

SOLUTIONS MANUAL



COLLEGE GEOMETRY

A PROBLEM-SOLVING APPROACH WITH APPLICATIONS



NEW! NEW EDITION!

Musser • Trimpe • Maurer

Chapter 2

GEOMETRY INVESTIGATION

Answers will vary.

Section 2.1

2. 4 segments: \overline{AB} , \overline{BC} , \overline{BD} , \overline{BE}

4. 2 rays: \overrightarrow{CD} (or \overrightarrow{CE}), \overrightarrow{CB} (or \overrightarrow{CA})

6. \overrightarrow{ED} , \overrightarrow{EC} , \overrightarrow{EB}

8. (a) $6\sqrt{2}$ (b) $5\sqrt{2}$ (c) $2\sqrt{2}$ (d) $9\sqrt{2}$

10. (a) $\angle PQR$ or $\angle RQP$, $\angle PQS$ or $\angle SQP$,
 $\angle SQR$ or $\angle RQS$

(b) $\angle PQS$ and $\angle SQR$, $\angle PSQ$ and $\angle RSQ$

12. (a) 6 angles

(b) 2

(c) 2 pairs: $\angle WSV$ and $\angle VST$, $\angle WSU$ and $\angle UST$

14. (a) 85° acute (b) 129° obtuse (c) 100° obtuse

16. $\angle AOB = 78^\circ$, $\angle BOC = 12^\circ$

18. $\angle 1 \approx 55.33^\circ$, $\angle 2 \approx 34.67^\circ$

20. $\angle X = 123^\circ$

22. 4 points, 6 lines; 5 points, 10 lines;
6 points, 15 lines; n points, $\frac{n(n-1)}{2}$ lines

24. (a) 189.85°

(b) 220.615°

(c) 95.567°

(d) 353.430°

26. (a) $175^\circ 57'$

(b) $11^\circ 24'$

(c) $87^\circ 11'$

(d) $270^\circ 40'$

28. (a) $15^\circ 43' 48''$

(b) $2^\circ 9' 36''$

(c) $112^\circ 13' 19''$

(d) $244^\circ 19' 34''$

30. A: $N 60^\circ W$, $S 60^\circ E$

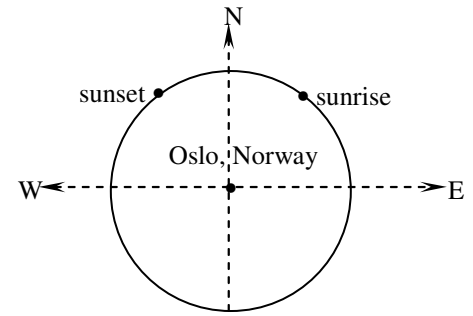
B: $S 20^\circ W$, $N 20^\circ E$

C: $S 36^\circ E$, $N 36^\circ W$

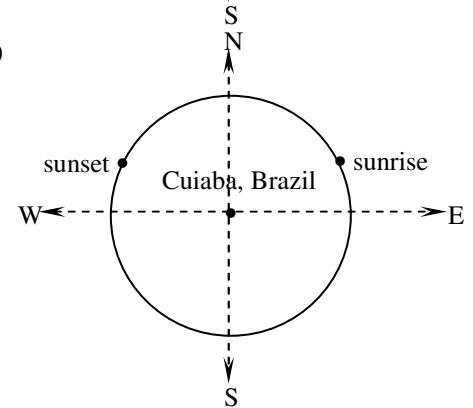
D: $N 38^\circ E$, $S 38^\circ W$

32. $N 53^\circ E$

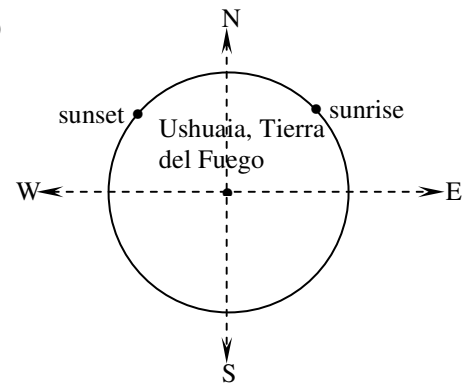
34. (a)



(b)



(c)



36. (a) $S 17^\circ E$ or $N 17^\circ W$

(b) $S 61^\circ W$ or $N 61^\circ E$

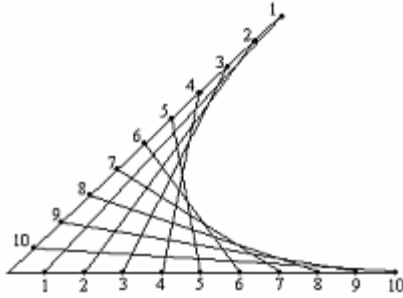
(c) $S 56^\circ 12' E$ or $N 56^\circ 12' W$

