

**LESSON**  
**13-1**

**Tangent Ratio**

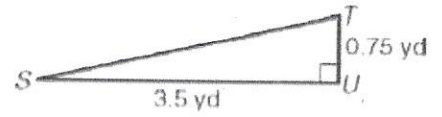
*Practice and Problem Solving: A/B*

Use a calculator to find each tangent or inverse tangent. Round tangents to the nearest tenth and angles to the nearest degree.

2.  $\tan 23^\circ \approx$  0.4      3.  $\tan 43^\circ \approx$  0.9      4.  $\tan 47^\circ \approx$  1.1
5.  $\tan^{-1} 0.14 \approx$  8  $^\circ$       6.  $\tan^{-1} 1 =$  45  $^\circ$       7.  $\tan^{-1} 6.1 \approx$  81  $^\circ$

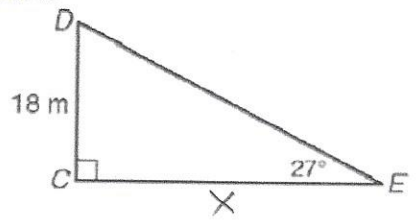
9. Write a ratio that gives  $\tan S$ .  $\frac{0.75}{3.5}$  Use the inverse tangent on your calculator to find  $m\angle S$ .

$$S = \tan^{-1} \left( \frac{0.75}{3.5} \right) = 12$$

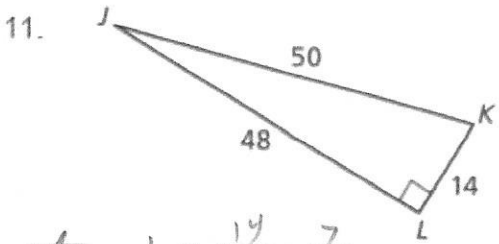


10. Write and solve a tangent equation to find the length of CE. Round to the nearest 0.1 meter.

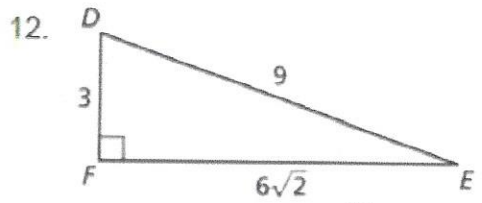
$$\begin{aligned} \tan 27^\circ &= \frac{18}{x} \\ x \tan 27^\circ &= 18 \\ x &= \frac{18}{\tan 27^\circ} = 35.3 \end{aligned}$$



In Exercises 11 and 12, find the value of  $\tan (J)$ ,  $\tan (K)$ ,  $\tan (D)$ , and  $\tan (E)$ . Write each answer as a fraction.

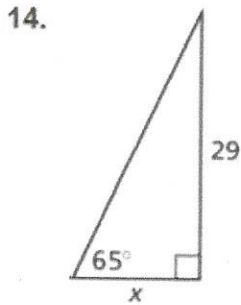


$$\begin{aligned} \tan J &= \frac{14}{48} = \frac{7}{24} \\ \tan K &= \frac{48}{14} = \frac{24}{7} \end{aligned}$$

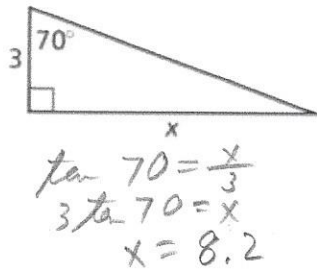


$$\begin{aligned} \tan D &= \frac{6\sqrt{2}}{3} = 2\sqrt{2} \\ \tan E &= \frac{3}{6\sqrt{2}} = \frac{1}{2\sqrt{2}} \end{aligned}$$

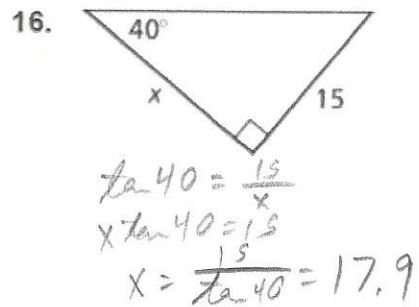
In Exercises 14 - 23, find the value of  $x$ . Round your answer to the nearest tenth.



