

Clue 2: 2C – 10 = D. Replace D with 65 – C. Then, 2C – 10 = 65 – C. So, 3C = 75, and C = 25 degrees.

Clue 4: C + D = 65. Replace C with 25. Then 25 + D = 65, and D = 40 degrees.

Since the total nnumber of degrees is 540, to solve for A:

540 – (230 + 25 + 40 + 210) = 35. So, A = 35 degrees.

From A to E, angle measures:

35 + 230 + 25 + 40 + 210 = 540 degrees

Problem 8:

I am a convex pentagon.

Clues:

1) **B + C = 230**
2) **B - C = 50**
3) **D = B – 50**
4) **2E – 80 = 200**

My angles are:

A = 80 degrees

B = 140 degrees

C = 90 degrees

D = 90 degrees

E = 140 degrees

Solution

Clue 4: 2E – 80 = 200. So, 2E = 200 + 80. Then, 2E = 280, and E = 140 degrees.

Both Clue 1: B + C = 230 and Clue 2: B = C = 50 contain B and C. Add those equations: B + C + B – C = 230 + 50 Then, 2B = 280, and B = 140 degrees.

Clue 1: B + C = 230. Replace B with 140. Then, 140 + C = 230, and C = 90 degrees.

Clue 3: D = B – 50. Replace B with 140. Then D = 140 – 50, and D = 90 degrees.

Since the total number of degrees is 540, to solve for A:
540 – (140 + 140 + 90 + 90) = 540 - 460) = 80. So, A = 80 degrees.

From A to E, angle measures:

80 + 140 + 90 + 90 + 140 = 540 degrees

Section 2: Solutions
Hexagons 1 – 8

I am a concave hexagon.

Clues:

1) **A = 100 - 10**
2) **D = E**
3) **E = A + 20**
4) **2F - 30 = 2D - 110**
5) **3A - (30 x 2) = B**

My angles are:

A = 90 degrees

B = 210 degrees
C = 130 degrees
D = 110 degrees
E = 110 degrees
F = 70 degrees

Solution

Clue 1: A = 100 - 10. So, A = 90 degrees.

Clue 3: E = A + 20. Replace A with 90. Then, E = 90 + 20, and E = 110 degrees.

Clue 2: D = E. Replace E with 110. Then, D = 110 degrees.

Clue 4: 2F - 30 = 2D - 110. Replace D with 110. Then 2F – 30 = 220 – 110.
So, 2F – 30 = 110. Then, 2F = 140, and F = 70 degrees.

Clue 5: 3A - (30 x 2) = B. Replace A with 90. Then, 270 – 60 = B, and B = 210 degrees.

Since the total number of degrees is 720, to solve for C:

720 - (90 + 210 + 110 + 110 + 70) = 130. So, C = 130 degrees.

From A to F, angle measures:

90 + 210 + 130 + 110 + 110 + 70 = 720 degrees

Problem 2:

I am a convex hexagon.

Clues:

1) $B + 20 = 140$
2) $3B/2 = E + 40$
3) $E = F$
4) $A + B - F = 110$
5) $B/2 + 40 + F = 3D$

My angles are:

A = 130 degrees
B = 120 degrees
C = 110 degrees
D = 80 degrees
E = 140 degrees
F = 140 degrees

Solution:

Clue 1: $B + 20 = 140$. So, B = 120 degrees.

Clue 2: $3B/2 = E + 40$. Replace B with 120. Then $360/2 = E + 40$.
So, $180 = E + 40$, and E = 140 degrees.

Clue 3: E = F. Since E = 140 degrees, then F = 140 degrees.

Clue 4: $A + B - F = 110$. Replace B with 120 and F with 140. Then, $A + 120 - 140 = 110$.
So, A = 130 degrees.

Clue 5: $B/2 + 40 + F = 3D$. Replace B with 120 and F with 140. Then, $60 + 40 + 140 = 3D$,
and $240 = 3D$. So, D = 80 degrees.

Since the total number of degrees is 720, to solve for C :
$720 - (130 + 120 + 80 + 140 + 140) = 110$. So, C = 110 degrees.

From A to F, angle measures:

130 + 120 + 110 + 80 + 140 + 140 = 720 degrees

Problem 3:

I am a concave hexagon.

Clues:

1) **2B = 240**
2) **F - 10 = B**
3) **C = D**
4) **3C - 40 = E**
5) **2C = F + 30**

My angles are:

A = 110 degrees
B = 120 degrees
C = 80 degrees
D = 80 degrees
E = 200 degrees
F = 130 degrees

Solution

Clue 1: 2B = 240. So, B = 120 degrees.

Clue 2: F - 10 = B. Replace B with 120. Then, F - 10 = 120, and F = 130 degrees.

