9.3 Exercises

CONCEPT CHECK

1. Two angles are supplementary angles if the sum of their measures equals _____ degrees.

2. Two angles are vertical angles if they are the _____ angles formed when two lines intersect.

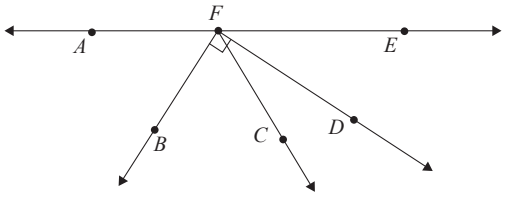
3. The three basic trigonometric functions are _____, _____, and _____.

4. True or False: The Pythagorean Theorem can be used for any type of triangle.

5. True or False: The Law of Sines and Law of Cosines can be used interchangeably.

PRACTICE

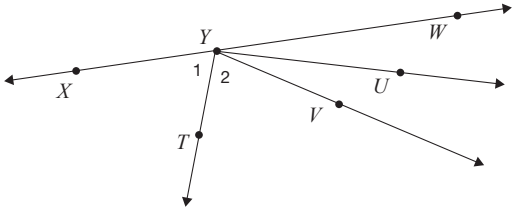
Determine whether each angle is acute, right, or obtuse.



6. $\angle BFD$ 7. $\angle DFE$ 8. $\angle AFD$

9. $\angle AFB$ 10. $\angle EFC$ 11. $\angle EFB$

In the figure, $\overrightarrow{YU}$ bisects (divides into 2 equal parts) $\angle WYV$ and $\overrightarrow{YT}$ bisects $\angle XYV$. Use the figure to answer each question.



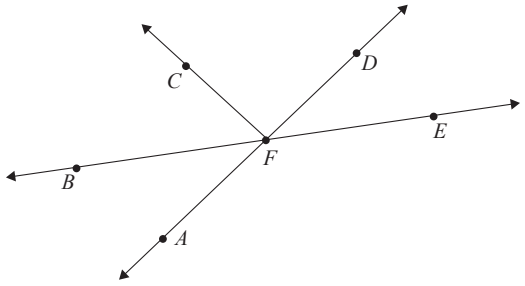
12. If $m\angle WYV = 36°$, find $m\angle WYU$.

13. If $m\angle 1 = 56°$, find $m\angle 2$.

14. If $m\angle VYW = 82°$ and $m\angle WYU = (4r + 25)°$, find r.

15. If $\angle XYV$ has a measure of 162°, find $m\angle 1$.

Use the figure to answer each question.

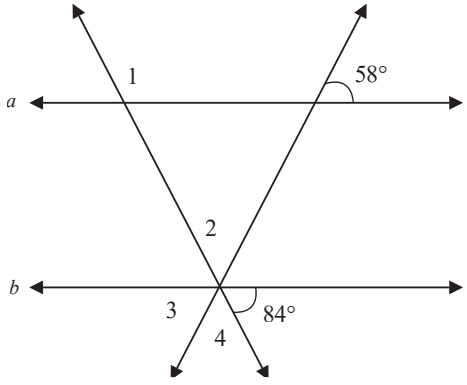


16. If $m\angle CFD = (15a + 45)°$, find a so that $\overrightarrow{FC} \perp \overrightarrow{FD}$.

17. If $m\angle AFB = (8x - 6)°$ and $m\angle BFC = (14x + 8)°$, find the value of x so that $\angle AFC$ is a right angle.

18. If $m\angle BFA = (3r + 12)°$ and $m\angle DFE = (-8r + 210)°$, find $m\angle AFE$. (**Hint:** Recall that lines that intersect at a common point share vertical angles that are congruent.)

In the following figure, lines *a* and *b* are parallel.



