

Test #1

In a right triangle, the three trigonometric ratios are defined from the angle you use.

En un right triangle, las tres trigonometric ratios se definen a partir del ángulo que usas.

a) Write the tile that defines each ratio.

Escribe la ficha que define cada ratio.

$\frac{\text{hyp}}{\text{opp}}$	$\frac{\text{opp}}{\text{adj}}$	$\frac{\text{adj}}{\text{hyp}}$	$\frac{\text{hyp}}{\text{adj}}$	$\frac{\text{opp}}{\text{hyp}}$	$\frac{\text{adj}}{\text{opp}}$
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opp = opposite leg, adj = adjacent leg, hyp = hypotenuse

sine =

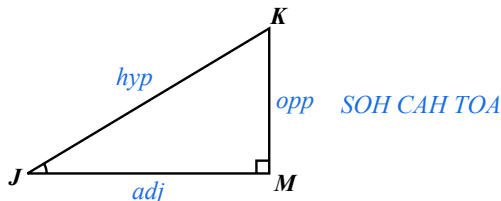
$$\frac{\text{opp}}{\text{hyp}}$$

cosine =

$$\frac{\text{adj}}{\text{hyp}}$$

tangent =

$$\frac{\text{opp}}{\text{adj}}$$

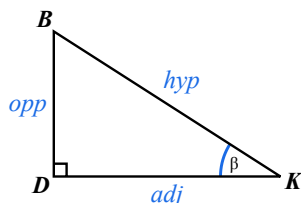
sine = opposite over hypotenuse, cosine = adjacent over hypotenuse,
tangent = opposite over adjacent: SOH CAH TOA.*sine = opposite leg sobre hypotenuse, cosine = adjacent leg sobre hypotenuse,
tangent = opposite leg sobre adjacent leg: SOH CAH TOA.*b) Name the sides for $\angle J$.*Nombra los lados para $\angle J$.*The hypotenuse is across from the right angle at M. The opposite leg is across from $\angle J$. The adjacent leg touches $\angle J$.*The hypotenuse está frente al right angle en M. The opposite leg está frente a $\angle J$.
The adjacent leg toca $\angle J$.*b. hypotenuse: JKleg opposite $\angle J$: KMleg adjacent to $\angle J$: JMSOH CAH TOA: sine = $\frac{\text{opp}}{\text{hyp}}$, cosine = $\frac{\text{adj}}{\text{hyp}}$, tangent = $\frac{\text{opp}}{\text{adj}}$. Name the sides from the angle first.

Test #2

A right triangle is shown. Decide which equations are trigonometric ratios of the marked angle.

Se muestra un right triangle. Decide qué ecuaciones son trigonometric ratios del ángulo marcado.

a)



Select all that apply.

(A) $\sin \beta = \frac{BD}{BK}$

(B) $\cos \beta = \frac{BD}{BK}$

(C) $\tan \beta = \frac{DK}{BD}$

(D) $\sin \beta = \frac{DK}{BK}$

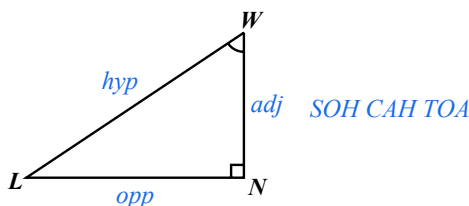
(E) $\cos \beta = \frac{BK}{DK}$

(F) $\tan \beta = \frac{BD}{DK}$

★ For β : opp = BD, adj = DK, hyp = BK. Check each equation against SOH CAH TOA.*Para β : opp = BD, adj = DK, hyp = BK. Revisa cada ecuación con SOH CAH TOA.*

$$\sin \beta = \frac{BD}{BK}$$

$$\tan \beta = \frac{BD}{DK}$$

a. Circle all that are true: (A) B C D E (F)b) Write the three ratios for $\angle W$ with the triangle's letters.*Escribe las tres ratios para $\angle W$ con las letras del triángulo.*Name the sides for $\angle W$ first: opp = LN, adj = NW, hyp = LW.*Primero nombra los lados para $\angle W$: opp = LN, adj = NW, hyp = LW.*

b. $\sin W = \frac{LN}{LW}$

$$\cos W = \frac{NW}{LW}$$

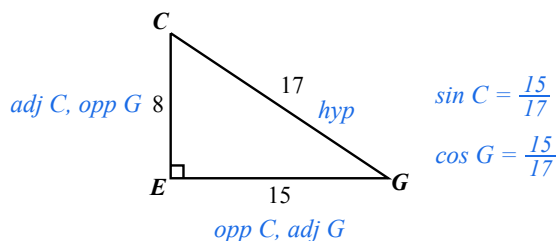
$$\tan W = \frac{LN}{NW}$$

Name opp, adj, hyp for the marked angle, then check every equation: more than one can be true.

Test #3 A right triangle is shown with its side lengths. Decide which ratios have the value given.

Se muestra un right triangle con las longitudes de sus lados. Decide qué ratios tienen el valor dado.

a)



Which ratios have a value equal to $\frac{15}{17}$? Select all that apply.

¿Qué ratios tienen un valor igual a $\frac{15}{17}$? Selecciona todas las que correspondan.

- (A) $\cos(C)$ (B) $\sin(C)$
(C) $\tan(C)$ (D) $\cos(G)$
(E) $\sin(G)$ (F) $\tan(G)$

★ 15 is opposite $\angle C$ and adjacent to $\angle G$. 17 is the hypotenuse.

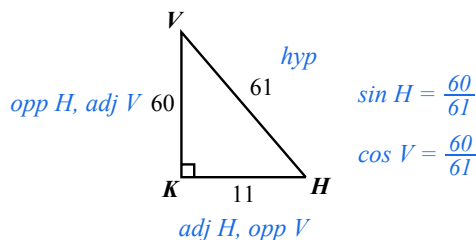
15 está opposite a $\angle C$ y adjacent a $\angle G$. 17 es the hypotenuse.

$$\sin C = \frac{15}{17} \quad \cos G = \frac{15}{17}$$

a. Circle all that are true: A ☐ B ☒ C ☐ D ☒ E ☐ F

b) Two of the six ratios of this triangle equal $\frac{60}{61}$. Write both.

Dos de las seis ratios de este triángulo son iguales a $\frac{60}{61}$. Escribe las dos.



60 is opposite $\angle H$ and adjacent to $\angle V$. 61 is the hypotenuse.

60 está opposite a $\angle H$ y adjacent a $\angle V$. 61 es the hypotenuse.

$$\sin H = \frac{60}{61} \quad \cos V = \frac{60}{61}$$

b. ratio 1: $\frac{\sin H}{\cos V}$

ratio 2: $\frac{\cos V}{\sin H}$

One side is opposite one acute angle and adjacent to the other → a sine of one equals a cosine of the other.

Test #4 No figure is given. Build the triangle from its letters: the angle given as 90° is the right angle.

No hay figura. Construye el triángulo a partir de sus letras: el ángulo dado como 90° es the right angle.

a) In $\triangle PNM$, $m\angle N = 90^\circ$. Which ratio represents the sine of $\angle P$?

En $\triangle PNM$, $m\angle N = 90^\circ$. ¿Qué ratio representa the sine de $\angle P$?

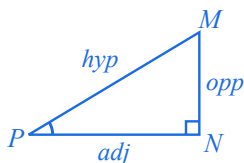
- (A) $\frac{NP}{MP}$ (B) $\frac{MN}{NP}$
(C) $\frac{MN}{MP}$ (D) $\frac{NP}{MN}$

★ $m\angle N = 90^\circ \rightarrow$ right angle at N $\rightarrow$ hypotenuse MP. Opposite $\angle P$ is MN, adjacent is NP. Opposite and hypotenuse: SOH, sine.