Clue 5: 2C = F + 30. Replace F with 130.Then 2C = 160, and C = 80 degrees.

Clue 3: C = D. Since C = 80, then D = 80 degrees.

Clue 4: 3C - 40 = E. Replace C with 80. Then 240 – 40 = E, and E = 200 degrees.

Since the total number of degrees is 720, to solve for A:
720 - (120 + 80 + 80 + 200 + 130) = 110. So, A = 110 degrees.

From A to F, angle measures:

110 + 120 + 80 + 80 + 200 + 130 = 720 degrees

Problem 4:

I am a convex hexagon.

Clues:

1) **B = (30 + 40) x 2**
2) **E = F**
3) **3A - 60 = 2B**
4) **A + B + E + F = 470**
5) **2C = 100 + 9 x 9 - 1**

My angles are:

A = 100 degrees
B = 140 degrees
C = 90 degrees
D = 160 degrees
E = 115 degrees
F = 115 degrees

Solution

Clue 1: B = (30 + 40) x 2. So, B = 140 degrees.

Clue 5: 2C = 100 + 9 x 9 - 1. So, 2C = 100 +81 – 1 Then 2C = 180, and C = 90 degrees.

Clue 3: 3A - 20 = 2B. Replace B with 140. Then, 3A – 20 = 280, and A = 100 degrees.

Clue 4: A + B + E + F = 470. Replace A with 100 and B with 140. Then, 240 + E + F = 470. So, E + F = 230

Clue 2: E = F. Clue 4: E + F = 230. So, E = 115 degrees and F = 115 degrees.

Since the total number of degrees is 720, to solve for D:
720 - (100 + 140 + 90 + 115 + 115) = 160. So, D = 160 degrees.

From A to F, angle measures:

100 + 140 + 90 + 160 + 115 + 115 = 720 degrees

Problem 5:

I am a convex hexagon.

Clues:

1) **2E = B + 15**
2) **B = 2A - 35**
3) **70 = E - 20**
4) **C = D - 35**
5) **A + D = 240**

My angles are:

A = 100 degrees
B = 165 degrees
C = 115 degrees
D = 140 degrees
E = 90 degrees
F = 110 degrees

Solution

Clue 3: 70 = E - 20. So, E = 90 degrees.

Clue 1: 2E = B + 15. Replace E with 90. Then, 2(90) = B + 15. So, 180 = B + 15, and B = 165 degrees.

Clue 2: B = 2A - 35. Replace B with 165. Then, 165 = 2A – 35. So, 200 = 2A, and A = 100 degrees.

Clue 5: A + D = 240. Replace A with 100. So, 100 + D = 240, and D = 140 degrees.

Clue 4: C = D - 35. Replace D with 140. Then, C = 140 – 35, and C = 115 degrees.

Since the total number of degrees is 720, to solve for F:
720 - (100 + 165 + 115 + 140 + 90) = 110. So, F = 110 degrees.

From A to F, angle measures:

100 + 165 + 115 + 140 + 90 + 110 = 720 degrees

Problem 6:
I am a concave hexagon.
Clues:

1) B + C = A
2) B = E
3) 2F = 2B - 20
4) A/2 - 30 = F
5) 2E - 10 = 150

My angles are:

G = 200 degrees
H = 80 degrees
I = 120 degrees
J = 170 degrees
K = 80 degrees
L = 70 degrees

Solution

Clue 5: 2E - 10 = 150. So, 2E = 160, and E = 80 degrees.

Clue 2: B = E. Since E = 80 degrees, then B = 80 degrees.

Clue 3: 2F = 2B - 20. Replace B with 80. Then, 2F = 2(80) – 20.
So, 2F = 160 – 20. Then, 2F = 140, and F = 70 degrees.

Clue 4: A/2 - 30 = F. Replace F with 70. Then, A/2 - 30 = 70.
So, A/2 = 100, and A = 200 degrees.

Clue 1: B + C = A. Replace B with 80 and A with 200. Then, 80 + C = 200, and C = 120 degrees.

Since the total number of degrees is 720, to solve for D:
720 - (200 + 80 + 120 + 80 + 70) = 170, then D = 170 degrees.

From A to F, angle measures:

200 + 80 + 120 + 170 + 80 + 70 = 720 degrees

Problem 7:

I am a concave hexagon.

Clues:

1) **B = C**
2) **3D + 60 = 300**
3) **2D + 2F = 380**
4) **E - 60 = A/2 - 15**
5) **2F - 30 = A**

My angles are:

A = 190 degrees
B = 100 degrees
C = 100 degrees
D = 80 degrees
E = 140 degrees
F = 110 degrees

Solution

Clue 2: 3D + 60 = 300. So, 3D = 240, and D = 80 degrees.

