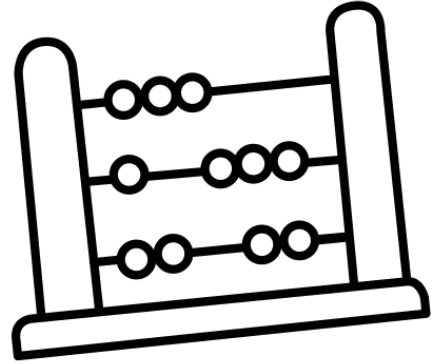


Isticmaalka saamiga sine (sine ratio)

Maths

Cutub: Trigonometry (Trigonometry)



Natiijo

Waxaan isticmaali karaa saamiga sine (sine ratio) si aan u helo dhinaca ama xagasha maqan ee saddexagalka qumman (right-angled triangle).

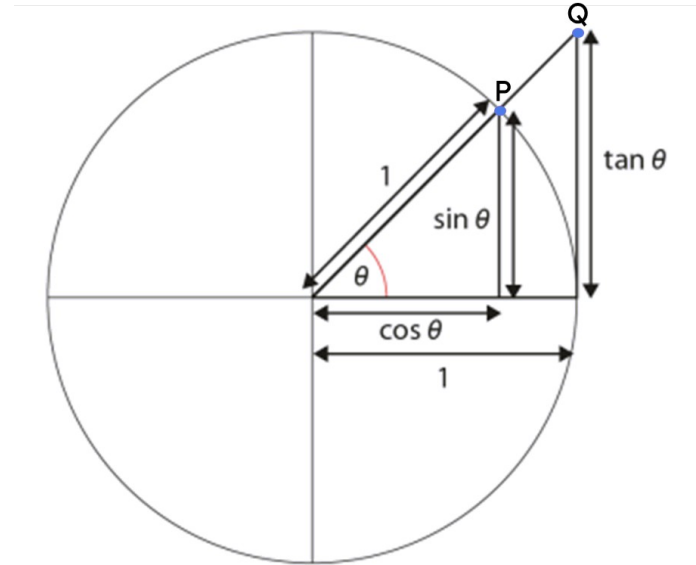
Erayada muhiimka ah

Hypotenuse (hypotenuse) waa dhinaca saddexagalka qumman (right-angled triangle) ee ka soo horjeeda xagasha qumman.

Dhinaca ka soo horjeeda (opposite side) ee saddexagalka qumman (right-angled triangle) waa dhinaca ka soo horjeeda xagasha calaamadeysan.

Hawlaha trigonometric (trigonometric functions) waxaa badanaa lagu qeexaa saamiga labada dhinac ee saddexagalka qumman (right-angled triangle) xagal la siiyay.

Sine-ga xagal ($\sin(\theta^\circ)$) waa isku-duwayaasha y (y-coordinate) ee barta P ee saddexagalka ku dhex samaysmay goobada halbeegga (unit circle).



Qaabka casharka

Isticmaalka saamiga sine (sine ratio)



Qaabaynta qaacidada sine (sine formula)



Xisaabinta xaglaha iyadoo la isticmaalayo qaacidada sine (sine formula)

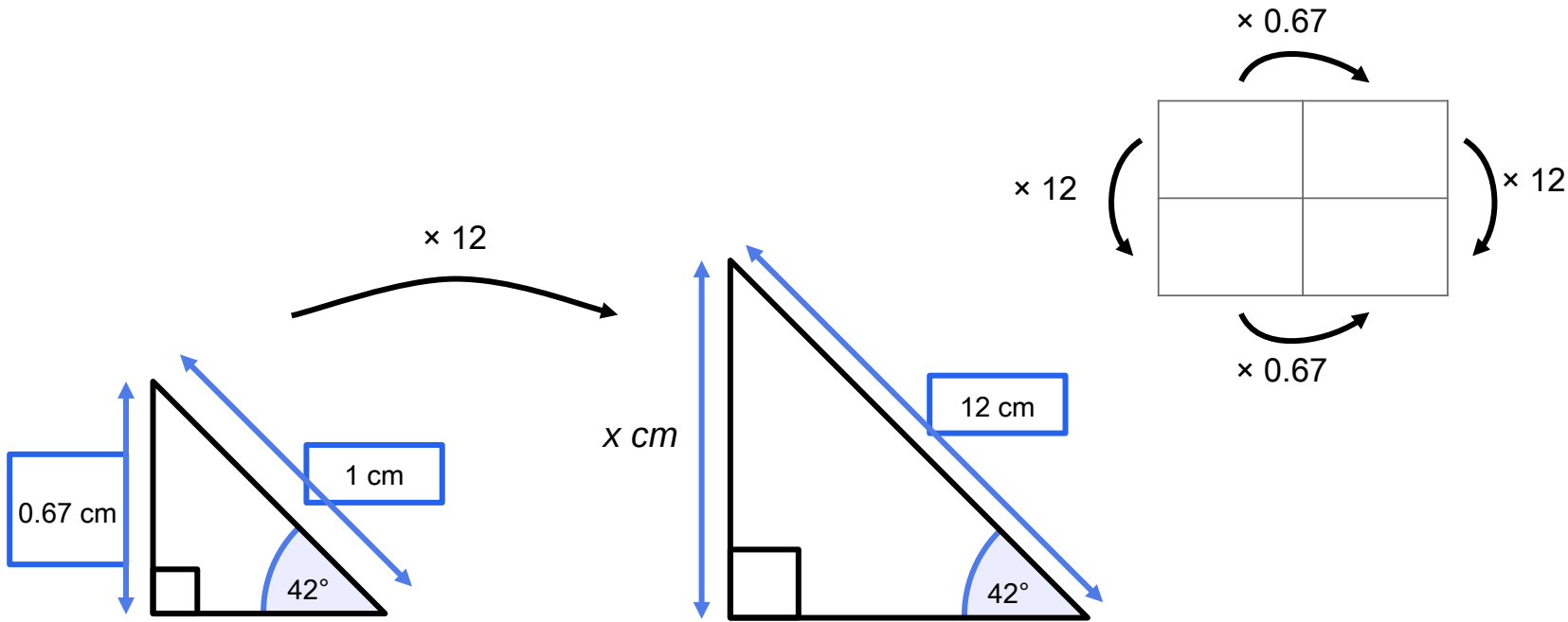
Qaabaynta qaacidada sine (sine formula)



Sharaxaad

Waxaan ognahay in labadan saddexagal ay isku mid yihiin (similar), sababtoo ah laba xagal oo ka mid ah saddexagalka ayaa la mid ah laba xagal ee kan kale.

Waxaan heli karnaa dhererka dhinaca lagu calaamadeeyay x adigoo isticmaalaya jaantuska saamiga (ratio table).

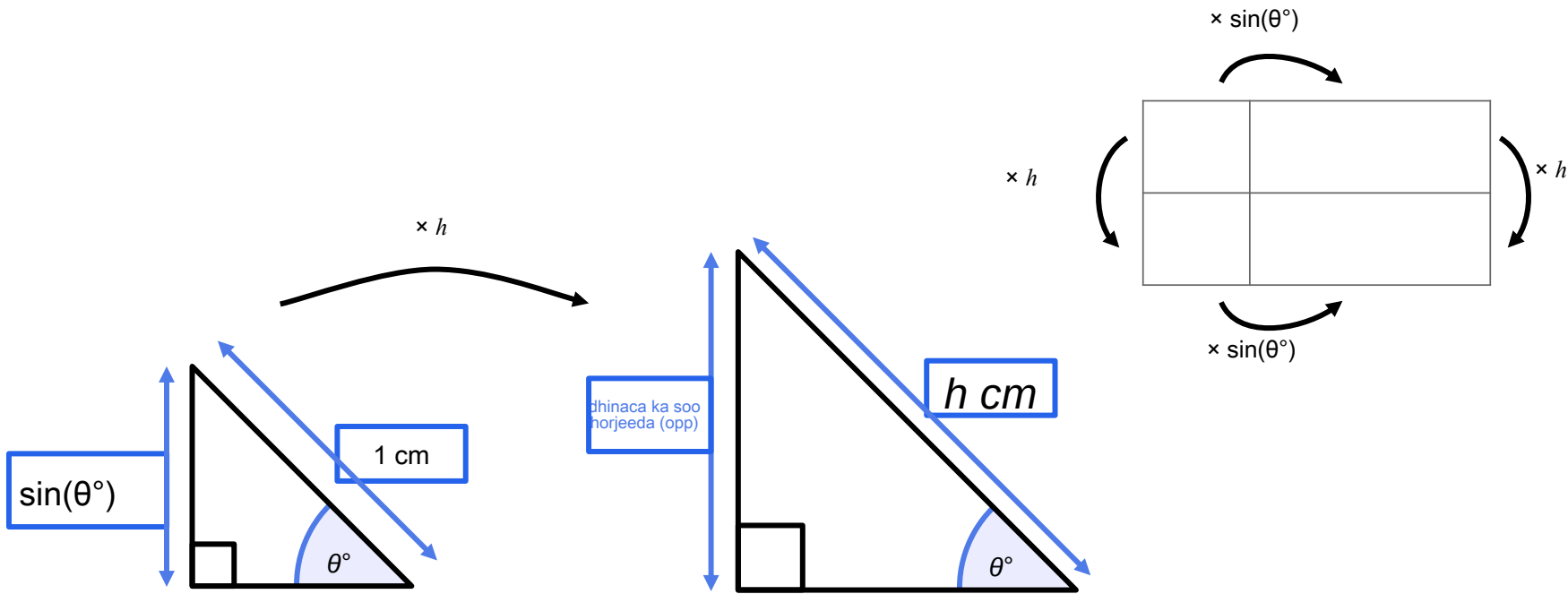


Qaabaynta qaacidada sine (sine formula)



Sharaxaad

Waxaan kaloo guudmarin karnaa habkan oo dhan saddex-xagal kasta oo qumman oo leh xagal θ° , halkaas oo dhinaca ka soo horjeeda θ° uu leeyahay dherer $\sin(\theta^\circ)$.

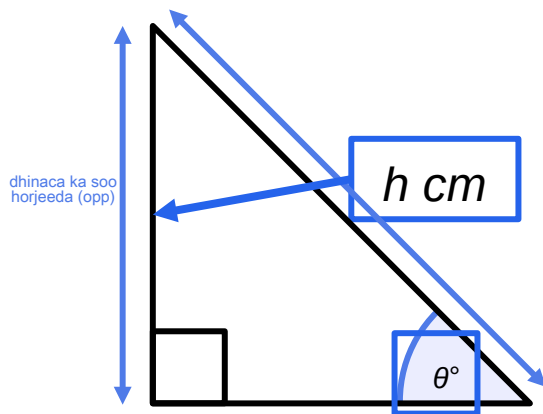


Qaabaynta qaacidada sine (sine formula)



Sharaxaad

Waxaan kaloo guudmarin karnaa habkan oo dhan saddex-xagal kasta oo qumman oo leh xagal θ° , halkaas oo dhinaca ka soo horjeeda θ° uu leeyahay dherer $\sin(\theta^\circ)$.