$m\angle N = 90^\circ \rightarrow$ right angle en N $\rightarrow$ hypotenuse MP. Opposite a $\angle P$ es MN, adjacent es NP. Opposite e hypotenuse: SOH, sine.

$$\sin P = \frac{MN}{MP}$$

a. A / B ☒ C / D

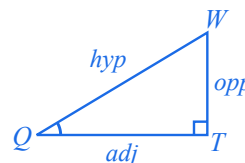


b) In $\triangle QTW$, $m\angle T = 90^\circ$. Sketch the triangle, mark the right angle, then write $\tan Q$ and $\cos Q$.

En $\triangle QTW$, $m\angle T = 90^\circ$. Dibuja el triángulo, marca the right angle, luego escribe $\tan Q$ y $\cos Q$.

Right angle at T, hypotenuse QW. Opposite $\angle Q$ is TW, adjacent is QT.

Right angle en T, hypotenuse QW. Opposite a $\angle Q$ es TW, adjacent es QT.



$$\tan Q = \frac{TW}{QT}$$

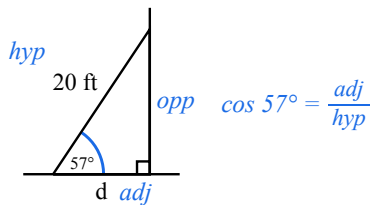
$$\cos Q = \frac{QT}{QW}$$

The angle given as 90° is the right angle; the hypotenuse is the two letters without it.

Test #5 Decide which ratio finds the length asked for. Do not solve.*Decide qué ratio halla la longitud que se pide. No resuelvas.*

- a) A 20 ft ladder leans against a wall and makes a 57° angle with the ground. Which ratio would you use to find d, how far the foot of the ladder is from the wall?

Una escalera de 20 pies está apoyada contra una pared y forma un ángulo de 57° con el suelo. ¿Qué ratio usarías para hallar d, la distancia del pie de la escalera a la pared?



- (A) $\tan(57^\circ)$ (B) $\sin(57^\circ)$
 (C) $\cos(57^\circ)$ (D) none of the above

★ Ladder = hypotenuse. The distance to the wall touches 57° : adjacent. Adjacent and hypotenuse: cosine.

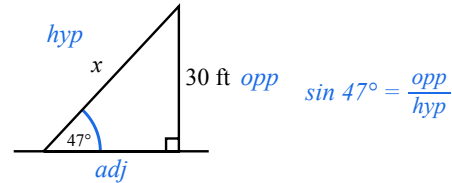
Escalera = hypotenuse. La distancia a la pared toca 57° : adjacent. Adjacent e hypotenuse: cosine.

$$\frac{\cos 57^\circ}{1} = \frac{d}{20}$$

a. A / B **C** / D

- b) A wire runs from the top of a 30 ft pole to the ground and makes a 47° angle with the ground. Write the equation you would use to find x, the length of the wire. Do not solve.

Un alambre va desde la punta de un poste de 30 pies hasta el suelo y forma un ángulo de 47° con el suelo. Escribe la ecuación que usarías para hallar x, la longitud del alambre. No resuelvas.



Wire = hypotenuse. The pole is across from 47° : opposite. Opposite and hypotenuse: sine.

Alambre = hypotenuse. El poste está frente a 47° : opposite. Opposite e hypotenuse: sine.

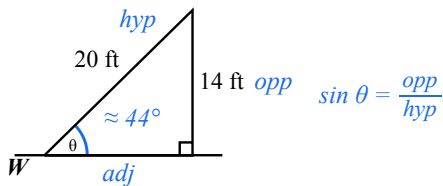
b. equation: $\sin 47^\circ = \frac{30}{x}$

Name the side you know and the side you want, then pick the ratio that uses those two.

Test #6 Two sides are known and the angle is wanted. Write the inverse expression that gives the angle.*Se conocen dos lados y se busca el ángulo. Escribe la expresión inversa que da el ángulo.*

- a) A 20 ft wire runs from the top of a 14 ft pole to a stake at point W. Which expression gives θ , the angle the wire makes with the ground?

Un alambre de 20 pies va desde la punta de un poste de 14 pies hasta una estaca en el punto W. ¿Qué expresión da θ , el ángulo que forma el alambre con el suelo?



- (A) $\cos^{-1}(\frac{14}{20})$ (B) $\sin^{-1}(\frac{14}{20})$
 (C) $\tan^{-1}(\frac{14}{20})$ (D) $\sin^{-1}(\frac{20}{14})$

★ Pole 14 opposite θ , wire 20 hypotenuse: sine. Angle wanted: the inverse.

Poste 14 opposite a θ , alambre 20 hypotenuse: sine. Se busca el ángulo: la inversa.

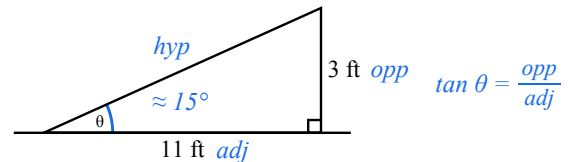
$$\sin \theta = \frac{14}{20}$$

$$\theta = \sin^{-1}\left(\frac{14}{20}\right)$$

a. A B C / D

- b) A ramp rises 3 ft over 11 ft of ground. Write the expression for θ , the angle the ramp makes with the ground, then find θ to the nearest degree.

Una rampa sube 3 pies en 11 pies de suelo. Escribe la expresión para θ , el ángulo que forma la rampa con el suelo, luego halla θ al grado más cercano.



Rise 3 opposite θ , run 11 adjacent: tangent, then the inverse.

Subida 3 opposite a θ , recorrido 11 adjacent: tangent, luego la inversa.

$$\tan \theta = \frac{3}{11}$$

$$\theta = \tan^{-1}\left(\frac{3}{11}\right) \approx 15.3^\circ \rightarrow 15^\circ$$

b. $\theta = \tan^{-1}\left(\frac{3}{11}\right)$

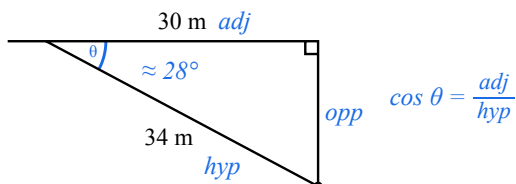
$\theta \approx 15^\circ$

Two sides known, angle wanted: write the ratio, then the inverse of it.

Test #7 Find the angle of depression from the horizontal, to the nearest degree.*Halla the angle of depression desde la horizontal, al grado más cercano.*

- a) On a map, the horizontal distance from the top of a cliff to a boat is 30 m. The actual line of sight from the top of the cliff to the boat is 34 m. Find the angle of depression from the horizontal.

En un mapa, la distancia horizontal desde lo alto de un acantilado hasta un bote es 30 m. La línea de visión real desde lo alto del acantilado hasta el bote es 34 m. Halla the angle of depression desde la horizontal.



The angle of depression is at the top. 30 adjacent, 34 hypotenuse: cosine.

The angle of depression está arriba. 30 adjacent, 34 hypotenuse: cosine.

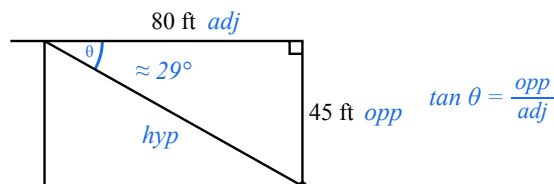
$$\cos \theta = \frac{30}{34}$$

$$\theta = \cos^{-1} \left(\frac{30}{34} \right) \approx 28.1^\circ \rightarrow 28^\circ$$

a. angle of depression $\approx$ 28 °

- b) From the top of a 45 ft lighthouse, a boat is 80 ft out from the base. Which is closest to the angle of depression from the top of the lighthouse to the boat?

Desde lo alto de un faro de 45 pies, un bote está a 80 pies de la base. ¿Cuál es el más cercano al angle of depression desde lo alto del faro hasta el bote?