Clue 3: 2D + 2F = 380. So, D + F = 190. Replace D with 80.
Then, 80 + F = 190, and F = 110 degrees.

Clue 5: 2F - 30 = A. Replace F with 110. Then 220 - 30 = A, and A = 190 degrees.

Clue 4: E - 60 = A/2 - 15. Replace A with 190. Then E - 60 = 95 – 15. So,
E – 60 = 80, and E = 140 degrees.

Since the total number of degrees is 720, to solve for B and C:
720 - (190 + 80 + 140 + 110) = 200. So, B + C = 200 degrees.

Clue 1: B = C. So, 200/2 = 100. Then, B = 100 degrees and C = 100 degrees.

From A to F, angle measures:

190 + 100 + 100 + 80 + 140 + 110 = 720 degrees

8. I am a convex hexagon.

Clues:

1) **A + B + D + F = 500**
2) **C = E**
3) **3E = 3A - 60**
4) **2A = B/2 + 2C - 20**
5) **(D+ E)/3 = B/2 + 20**

My angles are:

A = 130 degrees
B = 120 degrees
C = 110 degrees
D = 130 degrees
E = 110 degrees
F = 120 degrees

Solution

Clue 1: A + B + D + F = 500. So, C + E = 720 - 500, or 220 degrees.

Clue 2: C = E. From Clue 1: C + E = 220. So, 220/2 = 110, and C = 110 degrees and E = 110 degrees.

Clue 3: 3E = 3A - 60. Replace E with 110. Then: 330 = 3A – 60. So, 3A = 390, and A = 130 degrees.

Clue 4: 2A = B/2 + 2C - 20. Replace A with 130 and C with 110. Then, 260 = B/2 + 220 – 20. So, 260 = B/2 + 200. Then, 60 = B/2 and B = 120 degrees.

Clue 5: (D + E)/3 = B/2 + 20. Replace E with 110 and B with 120. Then, (D + 110)/3 = 120/2 + 20, and D/3 + 110/3 = 90. So, D = 130 degrees.

Since the total number of degrees is 720, to solve for F: 720 - (130 + 120 + 110 + 130 + 110) = F. So, F = 120 degrees.

From A to F, angle measures:

130 + 120 + 110 + 130 + 110 + 120 = 720 degrees

Section 2: Solutions
Heptagons 1 – 8

1. **I am a convex heptagon.**

Clues:

1) A = E

2) B/2 = 120/2 – 5

3) 2C – B = G

4) G + 20 = B

5) A + B + C + E = 490

6) D = A + 10

My angles are:

A = 140 degrees

B = 110 degrees

C = 100 degrees

D = 150 degrees

E = 140 degrees

F = 170 degrees

G = 90 degrees

Problem 1:

Solution:

Clue 2: B/2 = 120/2 – 5. So, B/2 = 60, and B = 110 degrees.

Clue 4: G + 20 = B. Replace B with 110. Then, , G + 20 = 110, and G = 90 degrees.

Clue 3: 2C – B = G. Replace B with 110 and G with 90. So, 2C – 110 = 90. Then, 2C = 200, and C = 100 degrees.

Clue 4: A + B + C + E = 490. Replace B with 110 and C with 100.
Then, A + 110 + 100 + E = 490. So, A + E = 280

Clue 1: A = E. From Clue 4: A + E = 280. So, A = 140 degrees and E = 140 degrees.

Clue 6: D = A + 10. Replace A with 140. Then, D = 140 + 10, and D = 150 degrees.

Since the total number of degrees is 900, to solve for F:
900 - (140 + 110 + 100 + 150 + 140 + 90) = 170. So, F = 170 degrees.

From A to F, angle measures:

140 + 110 + 100 + 150 + 140 + 170 + 90 = 900 degrees

2. I am a concave heptagon.

Clues:

1) B = C

2) 3D = 2C + 10

3) BF + G = 220

4) 2(A – B) = G + 5

5) 2B = 300 – 10

6) D + G = 205

My angles are:

A = 200 degrees

B = 145 degrees

C = 145 degrees

D = 100 degrees

E = 90 degrees

F = 115 degrees

G = 105 degrees

Problem 2:

Solution

Clue 5: 2B = 300 – 10. So, 2B = 290, and B = 145 degrees.

Clue 1: B = C. Since B = 145, then C = 145 degrees.

Clue 2: 3D = 2C + 10. Replace C with 145. Then 3D = 290 + 10. So, 3D = 300, and D = 100 degree

Clue 6: D + G = 205. Replace D with 100. Then 100 + G = 205, and G = 105 degrees.

Clue 3: F + G = 220. Replace G with 105. Then F + 105 = 220, and F = 115 degrees.