1	$\sin(\theta^\circ)$
h	$h \times \sin(\theta^\circ)$

$\times \sin(\theta^\circ)$

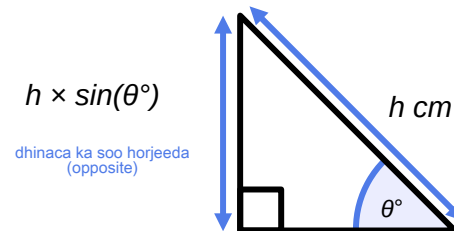
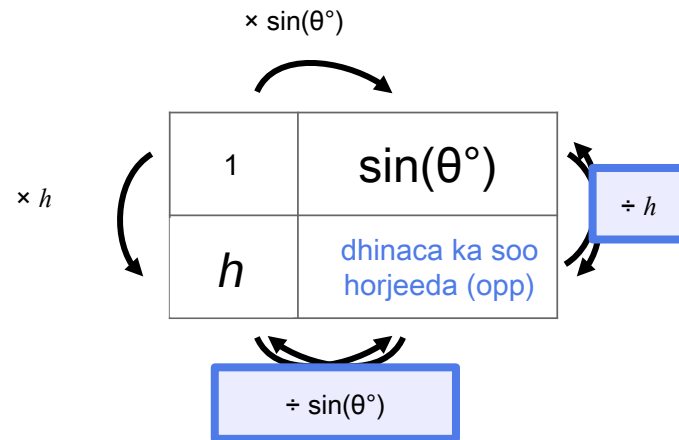
wuxuu la mid yahay dhererka dhinaca ka soo horjeeda xagashaas.

Qaabaynta qaacidada sine (Formalising the sine formula)



Sharaxaad

Waxaan u isticmaali karnaa jaantuska saamiga (ratio table) si aan u soo saarno qaacidada (formula) tusaysa xiriirka ka dhexeeya dhinaca ka soo horjeeda xagasha θ° iyo hypotenuse-ka, waxaana u matali karnaa qaacidada saddex siyaabood.



Qaabaynta qaacidada sine (Formalising the sine formula)

Waxaan sidoo kale ka soo saari karnaa laba nooc oo qaacidada ah marka la eego mid ka mid ah kuwa kale adoo sameynaya qaybin (division).

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

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

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

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

Qaabaynta qaacidada sine (Formalising the sine formula)

Waxaan ku beddeli karnaa qiimayaasha (values) saddexagal qumman (right-angled triangle) nooc kasta oo ka mid ah qaacidada sine si aan u matallo xiriirka ka dhexeeya dhinaca ka soo horjeeda xagasha iyo hypotenuse-ka siyaabo kala duwan.

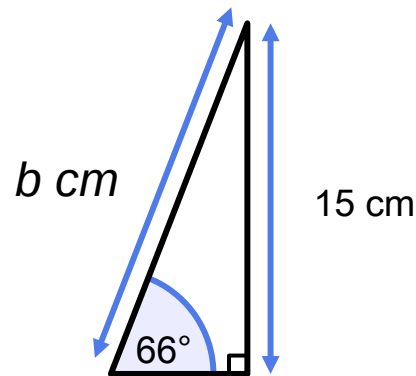
$$h \times \sin(\theta^\circ) = \text{opp} \quad b \times \sin(66^\circ) = 15$$

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

$$\frac{15}{\sin(66^\circ)} = b$$

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

$$\frac{15}{b} = \sin(66^\circ)$$



Qaabaynta qaacidada sine (Formalising the sine formula)

Kee ayaa si sax ah u tusaya xiriirka ka dhexeeya hypotenuse-ka iyo dhinaca ka soo horjeeda xagasha 82° ee saddexagalkan (lagu soo koobay tirada ugu dhow)?

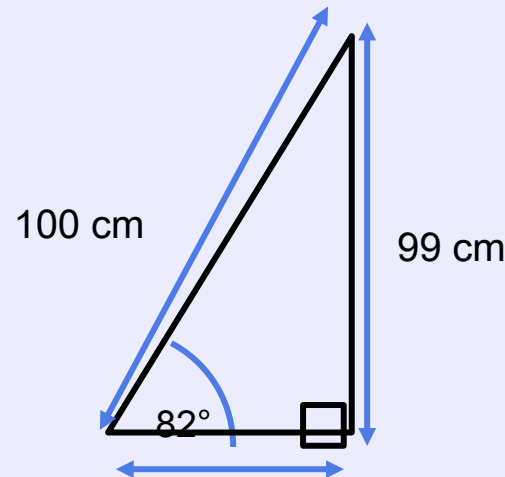
a $\frac{99}{100} = \sin(82^\circ)$ ✓

b $\sin(82^\circ \times 100) = 99$ ✗

c $100 \times \sin(82^\circ) = 99$ ✓

d $\frac{99}{\sin(82^\circ)} = 100$ ✓

e $\sin\left(\frac{82^\circ}{99}\right) = 100$ ✗



Qaabaynta qaacidada sine (sine formula)



Hubi

Kee ayaa si sax ah u muujinaya xiriirka ka dhexeeya hypotenuse-ka iyo dhinaca ka soo horjeeda xagasha θ° ee saddexagalkaan (lagu soo wareejiyay tirada ugu dhow)?

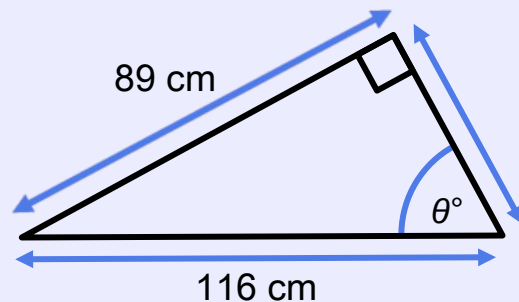
a $\frac{\sin(\theta^\circ)}{89} = 116$ ✗

b $\frac{89}{\sin(\theta^\circ)} = 116$ ✓

c $\frac{89}{116} = \sin(\theta^\circ)$ ✓

d $116 \times \sin(89^\circ) = \theta$ ✗

e $116 \times \sin(\theta^\circ) = 89$ ✓



1) Ku beddel dhinacyada la calaamadeeyay iyo xagasha saddexagal kasta labadan nooc ee qaacidada sine (sine formula).

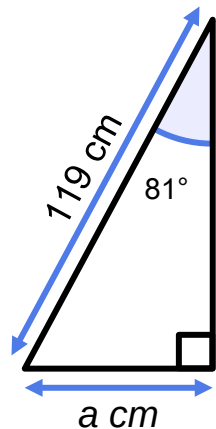
Saddexagal kasta, dooro nooca ugu habboon ee qaacidada sine (sine formula) si aad u hesho dhererka dhinaca maqan.

$$h \times \sin(\theta^\circ) = \text{opp}$$

$$\boxed{119} \times \sin(\boxed{81}) = \boxed{} \quad \boxed{}$$

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

$$\frac{\boxed{}}{\sin(\boxed{})} = \boxed{}$$

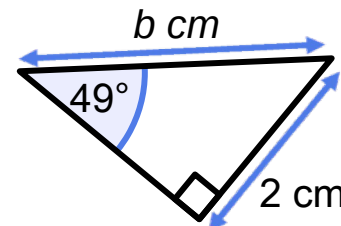


$$h \times \sin(\theta^\circ) = \text{opp}$$

$$\boxed{} \times \sin(\boxed{}) = \boxed{} \quad \boxed{}$$

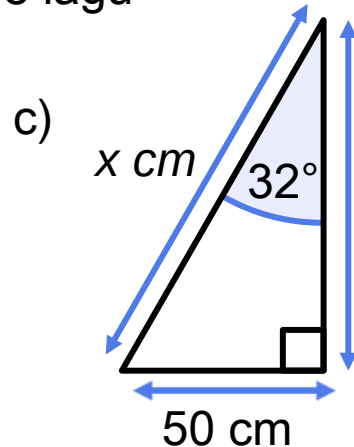
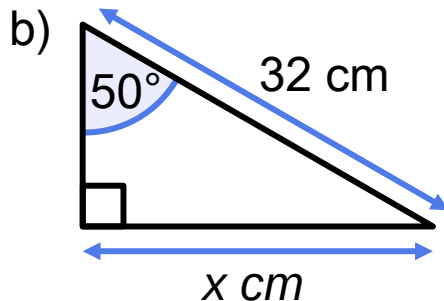
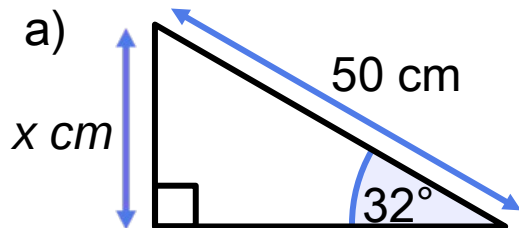
$$\frac{\text{opp}}{\sin(\theta^\circ)} = h$$

$$\frac{\boxed{}}{\sin(\boxed{})} = \boxed{}$$



2) Isku dhig saddexagalka iyo isla'egta muujinaysa xiriirka ka dhexeeya hypotenuse-kiisa iyo dhinaca ka soo horjeeda.

U isticmaal isla'egta si aad u hesho dhererka dhinaca maqan ee lagu calaamadeeyay x ee saddexagal kasta (2 d.p.)



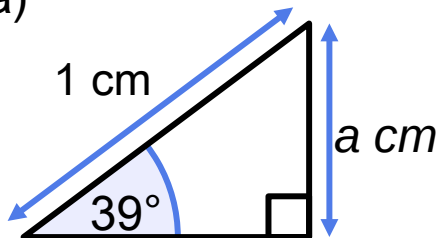
d) $x \times \sin(32^\circ) = 50$

e) $50 \times \sin(32^\circ) = x$

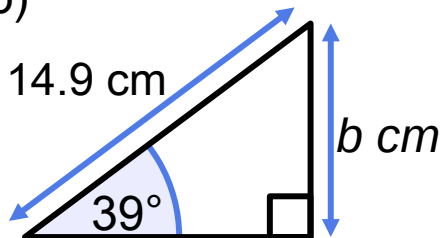
f) $32 \times \sin(50^\circ) = x$

3) Adigoo isticmaalaya qaacidada sine (sine formula), hel dhererka dhinaca maqan ee ku calaamaysan xaraf saddexagal kasta (2 d.p.)

