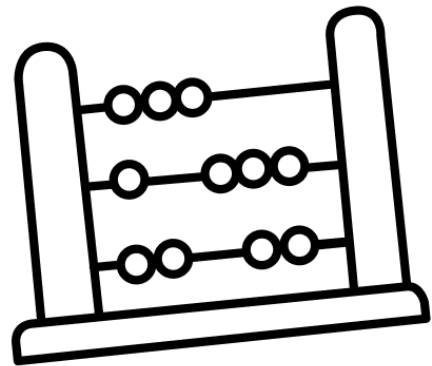


Doorashada hab ku habboon helista dhererka saddexagalka

Maths

Cutub: Trigonometry (Xisaabta saddexagalka)



Natiijo

Waxaan dooran karaa habka ku habboon si aan u helo dhinaca maqan ee saddexagal qumman (right-angled triangle).

Erayada muhiimka ah

Saamiyada trigonometric (trigonometric ratios) waa saamiyo u dhexeeya laba dherer oo saddexagal qumman ah:

$\sin(\theta^\circ) = \frac{\text{opposite}}{\text{hypotenuse}}$ (ka soo horjeeda)
 $\cos(\theta^\circ) = \frac{\text{adjacent}}{\text{hypotenuse}}$ (ku xiga)
 $\tan(\theta^\circ) = \frac{\text{opposite}}{\text{adjacent}}$ (ka soo horjeeda)

Doorashada hab ku habboon helista dhererka
saddexagalka

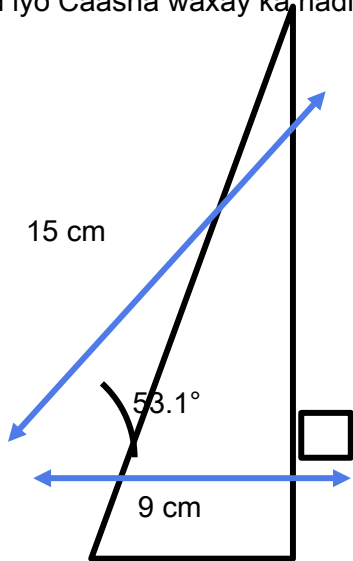


Trigonometry (Xisaabta saddexagalka) iyo waxa aan ahayn



Isticmaalka dhabta ah ee trigonometry (Xisaabta saddexagalka)

Axmed iyo Caasha waxay ka hadlayaan sida ay u heli lahaayeen wareega (perimeter) saddexagalkan.



Caasha

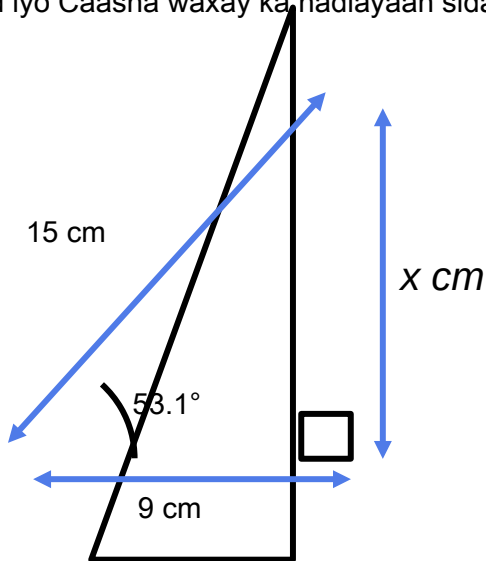
Marka waxaan u baahanahay inaan xisaabino cidhifka saddexaad marka hore.

Wareega (perimeter) waa wadarta cidhifyada.



Axmed

Axmed iyo Caasha waxay ka hadlayaan sida ay u heli lahaayeen wareega (perimeter) saddexagalkan.



Caasha

Cidhifka saddexaad ha ahaado x , kaas oo ka soo horjeeda xagasha la siiyay. Waan ogahay dhererka hypotenuse (hypotenuse) marka waxaan isticmaali doonaa sine (sine).

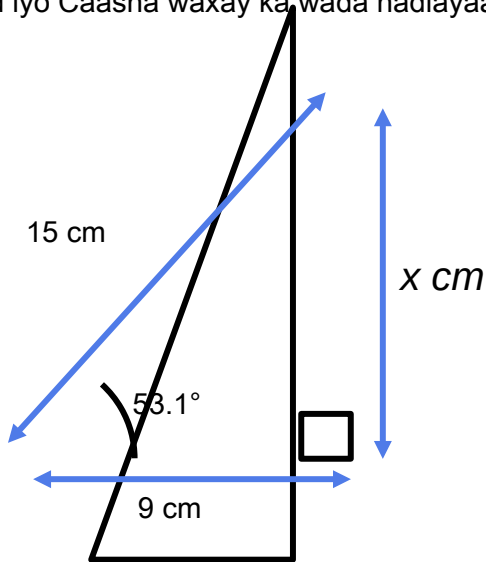
$$x = 15 \times \sin(53.1^\circ) = 12.0 \text{ cm}$$

$$\text{Wareegga (Perimeter)} = 15 + 9 + 12 = 36 \text{ cm}$$



Axmed

Axmed iyo Caasha waxay ka wada hadlayaan sida ay u heli lahaayeen wareegga (perimeter) saddexagalkan.



Caasha

Waxaan isticmaali lahaa aragtida Pythagoras (Pythagoras' theorem) si aan u xisaabiyo dhererka x .

$$15^2 = 9^2 + x^2$$

$$x^2 = 15^2 - 9^2 = 144$$

$$x = 12 \text{ cm}$$

$$\text{Wareegga (Perimeter)} = 15 + 9 + 12 = 36 \text{ cm}$$



Axmed

Macluumaadka la siiyay, waxaad awoodi lahayd...

a

...isticmaalka trigonometry (trigonometry) si loo xisaabiyo labada dherer ee cidhifyada kale

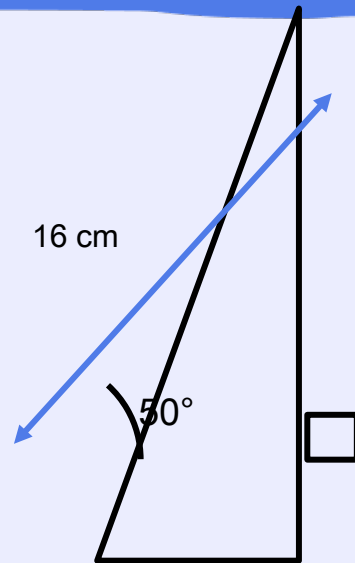


b

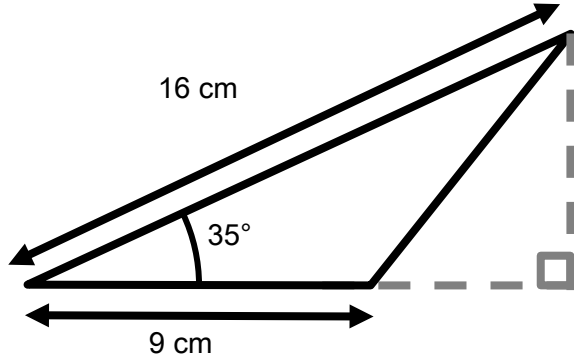
...isticmaalka Aragtida Pythagoras (Pythagoras' Theorem) si loo xisaabiyo labada dherer ee cidhifyada kale

c

...xisaabinta xagasha saddexaad ee saddexagalka



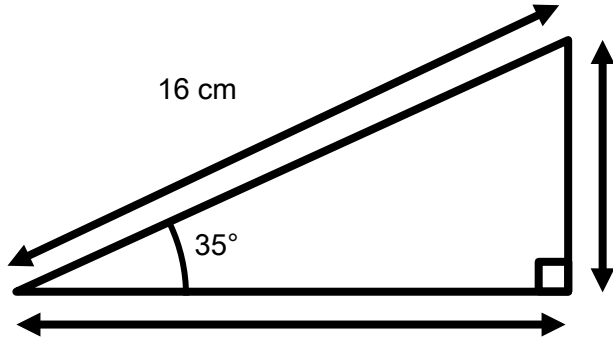
Si loo xisaabiyo wareegga (perimeter) saddexagalkaan, waxaan u baahanahay inaan ogaano dhererka cidhifka saddexaad.



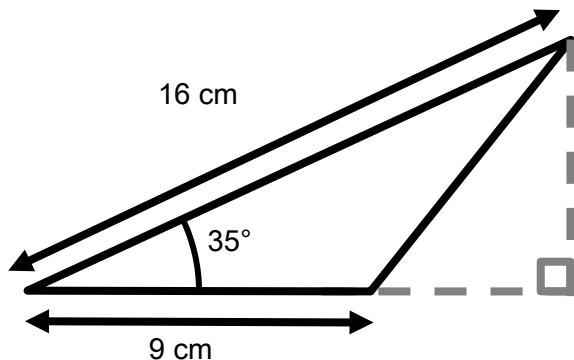
Aragtida Pythagoras (Pythagoras' theorem) iyo hawlo trigonometric (trigonometric functions) waxay u baahan yihiin saddexagallo qumman (right-angled triangles).

Xaggee ayaa saddexagal qumman (right-angled triangle) laga abuuri karaa?

Kordhinta cidhifka saldhiga (base edge) iyo soo dejin khad toosan (perpendicular line).

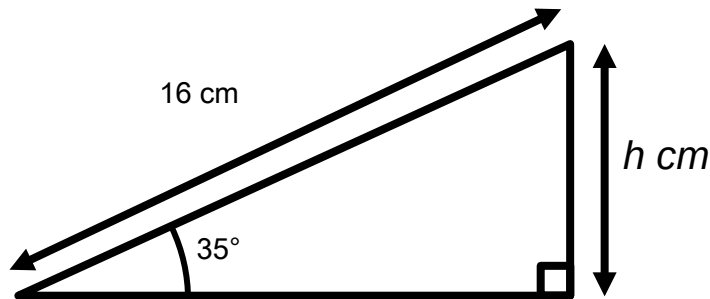


Si loo xisaabiyo wareegga (perimeter) saddexagalkaan, waxaan u baahanahay inaan ogaano dhererka cidhifka saddexaad.