Clue 4: 2(A - B) = G + 5. Replace B with 145 and G with 105. Then, 2(A – 145) = 110, So, 2A – 290 = 110. Then 2A = 400, and A = 200 degrees.

Since the total number of degrees is 900, to solve for E:
900 - (200 + 145 + 145 + 100 + 115 + 105) = 90. So, E = 90 degrees.

From A to F, angle measures:

200 + 145 + 145 + 100 + 90 + 115 + 105 = 900 degrees

3. I am a convex heptagon

Clues:

1) **A – F = 10**
2) **C = (A - 1) ½ x 10**
3) **A + F = 280**
4) **D + E = 220**
5) **2A + 2B = 580**
6) **115 – D = 10**

My angles are:

A = 145 degrees

B = 145 degrees

C = 120 degrees

D = 105 degrees

E = 115 degrees

F = 135 degrees

G = 135 degrees

Problem 3:

Solution

Clue 6: 115 - D = 10. So, D = 105 degrees.

Clue 4: D + E = 220. Replace D with 105. Then 105 + E = 220, and E = 115 degrees.

Clue 1: A – F = 10. Clue 3: A + F = 280. Both equations have A and F. Add these two equations.: A – F + A + F = 280 + 10. Then, 2A = 290, and A = 145 degrees.

Clue 5: 2A + 2B = 580. So, A + B = 290. Replace A with 145. Then, 145 + B = 290, and B = 145 degrees.

Clue 1: A – F = 10. Replace A with 145. Then, 145 – F = 10, and F = 135 degrees.

Clue 2: C = (A - 1) $^{1/2}$ x 10. Replace A with 145. Then C = (145 – 1) $^{1/2}$ x 10. So, C = 12 x 10, and C = 120 degrees.

Since the total number of degrees is 900, to solve for G:

900 – (145 + 145 +120 + 105 + 115 + 135) = 135. So, G = 135 degrees.

From A to G, angle measures:

145 + 145 + 120 + 105 +115 + 135 + 135 = 900 degrees

4. I am a concave heptagon
Clues:

1) **B + C + D + E = 360**
2) **B = C**
3) **A – 30 = G**
4) **A + G = 240**
5) **4D – F = 60**
6) **A – D = 45**
7) **B = (F + 60)/4**

My angles are:

A = 135 degrees

B = 90 degrees

C = 90 degrees

D = 90 degrees

E = 90 degrees

F = 300 degrees

G = 105 degrees

Problem 4:

Solution

Clue 3: A - 30 = G. So, A = G + 30.

Clue 4: A + G = 240. Replace A with G + 30. Then G + 30 + G = 240. So, 2G = 240 – 30. Then, 2G = 210, and G = 105 degrees.

Clue 4: A + G = 240. Replace G with 105. Then A + 105 = 240, and A = 135 degrees.

Clue 6: A – D = 45. Replace A with 135. Then 135 – D = 45, and D = 90 degrees.

Clue 5: 4D – F = 60. Replace D with 90. Then 360 – F = 60, and F = 300 degrees.

Clue 7: B = (F + 60)/4. Replace F with 300. Then B = (300 +60)/4, and B = 90 degrees.

Clue 2: B = C. Since B = 90, then C = 90 degrees.

Clue 1: B + C + D + E = 360. Replace B with 90, C with 90, and D with 90. Then, 90 + 90 + 90 + E = 360. So, 270 + E = 360, and E = 90 degrees.

From A to G, angle measures:

135 + 90 + 90 + 90 + 90 + 300 + 105 = 900 degrees

5. I am a concave heptagon

Clues:

1) A + B = 230

2) 3A – 2B = 140

3) 2E – B = 2A – 10

4) D/2 = G + 5

5) E + 20 = D

6) 2C - 10 = 3G

My angles are:

A = 120 degrees

B = 110 degrees

C = 140 degrees

D = 190 degrees

E = 170 degrees

F = 80 degrees

G = 90 degrees

Problem 5:

Solution:

Clue 1: A + B = 230. So, A = 230 – B.

Clue 2: 3A – 2B = 140. Replace A with 230 – B. Then, 3(230 – B) – 2B = 140.
So, 690 – 3B – 2B = `140. Then, 690 – 5B = 140. So, 5B = 550, and B = 110 degrees.

Clue 1: A = 230 – B. Replace B with 110. Then, A = 230 – 110, and A = 120 degrees.

Clue 3: 2E – B = 2A – 10. Replace B with 110 and A with 120. Then, 2E – 110 = 240 – 10.
So, 2E – 110 = 230. So, 2E = 340, and E = 170 degrees.

Clue 5: E + 20 = D. Replace E with 170. Then, 170 + 20 = D, and D = 190 degrees.