19. Find $m\angle 1$.

20. Find $m\angle 2$.

21. Find $m\angle 3$.

22. Find $m\angle 4$.

23. The measures of two complementary angles are $(16z - 1)°$ and $(12z + 7)°$. Find the measures of the angles.

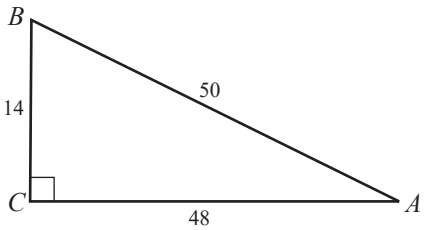
24. Find $m\angle T$ if $m\angle T$ is 20 more than four times its supplement.

25. Two angles are supplementary. One angle is 12° more than the other. Find the measures of the angles.

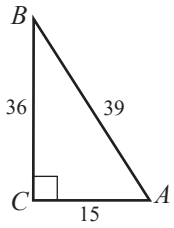
26. A regular dodecagon has 12 interior angles, each measuring 150°. Can a tessellation be created using only regular dodecagons?

27. A regular nonagon has 9 interior angles, each measuring 140°. Can a tessellation be created using only regular nonagons?

28. Use ΔABC to find sin A, cos A, tan A, sin B, cos B, and tan B. Round your answers to the nearest hundredth.

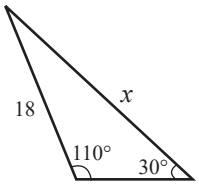


29. Use ΔABC to find sin A, cos A, tan A, sin B, cos B, and tan B. Round your answers to the nearest hundredth.



Decide whether to use the Law of Sines or the Law of Cosines to solve for the unknown value x in each scenario.

30.



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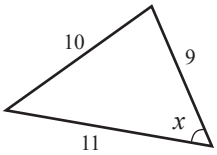

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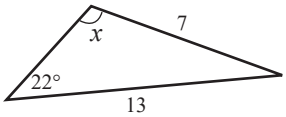

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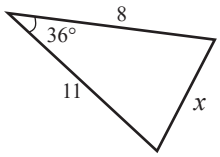
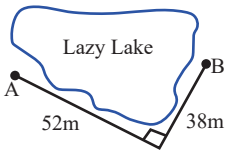
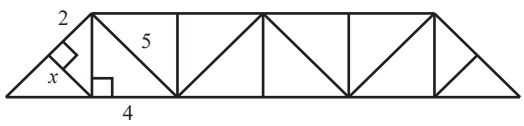


APPLICATIONS

34. The shortest path from A to B is across Lazy Lake, shown below. How far is this path?



35. Find the value of x in the following diagram of a truss bridge.



36. Jonathan is building a cabinet in his workshop and will be installing it in his den which has 7-foot-high ceilings.

a. If the cabinet is 6-feet tall, what is the deepest that he can make the cabinet and clear the ceiling when it is stood upright?

b. Determine a general formula that Jonathan can use when building cabinets so that he can always know the maximum depth of any cabinet given the height of the ceiling and the height of the cabinet.

37. Anastasia is designing a cabinet for a client whose living room has 9-foot ceilings. The client wants the cabinet to be as tall as possible. Anastasia will create the cabinet in her workshop and transport it to the client's home.

a. If the depth of the cabinet is 18 inches, what is the tallest Anastasia can make the cabinet and clear the ceiling when it is stood upright?

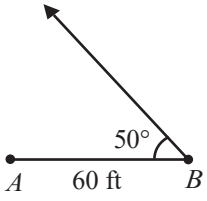
b. Determine a general formula that Anastasia can use when designing cabinets so that she can always know the maximum height of any cabinet given the height of the ceiling and the depth of the cabinet.

38. Bartholomew is designing a bookcase for the town library. The ceilings are 12-feet high.

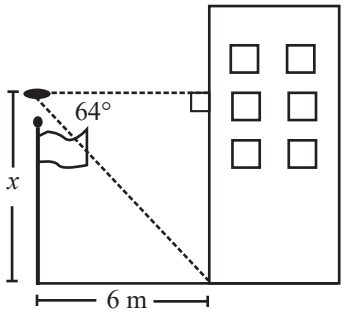
a. If he wants the bookcase to be as tall as possible, and if the depth of the bookcase must be 16 inches, what is the maximum height that he can make the bookcase and it still be able to clear the ceiling when stood upright?

b. Determine a general formula that he can use when designing cabinets so that he can always know the maximum height of any cabinet given the height of the ceiling and the depth of the cabinet.

