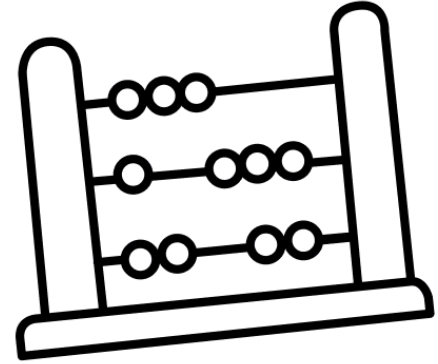


Doorashada saamiga saxda ah ee trigonometry (trigonometric ratio)



Maths

Cutub: Trigonometry

Natiijo

Waxaan dooran karaa saamiga trigonometric (trigonometric ratio) ku habboon si aan u xalliyo dhibaatooyinka saddexagalka qumman (right-angled triangles).

Erayada muhiimka ah

Saamivada trigonometric (trigonometric ratios) waa saamivada u dhexeeya labada dherer ee saddexagalka qumman (right-angled triangle):
 $\sin(\theta^\circ) = \frac{\text{ka soo horieeda (opposite)}}{\text{hypotenuse}}$ $\cos(\theta^\circ) = \frac{\text{ku xiga (adjacent)}}{\text{hypotenuse}}$ $\tan(\theta^\circ) = \frac{\text{ka soo horjeeda (opposite)}}{\text{adjacent}}$

Qaabka casharka

Doorashada saamiga saxda ah ee trigonometry (trigonometric ratio)



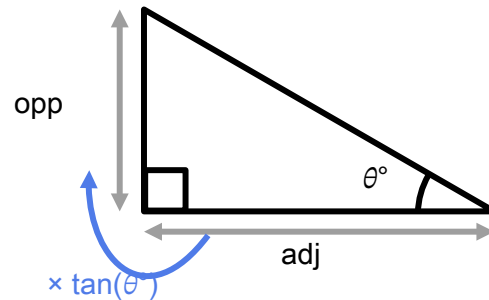
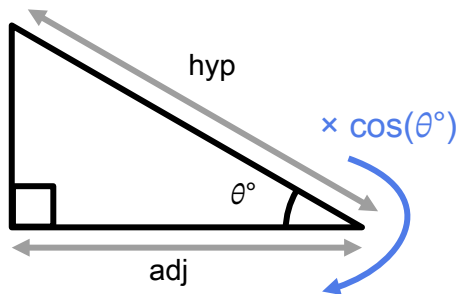
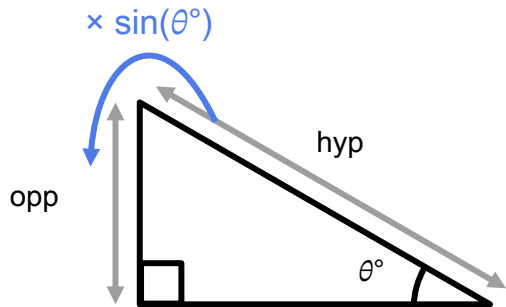
Doorashada shaqada trigonometric (trigonometric function) saxda ah



Isticmaalka saamiyada (ratios)

Saddexagalka, xiriirka saamiyeed (proportional relationship) ee u dhexeeya labada dhinac waxaa go'aamiya xaglaha.

Mid kasta oo ka mid ah shaqooyinka trigonometric (sine, cosine, tangent) waxay helaan isku dhufashada (multiplier) u dhexeeya labada dhinac ee saddexagalka qumman (right-angled triangle) marka la eego mid ka mid ah xaglaha kale.

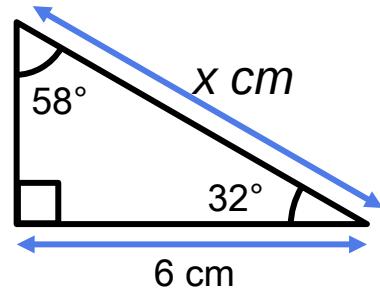


Farsamada (trigonometric function) ee nooc ee ayaan u isticmaali karnaa si aan u xisaabino qiimaha (value) x ?



Sine - 6 cm waa dhinaca ka soo horjeeda (opposite) 58° iyo x waa hypotenuse.

Maya, cosine - 6 cm waa dhinaca ku xiga (adjacent) 90° iyo 32° iyo x waa hypotenuse.



Labadooduba waa sax yihiin. Waxay doorteen inay isticmaalaan xagal diirad (focus angle) oo kala duwan.



Doorashada farsamada saxda ah (trigonometric function)

Farsamada (trigonometric function) ee nooc ee ayaan u isticmaali karnaa si aan u xisaabino qiimaha (value) x ?

$$\sin(58^\circ) = \frac{6}{x}$$

$$x = \frac{6}{\sin(58^\circ)}$$

$$x = 7.1 \text{ cm (1dp)}$$



Yacquub

Labaduba waxay si sax ah u xisaabiyaan x .

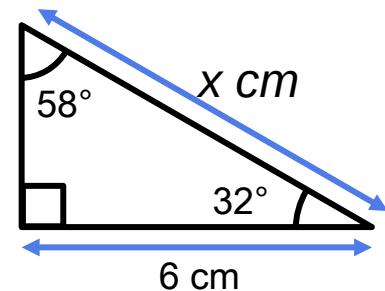
$$\cos(32^\circ) = \frac{6}{x}$$

$$x = \frac{6}{\cos(32^\circ)}$$

$$x = 7.1 \text{ cm (1dp)}$$



Cali



Doorashada shaqada trigonometric (trigonometric function) ee saxda ah

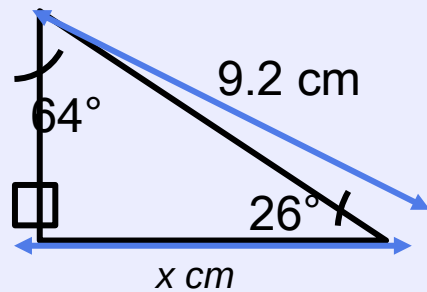
Haddii 26° uu yahay xagasha diiradda (focus angle), doorashada shaqada trigonometric (trigonometric function) ee aad isticmaali doonto si aad u xisaabiso qiimaha (value) x ?

a sine

b cosine



c tangent

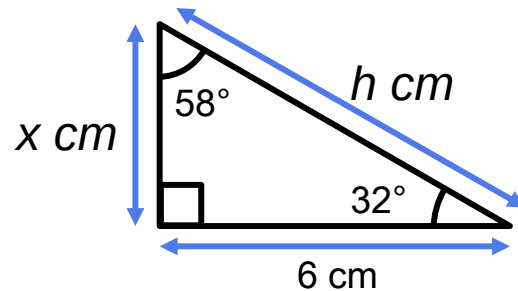


Marka la eego macluumaadkan, waa kuwee hababka loo isticmaali karo si loo xisaabiyo qiimaha (value) x ?

Waxaan isticmaali lahaa sine, si aan u xisaabiyo dhererka hypotenuse, ka dibna mar kale sine si aan u xisaabiyo x .



Axmed



$$\sin(58^\circ) = \frac{6}{h}$$

$$h = \frac{6}{\sin(58^\circ)}$$

$$h = 7.07\dots$$

$$= 7.1 \text{ (1dp)}$$

$$\sin(32^\circ) = \frac{x}{7.07\dots}$$

$$x = 7.07\dots \times \sin(32^\circ)$$

$$= 3.7 \text{ (1dp)}$$

Marka la eego macluumaadkan, waa kuwee hababka loo isticmaali karo si loo xisaabiyo qiimaha (value) x ?

Waxaan isticmaali lahaa cosine (cosine), si aan u xisaabiyo dhererka hypotenuse-ka (hypotenuse), ka dibna isticmaal sine (sine) si aan u xisaabiyo x .



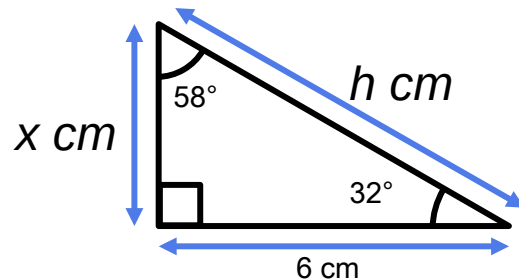
Caasha

$$\cos(32^\circ) = \frac{6}{h}$$

$$h = \frac{6}{\cos(32^\circ)}$$

$$h = 7.0750\dots$$

$$= 7.1 \text{ (1dp)}$$



$$\sin(32^\circ) = \frac{x}{7.07\dots}$$

$$x = 7.07\dots \times \sin(32^\circ)$$

$$x = 3.7 \text{ (1dp)}$$

Marka la eego macluumaadkan, waa maxay hababka loo isticmaali karo si loo xisaabiyo dhererka x?