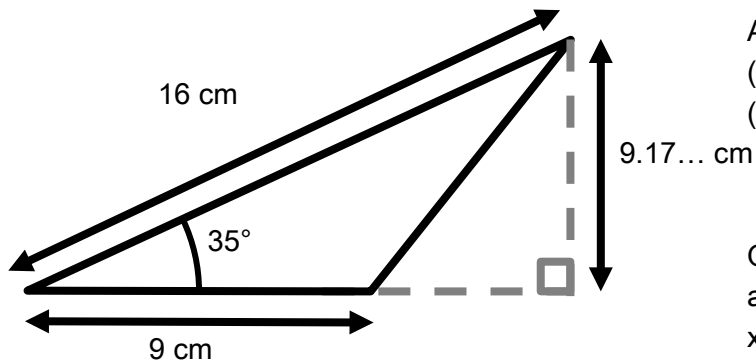
Aragtida Pythagoras (Pythagoras' theorem) iyo hawlo trigonometric (trigonometric functions) waxay u baahan yihiin saddexagallo qumman (right-angled triangles).

Hadda shaqada sine (sine function) ayaa loo isticmaali karaa in lagu xisaabiyo dhinaca ka soo horjeeda (opposite), dhererka tooska ah (vertical height).



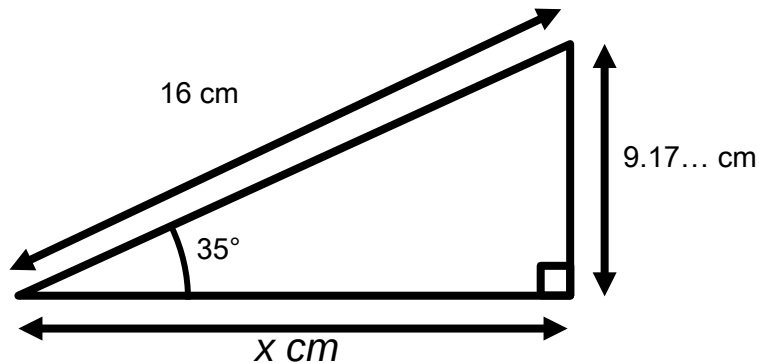
$$h = 16 \times \sin(35^\circ) = 9.177...$$

Si loo xisaabiyo wareegga (perimeter) saddexagalkaan, waxaan u baahanahay inaan ogaano dhererka cidhifka saddexaad.



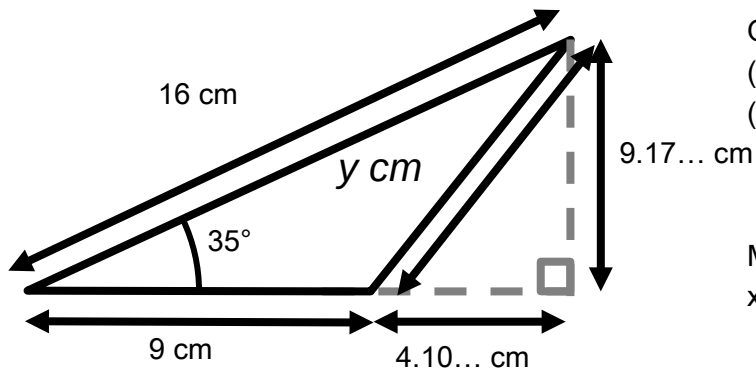
Aragtida Pythagoras (Pythagoras' theorem) iyo hawlo trigonometric (trigonometric functions) waxay u baahan yihiin saddexagallo qumman (right-angled triangles).

Qaaciddada (theorem) Pythagoras, shaqada cosine (cosine function) ama shaqada tangent (tangent function) ayaa loo isticmaali karaa xisaabinta dhererka x.



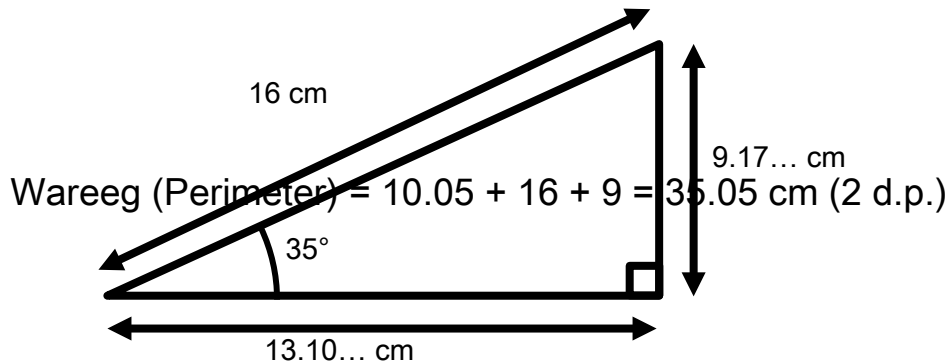
$$x = 16 \times \cos(35^\circ) = 13.10...$$

Si loo xisaabiyo wareegga (perimeter) saddexagalkaan, waxaan u baahanahay inaan ogaano dhererka cidhifka saddexaad.



Qaaciddada (theorem) Pythagoras iyo shaqooyinka trigonometric (trigonometric functions) waxay u baahan yihiin saddexagallo qumman (right-angled triangles).

Markaas qaaciddada (theorem) Pythagoras ayaa loo isticmaali karaa xisaabinta dhererka cidhifka saddexaad.



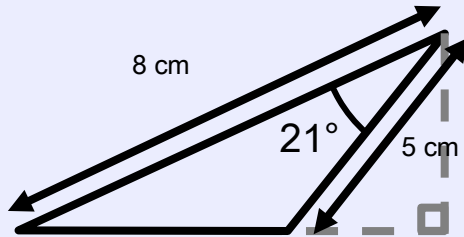
$$y^2 = 4.10...^2 + 9.17...^2$$

$$y^2 = 101.084...$$

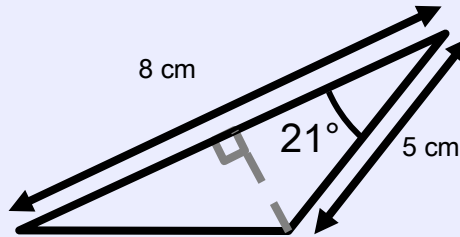
$$y = 10.05...$$

Trigonometry (Trigonometry) ama maya

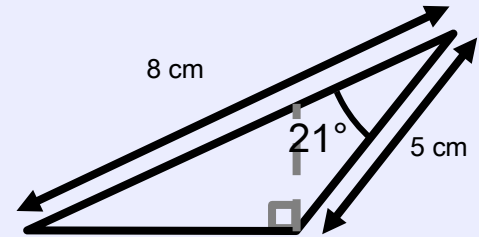
Khadadka dheeraadka ah (additional lines) ee ugu faa'iidada badan xisaabinta dhererka cidhifka saddexaad ee saddexagalka waa kuwee?



a



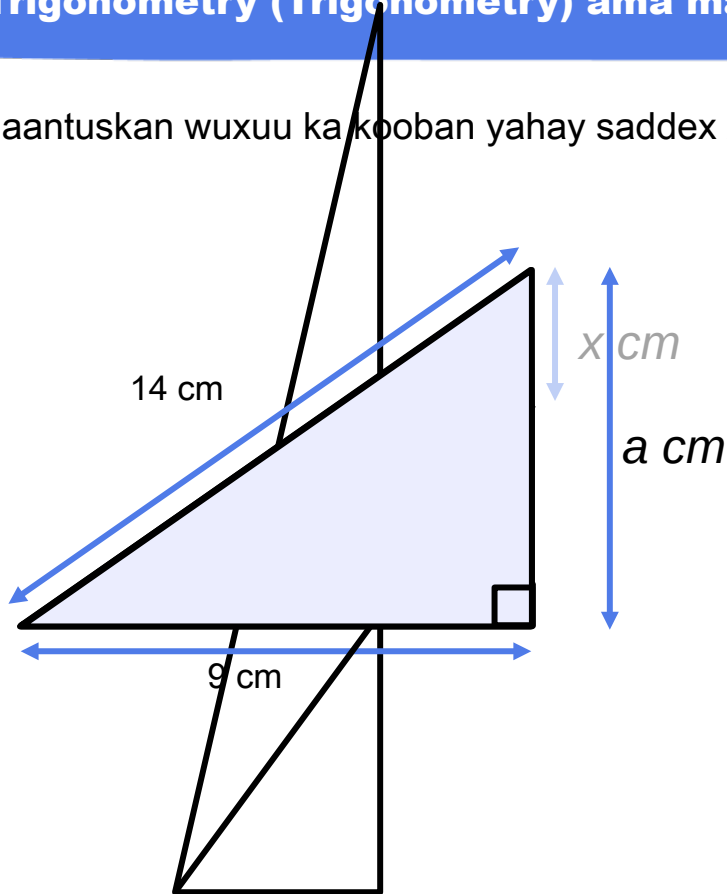
b



c

Jaantuskan wuxuu ka kooban yahay saddex xagal, ma heli kartaa?

Iyadoo diiradda la saarayo saddexagalkan, waxaan xisaabin karnaa dhererka cidfifka saddexaad adigoo isticmaalaya aragtida Pythagoras (Pythagoras' theorem).