(d) $N 30^\circ 35' W$ or $S 30^\circ 35' E$

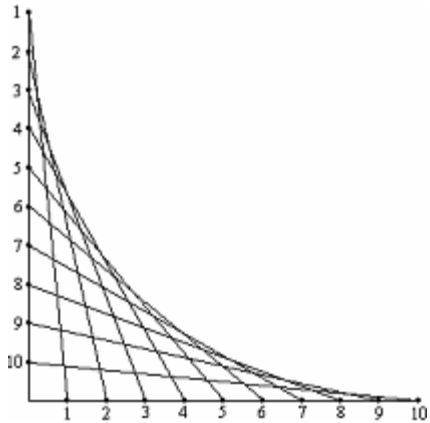
38. $\angle ABC = 105^\circ 2'$

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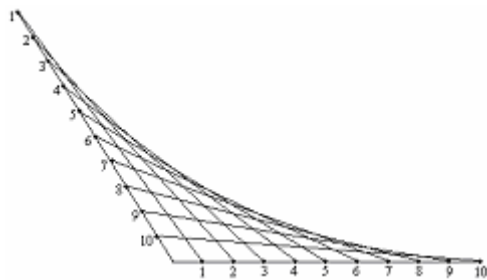
40. 45° angle:



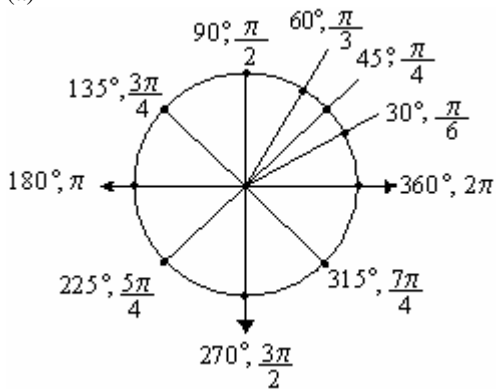
90° angle:



120° angle:



42. (a)



(b) $\frac{5\pi}{14}$

(c) $\frac{\pi}{3}, \frac{2\pi}{3}$

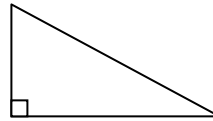
Selected Extended Problems

45. 45°: O, T, W
 90°: J, P, U, X
 135°: K, Q, V, Y
 180°: D, L, R
 225°: C, E, I, M, S
 270°: B, F, N
 315°: A, G, H, Z

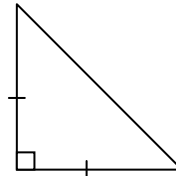
Section 2.2

2. (a) $\triangle GHI, \triangle MNO$
 (b) $\triangle ABC, \triangle DEF, \triangle JKL, \triangle PQR,$
 (c) $\triangle JKL, \triangle MNO$
 (d) $\triangle ABC, \triangle PQR$
 (e) None, based on the given information

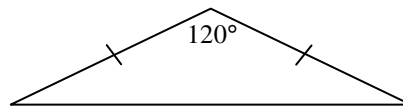
4. (a) One of many correct examples



- (b) One of many correct examples



- (c) One of many correct examples



- (d) Impossible; all angles must be less than 90° for the triangle to be acute.

6. (a) Five triangles: 2-11-11, 4-10-10, 6-9-9, 8-8-8, 10-7-7
 (b) Seven triangles: 3-10-11, 4-9-11, 5-9-10, 5-8-11, 6-7-11, 6-8-10, 7-8-9
 (c) One triangle: 8-8-8

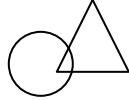
8. (a) 28 (b) 8 (c) 5 (d) 8 (e) 15

10. Many curves are possible.

12. (a)



(b)



(c)



(d)



14. (a) No - not all line segments

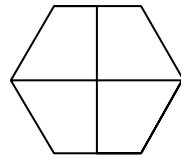
(b) Yes

(c) No - crosses itself

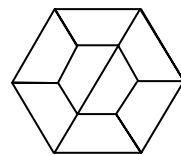
(d) Yes

(e) No - retraces itself

16. (a)



(b)



18. (a) *BDFH*

(b) *BCDG, AB DG, or BDEG*

(c) $\triangle ABG, \triangle BDG, \triangle GDE, \triangle BCD,$ or $\triangle ACE$