Waxaan isticmaali lahaa cosine (cosine) ama sine (sine), si aan u xisaabiyo dhererka hypotenuse-ka (hypotenuse), ka dibna isticmaal Aragtida Pythagoras (Pythagoras' Theorem).



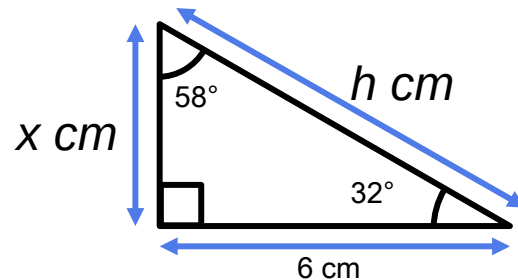
Nuur

$$\cos(32^\circ) = \frac{6}{h}$$

$$h = \frac{6}{\cos(32^\circ)}$$

$$h = 7.07\dots$$

$$= 7.1 \text{ (1dp)}$$



$$x^2 = h^2 - 6^2$$

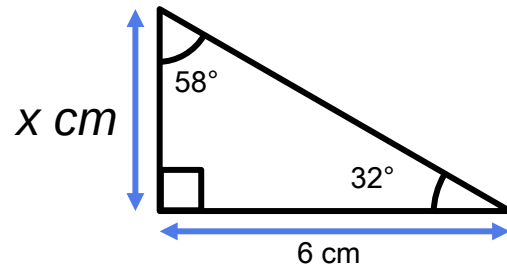
$$x^2 = 7.07\dots^2 - 6^2$$

$$x^2 = 14.05662145$$

$$x = \sqrt{14.05662145}$$

$$x = 3.7 \text{ (1d.p.)}$$

Markay macluumaadkani yihiin, waa kuwee hababka loo isticmaali karo si loo xisaabiyo dhererka x?



Waxaan kaliya isticmaali lahaa tangent (tangent) si aan u helo x.



Suad

$$\tan(32^\circ) = \frac{x}{6}$$

$$x = 6 \times \tan(32^\circ)$$

$$x = 3.7 \text{ (1dp)}$$

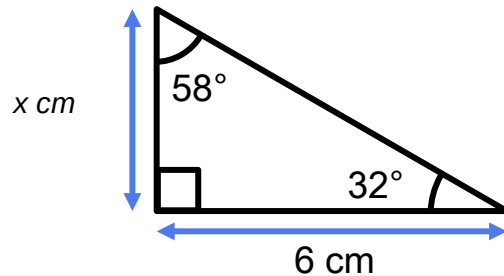
Habka ugu waxtarka badan ee loo xisaabiyo x waa isticmaalka shaqada tangent (tangent function).

Ma dhammaan hababkani waa isku mid (equivalent) baa?

$$\tan(32^\circ) = \frac{x}{6} \quad \checkmark$$

$$\tan(32^\circ) = \frac{6}{x} \quad \times$$

$$\tan(58^\circ) = \frac{6}{x} \quad \checkmark$$



Haddii xagasha diiradda la saaro ay tahay 32° , markaas opposite (ka soo horjeeda) waa x cm, adjacent (ku xiga) waa 6 cm.

Haddii xagasha diiradda la saaro ay tahay 58° , markaas opposite (ka soo horjeeda) waa 6 cm, adjacent (ku xiga) waa x cm.

Marka la isticmaalo shaqada tangent (tangent function), waxaa muhiim ah in la hubiyo in 'opposite' (ka soo horjeeda) ee xagasha la doortay loo qaybiyo 'adjacent' (ku xiga).

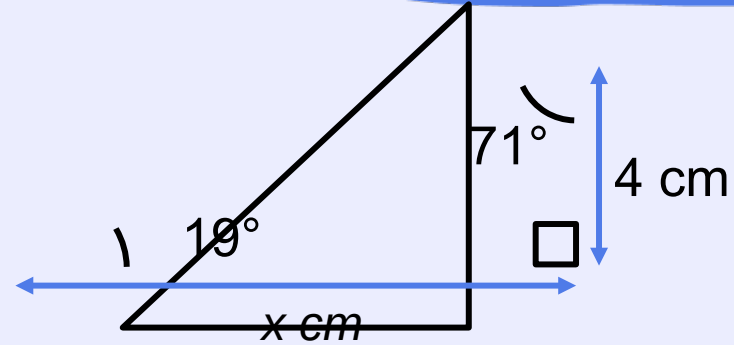
Doorashada shaqada trigonometric (trigonometric function) ee saxda ah



Hubi

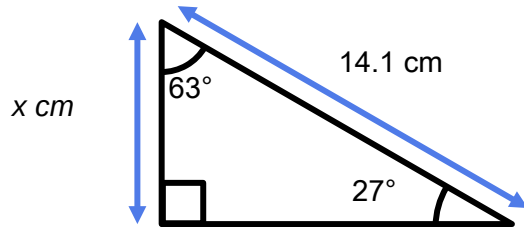
Dhammeystir isla'egta (equation).

$$\tan (71^\circ) = \frac{x}{4}$$



Habka ugu waxtarka badan ee loo xisaabiyo x halkan waa isticmaalka sine function, laakiin ma jiraa qaab kale?

Xagasha saddexaad ee saddex-xagalkan waxaa loo xisaabin karaa 63° , markaas geeska lagu calaamadeeyay x waa kuwa ku xiga (adjacent) xagasha saddexaad, waxaana loo isticmaali karaa cosine (cosine) beddelkeeda.



$$\sin(27^\circ) = \frac{x}{14.1}$$

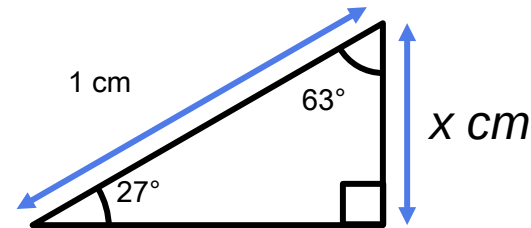
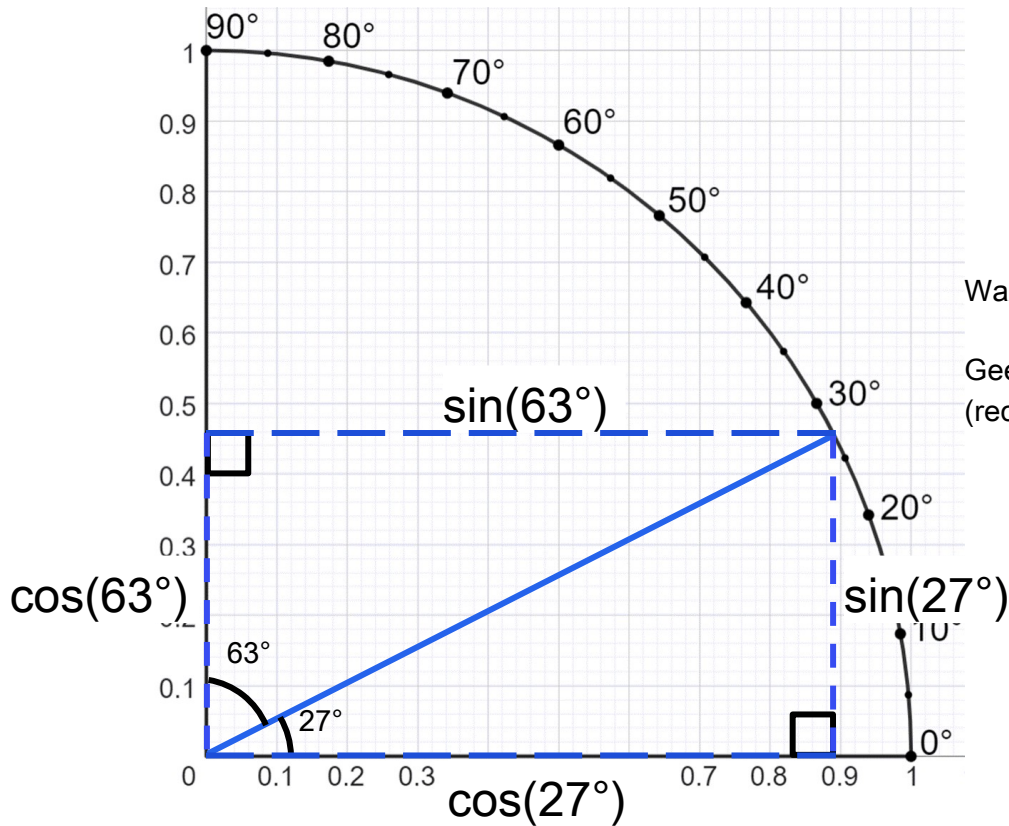
$$\cos(90^\circ - 27^\circ) = \frac{x}{14.1}$$

$$\cos(63^\circ) = \frac{x}{14.1}$$

Tani had iyo jeer waa sidaas oo kale, waxayna u shaqeysaa jihada kale sidoo kale.



