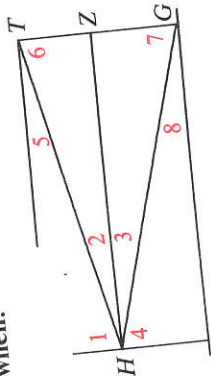
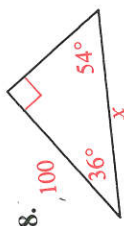
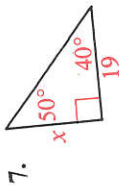


The lines shown are horizontal and vertical lines except for \overline{HT} and \overline{HG} . Give the number of the angle and its special name when:



- A person at H sights T .
- A person at H sights G .
- A person at T sights H .
- A person at G sights H .

State two equations you could use to find the value of x .

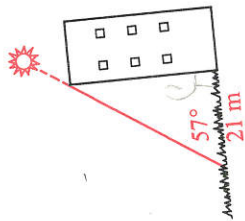


8. 100

Written Exercises

Express lengths correct to the nearest integer and measures of angles correct to the nearest degree.

- When the sun's angle of elevation is 57° , a building casts a shadow 21 m long. How high is the building?



- At a certain time, a 3 m vertical pole casts a 4 m shadow. What is the angle of elevation of the sun?

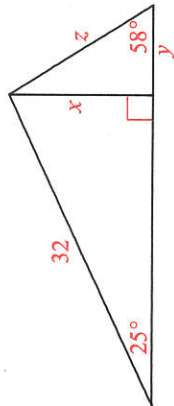


In Exercises 3–6, first draw a diagram.

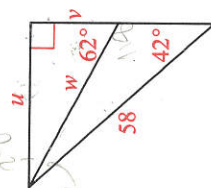
- A kite is flying at an angle of elevation of about 40° . All 80 m of string have been let out. Ignoring the sag in the string, find the height of the kite to the nearest 10 m.
- An advertising blimp hovers over a stadium at an altitude of 125 m. The pilot sights a tennis court at an 8° angle of depression. Find the ground distance in a straight line between the stadium and the tennis court. (Note: In an exercise like this one, an answer saying *about* . . . hundred meters is sensible.)
- A rectangle is 20 m long and 10 m wide.
 - Find the measure of the angle a diagonal makes with one of the longer sides.
 - Use trigonometry and your answer from (a) to find the length of a diagonal.
 - Use the Pythagorean Theorem to find the length of a diagonal.

- Martha is 180 cm tall and her daughter Heidi is just 90 cm tall. Who casts the longer shadow, Martha when the sun is 70° above the horizon or Heidi when the sun is 35° above the horizon? How much longer?

B 7. Find x , then y and z .



8. Find u , then v and w .



- Find the length of a diagonal of a regular pentagon with side 20.
- Points A , B , C , and D are four consecutive vertices of a regular 9-gon (nonagon) with sides 25 mm long. Find the length of AD .

11. The steepness of a hill is sometimes measured by the grade. A grade of 1 in 4 means that the hill rises one unit for every 4 horizontal units.

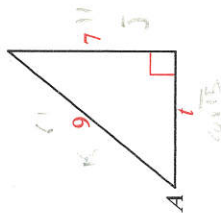
- For a grade of 1 in 4, what is the measure of $\angle A$, the angle the hill makes with the horizontal?
- The force of gravity pulling an object down the hill is its weight multiplied by the sine of $\angle A$. On a 1 in 4 grade, what is the force on a 2500 lb car?
- Could you push the car up the hill?



Given the value of one trigonometric ratio, find the exact value of the other two ratios.

Example $\sin A = \frac{7}{9}$

Solution (1) Sketch a right triangle with a leg and hypotenuse in the ratio 7:9.



(2) Use the Pythagorean Theorem to find the third side.

$$t^2 + 49 = 81 \quad t^2 = 32 \quad t = 4\sqrt{2}$$

$$(3) \tan A = \frac{7}{t} = \frac{7}{4\sqrt{2}} = \frac{7 \cdot \sqrt{2}}{4\sqrt{2} \cdot \sqrt{2}} = \frac{7\sqrt{2}}{8}$$

$$\cos A = \frac{9}{t} = \frac{9}{4\sqrt{2}}$$

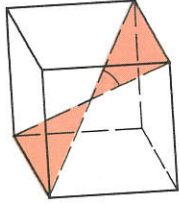
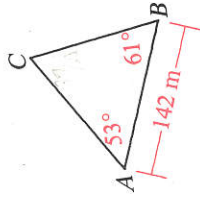
12. $\sin A = \frac{11}{61}$

13. $\tan A = \frac{5}{8}$

14. $\cos A = \frac{j}{k}$

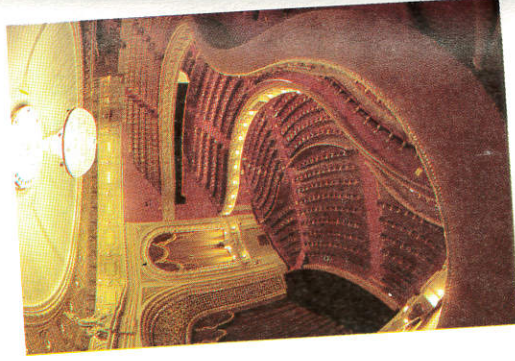
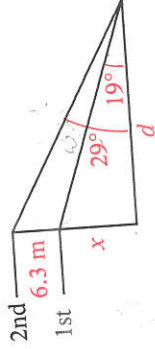
15. $\tan A = \frac{2uv}{u^2 - v^2}$

16. A surveyor wants to find the distance from points A and B to an inaccessible point C . Point C can be sighted from both A and B . The surveyor measures \overline{AB} , $\angle A$, and $\angle B$, with the results shown. Find AC and BC . (Hint: Use Exercise 19 on page 276.)



17. Find the acute angle at which two diagonals of a cube intersect.

- ★ 18. From the stage of a theater, the angle of elevation of the first balcony is 19° . The angle of elevation of the second balcony, 6.3 m directly above the first, is 29° . How high above stage level is the first balcony? (Hint: Use $\tan 19^\circ$ and $\tan 29^\circ$ to write two equations involving x and d . Solve for d , then find x .)



Application

PASSIVE SOLAR DESIGN

Passive solar homes are designed to let the sun heat the house during the winter, but to prevent the sun from heating the house during the summer. Because the Earth's axis is not perpendicular to the *ecliptic* (the plane of the Earth's orbit around the sun), the sun is lower in the sky in the winter than it is in the summer.