(d) $\triangle ABG, \triangle BDG, \triangle GDE, \triangle BCD,$ or $\triangle ACE$

(e) $\triangle EFI$

(f) $\triangle BHG, \triangle ABH, \triangle GDF,$ or $\triangle DEF$

(g) *ABDG, BDEG, or BCDG*

(h) *ABDE, BCEG, or ACDG*

(i) $\triangle DIE$

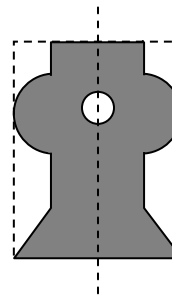
(g) *BDEH, or BDFA*

(k) *BCDGH, BCDFG, BCDFH, ABDIE, BDIEH, or BDJEH*

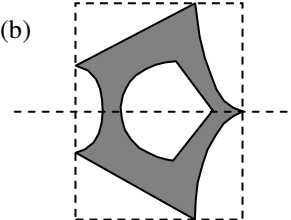
20. (a) 18 (b) 3 (c) 2 (d) 29

22. (a) 6 (b) 16 (c) 0

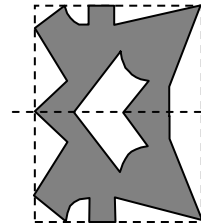
24. (a)



(b)



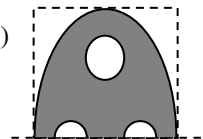
(c)



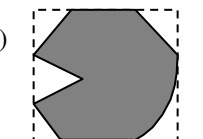
26. (a)



(b)



(c)



28. (a) Yes, 2 (b) Yes, 1

30. (a) Yes, 1 (b) No

32. (a) Pentagon: Four - $72^\circ, 144^\circ, 216^\circ, 288^\circ$

Hexagon: Five - $60^\circ, 120^\circ, 180^\circ, 240^\circ, 300^\circ$

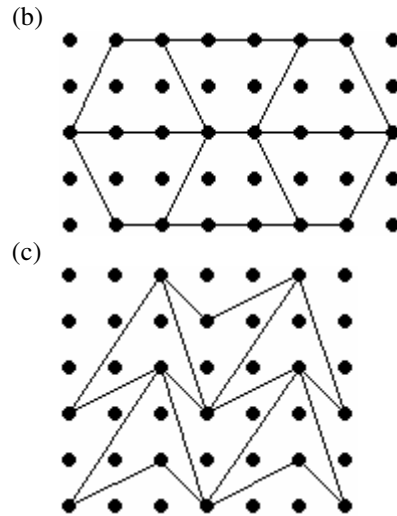
Octagon: Seven - $45^\circ, 90^\circ, 135^\circ, 180^\circ, 225^\circ, 270^\circ, 315^\circ$

(b) $n - 1$

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34. Parts (a), (b), (c), (d), (f), and (h) have both types of symmetry.
Parts (e) and (g) have reflection symmetry only.

36. (a) Isosceles right triangles and squares are used. There is no reflection symmetry. There is one rotation symmetry of 180° about the center of the block.
- (b) Squares are used. There are four axes of reflection symmetry: a horizontal line through the center, a vertical line through the center, and both diagonals. There are three rotation symmetries about the center of the block: 90° , 180° , and 270° .
- (c) Rectangles and a square are used. There are two axes of reflection symmetry: a horizontal line through the center and a vertical line through the center. There is one 180° rotation symmetry about the center of the block.
- (d) Right isosceles triangles, squares, rhombuses, and an octagon are used. There are four axes of reflection symmetry: a horizontal line through the center, a vertical line through the center, and both diagonals. There are three rotation symmetries about the center of the block: 90° , 180° , and 270° .

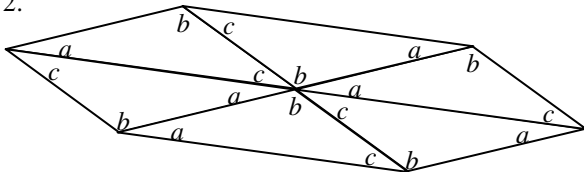


6. (a) $\angle WXY = 107^\circ$, $\angle XYZ = 54^\circ$, $\angle YZW = 113^\circ$, $\angle ZWX = 86^\circ$. The angle sum should be 360° . Answers may vary slightly due to measurement error.
- (b) $\angle TUP = 114^\circ$, $\angle UPQ = 126^\circ$, $\angle PQR = 125^\circ$, $\angle QRS = 139^\circ$, $\angle RST = 98^\circ$, $\angle STU = 118^\circ$; The angle sum should be 720° . Answers may vary slightly due to measurement error.