Layla



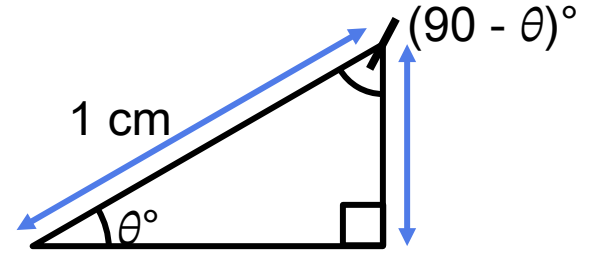
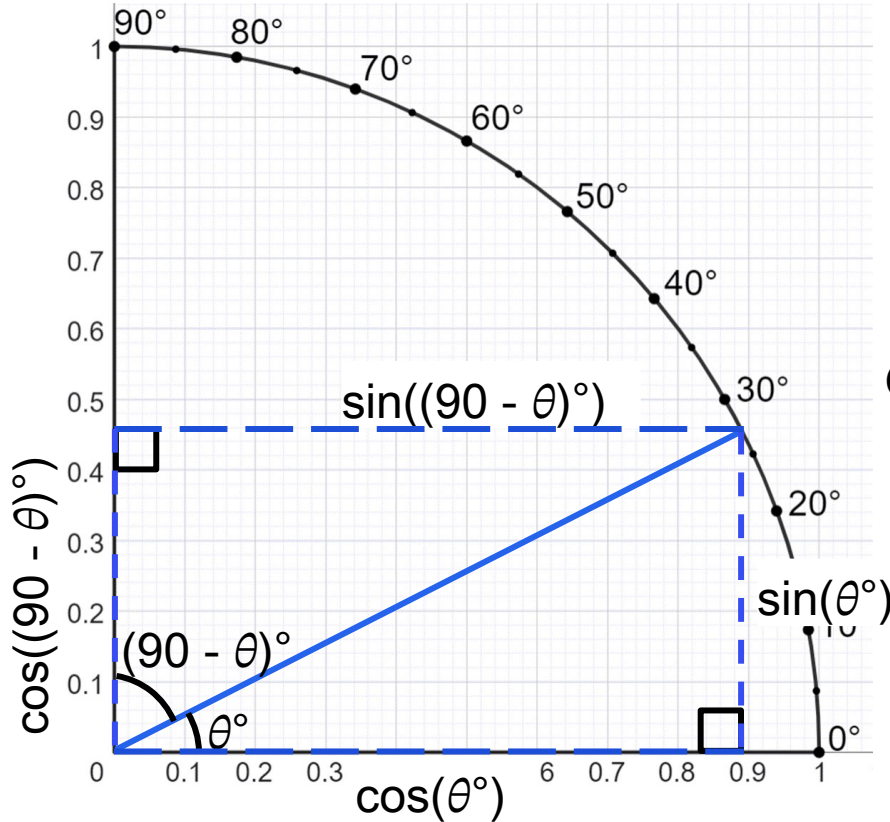
Waxan tan ku arki karnaa goobta halbeegga (unit circle).

Geeso iska soo horjeeda (Opposite edges) ee leexleex (rectangle) waa siman yihiin.

$$\sin(27^\circ) = \cos(63^\circ)$$

$$\sin(63^\circ) = \cos(27^\circ)$$

Doorashada shaqada trigonometric-ga saxda ah



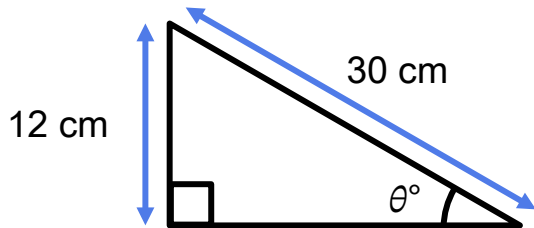
Guud ahaan,

$$\sin(\theta^\circ) = \cos(90^\circ - \theta^\circ)$$

$$\sin(90^\circ - \theta^\circ) = \cos(\theta^\circ)$$

Saddex xagal kasta oo qumman (right-angled), haddii la siiyo laba dherer oo gees ah ama hal gees iyo hal xagal oo kale, dhammaan saddexda shaqo ee trigonometric-ga waa la isticmaali karaa.

Si kastaba ha ahaatee, mid ayaa caadi ahaan ka waxtar badan labada kale su'aasha kasta.



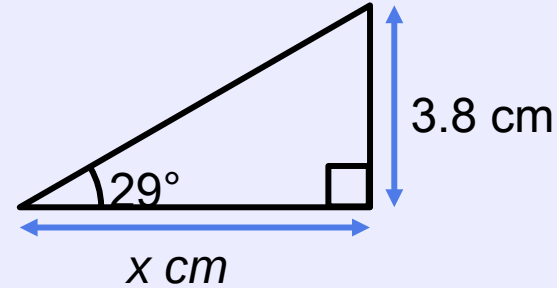
Marka la eego macluumaadkan oo la weydiisto in la xisaabiyo qiimaha θ iyadoo la isticmaalayo sine waxay noqon doontaa habka ugu waxtarka badan.

Shaqada trigonometric-ga ee ugu fiican su'aashan waa kee?