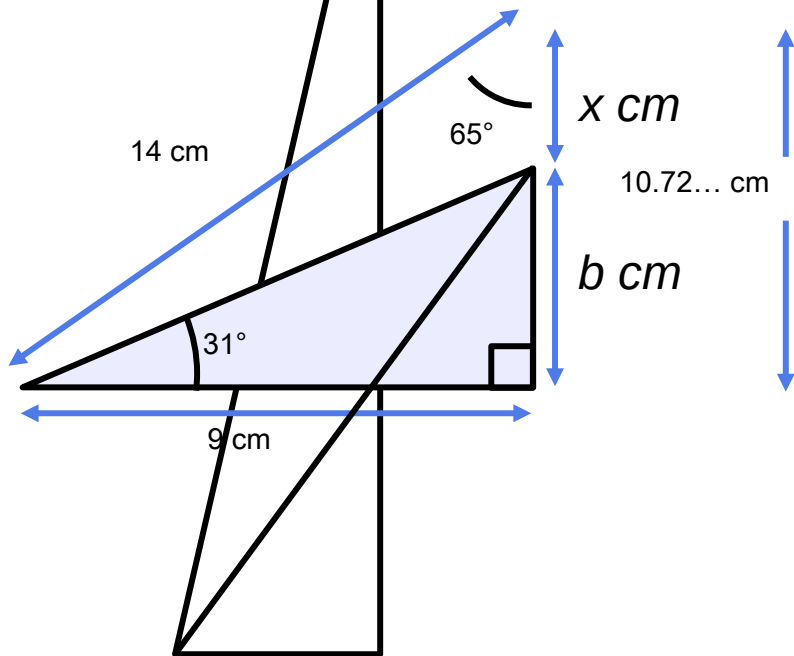
$$14^2 = 9^2 + a^2$$

$$a^2 = 14^2 - 9^2$$

$$a^2 = 196 - 81 = 115$$

$$a = 10.72...$$

Jaantuskan wuxuu ka kooban yahay saddex xagal, ma heli kartaa?



Hadda adigoo isticmaalaya saddexagalkan qumman, shaqada tangent (tangent function) waxaa loo isticmaali karaa in lagu xisaabiyo dhererka dhinaca ka soo horjeeda.

Taas oo u oggolaanaysa in x la xisaabiyo.

Trigonometry (Trigonometry) ama maya

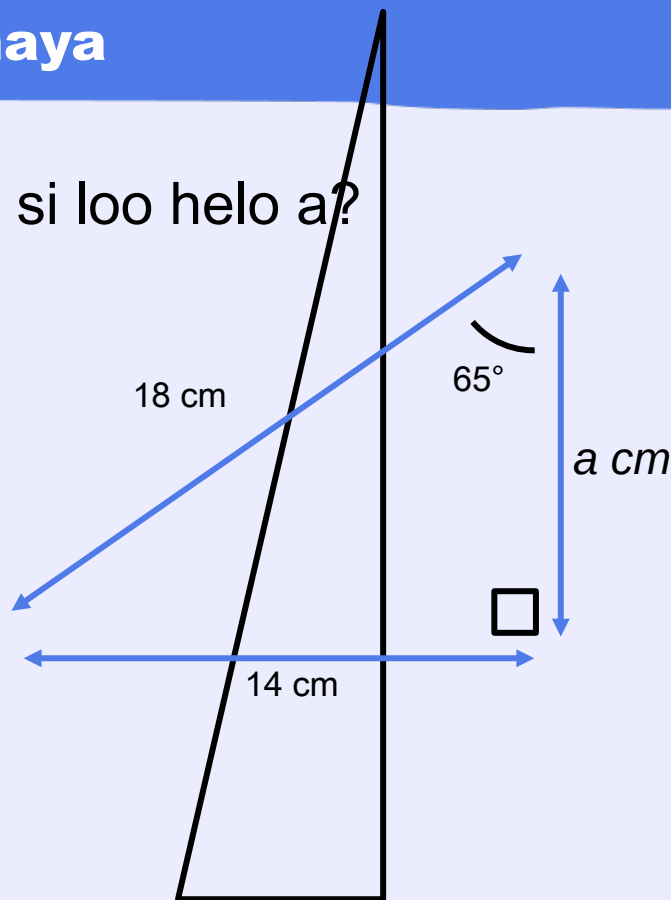
Kee ka mid ah xisaabahaan ayaa sax ah si loo helo a ?

a $a^2 = 18^2 - 14^2$ ✓

b $a = 18 \times \cos(65^\circ)$ ✓

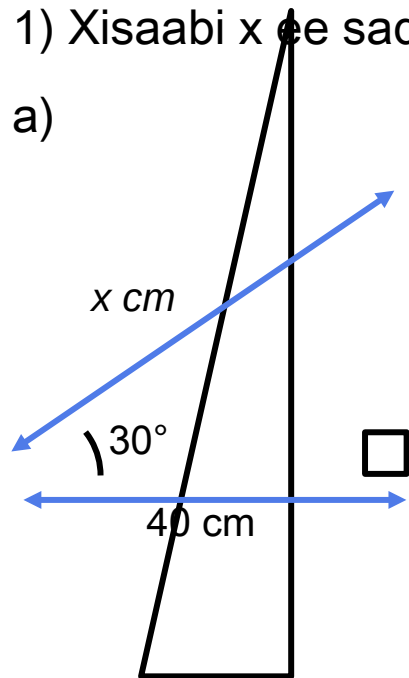
c $a = 18 \times \sin(25^\circ)$ ✓

d $a = 14 \div \tan(65^\circ)$ ✓

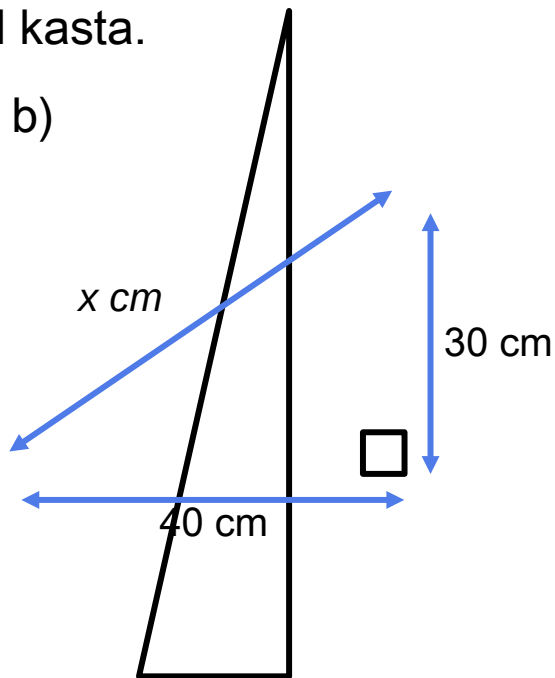


1) Xisaabi x ee saddex-xagal kasta.

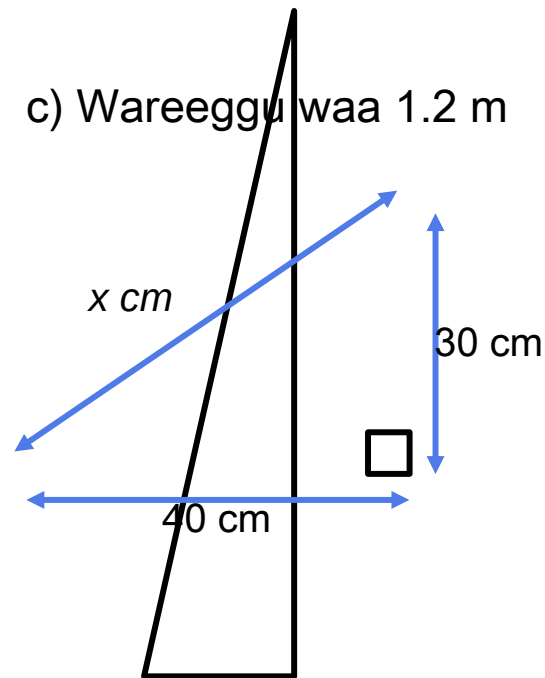
a)



b)

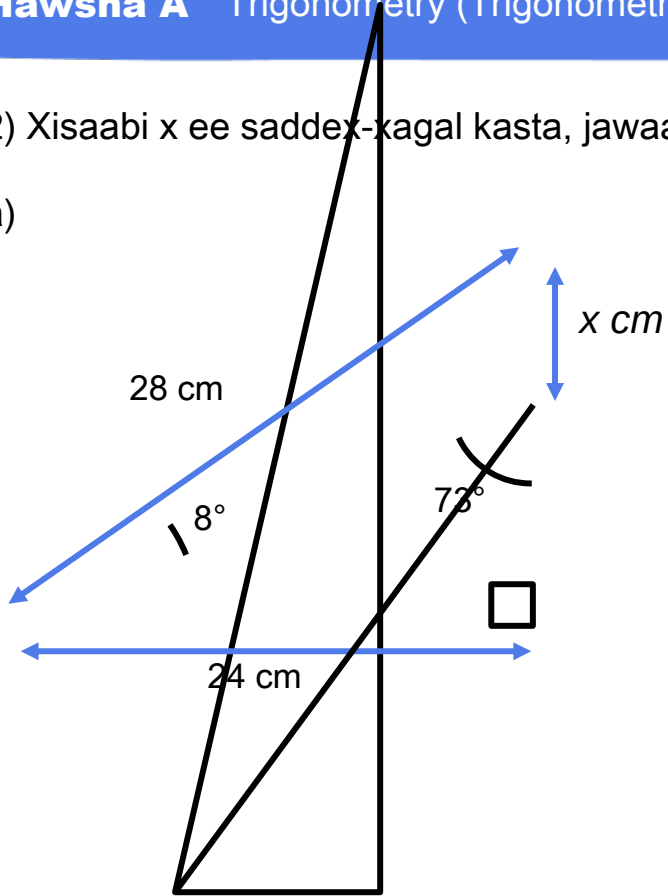


c) Wareeggu waa 1.2 m

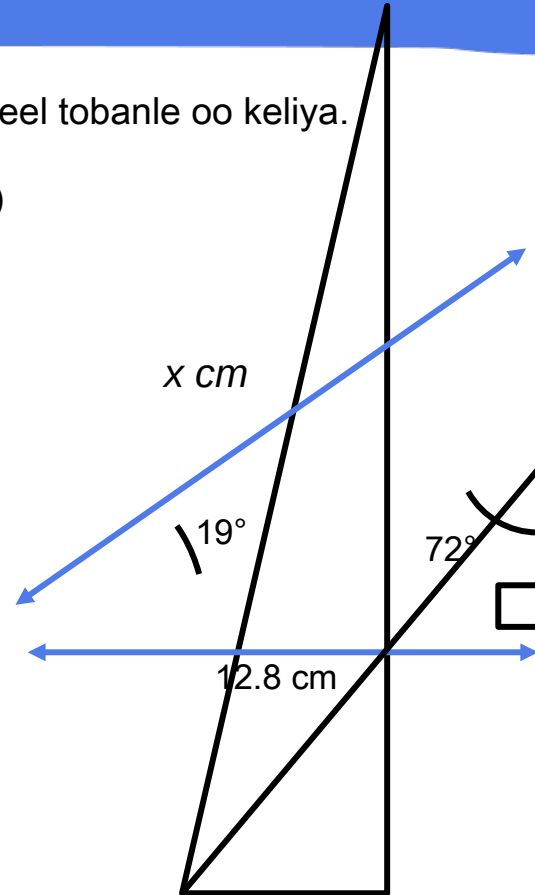


2) Xisaabi x ee saddex-kagal kasta, jawaabtaada ku qor meel tobanle oo keliya.