Clue 4: D/2 = G + 5. Replace D with 190. Then, 95 = G + 5, and G = 90 degrees.

Clue 6: 2C – 10 = 3G. Replace G with 90. Then 2C – 10 = 270. So, 2C = 280, and
C = 140 degrees.

Since the total number of degrees is 900, to solve for F:
900 - (120 + 110 + 140 + 190 + 170 + 90) = 80. So, F = 80 degrees.

From A to F, angle measures:

120 + 110 + 140 + 190 + 170 + 80 + 90 = 900 degrees

6. I am a convex heptagon.

Clues:

1) **B + C – 100 = A**
2) **D + G = 280**
3) **A – 15 = B**
4) **C + 25 = G**
5) **2E = 2F**
6) **F = C + 15**

My angles are:

A = 130 degrees

B = 115 degrees

C = 115 degrees

D = 140 degrees

E = 130 degrees

F = 130 degrees

G = 140 degrees

Problem 6:

Solution

Clue 3: A – 15 = B. Clue 1: B + C – 100 = A. Replace B with A – 15 in Clue 1. Then, A – 15 + C - 100 = A. So, A – 115 + C = A, and C = 115 degrees.

Clue 6: F = C + 15. Replace C with 115. Then, F = 115 +15, and F = 130 degrees.

Clue 5: 2E = 2F. So, E = F. Since E = F and F = 130, then E = 130 degrees.

Clue 4: C + 25 = G. Replace C with 115. Then 115 + 25 = G, and G = 140 degrees.

Clue 2: D + G = 280. Replace G with 140. Then D + 140 = 280, and D = 140 degrees.

Since the total number of degrees is 900, to solve for A + B:
900 - (115 + 140 + 130 + 130 + 140) = 245. So, A + B = 245.

Clue 2: A – 15 = B. Since A is 15 more than B, then subtract 15 from 245 to make A = B. So, 245 - 15 = 230, then A would be 115 and B would be 115. Since A is 15 more than B, then A = 130 degrees and B = 115 degrees.

From A to G, angle measures:

130 + 115 + 115 + 140 + 130 + 130 + 140 = 900 degrees.

7. I am a convex heptagon

Clues:

1) D = E

2) F – G = 30

3) 2F + G = 450

4) C + 20 = G

5) C + D + E = 390

6) 2D + A = 380

My angles are:

A = 100 degrees

B = 120 degrees

C = 110 degrees

D = 140 degrees

E = 140 degrees

F = 160 degrees

G = 130 degrees

Problem 7:

Solution

Both Clue 2: F – G = 30 and Clue 3: 2F + G = 450 have both F and G.
Add the two equations: F – G + 2F + G = 30 + 450. So, 3F = 480, and F = 160 degrees.

Clue 2: F – G = 30. Replace F with 160. Then, 160 – G = 30, and G = 130 degrees.

Clue 4: C + 20 = G. Replace G with 130. Then, C + 20 = 130, and C = 110 degrees.

Clue 5: C + D + E = 390. Replace C with 110. Then, D + E = 280.

Clue 1: D = E. Since D + E = 280, then D = 140 degrees and E = 140 degrees.

Clue 6: 2D + A = 380. Replace D with 140. Then 280 + A = 380, and A = 100 degrees.

Since the total number of degrees is 900, to solve for B:

900 - (100 + 110 + 140 + 140 + 160 + 130) = 120. So, B = 120 degrees.

From A to F, angle measures:

100 + 120 + 110 + 140 + 140 + 160 + 130 = 900 degrees

8. I am a concave heptagon.

Clues:

1) 2A + 20 = D

2) C/ 10^2 = 2

3) A + 30 = ½ C

4) G/7 = D/16

5) F – B = 20

6) B + F = 230

My angles are:

A = 70 degrees

B = 105 degrees

C = 200 degrees

D = 160 degrees

E = 170 degrees

F = 125 degrees

G = 70 degrees

Problem 8:

Solution

Clue 2: C/ 10^2 = 2. So, C/100 = 2, and C = 200 degrees.

Clue 3: A + 30 = ½ C. Replace C with 200. Then, A + 30 = 100, and A = 70 degrees.

Clue 1: 2A + 20 = D. Replace A with 70. Then 2 x 70 + 20 = D. So, D = 160 degrees.

Clue 4: G/7 = D/16. Replace D with 160. Then G/7 = 160 /16. So, G/7 = 10, and G = 70 degrees.

Clue 5: F – B = 20 and Clue 6: B + F = 230 . Both clues have B and F, so add those equations. F - B + B + F = 20 + 230. So, 2F = 250, and F = 125 degrees.

Clue 5: F – B = 20. Replace F with 125. Then, 125 – B = 20, and B = 105 degrees.