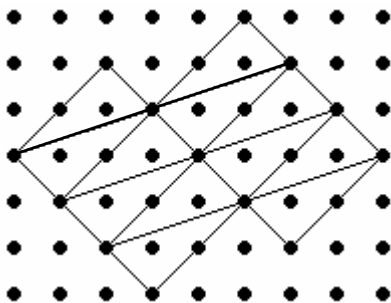
8. (a) Yes. The sum of the angle measures is 180° .
- (b) No. The sum of the angle measures is 200° .
- (c) No. The sum of the angle measures is 182° .

Section 2.3

2.



4. (a)



10. $a = 45^\circ$, $b = 45^\circ$, $c = 65^\circ$, $d = 80^\circ$, $e = 30^\circ$, $f = 70^\circ$, $g = 20^\circ$, $h = 55^\circ$

12. (a) 72°
(b) 82.5° , 97.5°
(c) 80°
(d) 110° , 76° , 117° , 57°

14. 21 sides

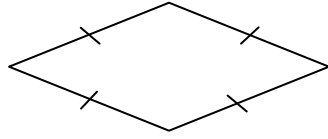
16. 5940°

18. (a) 156° (b) 165° (c) 171°
(d) 168.75° (e) 165.6° (f) 168°

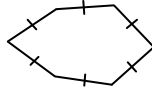
20. (a) 12 (b) 15 (c) 60 (d) 18

22. Equilateral triangle, square, regular hexagon, regular octagon, regular 12-gon, regular 24-gon

24. (a) Many answers are possible. One solution is shown.



- (b) Many answers are possible. One solution is shown.



26. The measure of one vertex angle in a regular octagon is 135° , which is not a factor of 360° .

28.

| Polygon | V | D | T |
|---------------|-----|---------|--------------------|
| Triangle | 3 | 0 | 0 |
| Quadrilateral | 4 | 1 | 2 |
| Pentagon | 5 | 2 | 5 |
| Hexagon | 6 | 3 | 9 |
| Octagon | 8 | 5 | 20 |
| n -gon | n | $n - 3$ | $\frac{n(n-3)}{2}$ |

30. $\angle CBA = 47^\circ 45'$

32. (a) Not closed. The angle measure sum is 357.2° .
 (b) Closed. The angle measure sum is 540° .

34. Quilt block designs will vary. Surrounding any vertex, the sum of the measures of the angles is 360° . Completed square quilt blocks will form a regular tessellation. Four 90° angles completely surround a vertex with no gaps.

Selected Extended Problems

35. (a) The measures of $\angle A$, $\angle B$, and $\angle C$ add up to 180° since they form a straight angle. That is, $a + b + c = 180^\circ$.
 (b) Rectangle, $\frac{1}{2}AC$.
 (c) Yes, the results are the same.

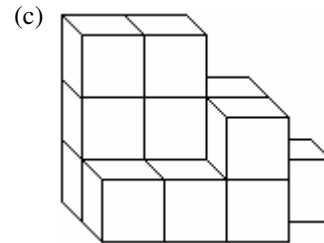
Section 2.4

2. (a) Not a polyhedron. It has a hole.
 (b) Not a polyhedron. A polyhedron is not curved.
 (c) Polyhedron

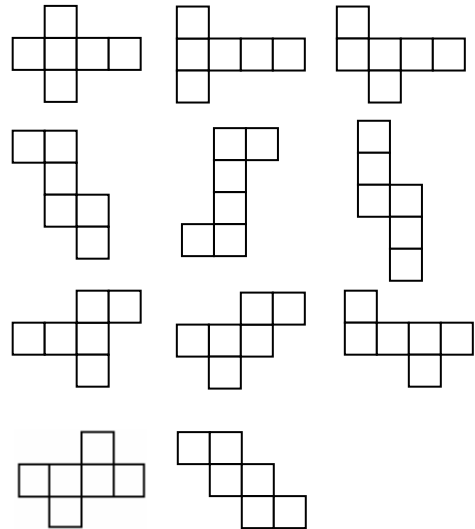
4. (a) (ii)

(b)

| | | |
|---|---|---|
| 3 | 2 | 5 |
| | 1 | 2 |
| | 1 | 1 |



- 6.



8. (a) $MPTQ$, $NOSR$
 (b) $MNOP$, $OSTP$, $MNRQ$, $RSTQ$
 (c) $MNRQ$, $NOSR$, $RSTQ$
 (d) Right trapezoidal prism

10. (a) Right isosceles trapezoidal prism
 (b) Oblique pentagonal prism

- 12.