a sine

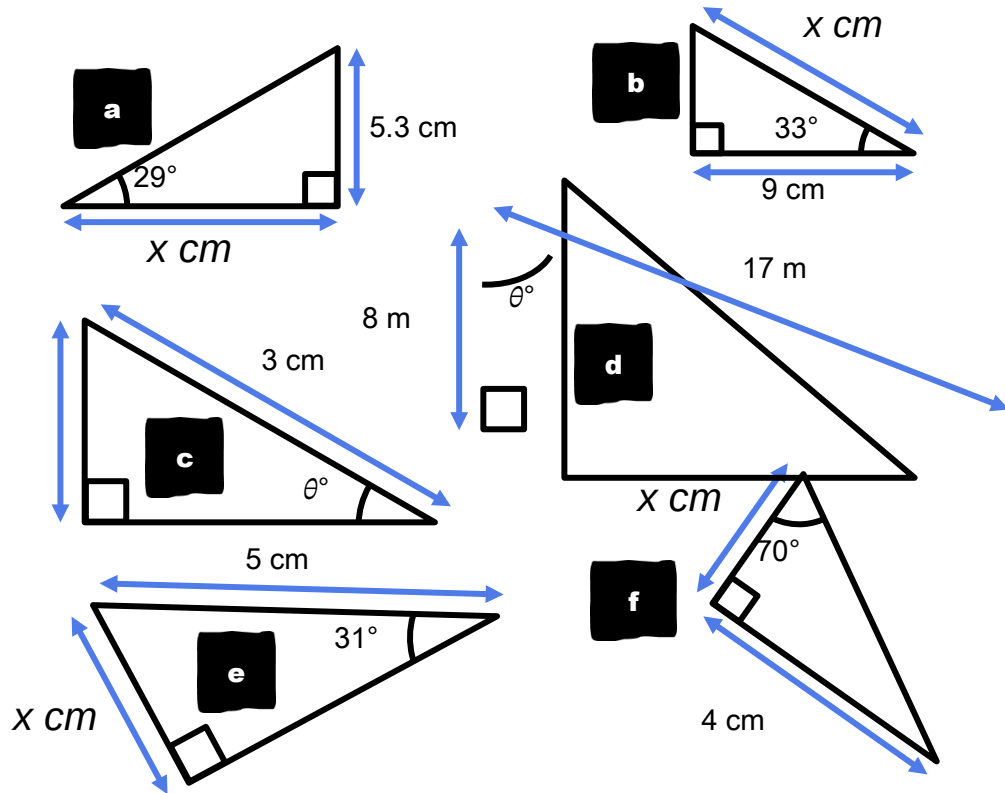
b cosine

c tangent ✓

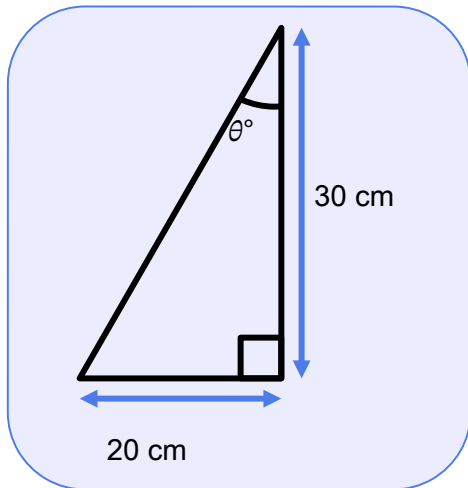


1) Kala saar saddexagalladan shaxda, iyadoo la eegayo shaqada trigonometric-ka ugu habboon (most efficient trigonometric function).

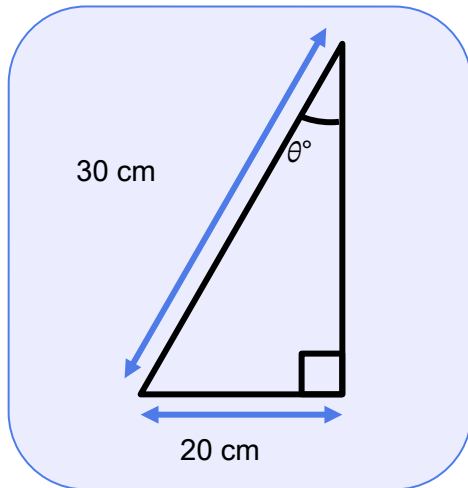
sine (sine)	cosine (cosine)	tangent (tangent)



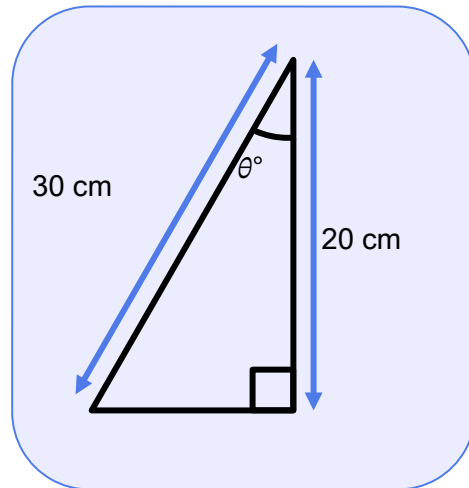
2) Isku dhig isla'egta (equation) iyo saddexagalka saxda ah.



$$\sin(\theta^\circ) = \frac{20}{30}$$



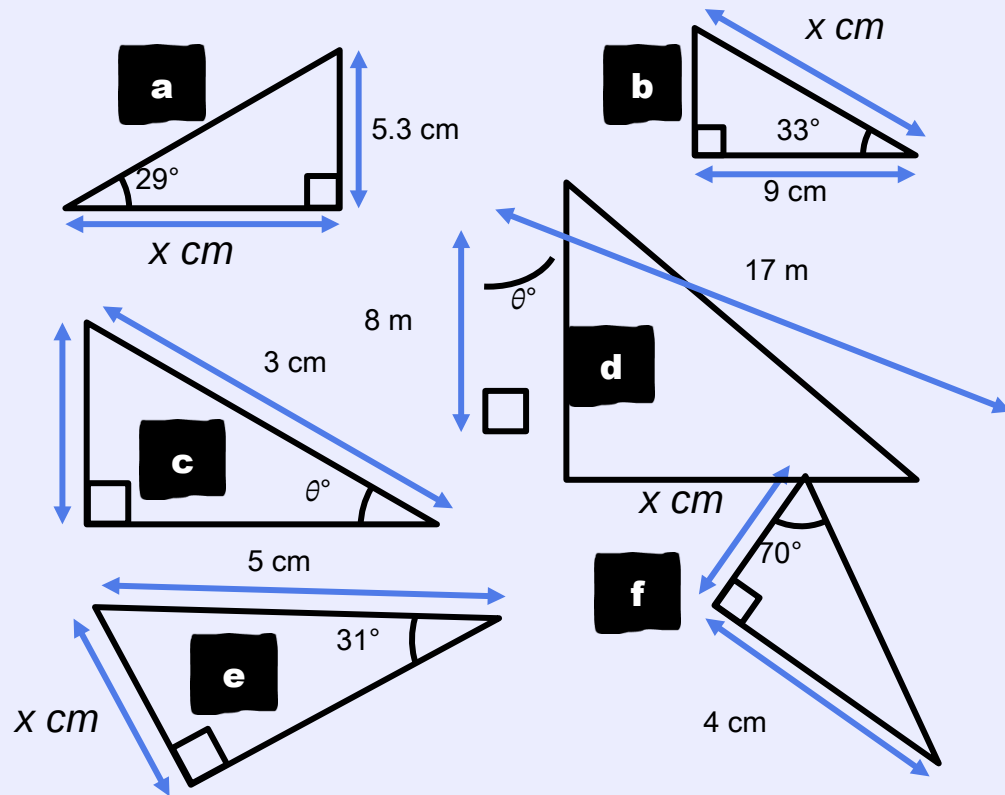
$$\cos(\theta^\circ) = \frac{20}{30}$$



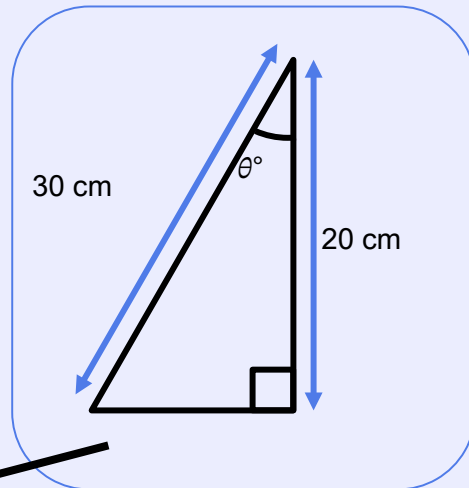
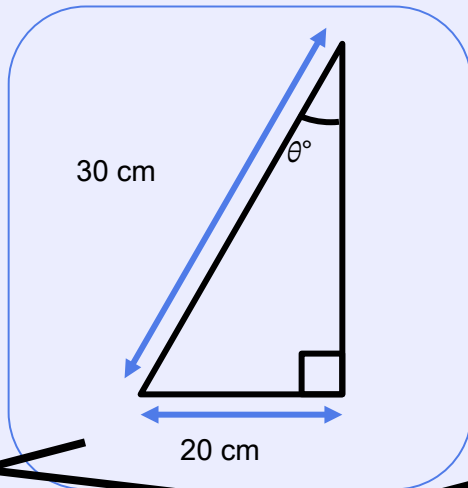
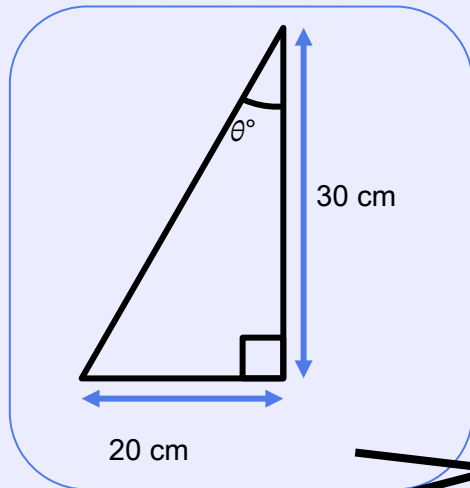
$$\tan(\theta^\circ) = \frac{20}{30}$$

1) Kala saar saddexagalladan (triangles) shaxda, iyadoo la tixgelinayo shaqada trigonometric-ga ugu habboon.

sine	cosine	tangent
c	b	a
e	d	f



2) Ku xiriir isla'egta (equation) saddexagalka saxda ah.



$$\sin(\theta^\circ) = \frac{20}{30}$$

$$\cos(\theta^\circ) = \frac{20}{30}$$

$$\tan(\theta^\circ) = \frac{20}{30}$$

Qaabka casharka

Doorashada saamiga trigonometric (trigonometric ratio) ee saxda ah

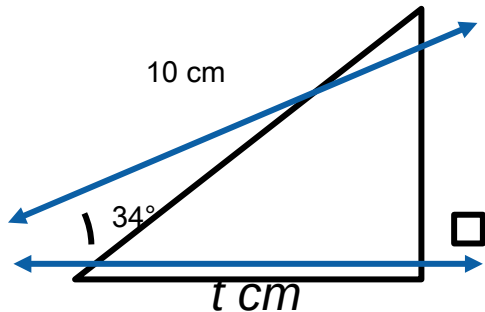


Doorashada shaqada trigonometric (trigonometric function) ee saxda ah



Isticmaalka saamiyada (ratios)

Shaqooyinka trigonometric (trigonometric functions) waxay u oggolaadaan xisaabinta xagal (angle) ama dhererka dhinaca (edge length).