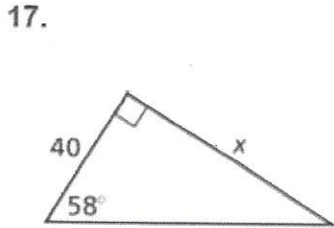
15.  $\tan 65 = \frac{29}{x}$   
 $x \tan 65 = 29$   
 $x = \frac{29}{\tan 65}$   
 $= 13.5$



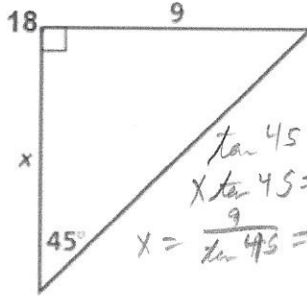
$\tan 70 = \frac{x}{3}$   
 $3 \tan 70 = x$   
 $x = 8.2$



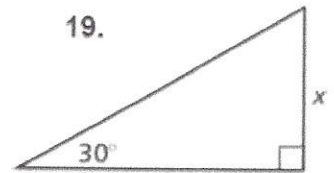
$\sin 40 = \frac{x}{15}$   
 $x \sin 40 = 15$   
 $x = \frac{15}{\sin 40} = 17.9$



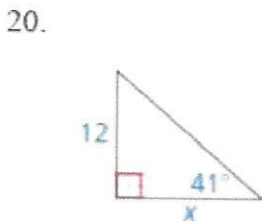
$\cos 58 = \frac{40}{x}$   
 $40 \cos 58 = x \rightarrow x = 64.0$



$\tan 45 = \frac{9}{x}$   
 $x \tan 45 = 9$   
 $x = \frac{9}{\tan 45} = 9$

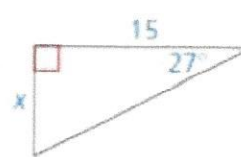


$\tan 30 = \frac{x}{\sqrt{3}}$   
 $\sqrt{3} \tan 30 = x \rightarrow x = 1$

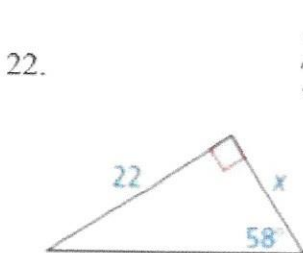


$\tan 41 = \frac{12}{x}$   
 $x \tan 41 = 12$   
 $x = \frac{12}{\tan 41} = 13.8$

21.

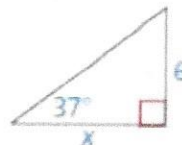


$\tan 27 = \frac{x}{15}$   
 $15 \tan 27 = x$   
 $x = 7.6$



$\sin 58 = \frac{22}{x}$   
 $x \sin 58 = 22$   
 $x = \frac{22}{\sin 58} = 13.7$

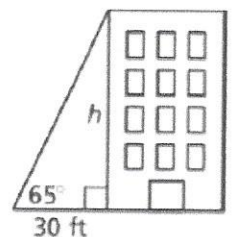
23.



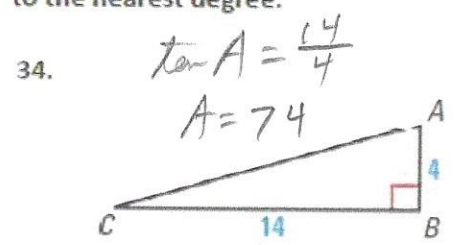
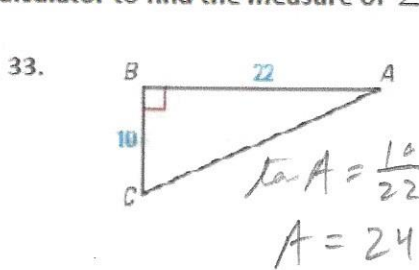
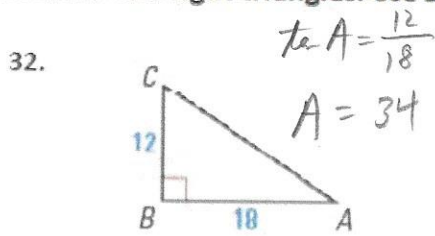
$\tan 37 = \frac{6}{x}$   
 $x \tan 37 = 6$   
 $x = \frac{6}{\tan 37} = 8.0$