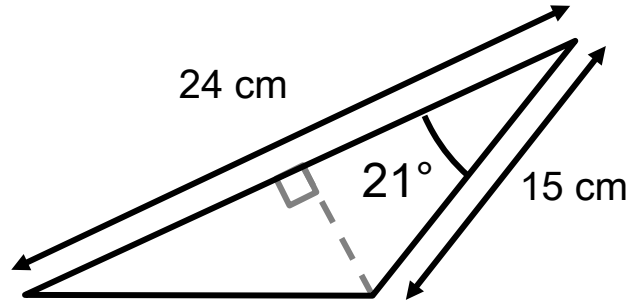
a)



b)

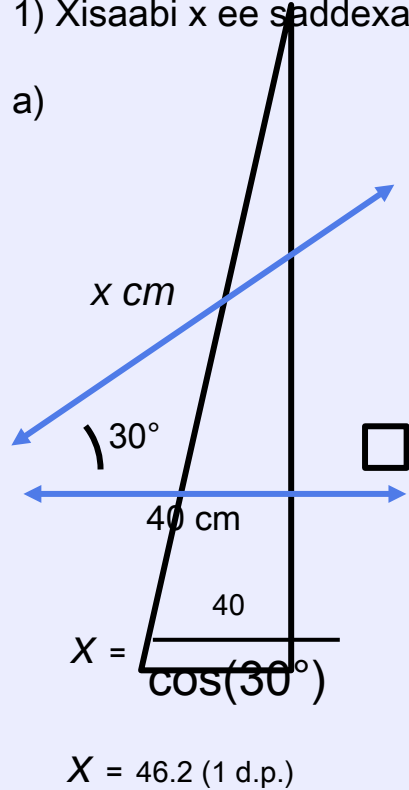


3) Soo saar wareegga (perimeter) saddexagalkaan, jawaabta ku bixi hal meel jajab tobanle (1 decimal place).

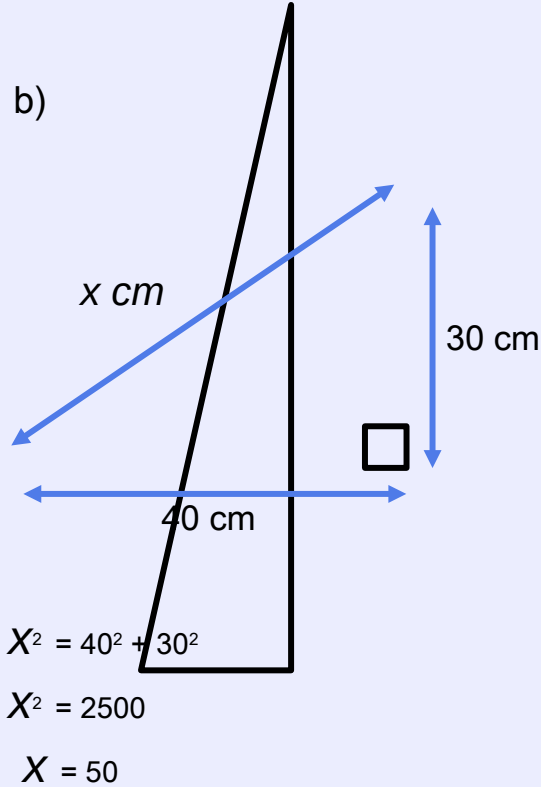


1) Xisaabi x ee saddexagal kasta.

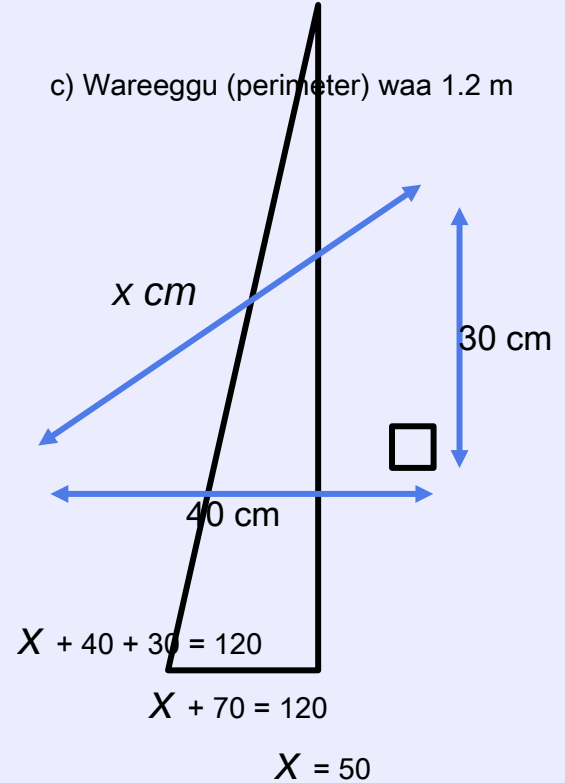
a)



b)

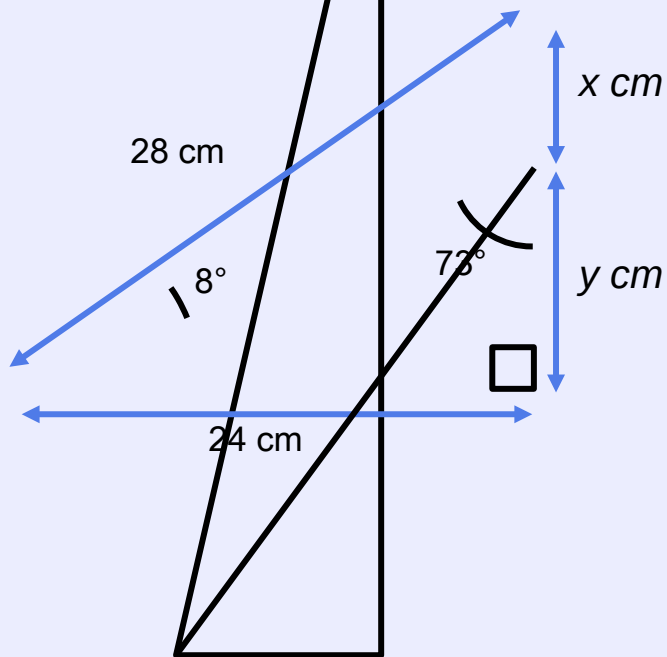


c) Wareeggu (perimeter) waa 1.2 m



2) X ku xisaab saddex-xagal kasta, jawaabtaada ku bixi 1 meel tobanle (1 decimal place).

a)



$$y = \frac{24}{\tan(73^\circ)}$$

$$y = 7.33...$$

$$28^2 = 24^2 + (X + 7.33...) ^2$$

$$28^2 - 24^2 = (X + 7.33...) ^2$$

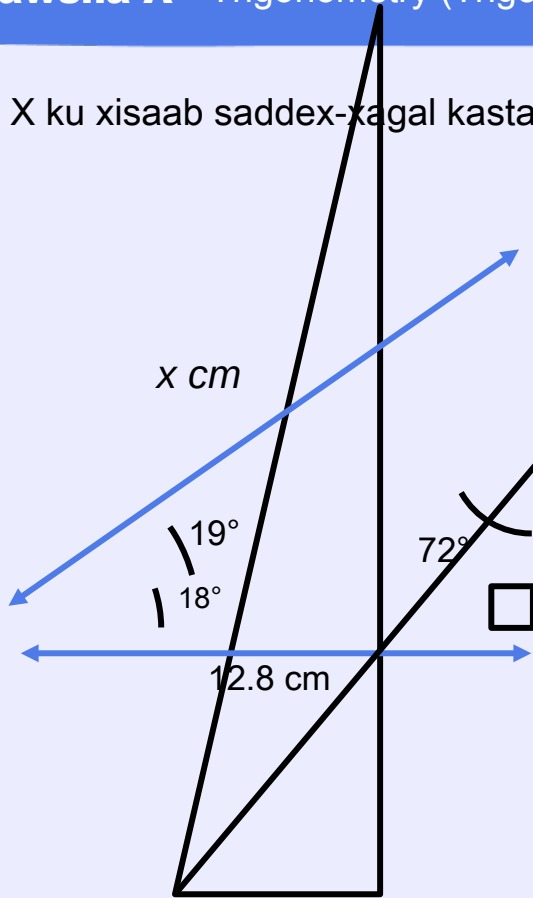
$$208 = (X + 7.33...) ^2$$

$$14.42... = X + 7.33...$$

$$7.1 = X \text{ (1 d.p.)}$$

2) X ku xisaab saddex-xagal kasta, jawaabtaada ku bixi 1 meel tobanle (1 decimal place).

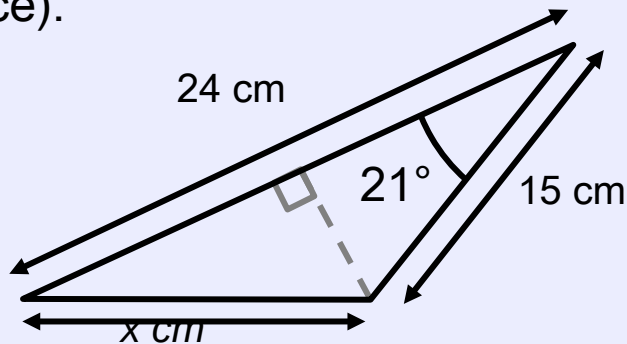
b)



$$X = \frac{12.8}{\cos(37^\circ)}$$

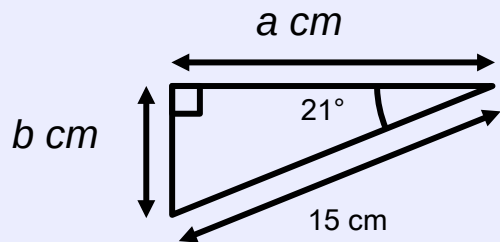
$$X = 16.0$$

3) Wareega (perimeter) saddex-xagalkan ku xisaab, jawaabtaada ku bixi 1 meel tobanle (1 decimal place).