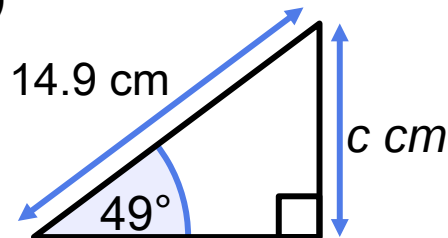
a)



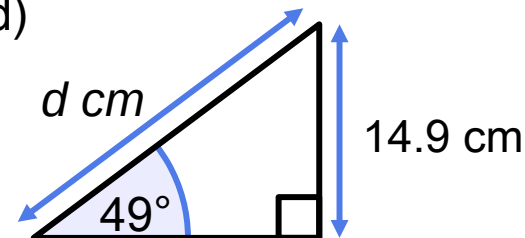
b)



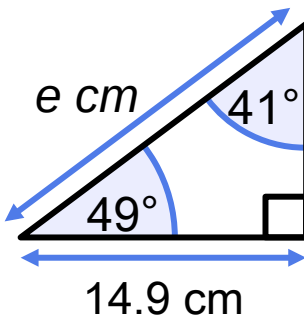
c)



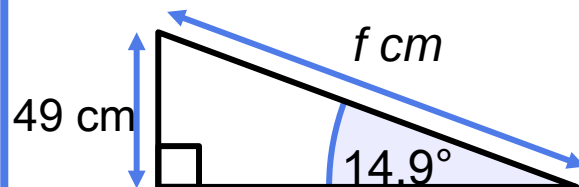
d)



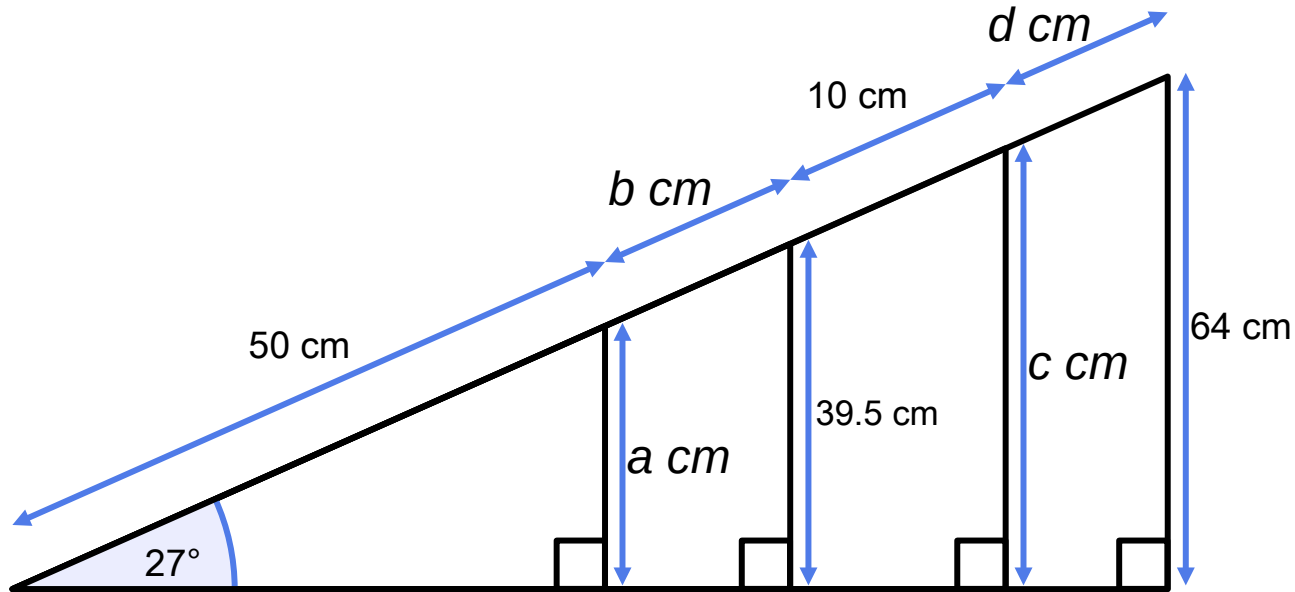
e)



f)



4) Hel dhererka masaafada a , b , c , iyo d (oo lagu soo wareejiyay tirada ugu dhow).



1) Ku beddel dhinacyada iyo xagasha la calaamadeeyay ee saddexagal kasta labadan nooc ee qaacidada sine (sine formula).

Saddexagal kasta, dooro nooca ugu habboon ee qaacidada sine (sine formula) si aad u hesho dhererka dhinaca maqan.

$$h \times \sin(\theta^\circ) = \text{opp}$$

$$119 \sin(\) = 81^\circ \quad a$$

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

$$\frac{a}{\sin(\) 81^\circ} = 119$$

$$a \text{ cm} = 117.53 \text{ cm}$$



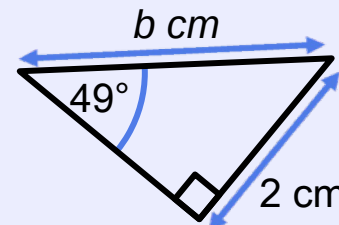
$$h \times \sin(\theta^\circ) = \text{opp}$$

$$2 \sin(\) = 49^\circ \quad b$$

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

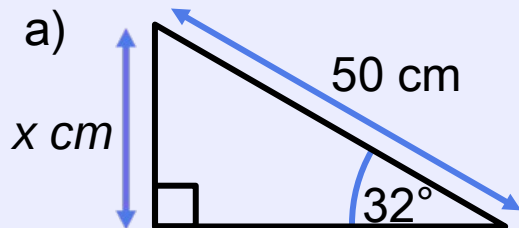
$$\frac{2}{\sin(\) 49^\circ} = b$$

$$b \text{ cm} = 2.65 \text{ cm}$$



2) Isku dhig saddexagalka iyo isla'egta muujinaysa xiriirka ka dhexeeya hypotenuse-kiisa iyo dhinaca ka soo horjeeda.

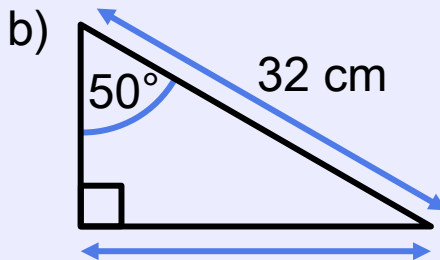
Isticmaal isla'egta si aad u hesho dhererka dhinaca maqan ee lagu calaamadeeyay x ee saddexagal kasta (2 d.p.)



e) $50 \times \sin(32^\circ) = x$

$X = 26.50$

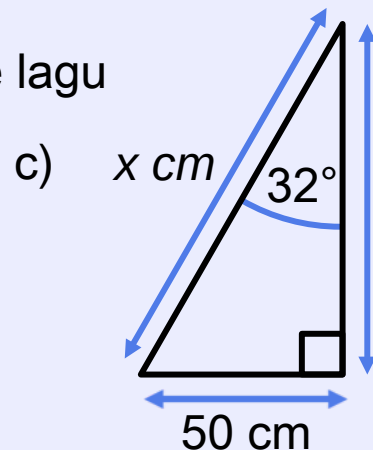
Dhinaca ka soo horjeeda 32° wuxuu leeyahay dherer 26.50 cm



f) $32 \times \sin(50^\circ) = x$

$X = 24.51$

Dhinaca ka soo horjeeda 50° wuxuu leeyahay dherer 24.51 cm



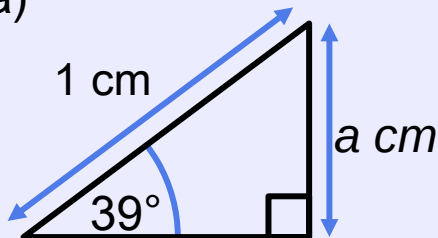
d) $x \times \sin(32^\circ) = 50$

$X = 94.35$

Hypotenuse-ku wuxuu leeyahay dherer 94.35 cm

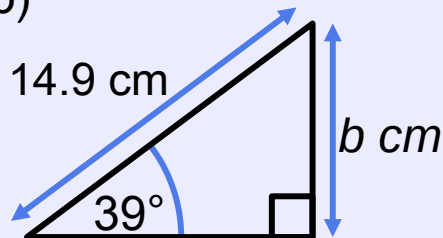
3) Adigoo isticmaalaya qaacidada sine (sine formula), raadi dhererka dhinaca maqan ee ku calaamaysan xaraf saddexagal kasta (2 d.p.)

a)



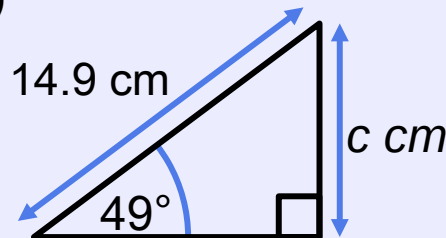
$$a = 0.63$$

b)



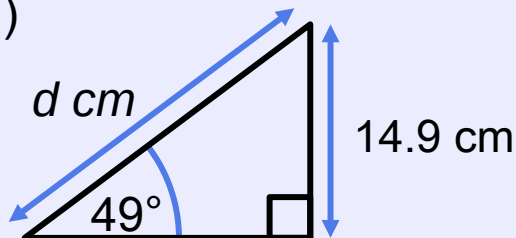
$$b = 9.38$$

c)



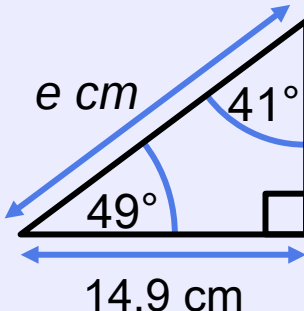
$$c = 11.25$$

d)



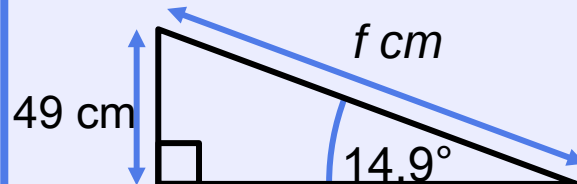
$$d = 19.74$$

e)



