1.2 Exercises

1. 180°
2. right; two
3. three
4. sides; angles

Answers are given in numerical order in Exercises 5 and 6.

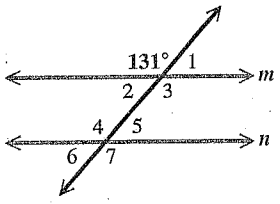
5. 49°; 49°; 131°; 131°; 49°; 49°; 131°
6. 60°; 120°; 60°; 60°; 65°; 60°; 65°; 55°; 55°; 55°
7. A and P; B and Q; C and R; AC and PR; BC and QR; AB and PQ
8. A and P; C and R; B and Q; AC and PR; CB and RQ; AB and PQ
9. A and C; E and D; ABE and CBD; EB and DB; AB and CB; AE and CD
10. H and F; K and E; HGK and FGE; HK and FE; GK and GE; HG and FG
11. 51°; 51°
12. 139°; 139°
13. 50°; 60°; 70°
14. 20°; 30°; 130°

CONCEPT PREVIEW *Fill in the blank(s) to correctly complete each sentence.*

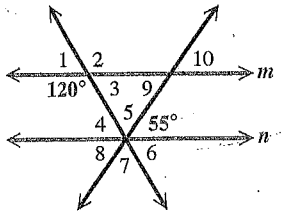
1. The sum of the measures of the angles of any triangle is _____.
2. An isosceles right triangle has one _____ angle and _____ equal sides.
3. An equilateral triangle has _____ equal sides.
4. If two triangles are similar, then their corresponding _____ are proportional and their corresponding _____ have equal measure.

CONCEPT PREVIEW *In each figure, find the measures of the numbered angles, given that lines m and n are parallel.*

5.

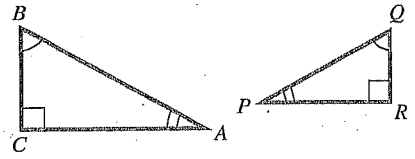


6.

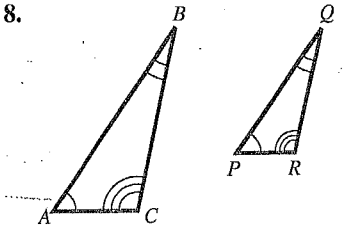


CONCEPT PREVIEW *Name the corresponding angles and the corresponding sides of each pair of similar triangles.*

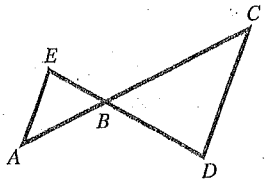
7.



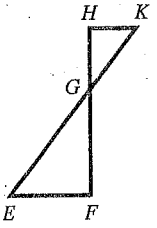
8.



9. (EA is parallel to CD.)

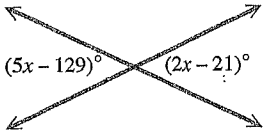


10. (HK is parallel to EF.)

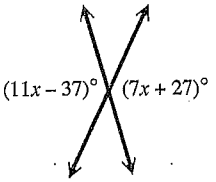


Find the measure of each marked angle. In Exercises 19–22, m and n are parallel. ***See Examples 1 and 2.***

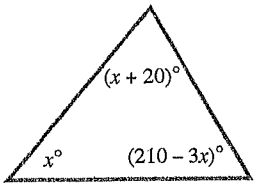
11.



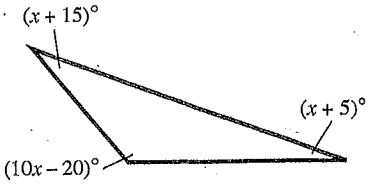
12.



13.



14.