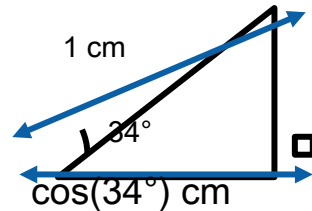


Xisaabi dhererka t , ilaa 1 d.p.

$$t = 10 \times \cos(34^\circ)$$

$$t = 8.3 \text{ cm}$$

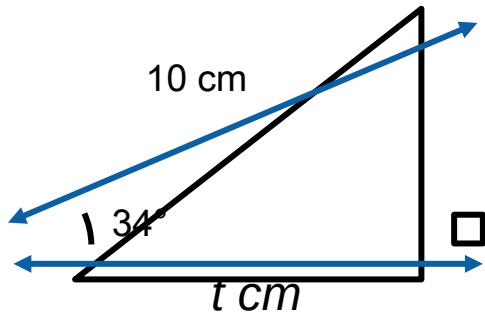
Isticmaalka saddexagalka qeexida (definition triangle).



adj	$\cos(34^\circ)$	t
hyp	1	10

$\times 10$ (arrow from $\cos(34^\circ)$ to t)
 $\times \cos(34^\circ)$ (arrow from 1 to t)
 $\times 10$ (arrow from 1 to 10)

Hawlaha trigonometric-ga waxay u oggolaadaan in xagal ama dhererka gees la xisaabiyo.



Xisaabi dhererka t , ilaa 1 d.p.

Isticmaalka qaacidada (Using the formula).

$$\cos(\theta^\circ) = \frac{\text{adj}}{\text{hyp}}$$

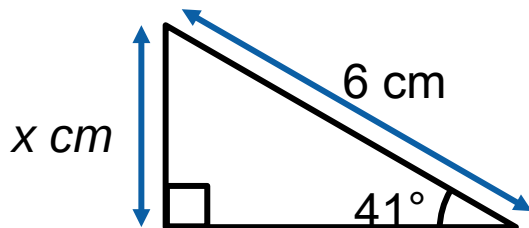
$$\cos(34^\circ) = \frac{t}{10}$$

$$t = 10 \times \cos(34^\circ)$$

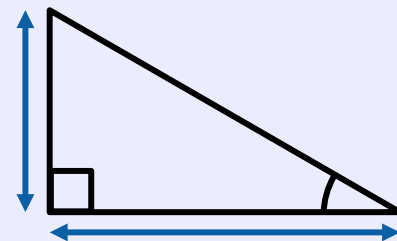
$$t = 8.3 \text{ cm}$$

Isticmaalka saamiyada (Using the ratios)

Raadi qiimaha x , ilaa 1 d.p.

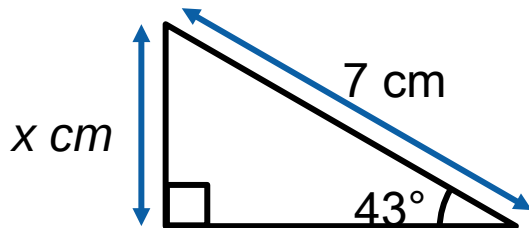


opp (opp)	$\sin(41^\circ)$	r	$\times \sin(41^\circ)$
hyp (hyp)	1	6	



opp (opp)	$\tan(29^\circ)$	y	$\times \tan(29^\circ)$
adj (adj)	1	4	

Raadi qiimaha (value) x , ilaa 1 d.p.



$$\sin(43^\circ) = \frac{x}{7}$$

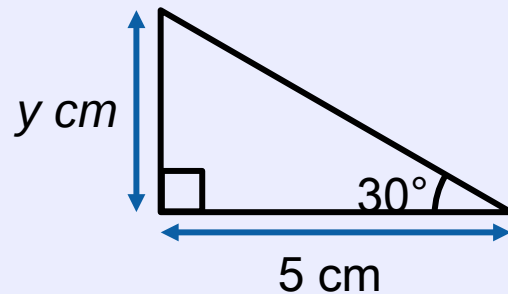
$$x = 7 \times \sin(43^\circ)$$

Jawaabaha:

$$x = 4.8 \text{ cm}$$

$$y = 2.9 \text{ cm}$$

Raadi qiimaha (value) y , ilaa 1 d.p.



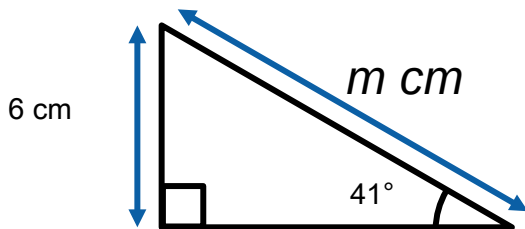
$$\tan(30^\circ) = \frac{y}{5}$$

$$y = 5 \times \tan(30^\circ)$$

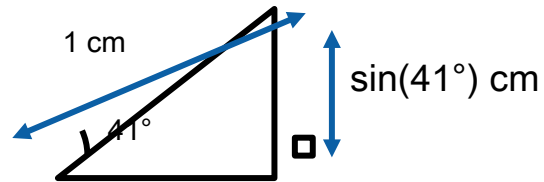
Mid kasta oo ka mid ah saamiyada (ratios) wuxuu ku darayaa laba gees. Sida aan u xisaabino waxay ku xiran tahay geeska ay yihiin.

Isticmaalka saddexagalka qeexida (definition triangle).

Raadi dhererka m , ilaa 1 d.p.



$$m = \frac{6}{\sin(41^\circ)} = 9.1 \text{ cm}$$



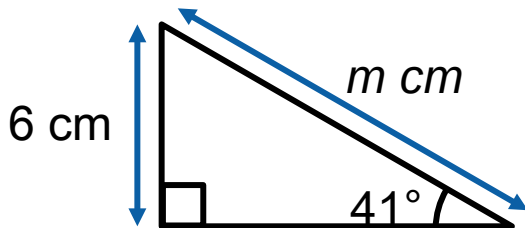
$$\begin{array}{|c|c|} \hline \sin(41^\circ) & 6 \\ \hline 1 & m \\ \hline \end{array}$$

Diagram illustrating the derivation of the formula for m using the definition triangle. The diagram shows a table with two rows and two columns. The top row contains $\sin(41^\circ)$ and 6. The bottom row contains 1 and m . Blue arrows indicate the operations: $\times \sin(41^\circ)$ on the left, $\times \frac{6}{\sin(41^\circ)}$ on the right, and $\div \sin(41^\circ)$ on the right.

Isticmaalka saamiyada (ratios)

Mid kasta oo ka mid ah saamiyada (ratios) wuxuu ku darayaa laba gees. Sida aan u xisaabino waxay ku xiran tahay geeska ay yihiin.

Soo hel dhererka m , ilaa 1 d.p.