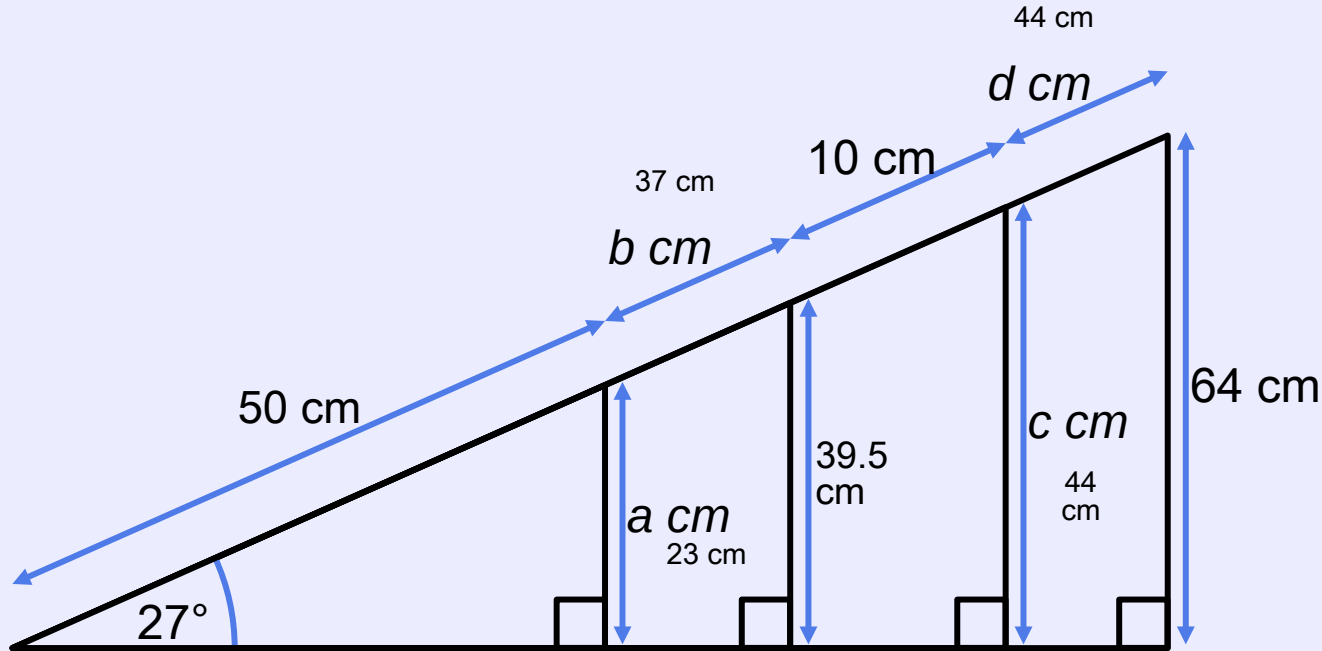
$$e = 22.71$$

f)



$$f = 190.56$$

4) Soo hel dhererrada masaafada a , b , c , iyo d (ku soo koob tirada ugu dhow).



Qaabka casharka

Isticmaalka saamiga sine (sine ratio)



Qaabaynta qaacidada sine (sine formula)



Xisaabinta xaglaha iyadoo la isticmaalayo qaacidada sine (sine formula)

Xisaabinta xaglaha iyadoo la adeegsanayo qaacidada sine (sine formula)



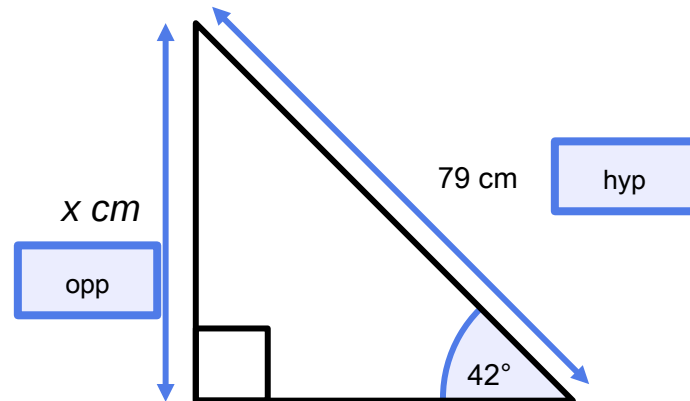
Sharaxaad

xagal (angle)	sine (sine)	cosine (cosine)	tangent (tangent)
0	0	1	0
5	0.087	0.996	0.087
10	0.174	0.985	0.176
15	0.259	0.966	0.268
20	0.342	0.94	0.364
25	0.423	0.906	0.466
30	0.5	0.866	0.577
35	0.574	0.819	0.7
40	0.643	0.766	0.839
45	0.707	0.707	1
50	0.766	0.643	1.192
55	0.819	0.574	1.428
60	0.866	0.5	1.732
65	0.906	0.423	2.145
70	0.94	0.342	2.747
75	0.966	0.259	3.732
80	0.985	0.174	5.671
85	0.996	0.087	11.43
90	1	0	∞

Waxaan hubaa inaan isticmaali karo shaqada sine (sine function) si aan u helo dhererka hypotenuse ama opposite ee saddexagal qumman (right-angled triangle)...



Isra

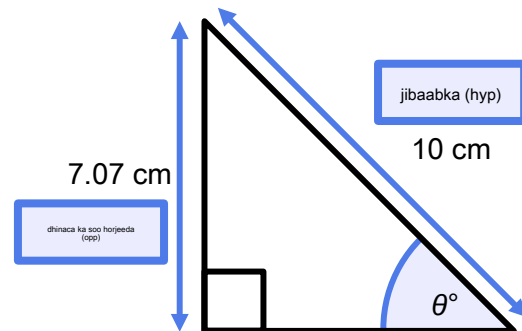


xagal (angle)	sine (sine)	cosine (cosine)	tangent (tangent)
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80	0.985	0.174	5.671
85	0.996	0.087	11.43
90	1	0	∞

...laakiin ma suurtagal tahay in la helo cabbirka xagal iyadoo la adeegsanayo qaacidada sine (sine formula)?



Isra



xagal (angle)	sine (sine)	cosine (cosine)	tangent (tangent)
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90	1	0	∞

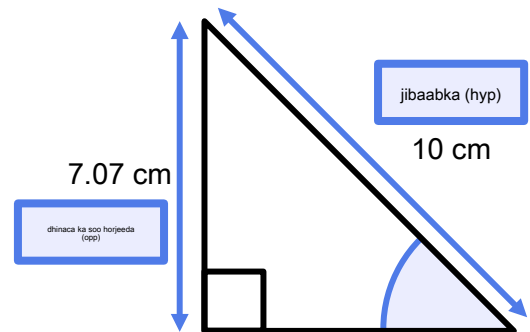
Waxaan isticmaali karnaa nooca qaacidada sine (sine formula) halkaasoo $\sin(\theta^\circ)$ ay tahay mawduuca.

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

Ku beddel dhererka jibaabka (hypotenuse) iyo dhinaca ka soo horjeeda θ° .

$$\sin(\theta^\circ) = \frac{7.07}{10}$$

Si loo helo xagasha, waxaan ka raadinaa 0.707 tiirka sine (sine column) waxaanna hubinaa xagasha u dhigma.



Xisaabinta xaglaha iyadoo la isticmaalayo qaacidada sine (sine formula)



Hubi

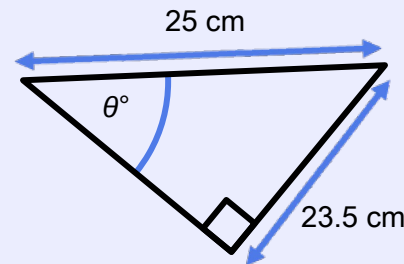
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85	0.996	0.087	11.43
90	1	0	∞

Isra waxay heshay qiime (value) ee $\sin(\theta^\circ)$ ee saddexagalkan.

Adigoo isticmaalaya shaxda raadinta, hel cabbirka xagasha θ° .

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

$$\sin(\theta^\circ) = \frac{23.5}{25} = 0.94$$



Xisaabinta xagasha iyadoo la isticmaalayo qaacidada sine



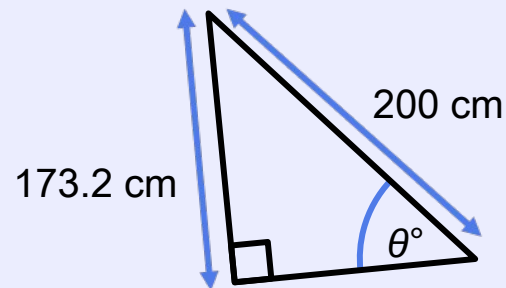
Hubi

xagal (angle)	sine	cosine	tangent
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85	0.996	0.087	11.43
90	1	0	∞

Adigoo ku beddelaya dhererka hypotenuse iyo dhinaca ka soo horjeeda θ° ee qaacidada sine, isticmaal shaxda raadinta si aad u hesho cabbirka xagasha θ° .

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

$$\sin(\theta^\circ) = \text{ ——— }$$

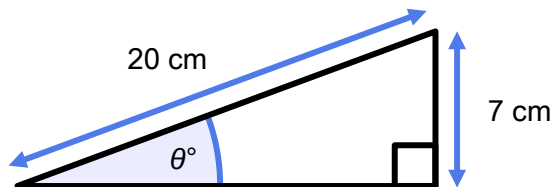




xagal (angle)	sine	cosine	tangent
0	0	1	0
5	0.087	0.996	0.087
10	0.174	0.985	0.176
15	0.259	0.966	0.268
20	0.342	0.94	0.364
25	0.423	0.906	0.466
30	0.5	0.866	0.577
35	0.574	0.819	0.7
40	0.643	0.766	0.839
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75	0.966	0.259	3.732
80	0.985	0.174	5.671
85	0.996	0.087	11.43
90	1	0	∞

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

$$\sin(\theta^\circ) = \frac{7}{20} = 0.35$$

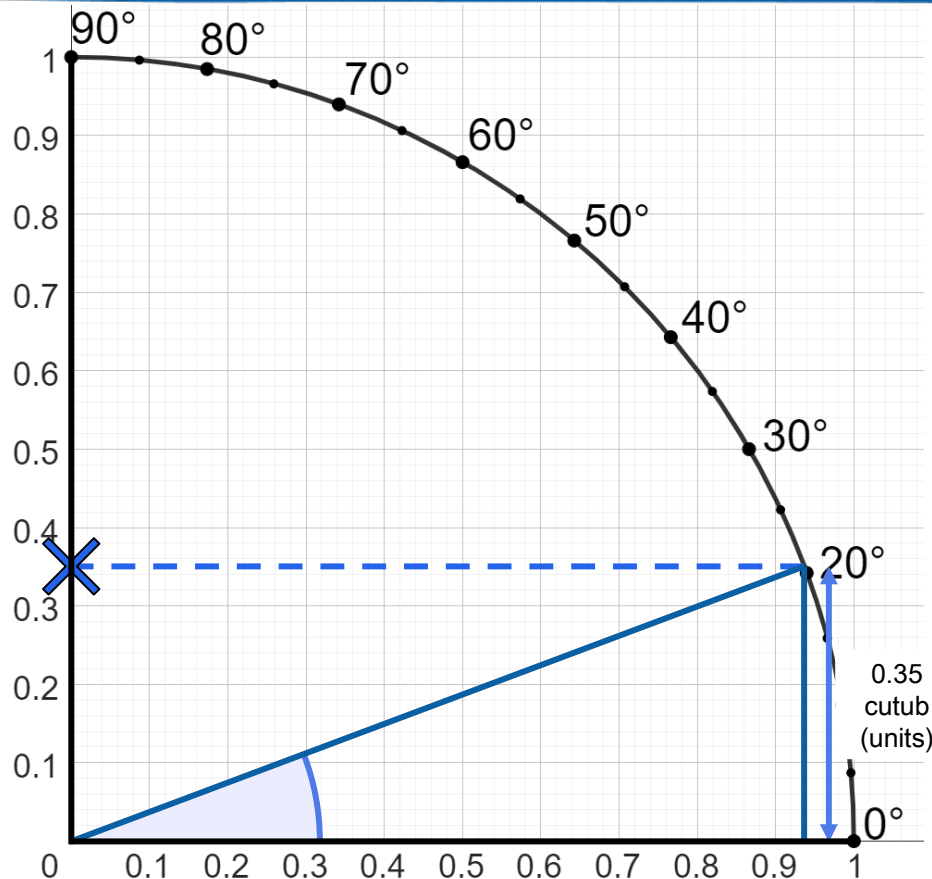


Oh maya!
Kawaran haddii aan helo qiime (value) $\sin(\theta^\circ)$
oo aan ku jirin shaxda?