Since the total number of degrees is 900, to solve for E:
900 – (70 + 105 + 200 + 160 + 125 + 70) = 170. So, E = 170 degrees.

From A to G, angle measures:

70 + 105 + 200 + 160 + 170 + 125 + 70 = 900 degrees

Section 2: Solutions
Octagons 1 – 8

Problem 1:

I am a concave octagon.

Clues:

1) A = E

2) 2B – A = F

3) E + (100/2) = 150

4) F – A = 60

5) B/2 = C/2 – 35

6) C – G = G – A

7) H = B - 10

My angles are:

A = 100 degrees

B = 130 degrees

C = 200 degrees

D = 120 degrees

E = 100 degrees

F = 160 degrees

G = 150 degrees

H = 120 degrees

Problem 1:

Solution

Clue 3: E + (100/2) = 150. So, E + 50 = 150, and E = 100 degrees.

Clue 1: A = E. Since E is 100, then A = 100 degrees.

Clue 4: F – A = 60. Replace A with 100. Then, F – 100 = 60, and F = 160 degrees.

Clue 2: 2B – A = F. Replace A with 100 and F with 160. So, 2B – 100 = 160. Then, 2B = 260, and B = 130 degrees.

Clue 5: B/2 = C/2 – 35. Replace B with 130. Then, 65 = C/2 – 35. So, C/2 = 100, and C = 200 degrees.

Clue 6: C – G = G – A. Replace C with 200 and A with 100. Then, 200 – G = G – 100. So, 2G = 300, and G = 150 degrees.

Clue 7: H = B – 10. Replace B with 130. Then, H = 130 – 10, and H = 120 degrees.

Since the total number of degrees is 1080, to solve for D:
1080 - (100 + 130 + 200 + 100 + 160 + 150 + 120) = 120. So, D = 120 degrees.

From A to H angle measures:

100 + 130 + 200 + 120 + 100 + 160 + 150 + 120 = 1080 degrees

Problem 2:

I am a concave octagon.

Clues:

1) 2F = 2H -10

2) 2H = 300 – D/2

3) D/10 = 14

4) F + 40 = E

5) A = E

6) 3A – 3G = 75

7) B = G + 35

My angles are:

A = 150 degrees

B = 160 degrees

C = 130 degrees

D = 140 degrees

E = 150 degrees

F = 110 degrees

G = 125 degrees

H = 115 degrees

Problem 2:

Solution

Clue 3: D/10 = 14. So, D = 140 degrees.

Clue 2: 2H = 300 – D/2. Replace D with 140. Then, 2H = 300 – 70, So 2H = 230, and H = 115 degrees.

Clue 1: 2F = 2H – 10. Replace H with 115. So, 2F = 230 - 10. Then, 2F = 220, and F = 110 degrees.

Clue 4: F + 40 = E. Replace F with 110. Then, 110 + 40 = E and E = 150 degrees.

Clue 5: A = E. Since E = 150, then A = 150 degrees.

Clue 6: 3A – 3G = 75. Divide all elements of the equation by 3. Then, A – G = 25. A with 150. Then, 150 – G = 25, and G = 125 degrees.

Clue 7: B = G + 35. Replace G with 125. Then, B = 125 + 35, and B = 160 degrees.

Since the total number of degrees is 1080, to solve for C:
1080 - (150 + 160 + 140 + 150 + 110 + 125 + 115) = 130. So, C = 130 degrees.

From A to H, angle measures:

150 + 160 + 130 + 140 + 150 + 110 + 125 + 115 = 1080 degrees

Problem 3:

I am a convex octagon.

Clues:

1) $10^2 + 1/4B - 10 = G$
2) $G + F - 100 = B$
3) $A + B = 2A$
4) $F - G = 0$
5) $D = E$
6) $D + E = 310$
7) $A + 40 = 200$
8) $C - H = 0$

My angles are:

A = 160 degrees

B = 160 degrees

C = 95 degrees

D = 155 degrees

E = 155 degrees

F = 130 degrees

G = 130 degrees

H = 95 degrees

Problem 3:

Solution

Clue 7: A + 40 = 200. So, A = 160 degrees.

Clue 3: A + B = 2A. Subtract A from both sides of the equation. Then, B = A. Since A = 160, then B = 160 degrees.

Clue 1: 10^2 + 1/4B – 10 = G. Replace B with 160. Then, 100 + 40 – 10 = G, and G = 130 degrees.

Clue 4: F – G = 0. Since G = 130, then F = 130 degrees.

Clue 5: D = E. Clue 6: D + E = 310. Since D = E in Clue 5, replace D with E in Clue 6. Then, 2E = 310, and E = 155 degrees. Since D = E, then D = 155 degrees.