Isticmaal qaacidada (formula).

$$\sin(\theta^\circ) = \frac{\text{opp}}{\text{hyp}}$$

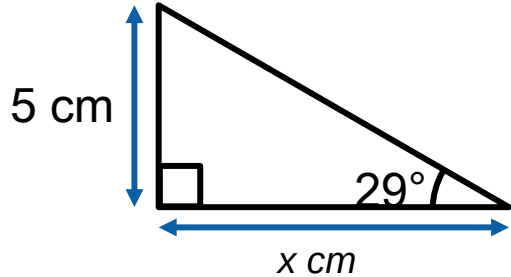
$$\sin(41^\circ) = \frac{6}{m}$$

$$m \times \sin(41^\circ) = 6$$

$$m = \frac{6}{\sin(41^\circ)} = 9.1 \text{ cm}$$

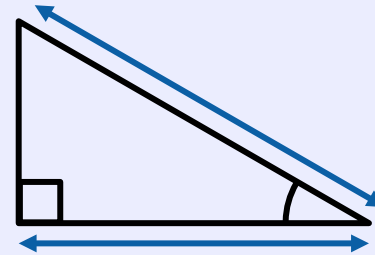
Isticmaal saamiga (ratios)

Soo hel qiimaha (value) x ilaa 1 d.p.



$\tan(29^\circ)$	
1	

Dhinaca lagu calaamadeeyay x waa 9.0 cm dhererkiisu (1 d.p.).

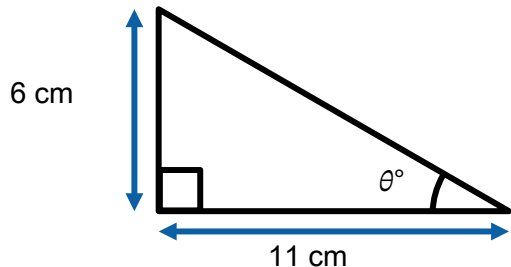


$\cos(34^\circ)$	8
1	y

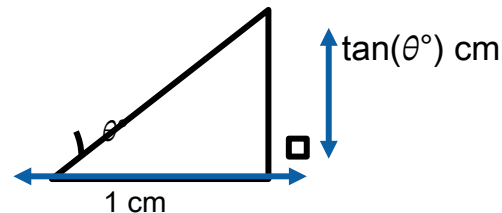
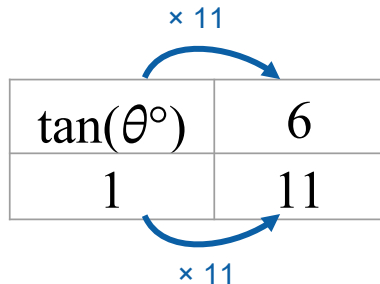
Dhinaca y waa 9.6 cm dhererkiisu (1 d.p.).

Xagasha sidoo kale waa la xisaabin karaa haddii labada gees la ogaado.

Raadi θ , ilaa darajo ugu dhow.



Isticmaalka saddexagalka qeexida (definition triangle).



$$11 \tan(\theta^\circ) = 6$$

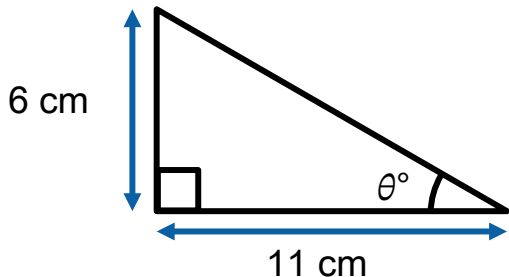
$$\tan(\theta^\circ) = \frac{6}{11}$$

$$\theta^\circ = \tan^{-1}\left(\frac{6}{11}\right)$$

$$\theta^\circ = 29^\circ$$

Xagasha (angle) waxaa sidoo kale la xisaabin karaa haddii labada gees (edges) la yaqaan.

Raadi θ , ilaa darajada (degree) ugu dhow.



Isticmaalka qaacidada (formula).

$$\tan(\theta^\circ) = \frac{\text{opp}}{\text{adj}}$$

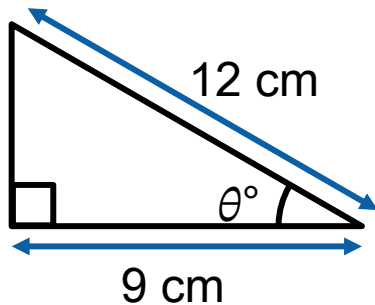
$$\tan(\theta^\circ) = \frac{6}{11}$$

$$\theta^\circ = \tan^{-1}\left(\frac{6}{11}\right)$$

$$\theta^\circ = 29^\circ$$

Isticmaalka saamiyada (ratios)

Raadi cabbirka (size) θ , ilaa darajada (degree) ugu dhow.



$\cos(\theta^\circ)$	
1	

$\times 12$

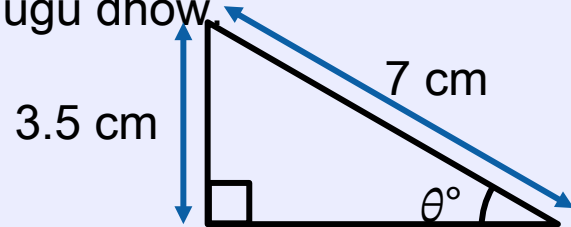
$$12\cos(\theta^\circ) = 9$$

$$\cos(\theta^\circ) = 0.75$$

$$\theta^\circ = \cos^{-1}(0.75)$$

$$\theta^\circ = 41^\circ$$

Raadi cabbirka (size) θ , ilaa darajada (degree) ugu dhow.