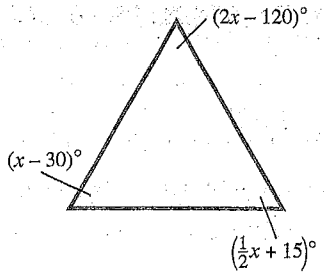
15. 60°; 60°; 60°
16. 60°; 60°; 60°
17. 45°; 75°; 120°
18. 35°; 20°; 55°
19. 49°; 49°
20. 117°; 117°
21. 48°; 132°
22. 141°; 141°

23. 91°
24. 47°
25. 2° 29′
26. 1° 32′
27. 25.4°
28. 100.7°
29. 22° 29′ 34″
30. 66° 06′ 37″

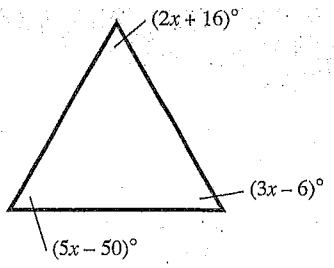
31. no
32. no

33. right; scalene
34. obtuse; scalene
35. acute; equilateral
36. acute; isosceles
37. right; scalene
38. obtuse; isosceles

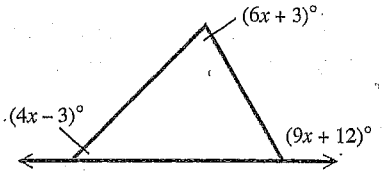
15.



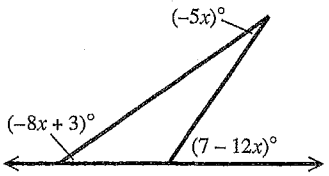
16.



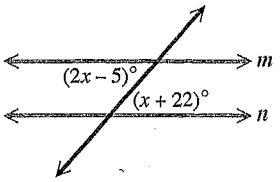
17.



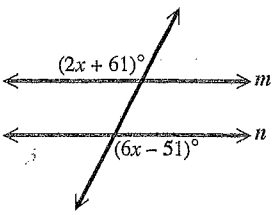
18.



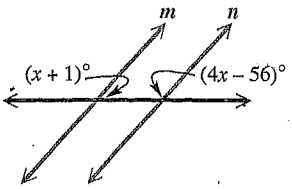
19.



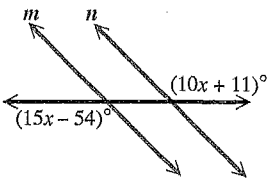
20.



21.



22.

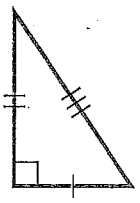


The measures of two angles of a triangle are given. Find the measure of the third angle. ***See Example 2.***

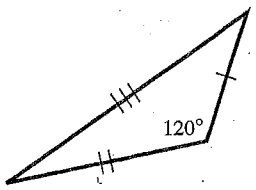
23. 37°, 52°
24. 29°, 104°
25. 147° 12′, 30° 19′
26. 136° 50′, 41° 38′
27. 74.2°, 80.4°
28. 29.6°, 49.7°
29. 51° 20′ 14″, 106° 10′ 12″
30. 17° 41′ 13″, 96° 12′ 10″
31. ***Concept Check*** Can a triangle have angles of measures 85° and 100°?
32. ***Concept Check*** Can a triangle have two obtuse angles?

Concept Check *Classify each triangle as* acute, right, *or* obtuse. *Also classify each as* equilateral, isosceles, *or* scalene. ***See the discussion following Example 2.***

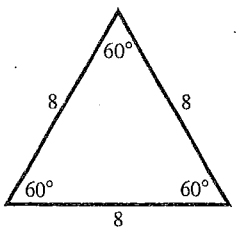
33.



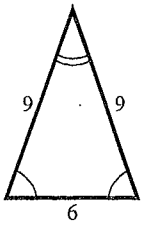
34.



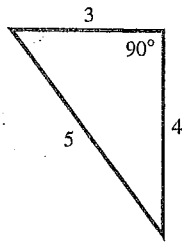
35.