Since the total number of degrees is 1080, then C + H is 1080 – (160 + 160 + 155 + 155 + 130 + 130) = 190. So, C + H = 190.

Clue 8: C – H = 0. Since C + H = 190 and C = H, then C = 95 degrees and H = 95 degrees.

From A to H, angle measures:

160 + 160 + 95 + 155 + 155 + 130 + 130 + 95 = 1080 degrees

Problem 4:

I am a concave octagon.

Clues:

1) **G/4 + 100 = E**
2) **G + 10 = A**
3) **A + B = 180**
4) **C = H**
5) **(C + 5)/ 3 = A**
6) **A + B + F = 280**
7) **H – F = 165**
8) **E – 20 = F**

My angles are:

A = 90 degrees

B = 90 degrees

C = 265 degrees

D = 70 degrees

E = 120 degrees

F = 100 degrees

G = 80 degrees

H = 265 degrees

Problem 4:

Solution

Clue 3: A + B = 180. Clue 6: A + B + F = 280. Since all of Clue 3 is in Clue 6, replace A + B with 180 in Clue 6. Then, 180 + F = 280, and F = 100 degrees.

Clue 8: E – 20 = F. Replace F with 100. Then E – 20 = 100, and E = 120 degrees.

Clue 7: H – F = 165. Replace F with 100. Then H – 100 = 165, and H = 265 degrees.

Clue 4: C = H. Since H = 265, then C = 265 degrees.

Clue 5: (C + 5)/3 = A. Replace C with 265. Then (265 + 5)/3 = A. So, 270/3 = A, and A = 90 degrees.

Clue 3: A + B = 180. Replace A with 90. Then 90 + B = 180, and B = 90 degrees.

Clue 2: G + 10 = A. Replace A with 90. Then G + 10 = 90, and G = 80 degrees.

To solve for D: 1080 – (90 + 90 + 265 + 120 + 100 + 80 + 265) = 70. So, D = 70 degrees.

From A to H, angle measures:

90 + 90 + 265 + 70 + 120 + 100 + 80 + 265 = 1080 degrees

Problem 5:

I am a convex octagon.

Clues:

1) D + E = 320

2) D – E = 86

3) 2C = D + 37

4) C + E = 2B - 33

5) 2H = F - 10

6) F – G = 60

7) B + (B – 100) = F

My angles are:

A = 145 degrees

B = 135 degrees

C = 120 degrees

D = 203 degrees

E = 117 degrees

F = 170 degrees

G = 110 degrees

H = 80 degrees

Problem 5:

Solution

Clue 1: D + E = 320. So, E = 320 – D.

Clue 2: D – E = 86. Replace E with 320 – D. So, D – (320 – D) = 86.
Then, D – 320 + D = 86. So, 2D = 406, and D = 203 degrees.

In Clue 1: D + E = 320. Replace D with 203. Then, 203 + E = 320, and E = 117 degrees.

Clue 3: 2C = D + 37. Replace D with 203. Then, 2C = 240, and C = 120 degrees.

Clue 4: C + E = 2B – 33. Replace C with 120 and E with 117. So, 237 = 2B – 33.
Then, 270 = 2B, and B = 135 degrees.

Clue 7: B + (B – 100) = F. Replace B with 135. Then, 135 + 135 – 100 = F,
and F = 170 degrees.

Clue 5: 2H = F – 10. Replace F with 170. Then, 2H = 170 -10. So, 2H = 160 ,
and H = 80 degrees.

Clue 6: F – G = 60. Replace F with 170. Then, 170 – G = 60 and G = 110 degrees.

Since the total number of degrees is 1080, to solve for A:
1080 - (135 + 120 + 203 + 117 + 170 + 110 + 80) = 145. So, A = 145 degrees.

From A to H, angle measures:

145 + 135 + 120 + 203 + 117 + 170 + 110 + 80 = 1080 degrees

Problem 6:

I am a concave octagon.

Clues:

1) **A + C + E = 120**
2) **H + 50 = F**
3) **A + C + E + G = 185**
4) **G + 5 = 1/4F**
5) **A + E = 75**
6) **B – H = 5**
7) **C – 10 = E**

My angles are:

A = 40 degrees

B = 235 degrees

C = 45 degrees

D = 150 degrees

E = 35 degrees

F = 280 degrees

G = 65 degrees

H = 230 degrees

Problem 6:

Solution

Clue 3: A + C + E + G = 185. Clue 1: A + C + E = 120. All of Clue 1 is in Clue 3. Subtract Clue 1 from Clue 3. A + C + E + G - (A + C + E) = 185 – 120. So, G = 65 degrees.