$\sin(\theta^\circ)$	3.5
1	7

$\times 7$

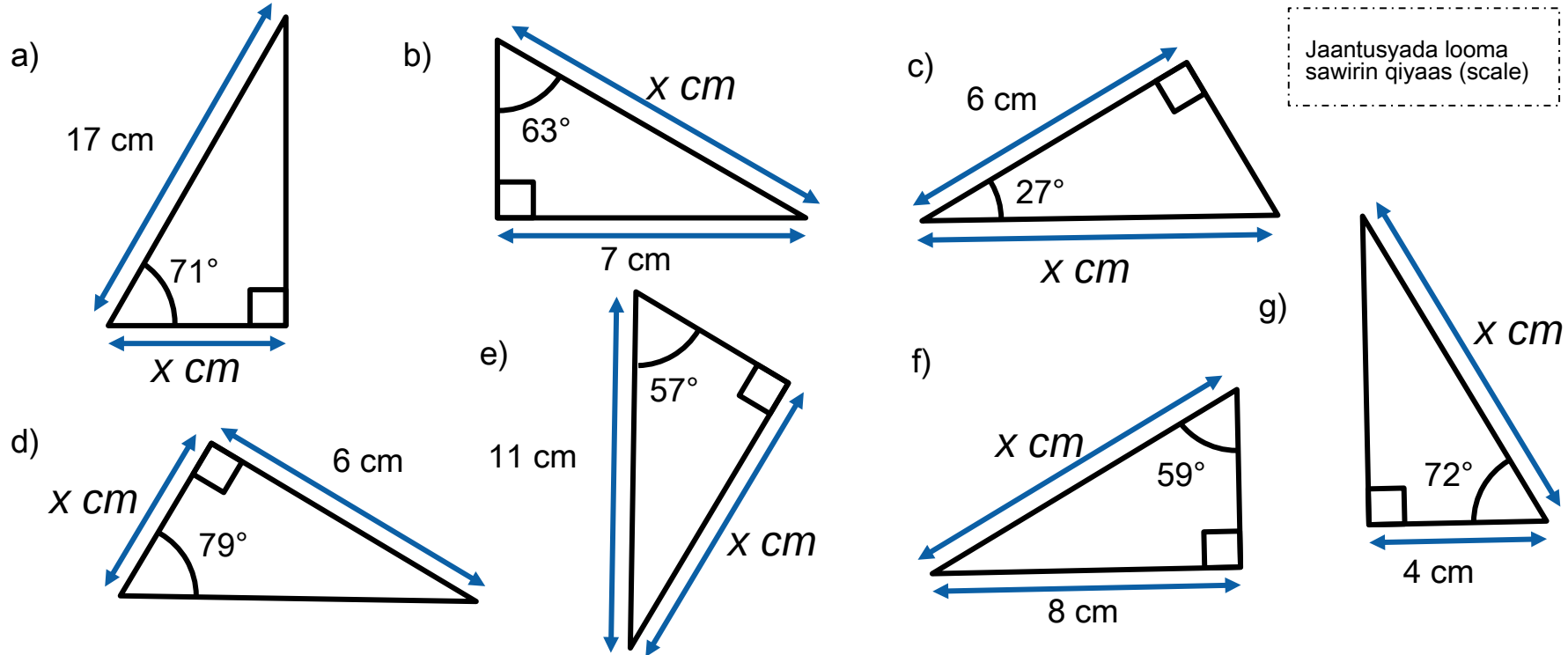
$$7\sin(\theta^\circ) = 3.5$$

$$\sin(\theta^\circ) = 0.5$$

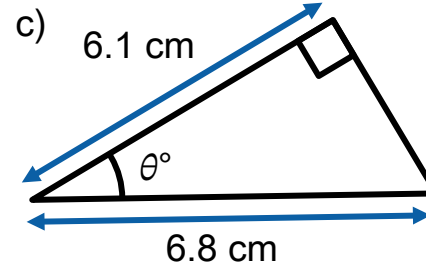
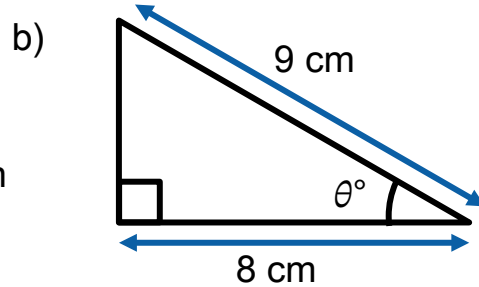
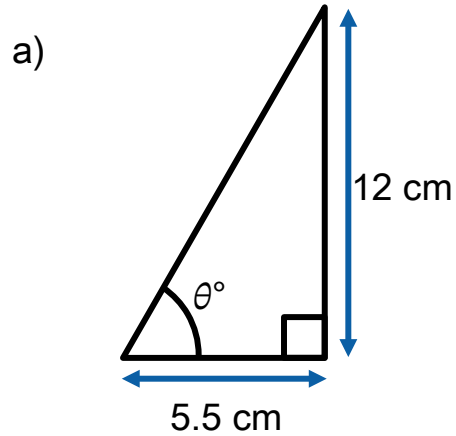
$$\theta^\circ = \sin^{-1}(0.5)$$

$$\theta^\circ = 30^\circ$$

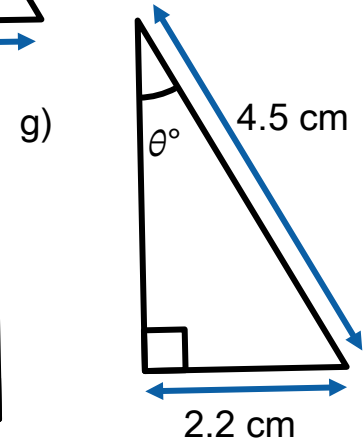
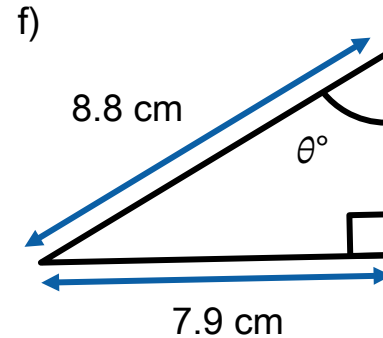
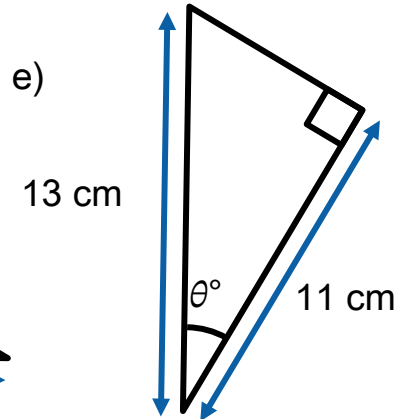
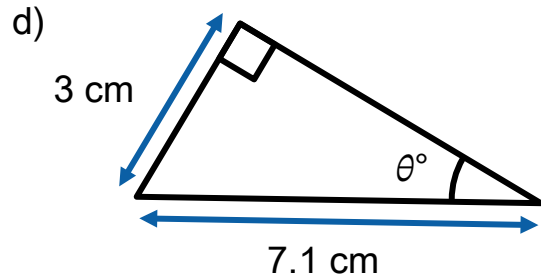
1) Xisaabi dhererka geeska lagu calaamadeeyay x, adigoo ku celinaya jawaabaha 1d.p.



2) Xisaabi cabbirka xagasha lagu calaamadeeyay θ , adigoo ku celinaya jawaabta 1d.p.

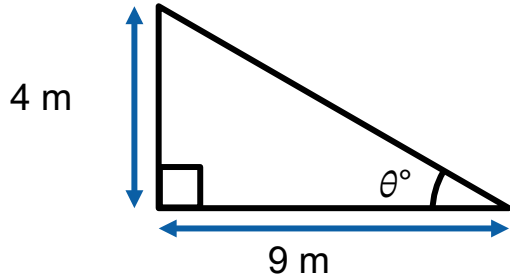


Jaantusyada looma sawirin qiyaas (scale)

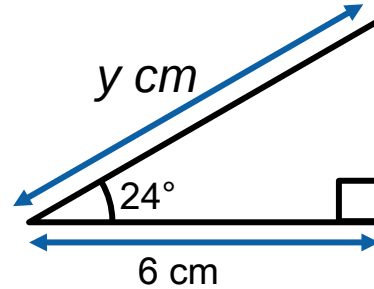


3) Xisaabi cabbirka xagasha lagu calaamadeeyay θ ama cidhifka lagu calaamadeeyay y , adigoo ku siinaya jawaabtaada 1d.p.

a)

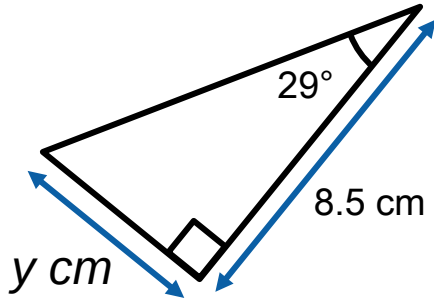


b)

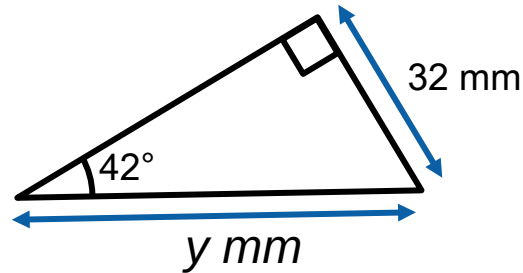


Jaantusyada looma
sawirin miisaan (scale)

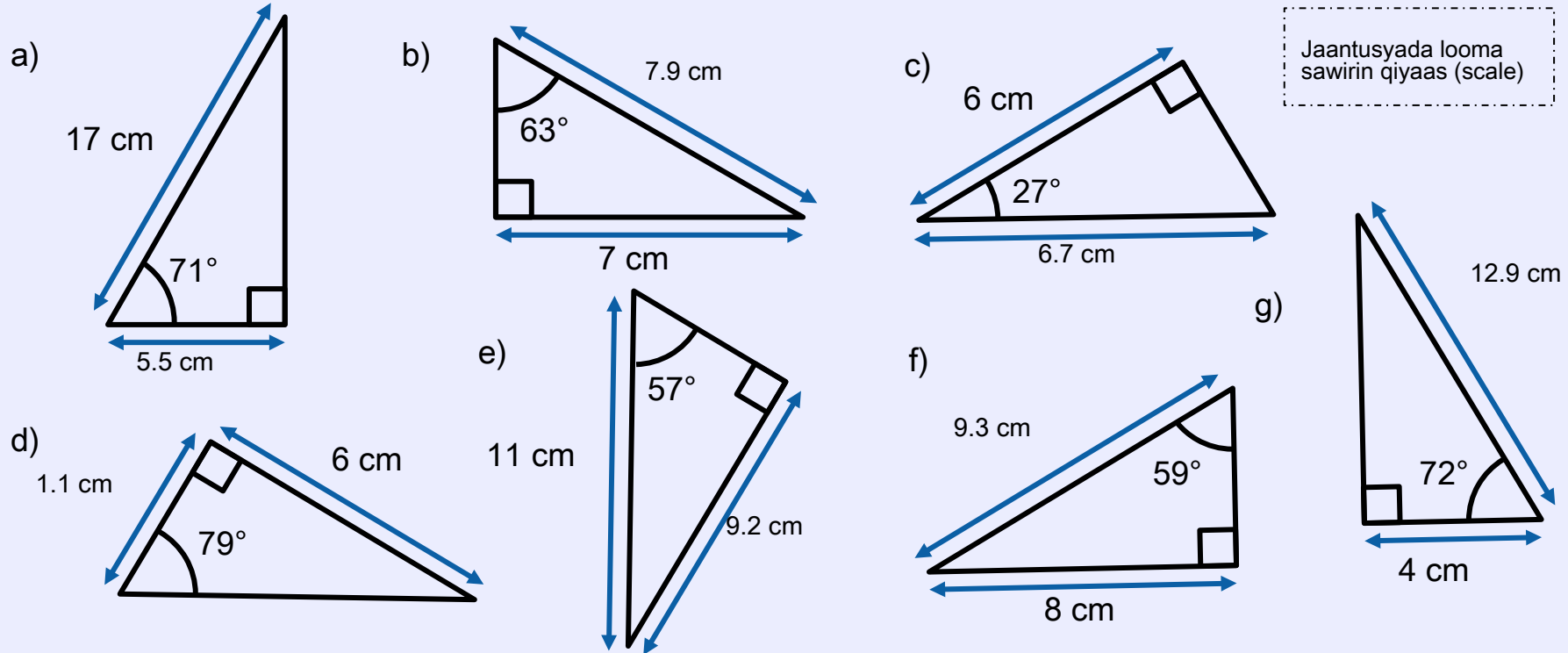
c)