39. Calvin is laying out a garden based on an architectural plan. He has marked the location of the first two corners, points A and B, which are 60 feet apart. The next corner will be 30 feet from point B at an angle of 50°. Using only a surveyor's rope and string, he needs to mark the 50° angle at point B. Determine how he can create this angle using a right triangle.



40. A drone is flying 2 meters directly above a flagpole that is located 6 meters from a building. If the angle of depression from the drone to the base of a building is 64°, find the height of the flagpole.



41. The sun hits a building of unknown height so that the building casts a shadow of 517 feet. If the angle of elevation from the tip of the shadow to the sun is 16°, how tall is the building?

42. A snow ski slope has a run of 1.5 miles with an angle of elevation of 24°. What is the length of the vertical drop of the ski slope?

43. A wheelchair ramp is to be constructed with a maximum incline of 6°. If the height of the ramp is to be 5 feet, how long should the ramp be after construction?

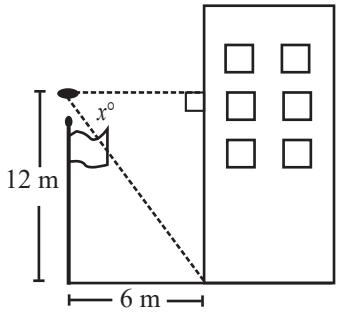
44. A section of highway has an incline of 10°. If the length of the incline is 5 miles, what is the horizontal distance of the incline?

45. A 16 ft ladder is leaning against a wall where it makes an angle of 68° with the ground and 22° with the building.

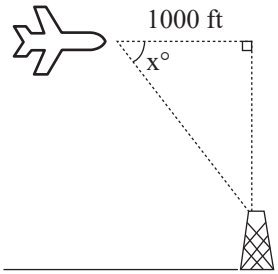
a. How far is the ladder base from the building?

b. How far does the ladder reach up the building?

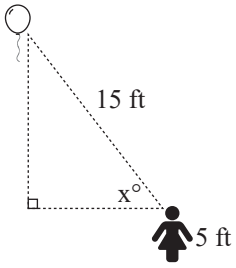
46. Leo is flying his drone from his apartment balcony to watch the entrance for his friend's arrival. The drone is currently flying 2 meters directly above a 10-meter tall flagpole, which is located 6 meters from the entrance of the building. Find the angle of depression that the camera on the drone would need to use to focus on the base of the door of the building. Round your answer to the nearest tenth.



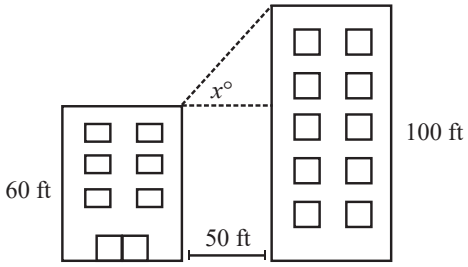
47. A plane is flying at an altitude of 2000 feet. It is on course maintain altitude and pass directly over a 150-foot tower. Determine the current angle of depression to the top of a 150-foot tower if the tower is 1000 feet away. Round your answer to the nearest tenth.



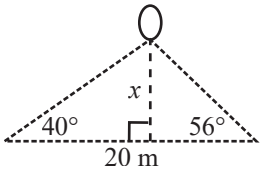
48. Selena spots a balloon that is 16 feet in the air. If she is 5-feet tall and the distance from the top of her head to the balloon is 15 feet, what is the angle of elevation from the top of her head to the balloon? Round your answer to the nearest tenth.