Isra

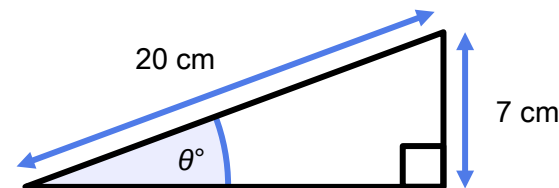
Waxaan ku arki karaa shaxda in θ° u
dhexeyso 20° iyo 25° , laakiin ma sii saxan
karaa?



Waxaad sidoo kale heli kartaa cabbirka xagasha θ° adigoo ka akhriya dhidibada goobta cutubka (unit circle), laga bilaabo dhidibka y (y-axis).

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

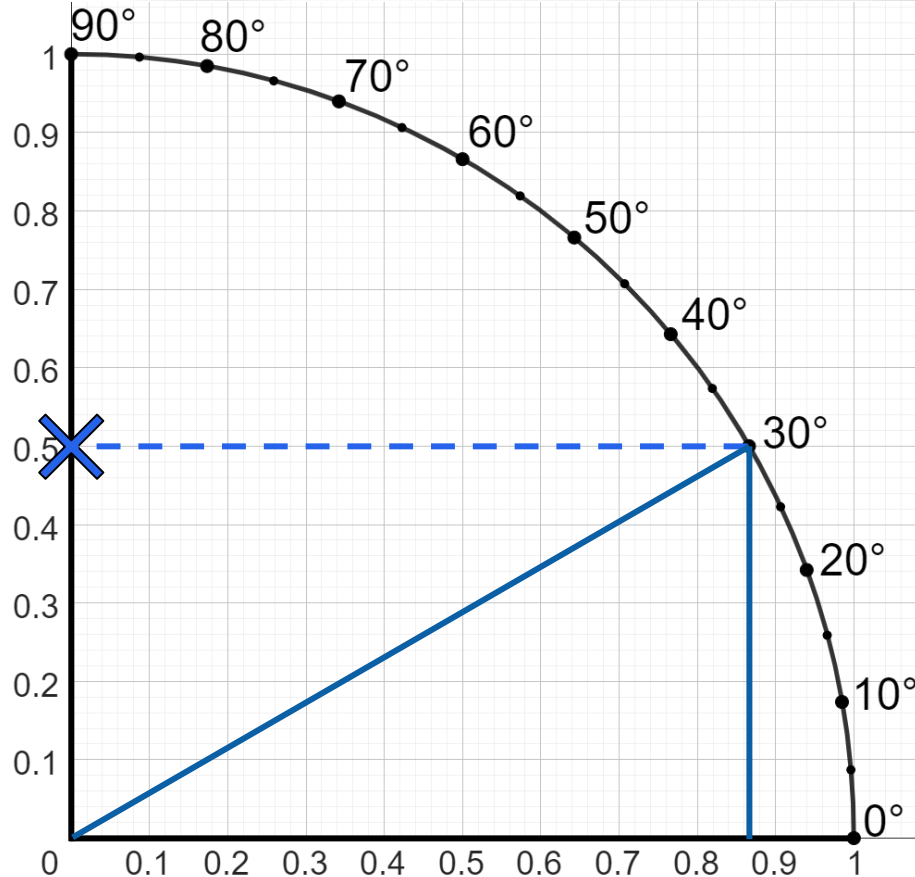
$$\sin(\theta^\circ) = \frac{7}{20} = \boxed{0.35}$$



Xisaabinta xaglaha iyadoo la isticmaalayo qaacidada sine (sine formula)



Sharaxaad

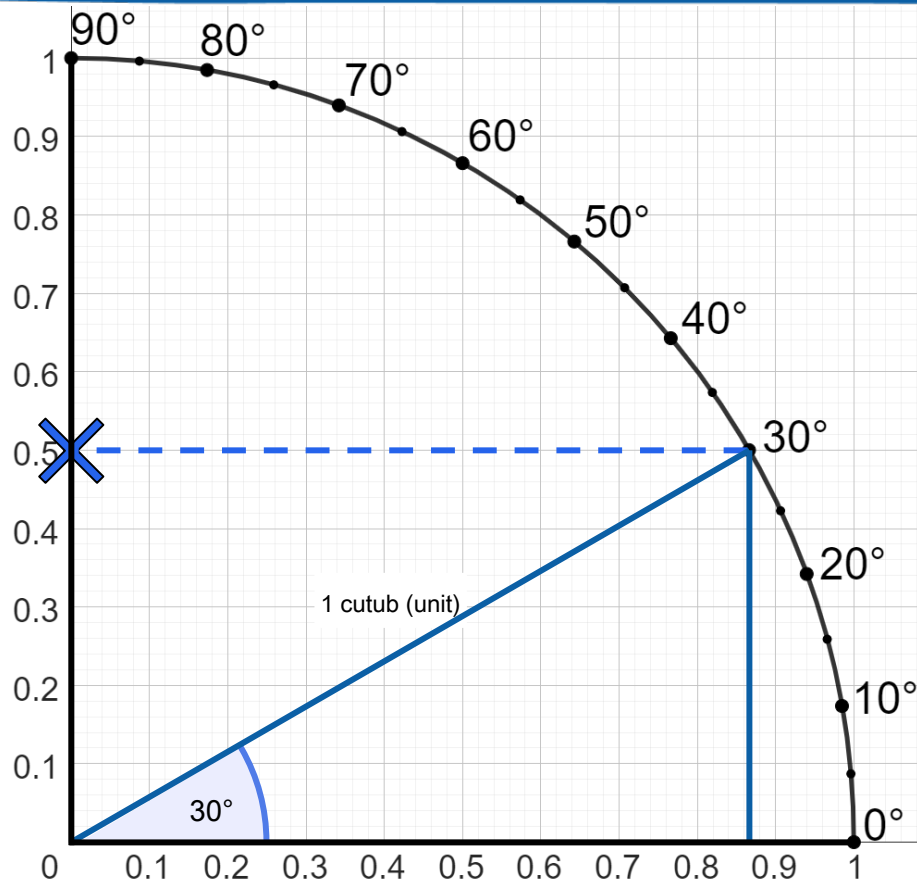


Isticmaalka goobta cutubka (unit circle) ayaa ka fiican shaxda, laakiin waa mid aad u dheer, oo weli ma aha mid sax ah.



Isra

Ma jirtaa hab saxan oo lagu helo xagal?
Sida aan u isticmaali karno xisaabiyaha (calculator) si aan u helno dhererka dhinaca?



Goobta cutubka (unit circle), waxaan ku heli karnaa dhererka dhinaca ka soo horjeeda xagasha 30° adigoo ku dabaqaya hawsha sine (sine function) xagashaas:

30°
xagal (angle)

dhererka dhinaca goobta cutubka
(unit circle)

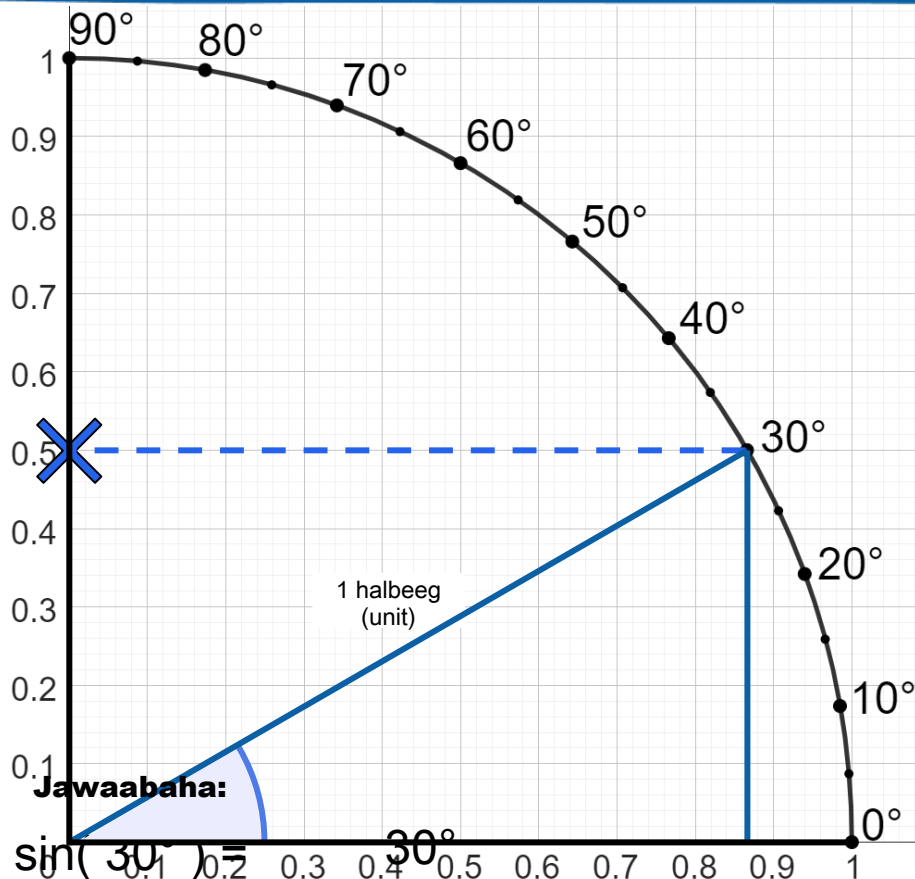
Hawsha sine (sine function) waxay leedahay hawl rogan (inverse function) oo loo yaqaan hawsha arcsine (arcsine function).

Waxaa laga yaabaa inaad ku aragto $\sin^{-1}$ xisaabiyaha (calculator).