(A) 34°

(B) 29°

(C) 56°

(D) 61°

★ The angle of depression is at the top. Drop 45 opposite, 80 across: adjacent. Tangent.

The angle of depression está arriba. Caída 45 opposite, 80 de distancia: adjacent. Tangent.

$$\tan \theta = \frac{45}{80}$$

$$\theta = \tan^{-1} \left(\frac{45}{80} \right) \approx 29.4^\circ \rightarrow 29^\circ$$

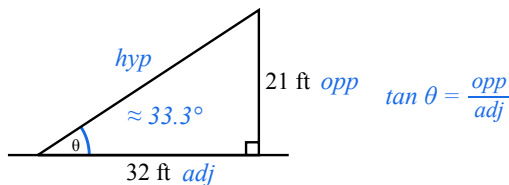
b. A / B / C / D

The angle of depression sits at the top, between the horizontal and the line of sight.

Test #8 Find the angle of elevation from the end of the shadow to the top, to the nearest tenth of a degree.*Halla the angle of elevation desde el final de la sombra hasta la punta, a la décima de grado más cercana.*

- a) A 21 ft tree casts a shadow 32 ft long. What is the angle of elevation from the end of the shadow to the top of the tree?

Un árbol de 21 pies proyecta una sombra de 32 pies de largo. ¿Cuál es the angle of elevation desde el final de la sombra hasta la punta del árbol?



- (A) 56.7° (B) 41.0°
(C) 33.3° (D) 49.0°

★ Tree 21 opposite, shadow 32 adjacent. Opposite and adjacent: TOA, tangent, then the inverse.

Árbol 21 opposite, sombra 32 adjacent. Opposite y adjacent: TOA, tangent, luego la inversa.

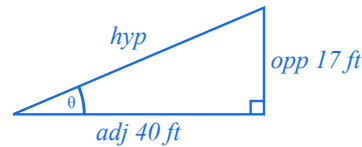
$$\tan \theta = \frac{21}{32}$$

$$\theta = \tan^{-1} \left(\frac{21}{32} \right) \approx 33.3^\circ$$

a. A / B C / D

- b) A 17 ft flagpole casts a shadow 40 ft long. What is the angle of elevation from the end of the shadow to the top of the flagpole?

Un asta de 17 pies proyecta una sombra de 40 pies de largo. ¿Cuál es the angle of elevation desde el final de la sombra hasta la punta del asta?



Flagpole 17 opposite, shadow 40 adjacent. Opposite and adjacent: TOA, tangent, then the inverse.

Asta 17 opposite, sombra 40 adjacent. Opposite y adjacent: TOA, tangent, luego la inversa.

$$\tan \theta = \frac{17}{40}$$

$$\theta = \tan^{-1} \left(\frac{17}{40} \right) \approx 23.0^\circ$$

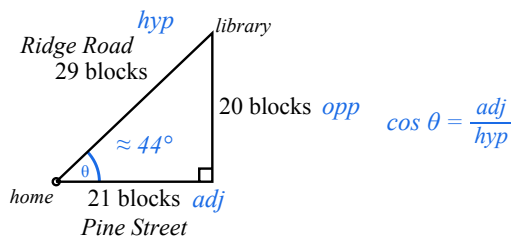
b. angle $\approx$ 23.0°

Height over shadow is a tangent; the inverse tangent gives the angle.

Test #9 The map shows two paths between two places. Find the angle they make, to the nearest degree.*El mapa muestra dos caminos entre dos lugares. Halla el ángulo que forman, al grado más cercano.*

- a) The map shows two paths Ravi takes from home to the library. What is the angle formed by Pine Street and Ridge Road?

El mapa muestra dos caminos que Ravi toma de su casa a la biblioteca. ¿Cuál es el ángulo que forman Pine Street y Ridge Road?



- (A) 46° (B) 44°
(C) 35° (D) 55°

★ Pine Street (21) touches the angle: adjacent. Ridge Road (29): hypotenuse. Cosine, then the inverse.

Pine Street (21) toca el ángulo: adjacent. Ridge Road (29): hypotenuse. Cosine, luego la inversa.

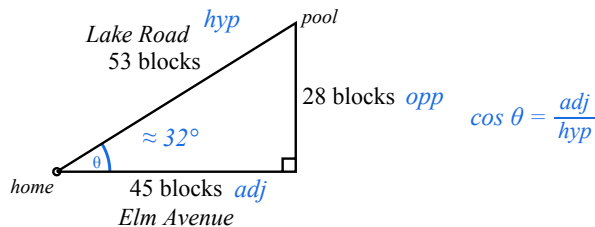
$$\cos \theta = \frac{21}{29}$$

$$\theta = \cos^{-1} \left(\frac{21}{29} \right) \approx 43.6^\circ \rightarrow 44^\circ$$

a. A / B / C / D

- b) The map shows two paths Nadia takes from home to the pool. What is the angle formed by Elm Avenue and Lake Road?

El mapa muestra dos caminos que Nadia toma de su casa a la piscina. ¿Cuál es el ángulo que forman Elm Avenue y Lake Road?



Elm Avenue (45) touches the angle: adjacent. Lake Road (53): hypotenuse. Cosine, then the inverse.

Elm Avenue (45) toca el ángulo: adjacent. Lake Road (53): hypotenuse. Cosine, luego la inversa.

$$\cos \theta = \frac{45}{53}$$

$$\theta = \cos^{-1} \left(\frac{45}{53} \right) \approx 31.9^\circ \rightarrow 32^\circ$$

b. angle $\approx$ 32°

The path that touches the angle is adjacent, the slanted path is the hypotenuse: cosine.

Test #10 One height, two shadows at two different times. Find how much the elevation of the sun changed, to the nearest tenth of a degree.

Una misma altura, dos sombras en dos momentos distintos. Halla cuánto cambió la elevación del sol, a la décima de grado más cercana.

- a) Marcus is 6 ft tall. He measured his shadow twice, as the table shows. By how much did the elevation of the sun change between 4:15 p.m. and 5:15 p.m.?

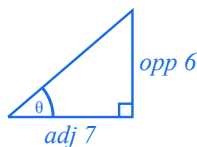
Marcus mide 6 pies. Midió su sombra dos veces, como muestra la tabla. ¿Cuánto cambió la elevación del sol entre las 4:15 p.m. y las 5:15 p.m.?

Time	Length of shadow (ft)
4:15 p.m.	7
5:15 p.m.	15

- (A) The elevation of the sun decreased by 40.6 degrees.
 (B) The elevation of the sun decreased by 18.8 degrees.
 (C) The elevation of the sun decreased by 62.4 degrees.
 (D) The elevation of the sun decreased by 35.4 degrees.

★ Two triangles: Marcus's height (6 ft) opposite the sun's angle, the shadow adjacent. Opposite and adjacent: TOA, tangent. Two inverse tangents, then subtract, round once.

Dos triángulos: la altura de Marcus (6 pies) opposite al ángulo del sol, la sombra adjacent. Opposite y adjacent: TOA, tangent. Dos tangentes inversas, luego resta, redondea una vez.



$$4:15 \text{ p.m.} : \tan \theta_1 = \frac{6}{7}$$

$$\theta_1 = \tan^{-1} \left(\frac{6}{7} \right) \approx 40.60^\circ$$

$$5:15 \text{ p.m.} : \tan \theta_2 = \frac{6}{15}$$

$$\theta_2 = \tan^{-1} \left(\frac{6}{15} \right) \approx 21.80^\circ$$

$$40.60^\circ - 21.80^\circ = 18.80^\circ \rightarrow 18.8^\circ$$

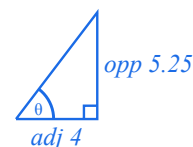
a. A B / C / D

- b) Priya is 5'3" tall. She measured her shadow twice, as the table shows. By how much did the elevation of the sun change between 3:30 p.m. and 5:30 p.m.?