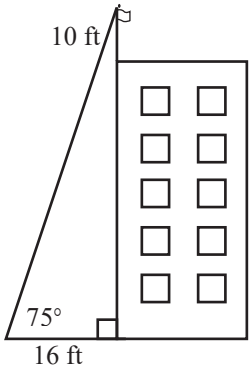
49. Two buildings are located 50 feet apart. One building is 100-feet tall and the other is 60-feet tall. A camera is placed the top edge of the shorter building to watch a bird nest located at the top edge of the taller building. What angle of elevation is needed to focus the camera from the top of the shorter building to the top of the taller building? Round your answer to the nearest tenth.



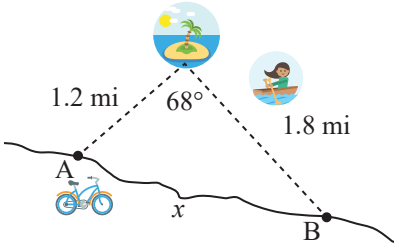
50. A weather balloon is spotted by two people who are 20 meters apart. The angle of elevation from the first person is 56° and the angle of elevation from the second person is 40°. Calculate the altitude of the balloon when it was spotted. Round your answer to the nearest tenth.



51. A person is standing 16 feet from the base of a building and looking at the top of a flagpole that is on top of the building. The flagpole is 10-feet tall. The angle of elevation from where the person is standing to the top of the flagpole is 75°. Determine the height of the building, rounded to the nearest tenth.



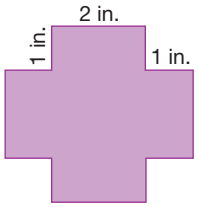
52. Patricia is currently located on a dock on an island. She wants to determine the route that would be fastest to travel from the island to dock B on the mainland. She has the options of rowing her boat to dock A and then riding a bike to dock B or of rowing her boat directly to dock B. She knows that the distance from the island dock to dock A is 1.2 miles and the distance from the island dock to dock B is 1.8 miles. The angle between docks A and B is 68 degrees. Patricia needs to determine the distance from dock A to dock B to help her determine which would be faster. How far is dock B from dock A?



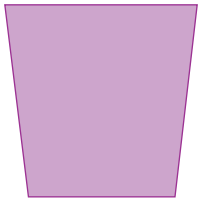
53. If you are standing at a certain spot on Lookout Mountain in Tennessee, you can see seven states. Of these seven, you can see Alabama, which is 25 miles away, and South Carolina, which is 80 miles away. The angle between these two states from your location is approximately 70°. Determine the distance between these two sites, rounded to the nearest mile.

WRITING & THINKING

54. Can you tessellate the plane with the following figure? Explain your answer.



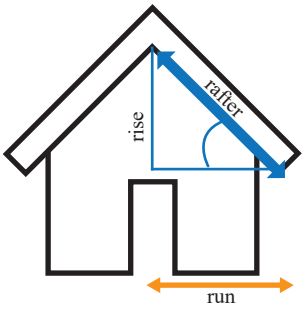
55. Use the given figure to create a tessellation by rotating, reflecting, or translating. Describe which transformations you used to create the tessellation.



9.3 PROJECT

MAN CAVES AND SHE SHEDS

The company *Tiny House Livings* is gearing up for their annual Man Cave and She Shed Competition. Every year the competition focuses on different features; this year's focus is the roof. The main contest restrictions this year are that you cannot measure anything directly with a tape measure, you must use your height and the length of your hand to "measure," and then you must provide the pitch angle and rafter length.



Suppose that you have always dreamed of owning one but haven't had a chance to save up the money to buy one nor the tools and materials to build one. Thanks to the competition, you now have the chance to win one! Use your own hand length as the standard unit of measurement.

1. Refer to the sketch provided of a man cave or she shed. First, estimate your height in hands and then estimate that the end of the roof overhang is 4 hands above your head. How high is the end of the roof overhang from the ground?
2. You use the length of your hand to measure the run of one side of the shed roof, which is half the width of the shed. You discover the run is twenty "hands" long. What is the length of the run in inches?
3. You estimate the rise to be 8 "hands" high. What is the pitch angle of the roof? **Hint:** Pay attention to your units!
4. What is the length of the rafter?
5. What influences the accuracy of your calculations? What can you do to make the estimations more precise?