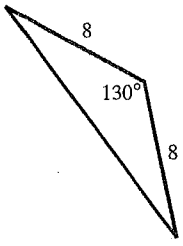
36.



37.



38.

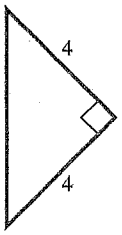


39. right; isosceles
40. right; scalene
41. obtuse; scalene
42. acute; equilateral
43. acute; isosceles
44. right; scalene

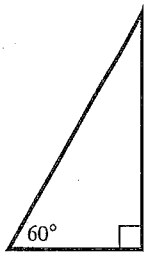
45. Angles 1, 2, and 3 form a straight angle on line m and, therefore, sum to 180°. It follows that the sum of the measures of the angles of triangle PQR is 180° because the angles marked 1 are alternate interior angles whose measures are equal, as are the angles marked 2.
46. Connect the right end of the semicircle to the point where the arc crosses the semicircle. The triangle is equilateral, and therefore each of its angles measures 60°.

47. $Q = 42°$; $B = R = 48°$
48. $P = 78°$; $M = 46°$; $A = N = 56°$
49. $B = 106°$; $A = M = 44°$
50. $T = 74°$; $Y = 28°$; $Z = W = 78°$

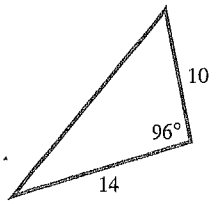
39.



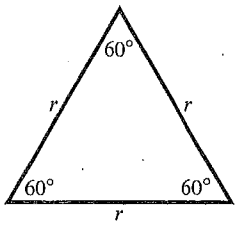
40.



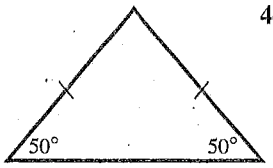
41.



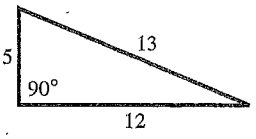
42.



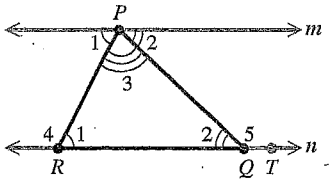
43.



44.

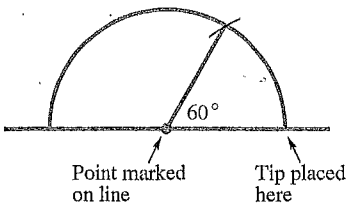


45. ***Angle Sum of a Triangle*** Use this figure to discuss why the measures of the angles of a triangle must add up to the same sum as the measure of a straight angle.



m and n are parallel.

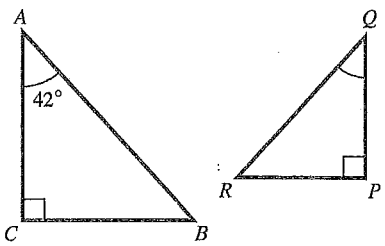
46. ***Carpentry Technique*** The following technique is used by carpenters to draw a 60° angle with a straightedge and a compass. Why does this technique work? (Data from Hamilton, J. E., and M. S. Hamilton, *Math to Build On,* Construction Trades Press.)



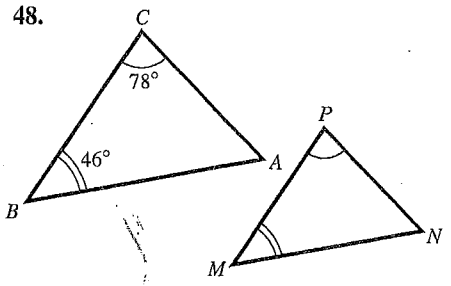
"Draw a straight line segment, and mark a point near the midpoint. Now place the tip on the marked point, and draw a semicircle. Without changing the setting of the compass, place the tip at the right intersection of the line and the semicircle, and then mark a small arc across the semicircle. Finally, draw a line segment from the marked point on the original segment to the point where the arc crosses the semicircle. This will form a 60° angle with the original segment."