Priya mide 5'3". Midió su sombra dos veces, como muestra la tabla. ¿Cuánto cambió la elevación del sol entre las 3:30 p.m. y las 5:30 p.m.?

Time	Length of shadow (ft)
3:30 p.m.	4
5:30 p.m.	9

Two triangles: Priya's height (5.25 ft) opposite the sun's angle, the shadow adjacent. Opposite and adjacent: TOA, tangent. Two inverse tangents, then subtract, round once.



Dos triángulos: la altura de Priya (5.25 pies) opposite al ángulo del sol, la sombra adjacent. Opposite y adjacent: TOA, tangent. Dos tangentes inversas, luego resta, redondea una vez.

$$5'3'' = 5 + \frac{3}{12} = 5.25 \text{ ft}$$

$$3:30 \text{ p.m.} : \tan \theta_1 = \frac{5.25}{4}$$

$$\theta_1 = \tan^{-1} \left(\frac{5.25}{4} \right) \approx 52.70^\circ$$

$$5:30 \text{ p.m.} : \tan \theta_2 = \frac{5.25}{9}$$

$$\theta_2 = \tan^{-1} \left(\frac{5.25}{9} \right) \approx 30.26^\circ$$

$$52.70^\circ - 30.26^\circ = 22.44^\circ \rightarrow 22.4^\circ$$

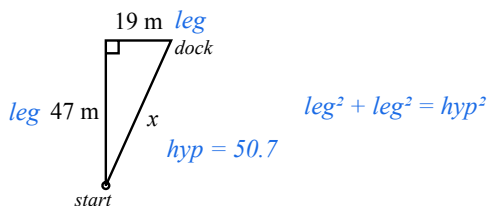
b. decreased by 22.4°

Two triangles, two inverse tangents, then subtract the angles.

Test #11 Find the distance, to the nearest tenth.*Halla la distancia, a la décima más cercana.*

- a) Omar walked 47 m along a river bank and then saw a dock straight across the river. The river is 19 m wide there. How far is the dock from his starting point?

Omar caminó 47 m por la orilla de un río y luego vio un muelle justo enfrente. El río mide 19 m de ancho ahí. ¿A qué distancia está el muelle de su punto de partida?



- (A) 43.0 (B) 50.7
(C) 66.0 (D) 28.0

★ Two sides given and no angle → the Pythagorean Theorem, not trig. The legs meet at a right angle; the distance asked for is the hypotenuse.

Dos lados dados y ningún ángulo → the Pythagorean Theorem, no trig. The legs se juntan en un right angle; la distancia que se pide es the hypotenuse.

$$47^2 + 19^2 = x^2$$

$$2209 + 361 = x^2$$

$$x^2 = 2570$$

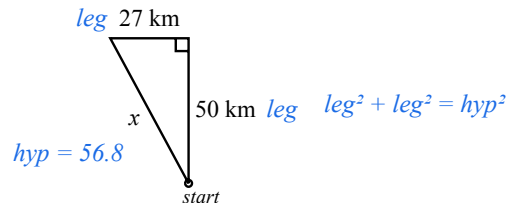
$$x = \sqrt{2570}$$

$$x \approx 50.7 \text{ m}$$

a. A **(B)** C / D

- b) Lena drives 50 km north, then 27 km west. How far is she from her starting point?

Lena maneja 50 km al norte, luego 27 km al oeste. ¿A qué distancia está de su punto de partida?



Two sides given and no angle → the Pythagorean Theorem, not trig. The legs meet at a right angle; the distance asked for is the hypotenuse.

Dos lados dados y ningún ángulo → the Pythagorean Theorem, no trig. The legs se juntan en un right angle; la distancia que se pide es the hypotenuse.

$$50^2 + 27^2 = x^2$$

$$2500 + 729 = x^2$$

$$x^2 = 3229$$

$$x = \sqrt{3229}$$

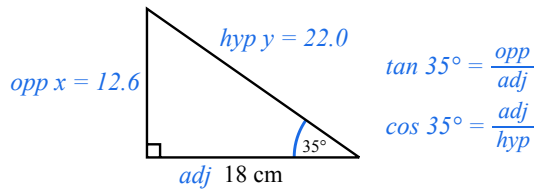
$$x \approx 56.8 \text{ km}$$

b. x ≈ **56.8 km**

Legs meet at the right angle; the hypotenuse gets the sum: $a^2 + b^2 = c^2$.

Test #12 Find the perimeter, to the nearest tenth.*Halla el perímetro, a la décima más cercana.*

- a)**
- A flag has the dimensions shown. Find its perimeter.

Una bandera tiene las dimensiones que se muestran. Halla su perímetro.18 is adjacent to 35° . Opposite leg by tangent, hypotenuse by cosine, then add all three.*18 es adjacente a 35° . Opposite leg con tangent, hypotenuse con cosine, luego suma los tres.*

$$\frac{\tan 35^\circ}{1} = \frac{x}{18}$$

$$x = 18 \cdot \tan 35^\circ$$

$$x \approx 12.6$$

$$\frac{\cos 35^\circ}{1} = \frac{18}{y}$$

$$y \cdot \cos 35^\circ = 18$$

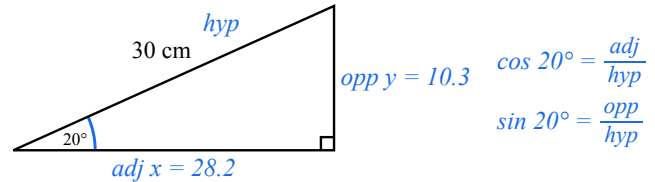
$$y = \frac{18}{\cos(35^\circ)}$$

$$y \approx 22.0$$

$$P = 18 + 12.6 + 22.0 = 52.6 \text{ cm}$$

a. perimeter $\approx$ **52.6** cm

- b)**
- A pennant has the dimensions shown. Which is closest to its perimeter?

Un banderín tiene las dimensiones que se muestran. ¿Cuál es el más cercano a su perímetro?

(A) 38.5

(B) 58.2

(C) 68.5

(D) 72.8

★ Hypotenuse 30. Adjacent by cosine, opposite by sine, then add all three.

Hypotenuse 30. Adjacent con cosine, opposite con sine, luego suma los tres.

$$\frac{\cos 20^\circ}{1} = \frac{x}{30}$$

$$x = 30 \cdot \cos 20^\circ$$

$$x \approx 28.2$$

$$\frac{\sin 20^\circ}{1} = \frac{y}{30}$$

$$y = 30 \cdot \sin 20^\circ$$

$$y \approx 10.3$$

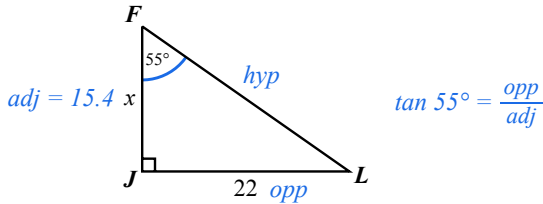
$$P = 30 + 28.2 + 10.3 = 68.5 \text{ cm}$$

b. A / B **C** / D

Find the two missing sides from the one angle (tan for the other leg, cos for the hypotenuse), then add all three.

Test #13 Find the side asked for, to the nearest tenth.*Halla el lado que se pide, a la décima más cercana.*

- a)**
- Right triangle FJL (feet). Which is closest to FJ?

Right triangle FJL (pies). ¿Cuál es el más cercano a FJ?