24. A surveyor is standing 30 feet from the base of a tall building. The surveyor measures the angle of elevation from the ground to the top of the building to be  $65^\circ$ . Find the height  $h$  of the building to the nearest foot.

$\tan 65 = \frac{h}{30}$   
 $30 \tan 65 = h$   
 $h = 64$



Consider the right triangles. Use a calculator to find the measure of  $\angle A$  to the nearest degree.

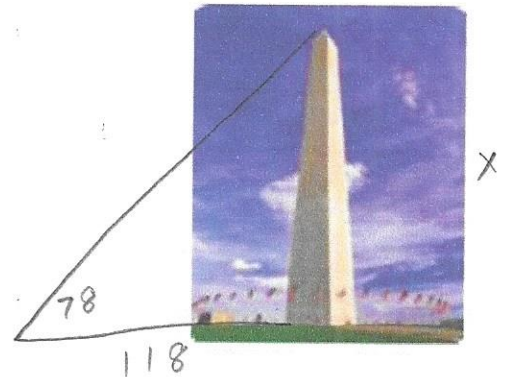


43. A surveyor is standing 118 feet from the base of the Washington Monument. The surveyor measures the angle of elevation from the ground and the top of the monument to be  $78^\circ$ . Draw a picture of the situation and then find the height of the Washington Monument to the nearest foot.

$$\tan 78 = \frac{x}{118}$$

$$118 \tan 78 = x$$

$$x = 555$$

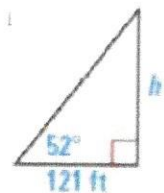


44. A roller coaster makes an angle of elevation of  $52^\circ$  with the ground. The horizontal distance from the crest of the hill to the bottom of the hill is about 121 feet, as shown. Find the height  $h$  of the roller coaster to the nearest foot.

$$\tan 52 = \frac{h}{121}$$

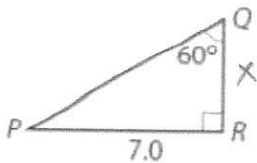
$$121 \tan 52 = h$$

$$h = 155$$



Use the tangent to find the unknown side length.

9. Find QR.

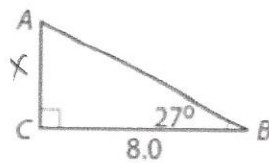


$$\tan 60 = \frac{7}{x}$$

$$x \tan 60 = 7$$

$$x = \frac{7}{\tan 60} = 4.0$$

10. Find AC.

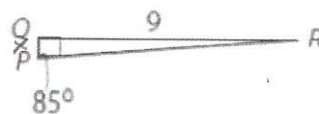


$$\tan 27 = \frac{x}{8}$$

$$8 \tan 27 = x$$

$$x = 4.1$$

11. Find PQ.



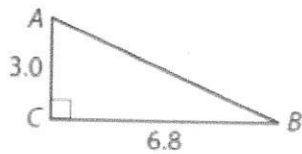
$$\tan 85 = \frac{9}{x}$$

$$x \tan 85 = 9$$

$$x = \frac{9}{\tan 85} = .8$$

Find the measure of the angle specified for each triangle. Use the inverse tangent ( $\tan^{-1}$ ) function of your calculator. Round your answer to the nearest degree.