Find all unknown angle measures in each pair of similar triangles. ***See Example 3.***

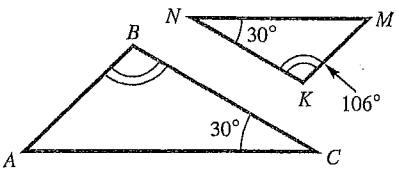
47.



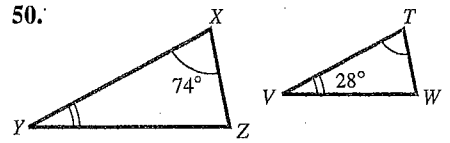
48.



49.

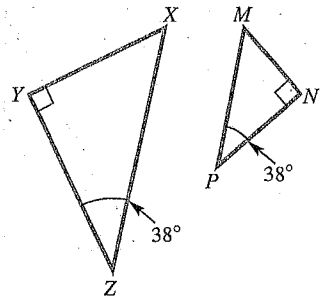


50.

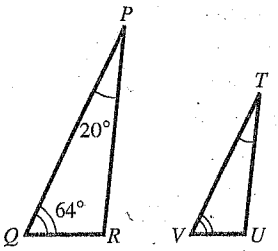


51. $X = M = 52°$
52. $T = 20°$; $V = 64°$; $R = U = 96°$
53. $a = 20$; $b = 15$
54. $a = 30$; $b = 60$
55. $a = 6$; $b = 7.5$
56. $a = 2$
57. $x = 6$ **58.** $m = 18$
59. 30 m **60.** 108 ft
61. 500 m; 700 m
62. 14 m

51.

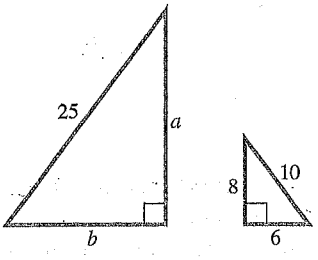


52.

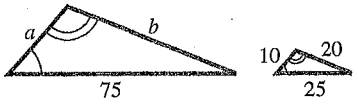


Find the unknown side lengths in each pair of similar triangles. ***See Example 4.***

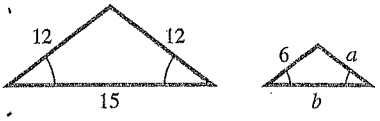
53.



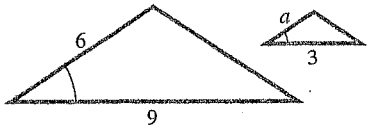
54.



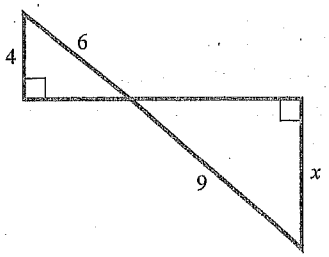
55.



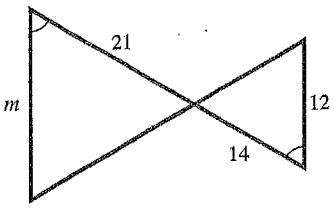
56.



57.



58.



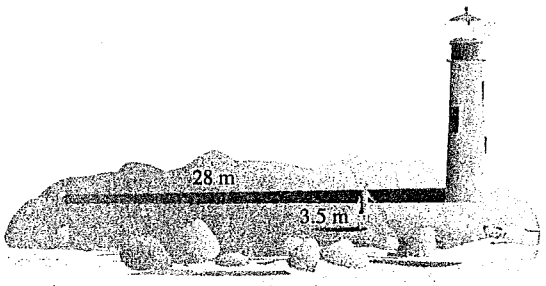
Solve each problem. ***See Example 5.***

59. ***Height of a Tree*** A tree casts a shadow 45 m long. At the same time, the shadow cast by a vertical 2-m stick is 3 m long. Find the height of the tree.