- (A) 15.4 (B) 31.4
(C) 26.9 (D) 18.0

★ 22 is opposite 55° , FJ is adjacent: TOA, tangent, x on the bottom.*22 es opposite a 55° , FJ es adjacent: TOA, tangent, x abajo.*

$$\frac{\tan 55^\circ}{1} = \frac{22}{x}$$

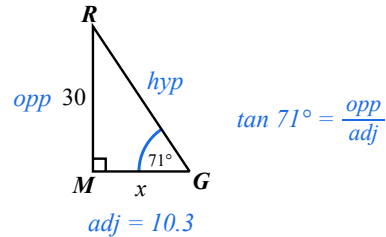
$$x \cdot \tan 55^\circ = 22$$

$$x = \frac{22}{\tan(55^\circ)}$$

$$x \approx 15.4 \text{ ft}$$

a. A / B / C / D

- b)**
- Right triangle GMR. Find GM.

Right triangle GMR. Halla GM.30 is opposite 71° , GM is adjacent: TOA, tangent, x on the bottom.*30 es opposite a 71° , GM es adjacent: TOA, tangent, x abajo.*

$$\frac{\tan 71^\circ}{1} = \frac{30}{x}$$

$$x \cdot \tan 71^\circ = 30$$

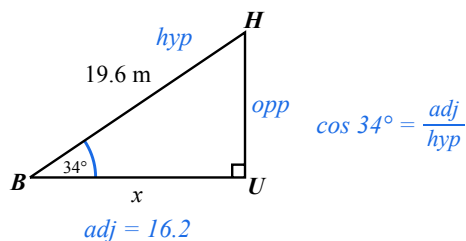
$$x = \frac{30}{\tan(71^\circ)}$$

$$x \approx 10.3$$

b. GM $\approx$ 10.3**x on the bottom: multiply both sides by x, then divide by the ratio.**

Test #14 Find the side asked for, to the nearest tenth.*Halla el lado que se pide, a la décima más cercana.*

- a)**
- Right triangle BUH (meters). Which is closest to BU?

Right triangle BUH (metros). ¿Cuál es el más cercano a BU?

(A) 11.0

(B) 23.6

(C) 13.2

(D) 16.2

★ BU touches $34^\circ \rightarrow$ adjacent. 19.6 is the hypotenuse. Adjacent and hypotenuse: CAH, cosine.

BU toca $34^\circ \rightarrow$ adjacent. 19.6 es the hypotenuse. Adjacent e hypotenuse: CAH, cosine.

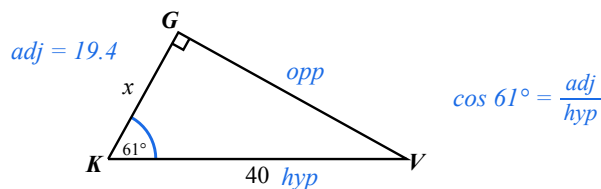
$$\frac{\cos 34^\circ}{1} = \frac{x}{19.6}$$

$$x = 19.6 \cdot \cos 34^\circ$$

$$x \approx 16.2 \text{ m}$$

a. A / B / C **D**

- b)**
- Right triangle KGV. Find GK.

Right triangle KGV. Halla GK.

GK touches $61^\circ \rightarrow$ adjacent. 40 is the hypotenuse. Adjacent and hypotenuse: CAH, cosine.

GK toca $61^\circ \rightarrow$ adjacent. 40 es the hypotenuse. Adjacent e hypotenuse: CAH, cosine.

$$\frac{\cos 61^\circ}{1} = \frac{x}{40}$$

$$x = 40 \cdot \cos 61^\circ$$

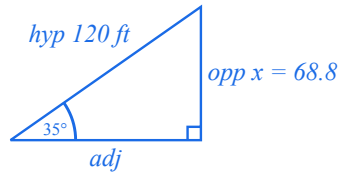
$$x \approx 19.4$$

b. GK $\approx$ **19.4**Adjacent over hypotenuse is cosine; x on top $\rightarrow$ multiply.

Test #15 Find the height.*Halla la altura.*

- a) Leo is flying a kite on a 120 ft string. The string makes a 35° angle of elevation with the ground. How high is the kite, to the nearest foot?

Leo vuela una cometa con una cuerda de 120 pies. La cuerda forma un angle of elevation de 35° con el suelo. ¿A qué altura está la cometa, al pie más cercano?



The string (120) is the hypotenuse, the height is across from 35° : sine.

La cuerda (120) es the hypotenuse, la altura está frente a 35° : sine.

$$\frac{\sin 35^\circ}{1} = \frac{x}{120}$$

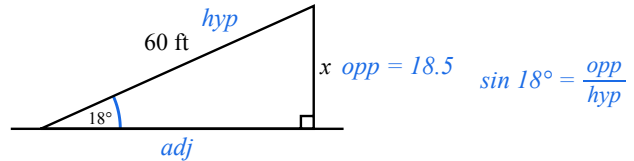
$$x = 120 \cdot \sin 35^\circ$$

$$x \approx 68.8 \rightarrow 69 \text{ ft}$$

a. height $\approx$ **69** _____ ft

- b) A 60 ft ramp rises at an angle of 18° . Which is closest to the height of the top of the ramp?

Una rampa de 60 pies sube con un ángulo de 18° . ¿Cuál es el más cercano a la altura de la parte alta de la rampa?



(A) 57.1

(B) 18.5

(C) 19.5

(D) 194.2

★ The ramp (60) is the hypotenuse, the height is across from 18° : sine.

La rampa (60) es the hypotenuse, la altura está frente a 18° : sine.

$$\frac{\sin 18^\circ}{1} = \frac{x}{60}$$

$$x = 60 \cdot \sin 18^\circ$$

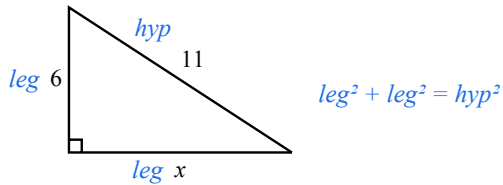
$$x \approx 18.5 \text{ ft}$$

b. A **B** / C / D

The string or the ramp is the hypotenuse and the height is opposite the angle: sine.

Test #16 Set up the Pythagorean Theorem for x.*Plantea the Pythagorean Theorem para x.*

- a)**
- Which equation could be used to find x?

¿Qué ecuación podría usarse para hallar x?

- (A) $x^2 - 6^2 = 11^2$ (B) $11^2 - 6^2 = x^2$
 (C) $x^2 + 11^2 = 6^2$ (D) $x + 6 = 11$

★ 11 is the hypotenuse → it sits alone on its side: $\text{leg}^2 + \text{leg}^2 = \text{hyp}^2$.
 Move 6^2 across to solve for x.

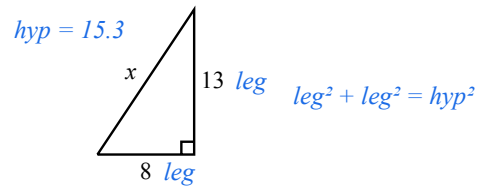
11 es the hypotenuse → va sola en su lado: $\text{leg}^2 + \text{leg}^2 = \text{hypotenuse}^2$. Pasa 6^2 al otro lado para despejar x.

$$x^2 + 6^2 = 11^2$$

$$11^2 - 6^2 = x^2$$

- a. A ☒ B C / D

- b)**
- Write the equation for x, then solve it to the nearest tenth.

Escribe la ecuación para x, luego resuélvela a la décima más cercana.

x is the hypotenuse → add the two squared legs.

x es the hypotenuse → suma los dos legs al cuadrado.

$$8^2 + 13^2 = x^2$$

$$64 + 169 = x^2$$

$$x^2 = 233$$

$$x = \sqrt{233}$$

$$x \approx 15.3$$

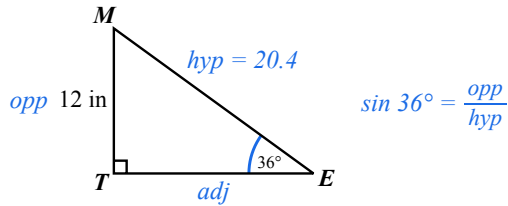
b. equation: $8^2 + 13^2 = x^2$

x ≈ **15.3**

The hypotenuse sits alone on its side of the equation.