Wareeg (Perimeter)

$$= 11.3 + 15 + 24 = 50.3 \text{ cm}$$



$$\begin{aligned} a &= 15\cos(21^\circ) \\ &= 14.00... \end{aligned}$$

$$\begin{aligned} b &= 15\sin(21^\circ) \\ &= 5.37... \end{aligned}$$

$$x^2 = b^2 + (24 - a)^2$$

$$x^2 = 5.37...^2 + 10^2$$

$$x^2 = 128.822...$$

$$x = 11.3499...$$

Doorashada hab ku habboon ee lagu helo dhererka
saddexagalka

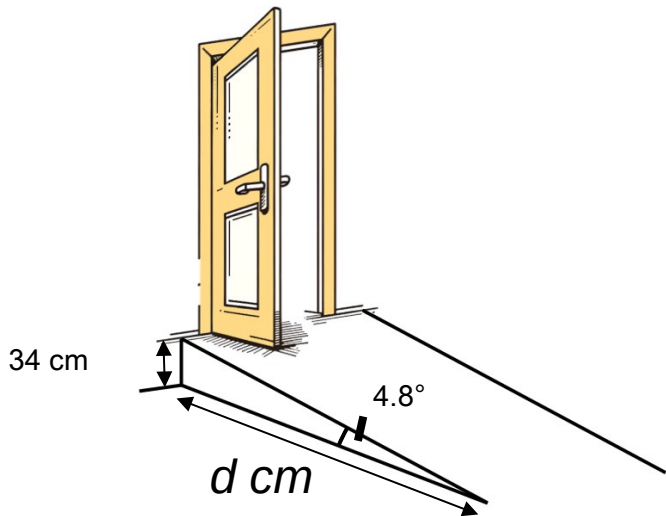


Trigonometry (Trigonometry) ama ma aha



Isticmaalka dhabta ah ee trigonometry-ga

Waa in la dhisa jid (ramp) oo ka baxsan dukaan si loogu helo cursiyaasha (wheelchair). Jiirada (incline) kama badnaan karto 4.8° . Salka albaabka wuxuu dhererkiisu yahay 34 cm. Intee ayay u jiri doontaa dukaanka bilowga jidka?

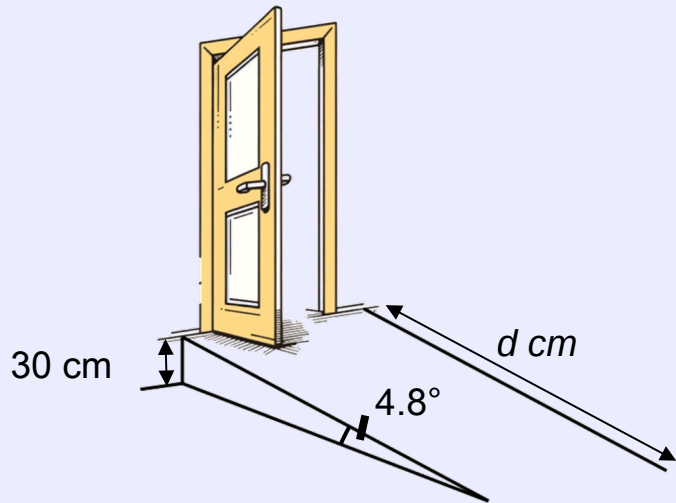


Iyadoo loo malaynayo in gidaarka dukaanku uu yahay mid toosan (perpendicular) dhulka. Waxaa loo isticmaali karaa shaqada tangent (tangent function) si loo go'aamiyo dhererka ku xiga (adjacent length).

$$d = \frac{34}{\tan(4.8^\circ)} = 404.9$$

Bilowga jidka (ramp) wuxuu u jiraa qiyaastii 4.05 mitir dukaanka.

Waa in la dhisaa jid (ramp) oo ka baxsan dukaan kale si loogu helo cursiyaasha (wheelchair). Jiirada (incline) weli kama badnaan karto 4.8° . Salka albaabkani wuxuu dhererkiisu yahay 30 cm. Immisa ayuu dhererkiisu yahay jidku?

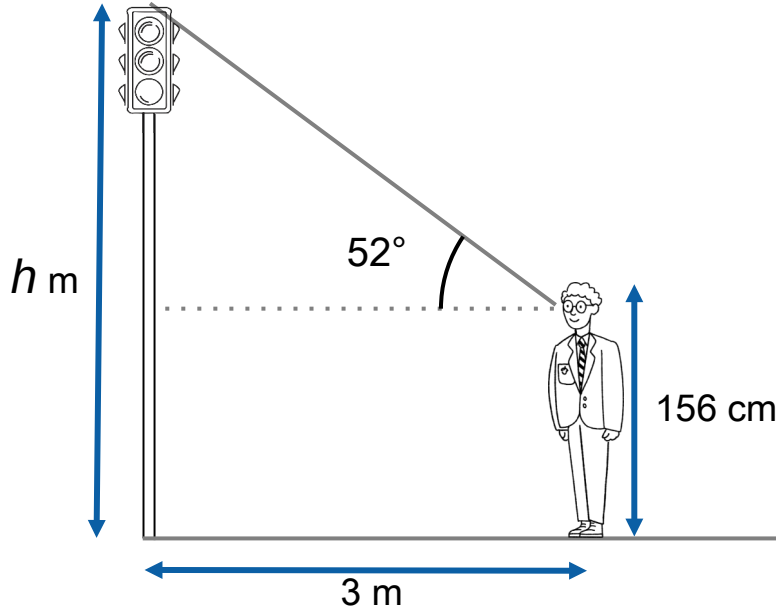


Jidku wuxuu dhererkiisu yahay 3.59 mitir.

Isticmaalka dhabta ah ee trigonometry-ga

Axmed iyo Saciid waxay qiyaasayaan dhererka nalalka taraafigga.

Sidee ayay u samayn karaan iyagoo isticmaalaya trigonometry?



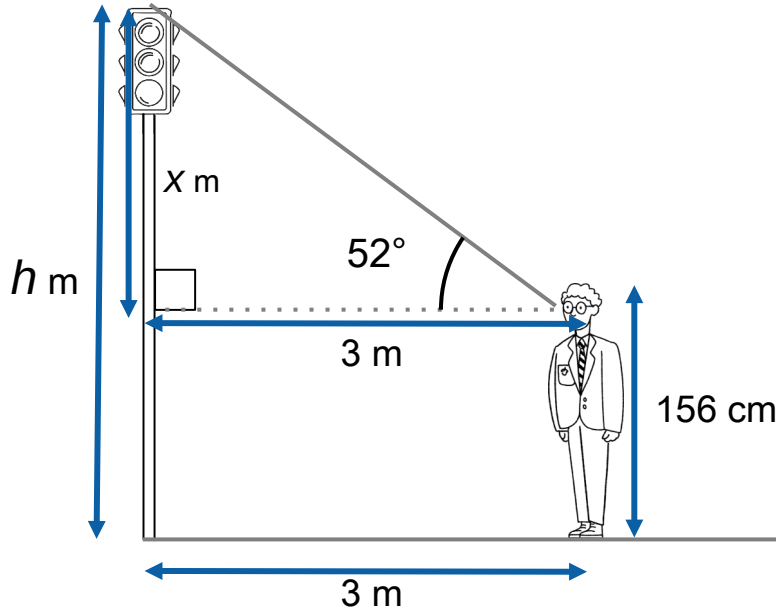
Haddii aan ognahay dhererka Axmed oo aan cabbirno xagasha (angle) ilaa sare ee nalalka taraafigga laga bilaabo heerka indhihiisa, waxaan isticmaali karnaa trigonometry.



Qalab loo yaqaan 'clinometer' ayaa cabbiri kara xagasha (angle).

Adeegsiga dhabta ah ee trigonometry

Axmed iyo Saciid waxay qiyaasayaan dhererka nalalka taraafigga.
Sidee bay u samayn karaan iyagoo adeegsanaya trigonometry?



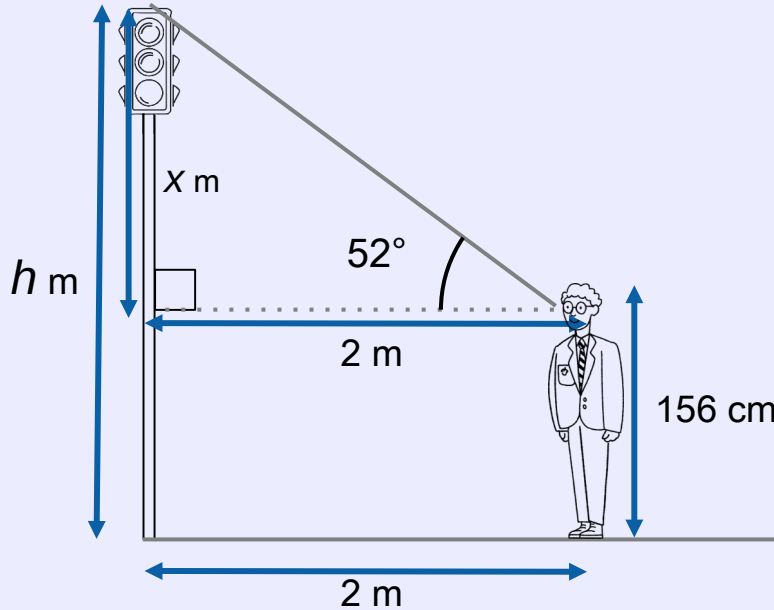
$$x = 3 \times \tan(52^\circ) = 3.839...$$

$$h = 3.83... + 1.56$$

$$= 5.4 \text{ (1 d.p.)}$$

Adeegsiga dhabta ah ee trigonometry

Buuxi meelaha bannaan si aad u qiyaasto dhererka nalka taraafiggan.