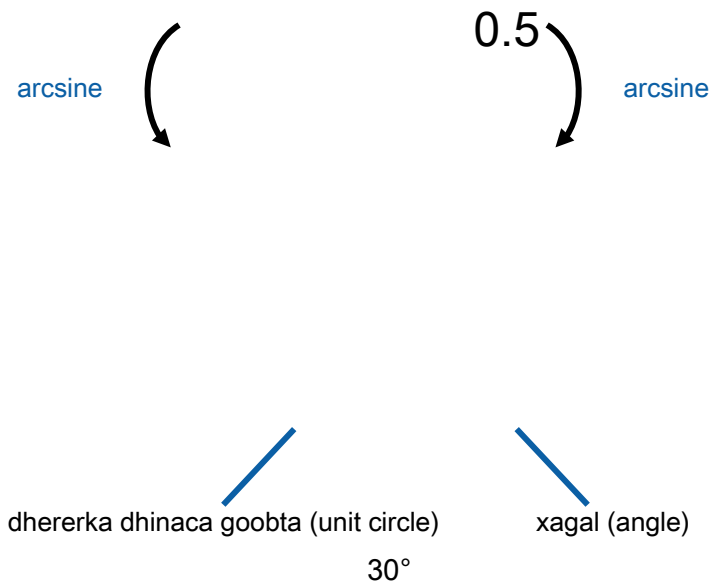
Xisaabinta xaglaha iyadoo la isticmaalayo qaacidada sine (sine formula)



Sharaxaad



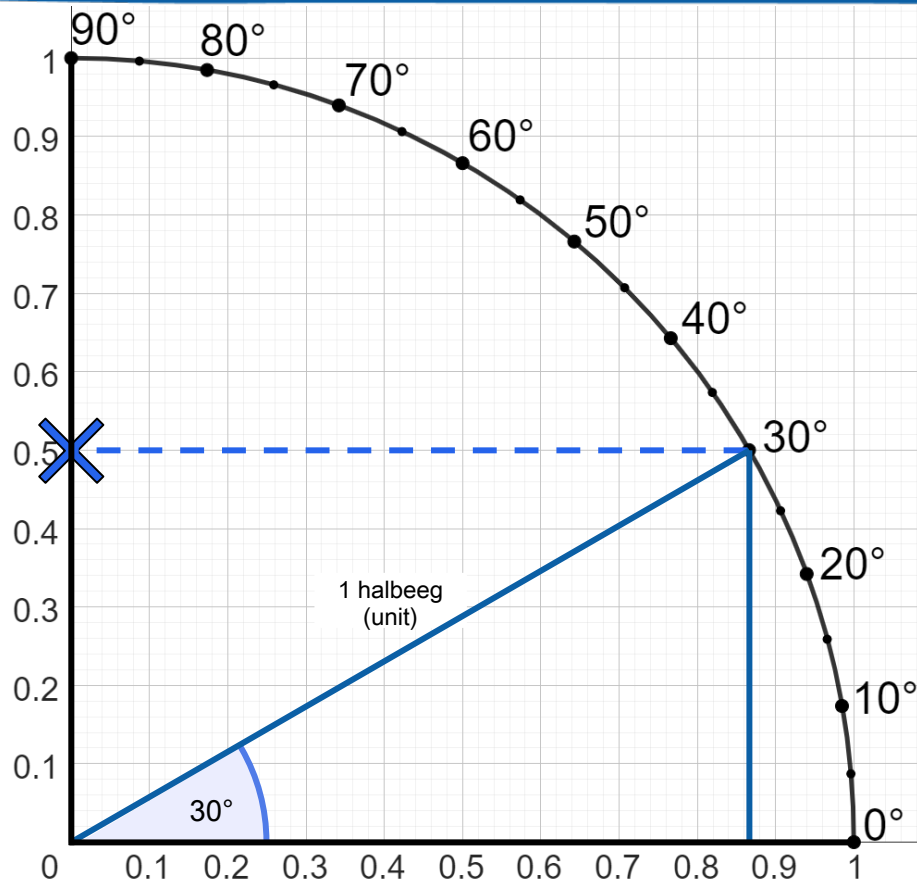
Goobta (unit circle) dhexdeeda, waxaan ka heli karnaa dhererka dhinaca ka soo horjeeda xagasha 30° adigoo ku dabaqaya shaqada sine (sine function) xagashaas:



Xisaabinta xaglaha iyadoo la isticmaalayo qaacidada sine (sine formula)



Sharaxaad



Waxaan isticmaali karnaa shaqada arcsine ee xisaabiyaha (calculator) si aan u helno xagal.

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



Xisaabinta xaglaha iyadoo la isticmaalayo qaacidada sine (sine formula)



Kee ka mid ah isla'egyadan (equations) ayaa sax ah marka la raadinayo cabbirka xagasha n° ee isla'egta:

$$\sin(n^\circ) = 0.24?$$

a $n = \frac{0.24}{\sin()}$

c $n = \sin^{-1}(0.24)$ ✓

b $n = \sin(0.24)$

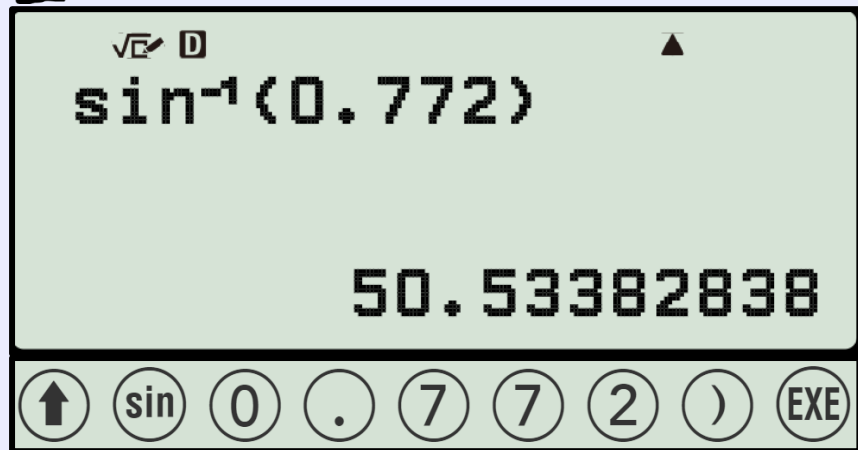
d $n = \arcsin(0.24)$ ✓

Xisaabinta xaglaha iyadoo la isticmaalayo qaacidada sine (sine formula)

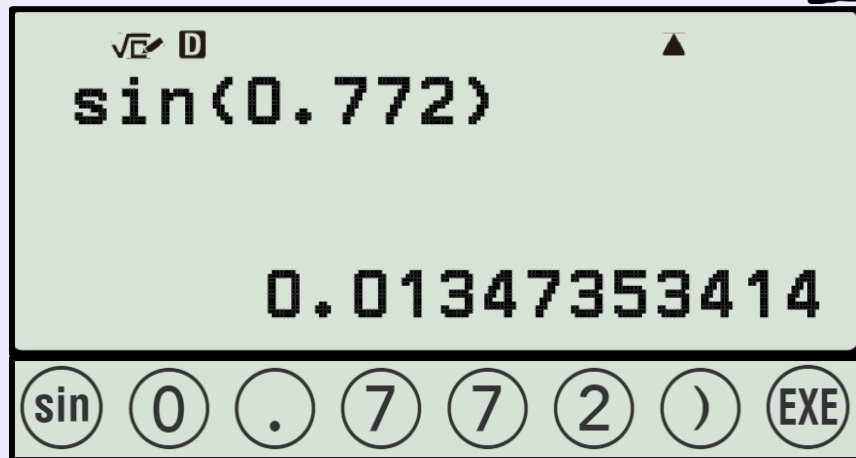
Bandhigga xisaabiyaha (calculator display) kee ayaa sax ah marka la raadinayo cabbirka xagasha p° ee isla'egta:

$$\sin(p^\circ) = 0.772?$$

a



b



Helista cabbirka xagasha waxay u baahan doontaa isticmaalka arcsine, kaas oo lagu muujiyo $\sin^{-1}$ ee xisaabiyaha (calculator).

Xisaabinta xaglaaha iyadoo la isticmaalayo qaacidada sine (sine formula)

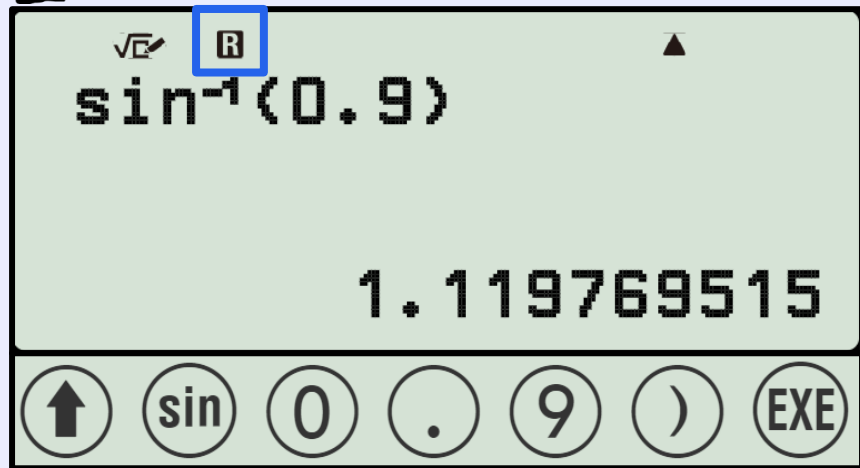


Hubi

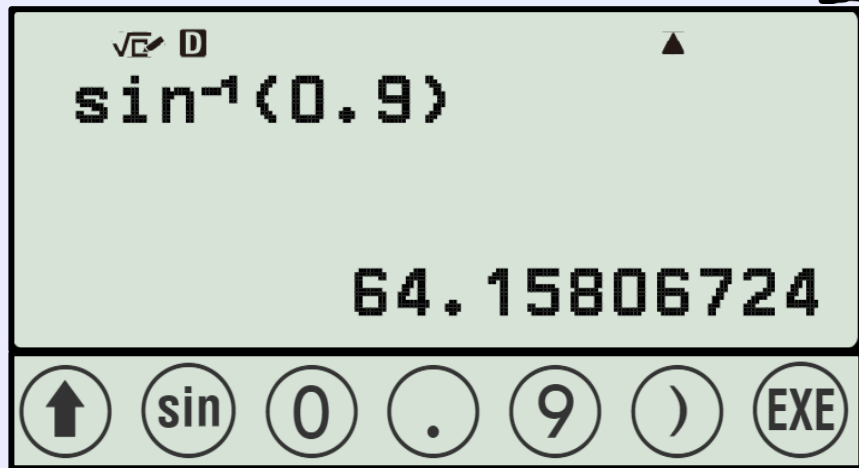
Bandhigga kalkuleetarka (calculator display) kee baa sax ah marka la raadinayo cabbirka xagasha (angle) y° ee isla'egta (equation):

$$\sin(y^\circ) = 0.9?$$

a



b



Jawaabaha labadaba si sax ah ayaa loo geliyay kalkuleetarka (calculator).

Si kastaba ha ahaatee, kalkuleetarka (calculator) a wuxuu loo dejiyay raadiyaan (radians), ma aha darajo (degrees). Sidaa darteed, natiijadiisu ma aha xagal (angle) lagu bixiyay darajo (degrees).