Test #17 Find the hypotenuse, to the nearest tenth.*Halla the hypotenuse, a la d cima m s cercana.*

- a)**
- Right triangle ETM (inches). Find EM.

Right triangle ETM (pulgadas). Halla EM.12 is opposite 36° , EM is the hypotenuse: SOH, sine, EM on the bottom.*12 es opposite a 36° , EM es the hypotenuse: SOH, sine, EM abajo.*

$$\frac{\sin 36^\circ}{1} = \frac{12}{EM}$$

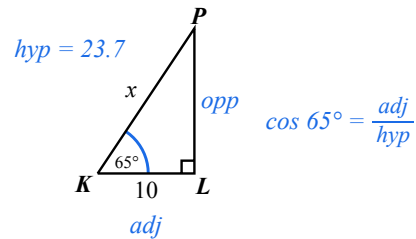
$$EM \cdot \sin 36^\circ = 12$$

$$EM = \frac{12}{\sin(36^\circ)}$$

$$EM \approx 20.4 \text{ in}$$

a. EM $\approx$ 20.4 in.

- b)**
- Right triangle KLP. Which is closest to KP?

Right triangle KLP.  Cu l es el m s cercano a KP?

(A) 4.2

(B) 11.0

(C) 21.4

(D) 23.7

★ 10 is adjacent to 65° , KP is the hypotenuse: CAH, cosine, x on the bottom.*10 es adjacent a 65° , KP es the hypotenuse: CAH, cosine, x abajo.*

$$\frac{\cos 65^\circ}{1} = \frac{10}{x}$$

$$x \cdot \cos 65^\circ = 10$$

$$x = \frac{10}{\cos(65^\circ)}$$

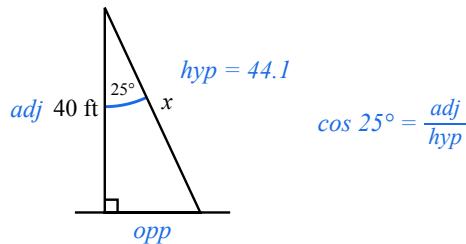
$$x \approx 23.7$$

b. A / B / C D**x on the bottom: multiply both sides by x, then divide.**

Test #18 The angle is at the top. Find the cable, to the nearest tenth.*El ángulo está arriba. Halla el cable, a la décima más cercana.*

- a) A pole is 40 ft tall. A cable from its top to the ground makes a 25° angle with the pole, as shown. Find x , the length of the cable.

Un poste mide 40 pies. Un cable desde su punta hasta el suelo forma un ángulo de 25° con el poste, como se muestra. Halla x , la longitud del cable.



- (A) 36.3 (B) 18.7
(C) 44.1 (D) 94.6

★ The 25° angle is at the top. The pole (40) touches it: adjacent.
Cable: hypotenuse. Cosine, x on the bottom.

*El ángulo de 25° está arriba. El poste (40) lo toca: adjacent. Cable: hypotenuse.
Cosine, x abajo.*

$$\frac{\cos 25^\circ}{1} = \frac{40}{x}$$

$$x \cdot \cos 25^\circ = 40$$

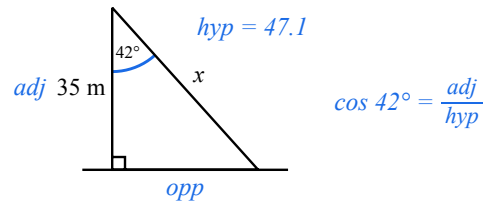
$$x = \frac{40}{\cos(25^\circ)}$$

$$x \approx 44.1 \text{ ft}$$

a. A / B **(C)** D

- b) A tower is 35 m tall. A cable from its top to the ground makes a 42° angle with the tower, as shown. Find x , the length of the cable.

Una torre mide 35 m. Un cable desde su punta hasta el suelo forma un ángulo de 42° con la torre, como se muestra. Halla x , la longitud del cable.



The 42° angle is at the top. The tower (35) touches it: adjacent.
Cable: hypotenuse. Cosine, x on the bottom.

*El ángulo de 42° está arriba. La torre (35) lo toca: adjacent. Cable: hypotenuse.
Cosine, x abajo.*

$$\frac{\cos 42^\circ}{1} = \frac{35}{x}$$

$$x \cdot \cos 42^\circ = 35$$

$$x = \frac{35}{\cos(42^\circ)}$$

$$x \approx 47.1 \text{ m}$$

b. $x \approx$ **47.1 m**

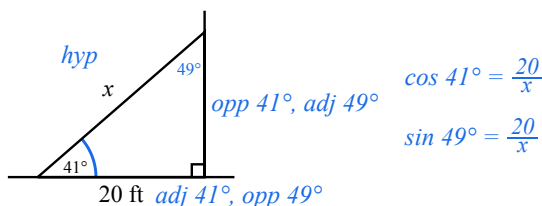
When the angle is at the top, the vertical side is adjacent to it.

Test #19 The beam makes two acute angles, one with the ground and one with the wall. Each one gives an equation for x.

La viga forma dos ángulos agudos, uno con el suelo y uno con la pared. Cada uno da una ecuación para x.

- a) A beam is fixed to the ground 20 ft from a wall at a 41° angle. Complete the two equations for x, the length of the beam, using the tiles.

Una viga está fija al suelo a 20 pies de una pared con un ángulo de 41° . Completa las dos ecuaciones para x, la longitud de la viga, usando las fichas.



sin	cos	tan	41°	49°	90°
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$$\cos 41^\circ = \frac{20}{x}$$

$$\sin 49^\circ = \frac{20}{x}$$

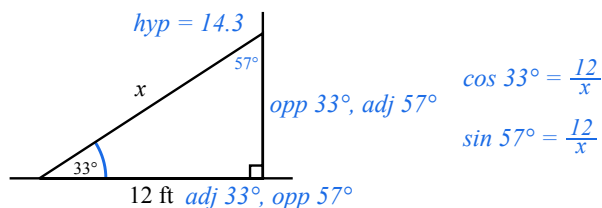
20 is adjacent to 41° : cosine. It is opposite the other angle, $90^\circ - 41^\circ = 49^\circ$: sine.

20 es adjacente a 41° : cosine. Es opuesta al otro ángulo, $90^\circ - 41^\circ = 49^\circ$: sine.

$$\frac{\cos 41^\circ}{1} = \frac{20}{x} \quad \frac{\sin 49^\circ}{1} = \frac{20}{x}$$

- b) A beam is fixed to the ground 12 ft from a wall at a 33° angle. Write one equation for x with 33° and one with the other acute angle, then find x to the nearest tenth.

Una viga está fija al suelo a 12 pies de una pared con un ángulo de 33° . Escribe una ecuación para x con 33° y otra con el otro ángulo agudo, luego halla x a la décima más cercana.



12 is adjacent to 33° and opposite the other angle, $90^\circ - 33^\circ = 57^\circ$. Both give the same x.

12 es adjacente a 33° y opuesta al otro ángulo, $90^\circ - 33^\circ = 57^\circ$. Las dos dan la misma x.

$$\frac{\cos 33^\circ}{1} = \frac{12}{x} \quad \frac{\sin 57^\circ}{1} = \frac{12}{x}$$

$$x \cdot \cos 33^\circ = 12$$

$$x = \frac{12}{\cos(33^\circ)}$$

$$x \approx 14.3 \text{ ft}$$

b. equation 1: $\cos 33^\circ = \frac{12}{x}$

equation 2: $\sin 57^\circ = \frac{12}{x}$

x $\approx$ **14.3 ft**

The two acute angles add to $90^\circ \rightarrow$ the same side is adjacent to one and opposite the other.