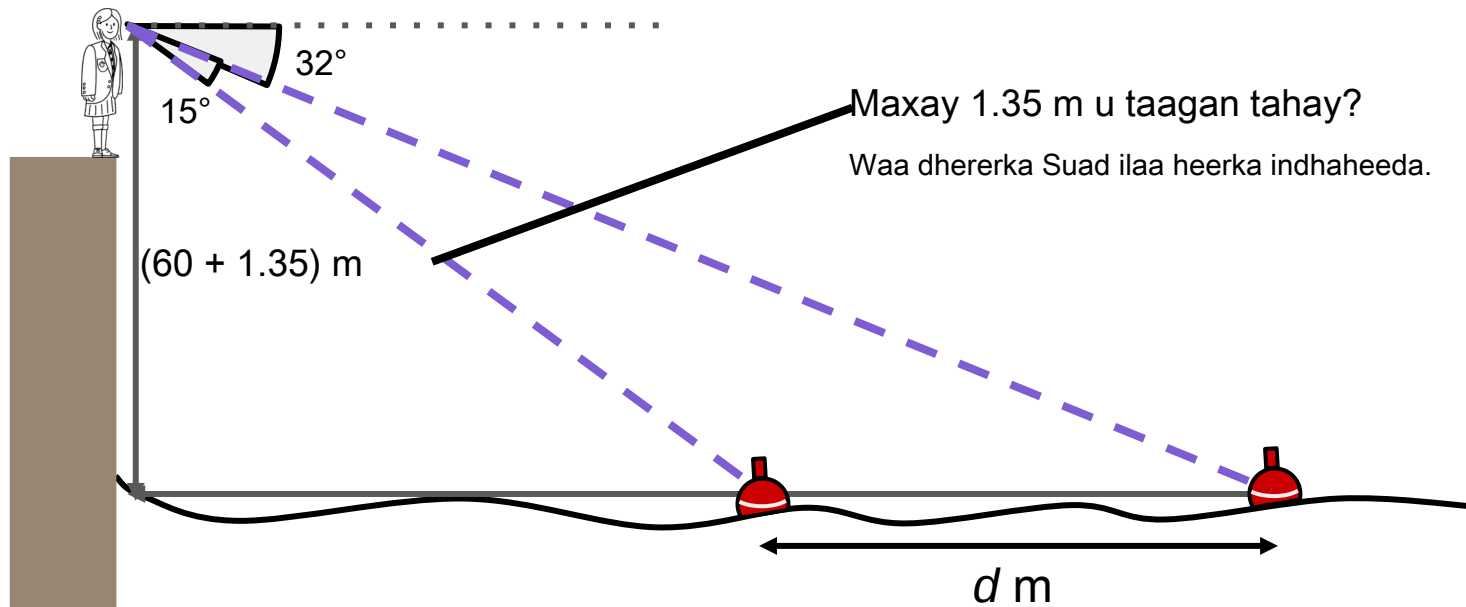


$$x = \times \tan(52^\circ) = m \quad \underline{2.55...}$$

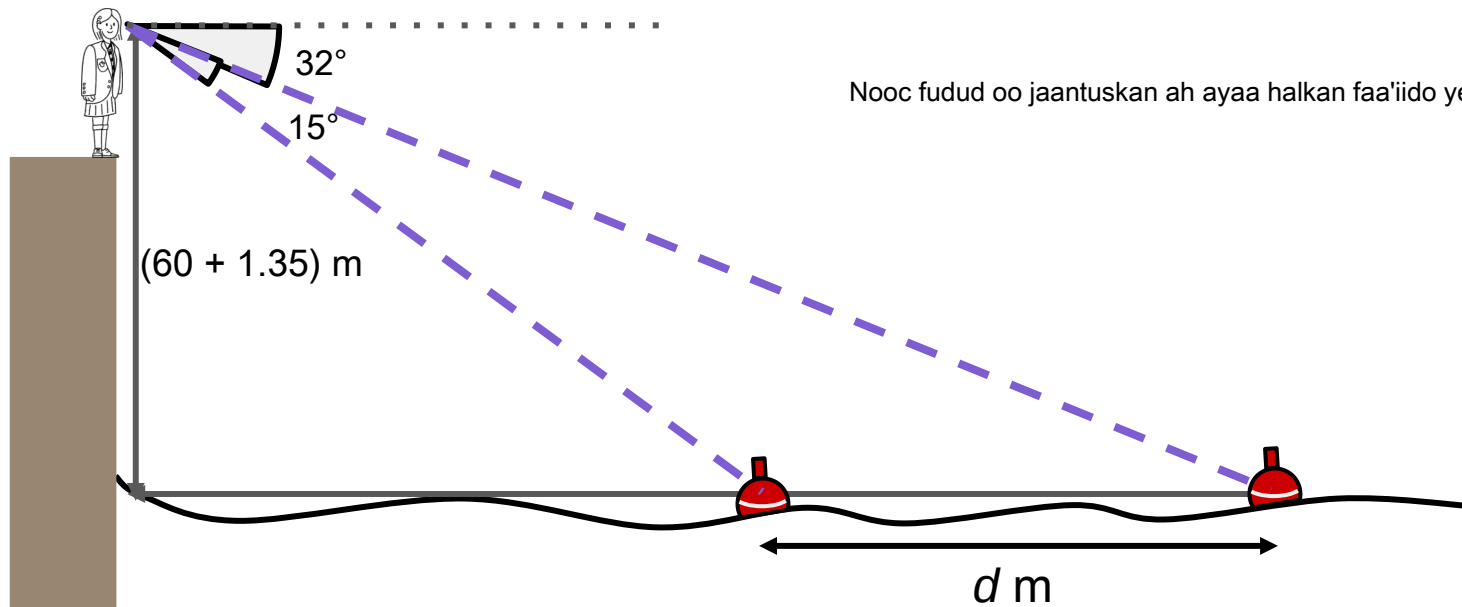
$$h = 2.55... + 1.56$$
$$= m$$

$$\underline{4.12}$$

Suad waxay taagan tahay dusha shan (cliff), 60 m oo ka sarreeya heerka badda. Waxay arki kartaa laba calaamad (buoys) oo toos ah horteeda. Xagasha hoos-u-dhaca (angles of depression) ee calaamadahan waa 47° iyo 32° siday u kala horreeyaan. Suad waxay rabta inay qiyaasto inta u dhaxaysa labada calaamad.

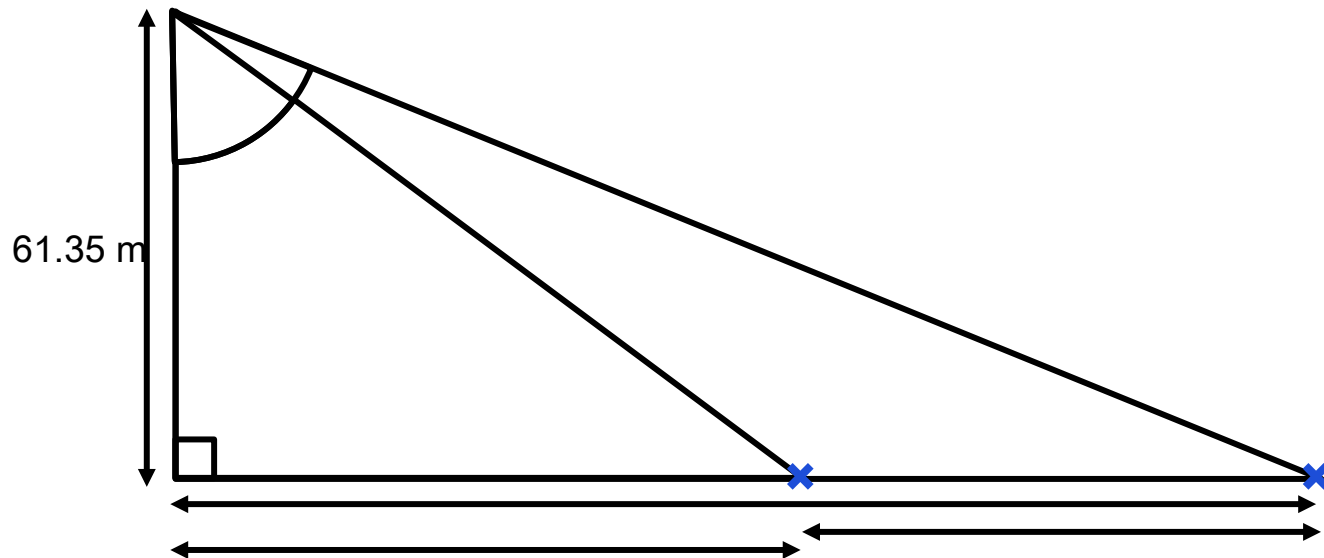


Suad waxay taagan tahay dusha shan (cliff), 60 m oo ka sarreeya heerka badda. Waxay arki kartaa laba calaamad (buoys) oo toos ah horteeda. Xagasha hoos-u-dhaca (angles of depression) ee calaamadahan waa 47° iyo 32° siday u kala horreeyaan. Suad waxay rabta inay qiyaasto inta u dhaxaysa labada calaamad.