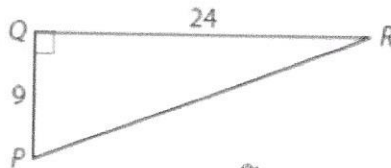
15. Find  $\angle A$ .



$$\tan A = \frac{6.8}{3}$$

$$A = 66$$

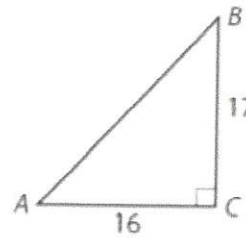
16. Find  $\angle R$ .



$$\tan R = \frac{9}{24}$$

$$R = 21$$

17. Find  $\angle B$ .

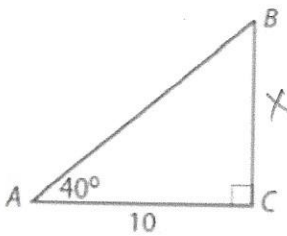


$$\tan B = \frac{16}{17}$$

$$B = 43$$

Write an equation using either  $\tan$  or  $\tan^{-1}$  to express the measure of the angle or side. Then solve the equation.

18. Find BC.

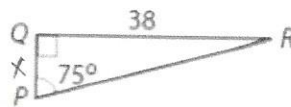


$$\tan 40 = \frac{x}{10}$$

$$10 \tan 40 = x$$

$$x = 8.4$$

19. Find PQ.

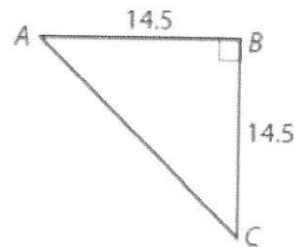


$$\tan 75 = \frac{38}{x}$$

$$x \tan 75 = 38$$

$$x = \frac{38}{\tan 75} = 10.2$$

20. Find  $\angle A$  and  $\angle C$ .



$$\tan A = \frac{14.5}{14.5}$$

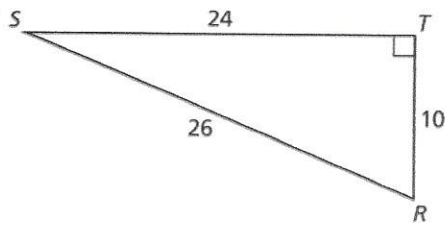
$$A = 45$$

$$\tan B = \frac{14.5}{14.5}$$

$$B = 45$$



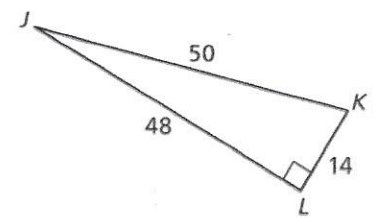
21. Consider this right triangle. Determine whether each equation is correct. Mark YES or No for each equation.



Equation	Yes	No
$\tan(R) = \frac{24}{10}$	X	
$\tan(S) = \frac{26}{24}$		X
$\tan(R) = \frac{10}{24}$		X
$\tan(S) = \frac{10}{24}$	X	

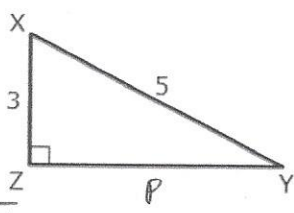
22. Consider this right triangle. Find the value of  $\tan(K)$ .

- A.  $\frac{14}{50}$
- B.  $\frac{48}{14}$
- C.  $\frac{50}{48}$
- D.  $\frac{48}{50}$



23. Consider this right triangle

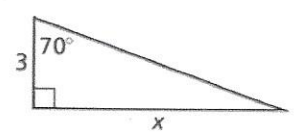
$\tan X = \frac{p}{3}$   
 $3 \tan X = p$   
 $\tan Y = \frac{3}{p}$   
 $p \tan Y = 3 \rightarrow p = \frac{3}{\tan Y}$



Decide whether each expression can be used to find the length of  $\overline{ZY}$ . Mark Yes or No for each expression.

expression	Yes	No
$3 \tan(X)$	X	
$3 \tan(Y)$		X

24. Consider this right triangle



Decide whether each expression can be used to find the length of  $x$ . Mark Yes or No for each expression.

expression	Yes	No
$\frac{3}{\tan(70^\circ)}$		X
$3 \tan(70^\circ)$	X	

$\tan 70 = \frac{x}{3}$   
 $3 \tan 70 = x$