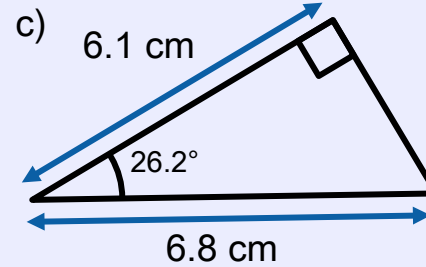
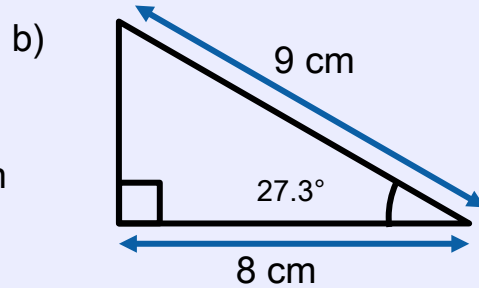
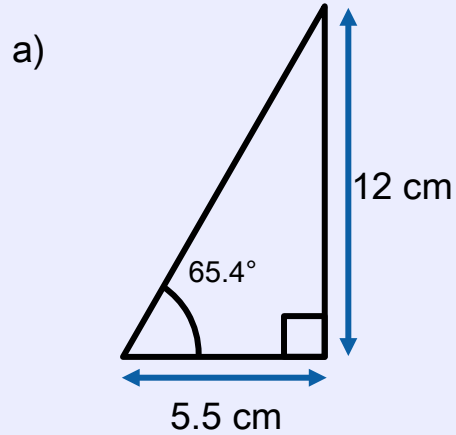
d)



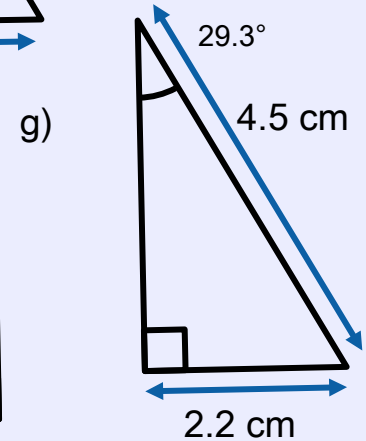
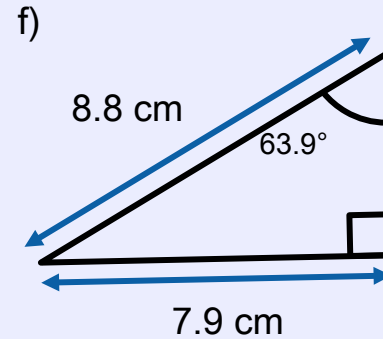
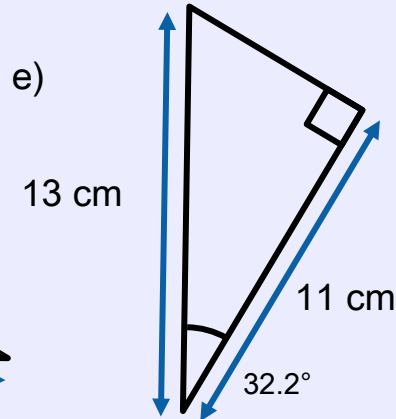
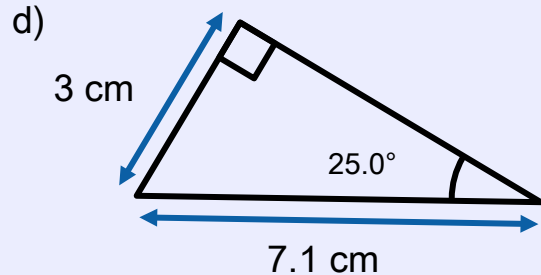
1) Xisaabi dhererka geeska lagu calaamadeeyay x, adigoo ku celinaya jawaabtaada 1d.p.



2) Xisaabi cabbirka xagasha lagu calaamadeeyay θ , adigoo ku celinaya jawaabtaada 1d.p.

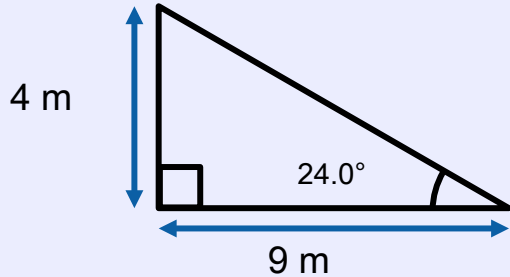


Jaantusyada looma
sawirin qiyaas (scale)

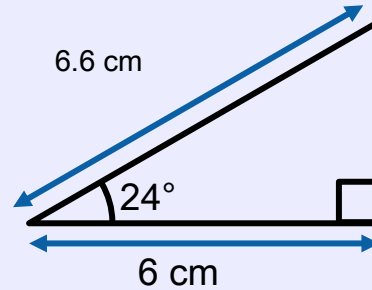


3) Xisaabi cabbirka xagasha lagu calaamadeeyay θ ama cidhifka lagu calaamadeeyay y , kuna soo celi jawaabtaada 1d.p.

a)

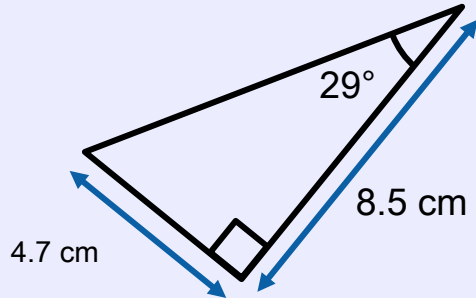


b)

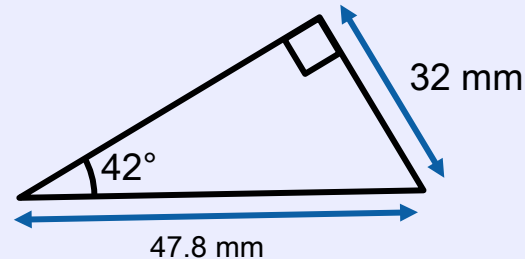


Jaantusyada looma
sawirin cabbir (scale)

c)



d)



Saamiyada trigonometric-ga (trigonometric ratios) waxay qeexayaan xiriirka saamiyeed ee u dhexeeya laba dherer oo ku yaal saddex-xagal quman (right-angled triangle) iyadoo lagu salaynayo cabbirka xagasha diiradda la saaray.

Go'aaminta saamiga (ratio) la isticmaalo waa tillaabada koowaad ee lagu jawaabo su'aasha trigonometry-ga.

Mararka qaarkood waxa aad u baahan tahay in aad xisaabiso laguma gaaro xisaab kaliya, marka tixgeli waxa aad ku xisaabin karto macluumaadka la siiyay marka hore. Tixgeli saxnaanta (accuracy), hana ku soo wareejin (round) ilaa jawaabta kama dambaysta ah.