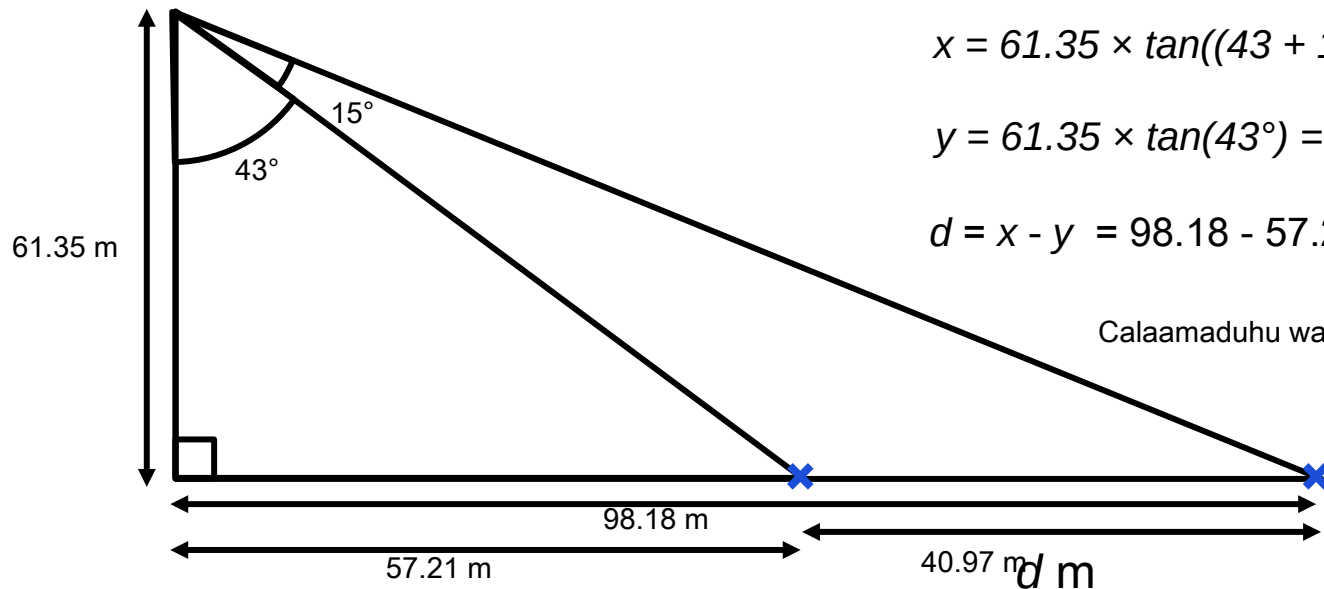


Nooc fudud oo jaantuskan ah ayaa halkan faa'iido yeelan doona.

Suad waxay taagan tahay dusha shan (cliff), 60 m oo ka sarreeya heerka badda. Waxay arki kartaa laba calaamad (buoys) oo toos ah horteeda. Xagasha hoos-u-dhaca (angles of depression) ee calaamadahan waa 47° iyo 32° siday u kala horreeyaan. Suad waxay rabta inay qiyaasto inta u dhaxaysa labada calaamad.



Suad waxay taagan tahay dusha sare ee jiir, 60 m oo ka sarreysa heerka badda. Waxay arki kartaa laba calaamadood oo toos ah horteeda. Xaglaha hoos-u-dhaca ee calaamadahan waa 47° iyo 32° siday u kala horreeyaan. Suad waxay rabtaa inay qiyaasto inta u dhaxaysa labada calaamadood.



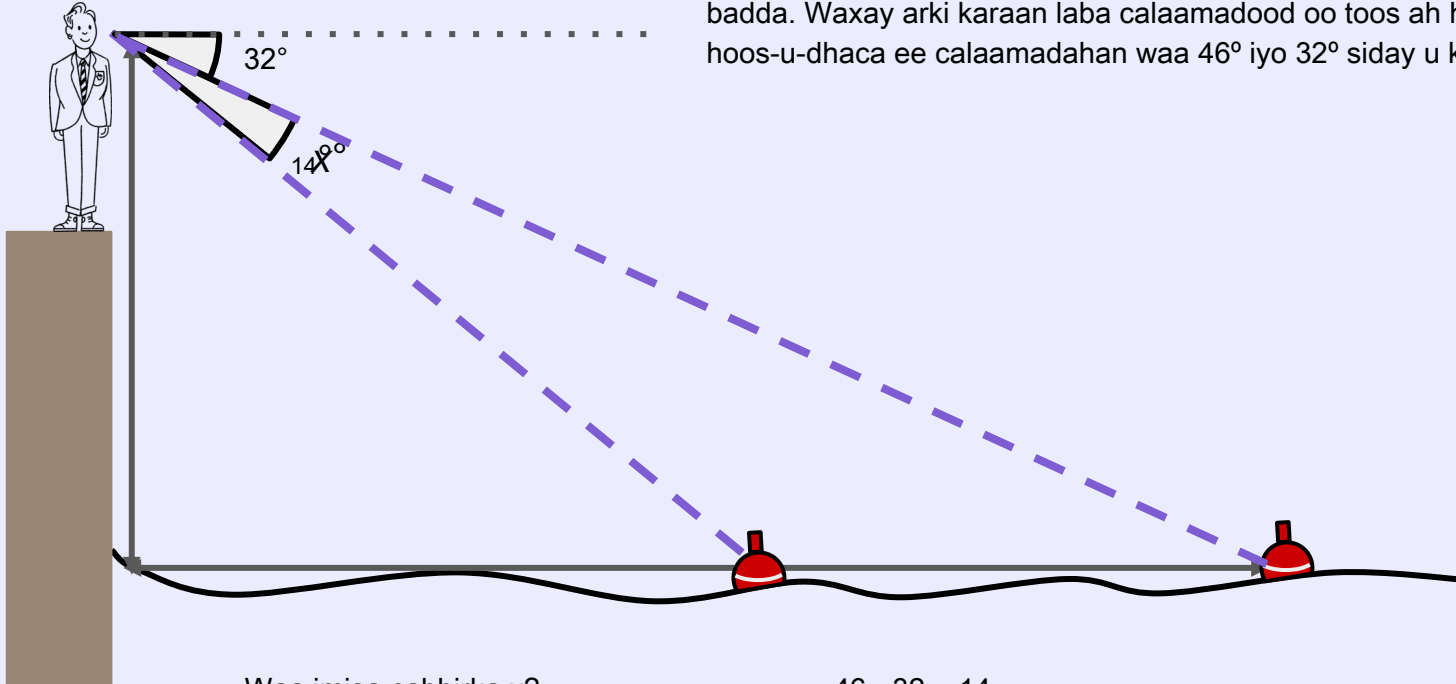
$$x = 61.35 \times \tan((43 + 15)^\circ) = 98.18$$

$$y = 61.35 \times \tan(43^\circ) = 57.21$$

$$d = x - y = 98.18 - 57.21 = 40.97$$

Calaamaduhu waxay u kala fog yihiin 40.97 m.

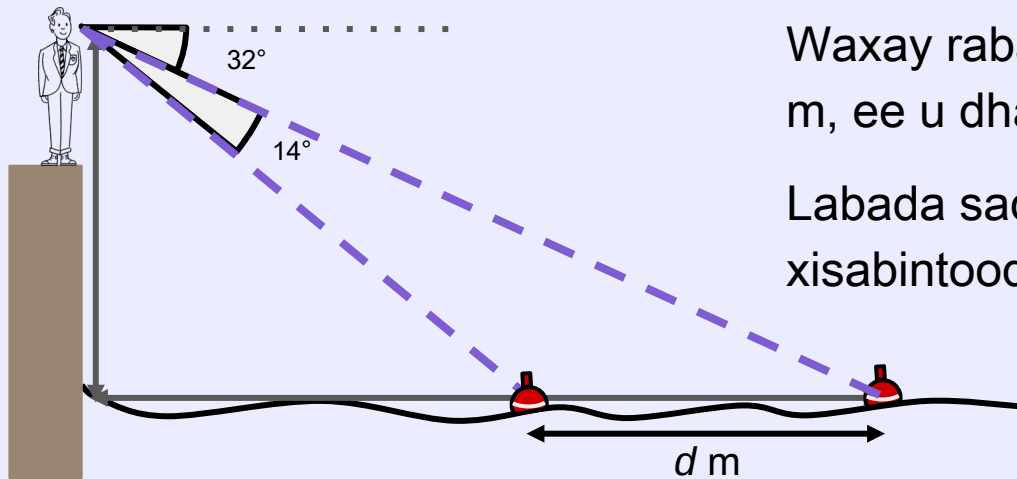
Saciid wuxuu taagan yahay dusha sare ee jiir, 60 m oo ka sarreysa heerka badda. Waxay arki karaan laba calaamadood oo toos ah hortooda. Xaglaha hoos-u-dhaca ee calaamadahan waa 46° iyo 32° siday u kala horreeyaan.



Waa imisa cabbirka x ?

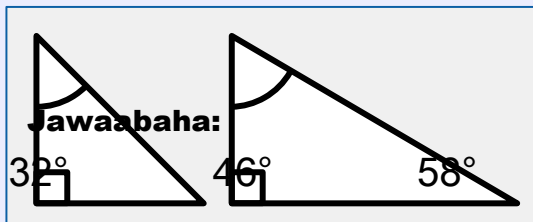
$$46 - 32 = 14$$

Isticmaalka dhabta ah ee trigonometry

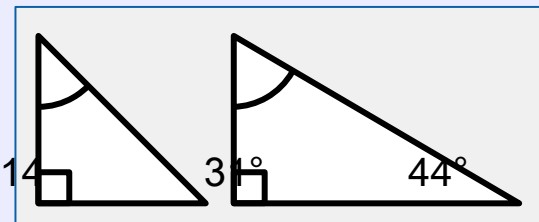


Waxay rabaan inay xisaabiyaan masaafada, d m, ee u dhaxaysa labada calaamadood.