Test #20 One trig ratio of a right triangle is given.*Se da una trigonometric ratio de un right triangle.*

- a) In a right triangle, $\sin x = \frac{9}{41}$. What is $\tan x$?

En un right triangle, $\sin x = \frac{9}{41}$. ¿Cuál es $\tan x$?

- (A) $\frac{40}{41}$ (B) $\frac{9}{40}$
 (C) $\frac{40}{9}$ (D) $\frac{41}{40}$

★ $\sin x = \frac{9}{41}$: opposite 9, hypotenuse 41. The third side, y , by $a^2 + b^2 = c^2$, then $\tan$.

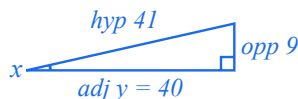
$\sin x = \frac{9}{41}$: opposite 9, hypotenuse 41. El tercer lado, y , con $a^2 + b^2 = c^2$, luego $\tan$.

$$9^2 + y^2 = 41^2$$

$$y^2 = 1681 - 81 = 1600$$

$$y = 40$$

$$\tan x = \frac{9}{40}$$



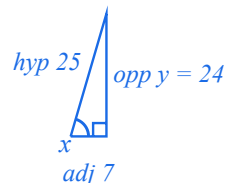
a. A / **B** / C / D

- b) In a right triangle, $\cos x = \frac{7}{25}$. Find $\sin x$ and $\tan x$.

En un right triangle, $\cos x = \frac{7}{25}$. Halla $\sin x$ y $\tan x$.

$\cos x = \frac{7}{25}$: adjacent 7, hypotenuse 25. The third side, y , by $a^2 + b^2 = c^2$.

$\cos x = \frac{7}{25}$: adjacent 7, hypotenuse 25. El tercer lado, y , con $a^2 + b^2 = c^2$.



$$7^2 + y^2 = 25^2$$

$$y^2 = 625 - 49 = 576$$

$$y = 24$$

$$\sin x = \frac{24}{25} \quad \tan x = \frac{24}{7}$$

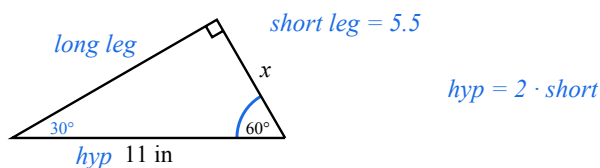
b. $\sin x = \frac{24}{25}$

$\tan x = \frac{24}{7}$

Draw the triangle from the ratio, find the third side with $a^2 + b^2 = c^2$, then read the other ratios.

Test #21 A company makes triangular flags in the shape shown.*Una empresa fabrica banderas triangulares con la forma que se muestra.*

- a)**
- Find
- x
- , the length in inches.

Halla x , la longitud en pulgadas.30-60-90: x is across from the 30° angle $\rightarrow x$ is the short leg, half the hypotenuse.30-60-90: x está frente al ángulo de $30^\circ \rightarrow x$ es the short leg, la mitad de the hypotenuse.

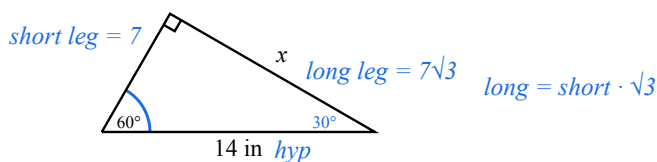
$$x = \frac{11}{2}$$

$$x = 5.5 \text{ in}$$

$$30-60-90 \rightarrow \text{short leg} = \text{half of } 11 = 5.5$$

$$\text{a. } x = \underline{5.5} \text{ in}$$

- b)**
- What is
- x
- , in inches?

¿Cuál es x , en pulgadas?

(A) 7

(C) $14\sqrt{3}$

(B) $7\sqrt{3}$

(D) $7\sqrt{2}$

★ 30-60-90: the short leg is half the hypotenuse, and x is the long leg, across from 60° : short leg $\cdot \sqrt{3}$.30-60-90: the short leg es la mitad de the hypotenuse, y x es the long leg, frente a 60° : short leg $\cdot \sqrt{3}$.

$$\text{short leg} = \frac{14}{2}$$

$$\text{short leg} = 7$$

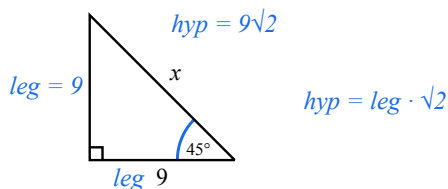
$$x = 7 \cdot \sqrt{3} = 7\sqrt{3}$$

$$30-60-90 \rightarrow \text{short leg } 7 \rightarrow \text{long leg } 7\sqrt{3}$$

$$\text{b. } A / \underline{B} / C / D$$

30-60-90: the short leg is half the hypotenuse; the long leg is the short leg times $\sqrt{3}$.**Test #22** A right triangle is shown with the dimensions given in units.*Se muestra un right triangle con las dimensiones dadas en unidades.*

- a)**
- What is the value of
- x
- ?

¿Cuál es el valor de x ?

(A) $9\sqrt{3}$

(C) $9\sqrt{2}$

(B) 18

(D) 9

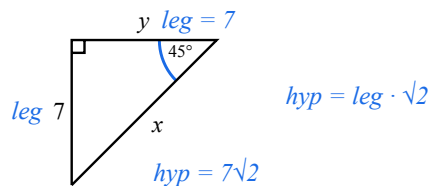
★ 45-45-90: the two legs are equal and the hypotenuse is a leg $\cdot \sqrt{2}$.45-45-90: los dos legs son iguales y the hypotenuse es un leg $\cdot \sqrt{2}$.

$$x = 9 \cdot \sqrt{2} = 9\sqrt{2}$$

$$45-45-90 \rightarrow \text{legs equal} \rightarrow \text{hyp} = \text{leg} \cdot \sqrt{2}$$

$$\text{a. } A / B / \underline{C} / D$$

- b)**
- Find
- x
- and
- y
- .

Halla x e y .45-45-90: the other leg equals 7, the hypotenuse is a leg $\cdot \sqrt{2}$.45-45-90: el otro leg es igual a 7, the hypotenuse es un leg $\cdot \sqrt{2}$.

$$y = 7$$

$$x = 7 \cdot \sqrt{2} = 7\sqrt{2}$$

$$45-45-90 \rightarrow \text{legs equal} \rightarrow \text{hyp} = \text{leg} \cdot \sqrt{2}$$

$$\text{b. } x = \underline{7\sqrt{2}}$$

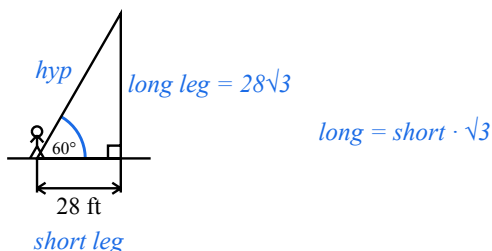
$$y = \underline{7}$$

45-45-90: equal legs, and the hypotenuse is a leg times $\sqrt{2}$.

Test #23 Find the exact height. Keep the radical.*Halla la altura exacta. Conserva el radical.*

- a) Mia stands 28 ft from a flagpole. The angle of elevation from the ground to the top is 60° . What is the height of the flagpole?

Mia está a 28 pies de un asta. The angle of elevation desde el suelo hasta la punta es 60° . ¿Cuál es la altura?



- (A) 28 ft (B) $28\sqrt{3}$ ft
(C) 56 ft (D) $14\sqrt{3}$ ft

★ 30-60-90: 28 ft is across from the 30° angle at the top: short leg.
Height = long leg = short leg $\cdot \sqrt{3}$.

30-60-90: 28 ft está frente al ángulo de 30° arriba: short leg. Altura = long leg = short leg $\cdot \sqrt{3}$.