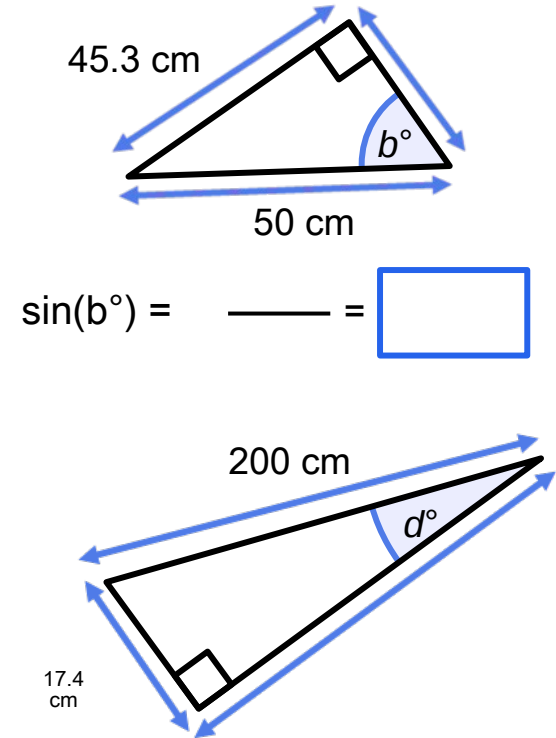
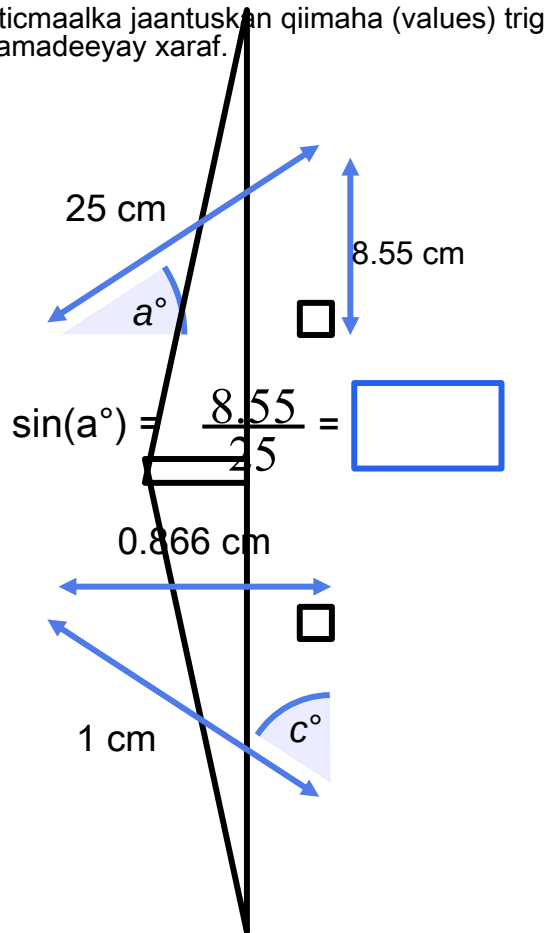


Hawsha B Xisaabinta xaglaha (angles) iyadoo la isticmaalayo qaacidada (formula) sine

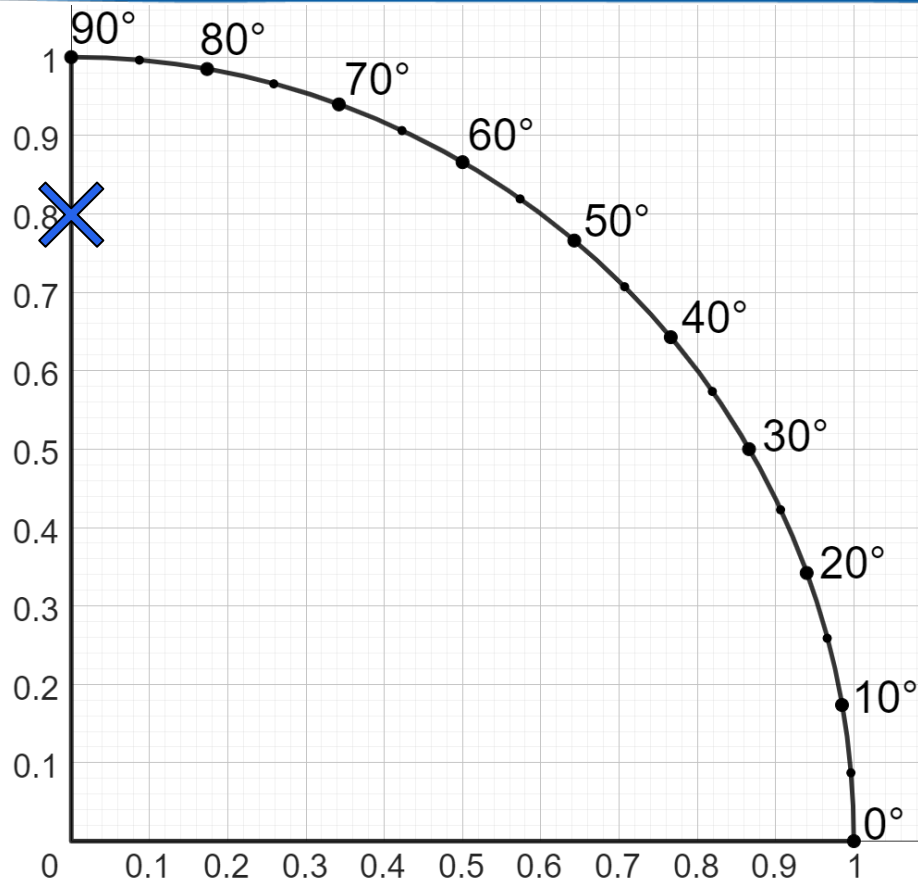


xagal (angle)	sine	cosine	tangent
0	0	1	0
5	0.087	0.996	0.087
10	0.174	0.985	0.176
15	0.259	0.966	0.268
20	0.342	0.94	0.364
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75	0.966	0.259	3.732
80	0.985	0.174	5.671
85	0.996	0.087	11.43
90	1	0	∞

1) Isticmaalka jaantuska qiimaha (values) trig, hel cabbirka xagal kasta oo maqan oo lagu calaamadeeyay xaraf.



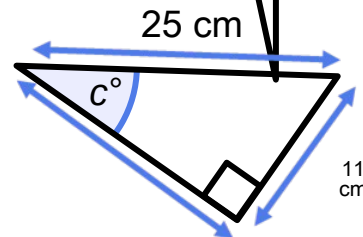
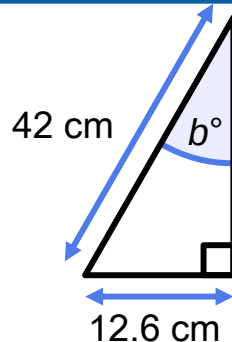
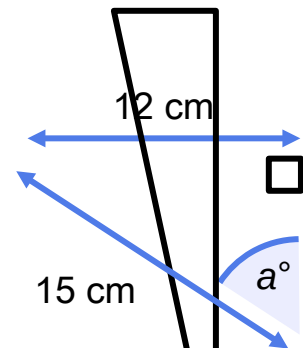
Hawsha B Xisaabinta xaglaha iyadoo la adeegsanayo qaacidada sine (sine formula)



2) Adoo sawiraya khadadka (lines) ku habboon qaybtan goobada (circle) halbeegga (unit), qiyaas cabbirka xagal kasta oo lagu calaamadeeyay xaraf (tiro dhan u dhow).

$$\sin(a^\circ) = \frac{12}{15} = 0.8$$

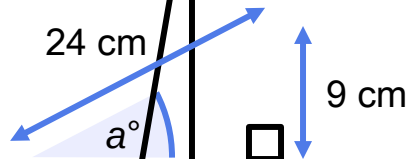
$$a^\circ =$$



Hawsha B Xisaabinta xaglahi iyadoo la adeegsanayo qaacidada sine (sine formula)

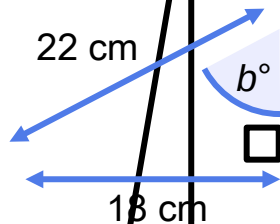


3) Isticmaal xisaabiyahaaga si aad u hesho cabbirka xagal kasta oo lagu calaamadeeyay xaraf (1 d.p.)



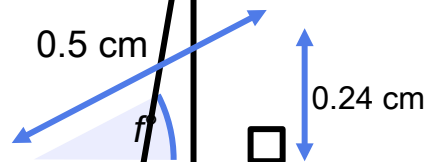
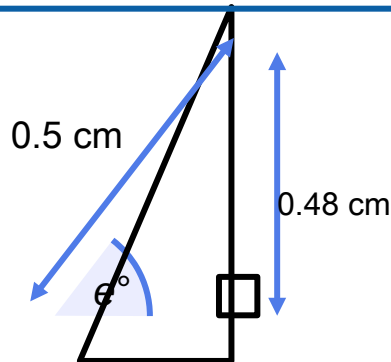
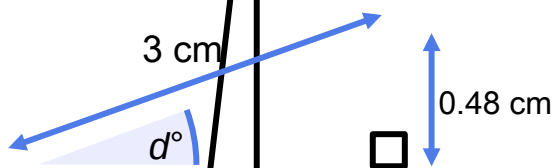
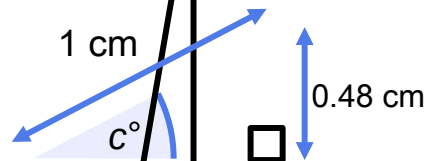
$$\sin(a^\circ) = \frac{9}{24}$$