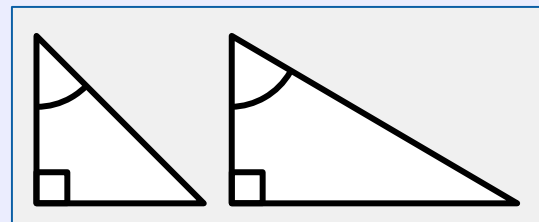
Labada saddexagal ee ay isticmaali doonaan xisabintooda waa kuwee?



a



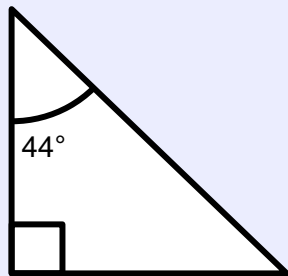
b



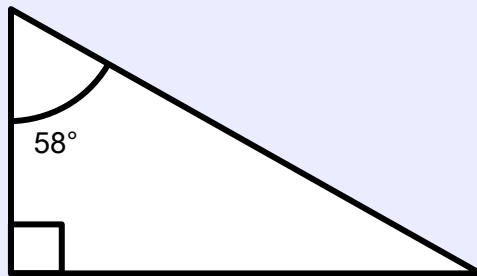
c



Jiirku wuxuu dhererkiisu yahay 60 m, waxaana jira 1.63 m ilaa heerka indhaha Saciid.



masaafada calaamadda
koowaad, x m

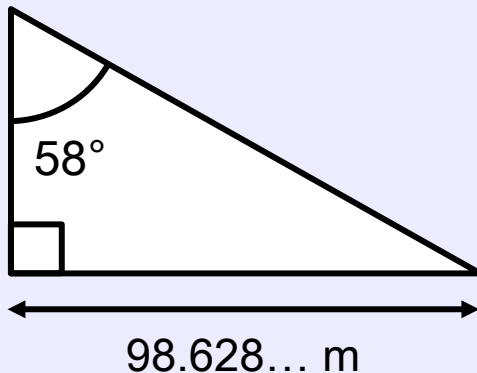
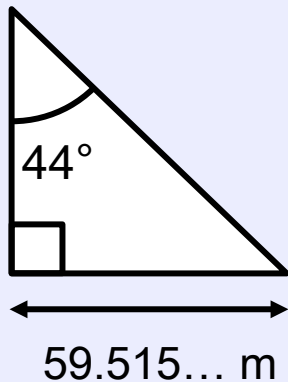


Dhammeystir xisaabinta si aad u hesho masaafada toosan ee calaamadda ugu dhow.

$$x = 61.63 \times \underline{\quad}(44^\circ) = 59.52 \text{ m (2dp)}$$

Isticmaalka dhabta ah ee trigonometry

Masaafada calaamadda koowaad waa 59.515.. m, masaafada calaamadda labaadna waa 98.628... m.



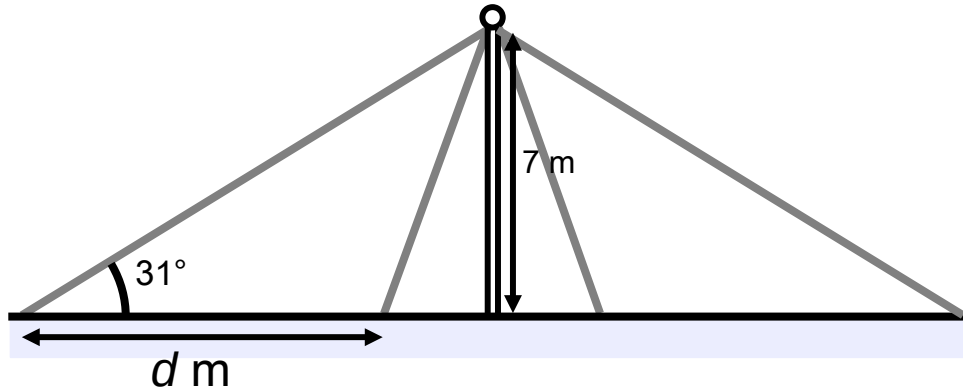
Waa imisa masaafada u dhaxaysa labada calaamadood, ilaa mitirka ugu dhow?

$$d = 98.628... - 59.515... = 39 \text{ m}$$

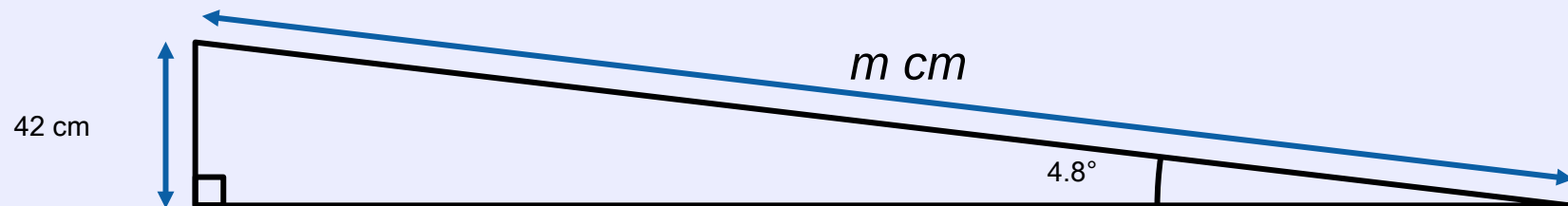
1) Waa la dhisayaa jidka loo yaqaan 'ramp' oo ka baxsan guri. Qaybta hoose ee albaabku waa 42 cm oo ka sarreysa dhulka. Xagasha u dhaxaysa ramp-ka iyo dhulka waa inaysan ka badnayn 4.8° Waa imisa dhererka ugu yar ee ramp-ka?

2) Nin taagan oo ku taal webi-banka wuxuu arkayaa geed gaar ah oo ku yaal banka ka soo horjeeda. Kadib wuxuu socdaa 60 mitir oo toos ah oo dhinaca webi-banka. Markuu dib u eego, wuxuu arki karaa in xagasha u dhaxaysa khadka socodkiisa iyo khadka geedka ay tahay 32° . Imisa ayay ballac tahay webiga?

3) Tiir dhererkiisu yahay 7 m waxaa lagu xidhay siligyo taageero. Siligyada waxaa lagu shubay xariiq toosan. Siligyada kore waxay la sameeyaan xagal 31° sagxadda, siligyada gudahana waxay la sameeyaan xagal laba jibaaran. Immisa ayay kala fog yihiin siligyadu?



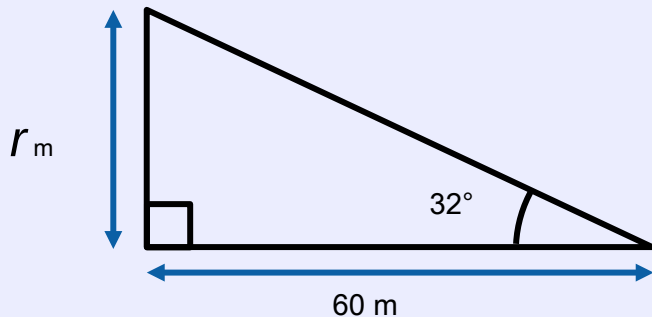
1) Jid loo dhisayaa guri ka baxsan. Gunta hoose ee albaabku waa 42 cm ka sarraaysa sagxadda. Xagasha u dhaxaysa jidka iyo dhulka waa inaysan ka badnayn 4.8° . Waa maxay dhererka ugu yar ee jidka?



$$m = \frac{42}{\sin(4.8^\circ)} = 501.9$$

Jidka dhererkiisu waa ugu yaraan 501.9 cm ama 5.02 m.

2) Nin taagan oo daanta webiga ku yaal wuxuu arkayaa geed gaar ah daanta kale. Kadib wuxuu socdaa 60 m oo toosan daanta webiga. Markuu dib u eego, wuxuu arkaa in xagasha u dhaxaysa dariiqiisa iyo xariiqda geedka ay tahay 32° . Immisa buu webigu u ballaaran yahay?

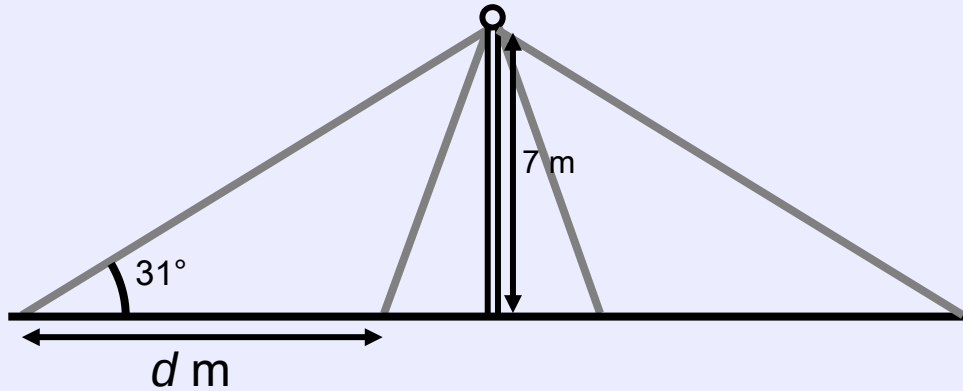


$$r = 60 \times \tan(32^\circ)$$

$$r = 37.5$$

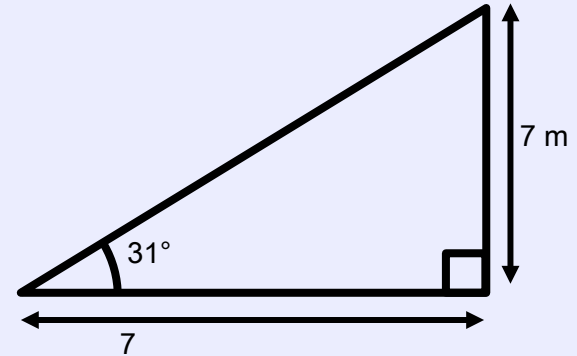
Webigu wuxuu ballaaran yahay 37.5 m.

3) Tiir dhererkiisu yahay 7 m waxaa lagu xidhay siligyo taageero. Siligyada waxaa lagu shubay xariiq toosan. Siligyada kore waxay la sameeyaan xagal 31° sagxadda, siligyada gudahana waxay la sameeyaan xagal laba jibaaran. Immisa ayay kala fog yihiin siligyadu?

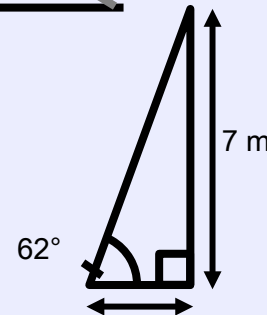


$$d = 11.65 - 3.72 = 7.93$$

Siligyadu waxay kala fog yihiin 7.93 m.



$$\frac{7}{\tan(31^\circ)} = 11.65 \text{ m}$$



$$\frac{7}{\tan(62^\circ)} = 3.72 \text{ m}$$

Trigonometry waxaa loo isticmaali karaa xaalado badan oo dhab ah. Inta badan waxaa loo isticmaalaa iyadoo lala shaqeynayo aragtida Pythagoras.

Waxaa loo isticmaalaa in lagu xisaabiyo ama lagu qiyaaso dhererka shay weyn, halka cabbirkoodu aanu macquul ahayn.