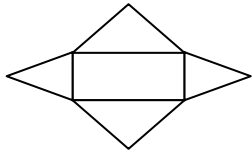


14. (a) Right regular pentagonal pyramid
 (b) Oblique square pyramid

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16. a and b

18.



20. All of the answers for problem 6 are possible nets.

22. (ii)

24.

| Base | F | V | $F + V$ | E |
|---------------|-------|-------|---------|------|
| Triangle | 4 | 4 | 8 | 6 |
| Quadrilateral | 5 | 5 | 10 | 8 |
| Octagon | 9 | 9 | 18 | 16 |
| n -gon | $n+1$ | $n+1$ | $2n+2$ | $2n$ |

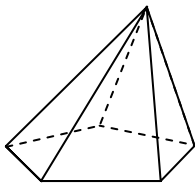
Yes, Euler's formula holds for these figures.

26.

| Base | F | V | $F + V$ | E |
|---------------|--------|------|---------|------|
| Triangle | 8 | 6 | 14 | 12 |
| Quadrilateral | 10 | 8 | 18 | 16 |
| Pentagon | 12 | 10 | 22 | 20 |
| n -gon | $2n+2$ | $2n$ | $4n+2$ | $4n$ |

Yes, Euler's formula holds for these figures.

28. 6 faces; One possible polyhedron is an oblique pentagonal pyramid.

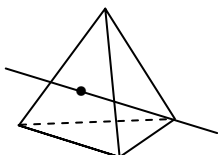


30. (a) Sphere
(b) Right circular cylinder

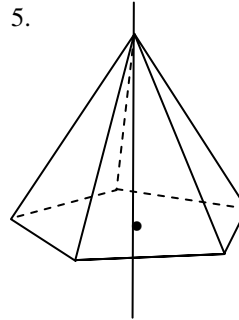
32. (a) Circle
(b) Isosceles triangle

34. 3 axes: one as shown through the middle of the top and bottom faces, one through the middle of the front and back faces, and one through the middle of the left and right faces.

36. (a) There are four axes of symmetry each of order 3. One such axis is shown.



(b) There is one axis of symmetry with order 5.



38. (a) Equilateral triangle
(b) Rectangle
(c) Hexagon
(d) Pentagon

40. (a) Right pentagonal prism
(b) Right circular cone
(c) Sphere
(d) Regular dodecahedron

Section 2.5

2. (a) $\frac{100 \text{ cm}}{1 \text{ m}}$ (b) $\frac{1 \text{ cm}}{10 \text{ mm}}$
(c) $\frac{1000 \text{ g}}{1 \text{ kg}}$ (d) $\frac{1 \text{ L}}{1000 \text{ mL}}$

4. (a) $\frac{60 \text{ min}}{1 \text{ deg}}$ (b) $\frac{1000 \text{ mm}}{1 \text{ m}}$
(c) $\frac{1 \text{ day}}{24 \text{ hours}}$ (d) $\frac{1 \text{ ft}}{12 \text{ in.}}$

6. $\frac{32.17 \text{ lb}}{1 \text{ slug}}$, $\frac{1 \text{ kg}}{2.2 \text{ lb}}$, $\frac{1 \text{ hyl}}{9.8 \text{ kg}}$, $\frac{1 \text{ glug}}{0.1 \text{ hyl}}$

8. (a) 0.058 g (b) 0.0007 km
(c) 96,000 oz (d) 0.02778 days

10. (a) 42,164.81 m (b) 39.37 in.
(c) 7.68 in. (d) 243.84 cm

12. (a) 10 mi/qt (b) 3.64 mi/hr
(c) 500 g/cm (d) 0.199 cents/mL

14. (a) 1.57 cents/cm (b) 3280.84 ft/min

16. 62 mi/hr

18. 0.12 ft/hr

20. \$208.26

22. \$39.97

24. 40 courses
26. 840 tons/month
28. (a) 57.30°
(b) 45°
(c) 171.89°
(d) 0.35 radian
(e) 5.24 radians
(f) 2.71 radians

Selected Extended Problems

30. A bit is the fundamental memory unit in all computer systems.
- 1 kilobit = 1024 bits = 2^{10} bits
- 1 megabit = 1024 kilobits = 2^{10} kilobits
- 1 byte = 8 bits
- 1 kilobyte = 1024 bytes = 2^{10} bytes
- 1 megabyte = 1,048,576 bytes = 2^{20} bytes
- 1 gigabyte = 1,073,741,824 bytes = 2^{30} bytes