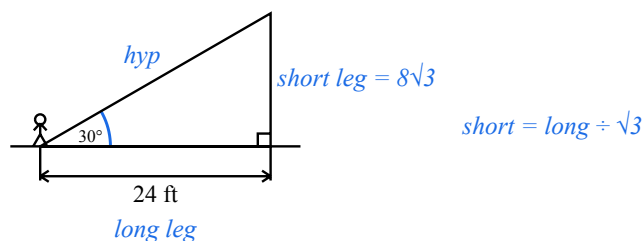
$$h = 28 \cdot \sqrt{3} = 28\sqrt{3} \text{ ft}$$

$$30\text{-}60\text{-}90 \rightarrow \text{short leg } 28 \rightarrow \text{long leg } 28\sqrt{3}$$

a. A ☒ B C / D

- b) Theo stands 24 ft from a building. The angle of elevation from the ground to the top is 30° . What is the height of the building?

Theo está a 24 pies de un edificio. The angle of elevation desde el suelo hasta la punta es 30° . ¿Cuál es la altura?



30-60-90: 24 ft is across from the 60° angle at the top: long leg.
Height = short leg = long leg $\div \sqrt{3}$.

30-60-90: 24 ft está frente al ángulo de 60° arriba: long leg. Altura = short leg = long leg $\div \sqrt{3}$.

$$h = \frac{24}{\sqrt{3}}$$

$$h = \frac{24\sqrt{3}}{3}$$

$$h = 8\sqrt{3} \text{ ft}$$

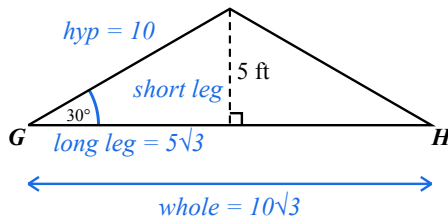
$$30\text{-}60\text{-}90 \rightarrow \text{long leg } 24 \rightarrow \text{short leg } 8\sqrt{3}$$

b. height = $8\sqrt{3}$ ft

60° at the ground means the height is the long leg; 30° means the height is the short leg.

Test #24 The drawing shows the frame of an isosceles roof. Find the whole base. Keep the radical.*El dibujo muestra la estructura de un techo isósceles. Halla la base completa. Conserva el radical.*

- a) The height of the roof is 5 ft. What is the distance from G to H?

La altura del techo mide 5 pies. ¿Cuál es la distancia de G a H?

- (A) 10 (B) $5\sqrt{3}$
(C) $\frac{10\sqrt{3}}{3}$ (D) $10\sqrt{3}$

★ Two 30-60-90 halves. 5 is the short leg (across from 30°), half the base is the long leg: $5 \cdot \sqrt{3}$. Double it.

Dos mitades 30-60-90. 5 es the short leg (frente a 30°), la mitad de la base es the long leg: $5 \cdot \sqrt{3}$. Duplicalo.

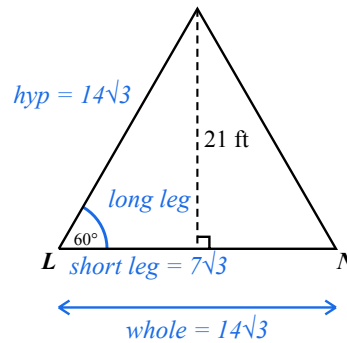
$$\text{half base} = 5 \cdot \sqrt{3} = 5\sqrt{3}$$

$$GH = 2 \cdot 5\sqrt{3} = 10\sqrt{3} \text{ ft}$$

$$30\text{-}60\text{-}90 \rightarrow \text{half base } 5\sqrt{3} \rightarrow \text{whole base } 10\sqrt{3}$$

a. A / B / C **(D)**

- b) The height of the roof is 21 ft. What is the distance from L to N?

La altura del techo mide 21 pies. ¿Cuál es la distancia de L a N?

Two 30-60-90 halves. 21 is the long leg (across from 60°), half the base is the short leg: $21 \div \sqrt{3}$. Double it.

Dos mitades 30-60-90. 21 es the long leg (frente a 60°), la mitad de la base es the short leg: $21 \div \sqrt{3}$. Duplicalo.

$$\text{half base} = \frac{21}{\sqrt{3}}$$

$$\text{half base} = \frac{21\sqrt{3}}{3}$$

$$\text{half base} = 7\sqrt{3}$$

$$LN = 2 \cdot 7\sqrt{3} = 14\sqrt{3} \text{ ft}$$

$$30\text{-}60\text{-}90 \rightarrow \text{half base } 7\sqrt{3} \rightarrow \text{whole base } 14\sqrt{3}$$

b. LN = **$14\sqrt{3}$ ft**

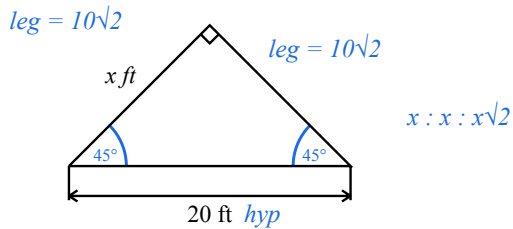
The height cuts the roof into two right triangles: find half the base, then double it.

Test #25 The frame of a roof is an isosceles right triangle. Find x , the length of each side.

La estructura de un techo tiene la forma de un isosceles right triangle (triángulo rectángulo isósceles). Halla x , la longitud de cada lado.

- a) The hypotenuse is 20 ft. Which measure is closest to x , the length in feet of each side?

The hypotenuse (la hipotenusa) mide 20 pies. ¿Qué medida es la más cercana a x , la longitud en pies de cada lado?



- (A) $10\sqrt{2}$ (B) 10
(C) $20\sqrt{2}$ (D) 5

★ 45-45-90: the base is the hypotenuse, each side is a leg.
Leg = hypotenuse $\div \sqrt{2}$.

45-45-90: la base es the hypotenuse, cada lado es un leg. Leg = hypotenuse $\div \sqrt{2}$.

$$x\sqrt{2} = 20$$

$$x = \frac{20}{\sqrt{2}}$$

$$x = \frac{20\sqrt{2}}{2}$$

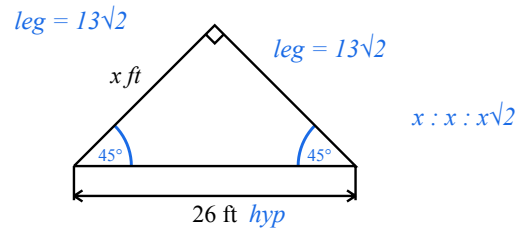
$$x = 10\sqrt{2} \text{ ft}$$

$$45-45-90 \rightarrow leg = 20 \div \sqrt{2} \rightarrow 10\sqrt{2}$$

a. A / B / C / D

- b) The hypotenuse is 26 ft. What is x , the length of each side, in simplest radical form?

The hypotenuse (la hipotenusa) mide 26 pies. ¿Cuál es x , la longitud de cada lado, en la forma radical más simple?



45-45-90: the base is the hypotenuse, each side is a leg.
Leg = hypotenuse $\div \sqrt{2}$.

45-45-90: la base es the hypotenuse, cada lado es un leg. Leg = hypotenuse $\div \sqrt{2}$.

$$x\sqrt{2} = 26$$

$$x = \frac{26}{\sqrt{2}}$$

$$x = \frac{26\sqrt{2}}{2}$$

$$x = 13\sqrt{2} \text{ ft}$$

$$45-45-90 \rightarrow leg = 26 \div \sqrt{2} \rightarrow 13\sqrt{2}$$

b. $x = 13\sqrt{2} \text{ ft}$

Hypotenuse given: divide by $\sqrt{2}$, then rationalize: $\frac{20}{\sqrt{2}} = 10\sqrt{2}$.