60. ***Height of a Lookout Tower*** A forest fire lookout tower casts a shadow 180 ft long at the same time that the shadow of a 9-ft truck is 15 ft long. Find the height of the tower.

61. ***Lengths of Sides of a Triangle*** On a photograph of a triangular piece of land, the lengths of the three sides are 4 cm, 5 cm, and 7 cm, respectively. The shortest side of the actual piece of land is 400 m long. Find the lengths of the other two sides.

62. ***Height of a Lighthouse*** The Biloxi lighthouse in the figure casts a shadow 28 m long at 7 A.M. At the same time, the shadow of the lighthouse keeper, who is 1.75 m tall, is 3.5 m long. How tall is the lighthouse?



NOT TO SCALE

63. 112.5 ft 64. $506\frac{2}{3}$ ft

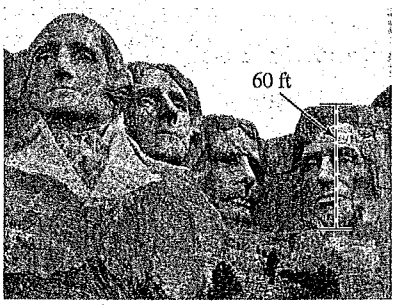
65. $x = 110$ 66. $y = 12$

67. $c \approx 111.1$ 68. $m \approx 85.3$

69. (a) 236,000 mi
(b) no

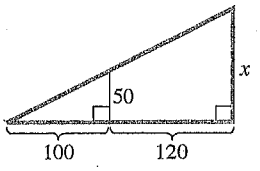
63. ***Height of a Building*** A house is 15 ft tall. Its shadow is 40 ft long at the same time that the shadow of a nearby building is 300 ft long. Find the height of the building.

64. ***Height of a Carving of Lincoln*** Assume that Lincoln was $6\frac{1}{3}$ ft tall and his head was $\frac{3}{4}$ ft long. Knowing that the carved head of Lincoln at Mt. Rushmore is 60 ft tall, find how tall his entire body would be if it were carved into the mountain.

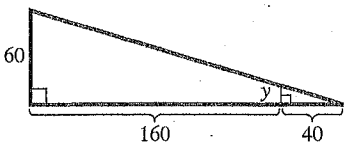


In each figure, there are two similar triangles. Find the unknown measurement. Give approximations to the nearest tenth.

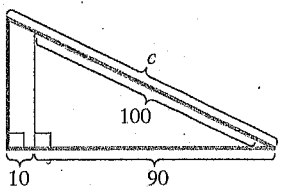
65.



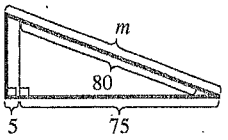
66.



67.

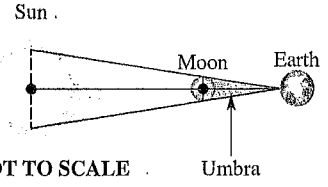


68.



Solve each problem.

69. ***Solar Eclipse on Earth*** The sun has a diameter of about 865,000 mi with a maximum distance from Earth's surface of about 94,500,000 mi. The moon has a smaller diameter of 2159 mi. For a total solar eclipse to occur, the moon must pass between Earth and the sun. The moon must also be close enough to Earth for the moon's **umbra** (shadow) to reach the surface of Earth. (Data from Karttunen, H., P. Kröger, H. Oja, M. Putannen, and K. Donners, Editors, *Fundamental Astronomy,* Fourth Edition, Springer-Verlag.)



(a) Calculate the maximum distance, to the nearest thousand miles, that the moon can be from Earth and still have a total solar eclipse occur. (*Hint:* Use similar triangles.)

(b) The closest approach of the moon to Earth's surface was 225,745 mi and the farthest was 251,978 mi. (Data from *The World Almanac and Book of Facts.*) Can a total solar eclipse occur every time the moon is between Earth and the sun?