$$a^\circ = \sin^{-1}\left(\frac{9}{24}\right) = \boxed{}$$



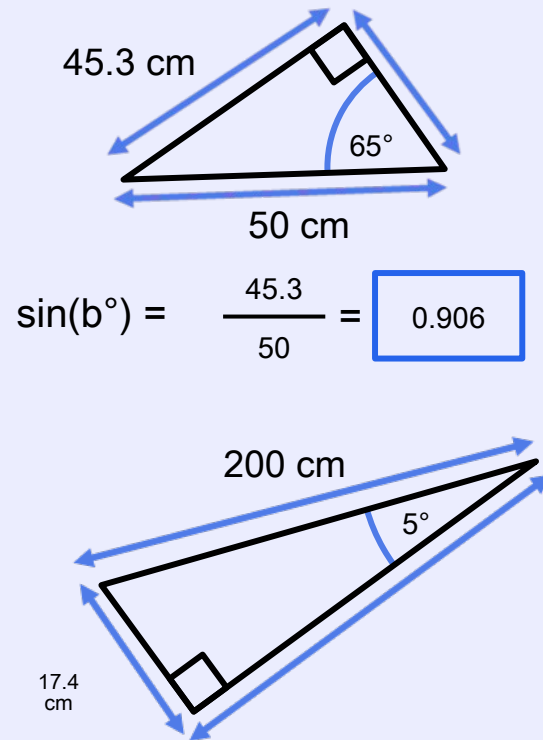
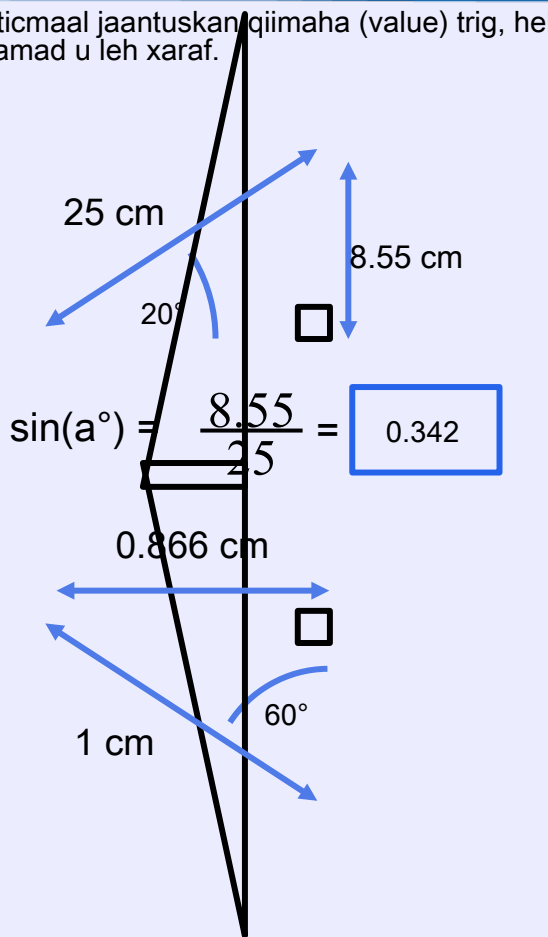
$$\sin(b^\circ) = \frac{18}{22}$$

$$b^\circ = \sin^{-1}\left(\frac{18}{22}\right) = \boxed{}$$

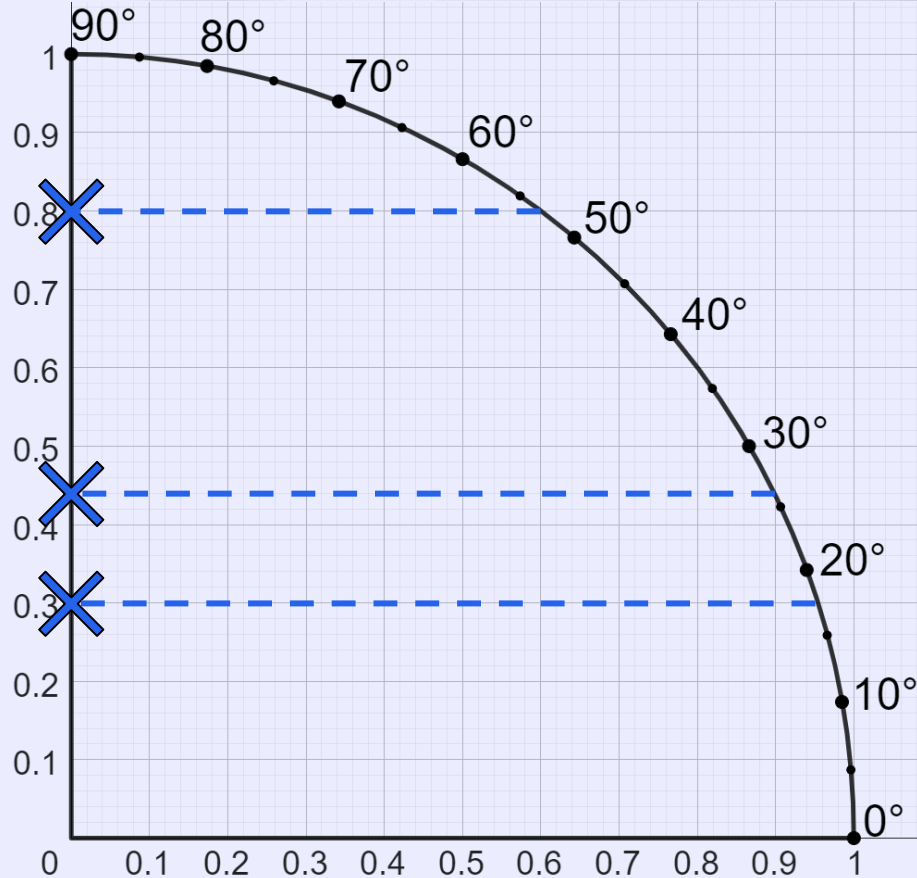


xagal (angle)	sine (sine)	cosine (cosine)	tangent (tangent)
0	0	1	0
5	0.087	0.996	0.087
10	0.174	0.985	0.176
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75	0.966	0.259	3.732
80	0.985	0.174	5.671
85	0.996	0.087	11.43
90	1	0	∞

1) Isticmaal jaantuska qiimaha (value) trig, hel cabbirka xagal (angle) kasta oo maqan oo calaamad u leh xaraf.



Hawsha B Xisaabinta xaglah (angles) iyadoo la isticmaalayo qaacidada sine (sine formula)

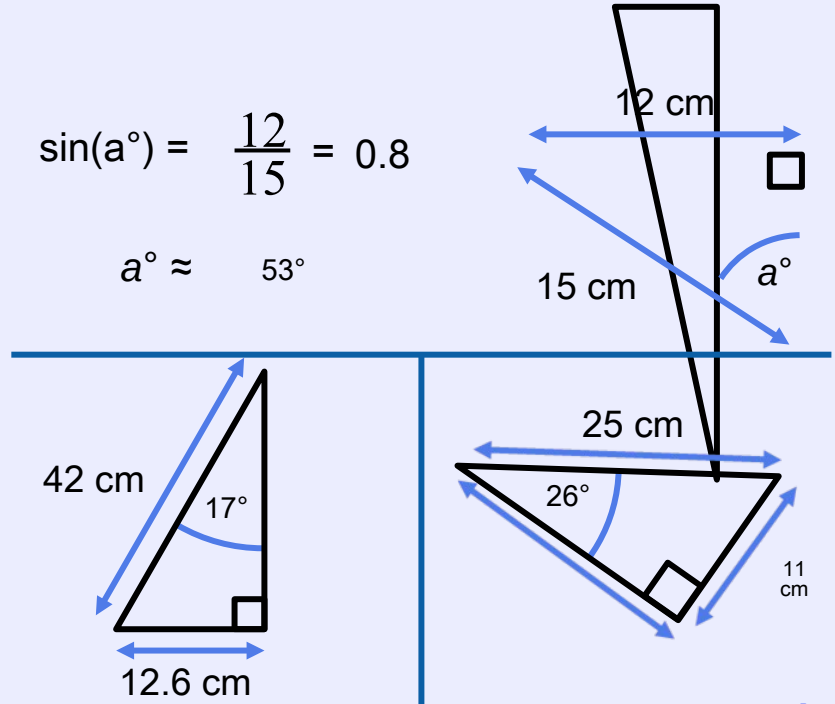


2)

Xagal kasta $\pm 2^\circ$ ee waxa la bixiyay waa qiyaas macquul ah.

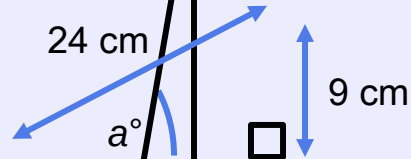
$$\sin(a^\circ) = \frac{12}{15} = 0.8$$

$$a^\circ \approx 53^\circ$$



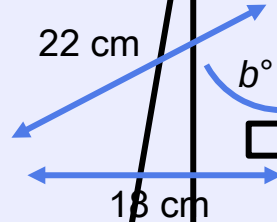
Hawsha B Xisaabinta xaglahi iyadoo la adeegsanayo qaacidada sine (sine formula)

3) Isticmaal xisaabiyahaaga si aad u hesho cabbirka xagal kasta oo calaamad u leh (1 d.p.)



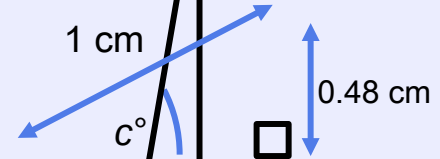
$$\sin(a^\circ) = \frac{9}{24}$$

$$a^\circ = \sin^{-1}\left(\frac{9}{24}\right) = 22.0^\circ$$

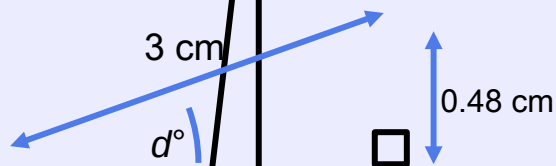


$$\sin(b^\circ) = \frac{18}{22}$$

$$b^\circ = \sin^{-1}\left(\frac{18}{22}\right) = 54.9^\circ$$

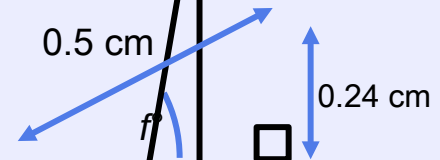
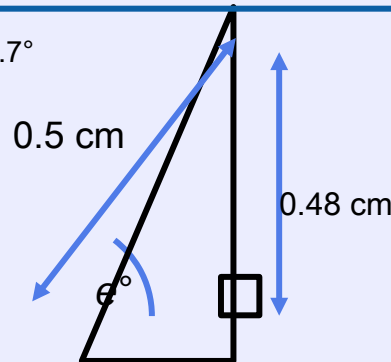


$$c^\circ = 28.7^\circ$$



$$d^\circ = 9.2^\circ$$

$$e^\circ = 73.7^\circ$$



$$f^\circ = 28.7^\circ$$

Soo koobid Isticmaalka saamiga sine (sine ratio)

Xiriirka ka dhexeeya hypotenuse-ka saddexagalka qumman (right-angled triangle) iyo dhinaca ka soo horjeeda xagal θ° waxaa loo qori karaa qaacidlo (formula) siyaabo kala duwan:

$$\frac{\text{opp}}{h} = \sin(\theta^\circ) \quad \frac{\text{opp}}{\sin(\theta^\circ)} = h \quad h \times \sin(\theta^\circ) = \text{opp}$$

Qaacidddadan sine (sine formula) waxaa loo isticmaali karaa in lagu helo dhererka hypotenuse-ka, dhererka dhinaca ka soo horjeeda xagal θ° , ama cabbirka xagasha θ° lafteeda.

Si loo helo cabbirka xagasha, waa in la isticmaalaa shaqada ka soo horjeeda shaqada sine (sine function): shaqada arcsine (arcsine function).

Kalkuleytarka, shaqada arcsine (arcsine function) waxaa badanaa loo qoraa $\sin^{-1}$.