Clue 1: A + C + E = 120. Clue 5: A + E = 75. In Clue 1, replace A + E with 75. Then, 75 + C = 120, and C = 45 degrees.

Clue 7: C – 10 = E. Replace C with 45. Then 45 – 10 = E, and E = 35 degrees.

Clue 1: A + C + E = 120. Replace C with 45 and E with 35. Then, A + 45 + 35 = 120. So, A + 80 = 120, and A = 40 degrees.

Clue 4: G + 5 = 1/4F. Replace G with 65. Then, 65 + 5 = 1/4F. So, 70 = 1/4F, and F = 280 degrees.

Clue 2: H + 50 = F. Replace F with 280. Then, H + 50 = 280, and H = 230 degrees.

Clue 6: B – H = 5. Replace H with 230. Then, B – 230 = 5, and B = 235 degrees.

To solve for D: 1080 – (40 + 235 + 45 + 35 + 280 + 65 + 230) = 150. So, D = 150 degrees.

From A to H, angle measures:

40 + 235 + 45 + 150 + 35 + 280 + 65 + 230 = 1080 degrees

Problem 7:

I am a convex octagon.

Clues:

1) **G = H – 25**
2) **A + B = D + E**
3) **B + D = 265**
4) **H/15 = 10**
5) **B – D = 25**
6) **C + E+ F + G = 545**
7) **F – C = 5**
8) **C + F = 275**

My angles are:

A = 120 degrees

B = 145 degrees

C = 135 degrees

D = 120 degrees

E = 145 degrees

F = 140 degrees

G = 125 degrees

H = 150 degrees

Problem 7:

Solution

Clue 4: H/15 = 10, so H = 150 degrees.

Clue 1: G = H – 25. Replace H with 150. Then, G = 150 -25. So, G = 125 degrees.

Clue 3: B + D = 265, and Clue 5: B – D = 25. Since both equations have B and D, add the equations: B + D + B – D = 265 + 25. So, 2B = 290, and B = 145 degrees.

Clue 5: B – D = 25. Replace B with 145. Then 145 – D = 25, and D = 120 degrees.

Clue 7: F – C = 5. Clue 8: C + F = 275. Since both equations have C and F, add the equations: F – C + C + F = 5 + 275. So, 2F = 280, and F = 140 degrees.

Clue 7: F – C = 5. Replace F with 140. Then, 140 – C = 5, and C = 135 degrees.

Clue 6: C + E+ F + G = 545. Replace C with 135, F with 140, and G with 125. Then, 135 + E + 140 + 125 = 545, and E = 145 degrees.

Clue 2: A + B = D + E. Replace B with 145, D with 120, and E with 145. Then, A + 145 = 120 + 145. So, A + 145 = 265, and A =120 degrees.

From A to H, total angle measures:
120 + 145 + 135 + 120 + 145 + 140 + 125 + 150 = 1080 degrees.

Problem 8:

I am a convex octagon.

Clues:

1) D = E

2) $B^2/4 = G^2/4 + 625$

3) 3G = 2H + 10

4) G + H = 295

5) H – 25 = E

6) 2B – E = F

7) A = F - 5

My angles are:

A = 145 degrees

B = 130 degrees

C = 140 degrees

D = 110 degrees

E = 110 degrees

F = 150 degrees

G = 120 degrees

H = 175 degrees

Problem 8:

Solution

Clue 4: G + H = 295. So, G = 295 – H.

Clue 3: 3G = 2H + 10. Replace G with 295 – H. Then, 3(295) - 3H = 2H + 10.
So, 885 = 5H + 10. Then 5H = 875, and H = 175 degrees.

Clue 5: H – 25 = E. Replace H with 175. Then, 175 – 25 = 150, and E = 150 degrees.

Clue 1:D = E. Since E = 150, then D = 150 degrees.

Clue 4: G + H = 295. Replace H with 175. Then G + 175 = 295, and G = 120 degrees.

Clue 2: $B^2/4 = G^2/4 + 625$. Multiply both sides of the equation by 4. Then,
$B^2 = G^2 + 2500$. Replace G with 120. Then, $B^2 = 14{,}400 + 2500$.
So, $B^2 = 16{,}900$, and B = 130 degrees.

Clue 6: 2B – E = F. Replace B with 130 and E with 150. Then, 2 x 130 – 150 = F, and F = 110 degrees.

Clue 7: A = F – 5. Replace F with 110. Then A = 110 – 5, and A = 105 degrees.

Since the total number of degrees is 1080, to solve for C:

1080 - (105 + 130 + 150 + 150 + 110 + 120 + 175) = 140. So, C = 140 degrees.

From A to F, angle measures:

105 + 130 + 140 + 150 + 150 + 110 + 120 + 175 = 1080 degrees