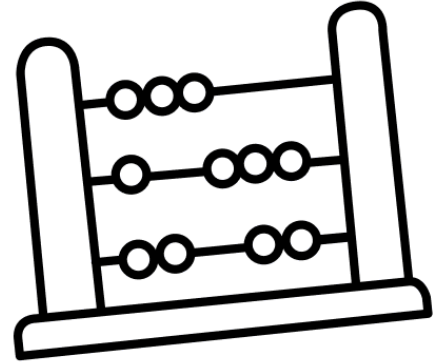


Goobo halbeeg (unit circle)

Maths

Cutub: Trigonometry (Trigonometry)



Natiijo

Waxaan qiimeyn (value) karaa in shaqooyinka trigonometric (trigonometric functions) laga soo qaatay cabbiro ku dhex jira goobo halbeeg (unit circle).

Radius (radius) waa qayb kasta oo xariiq ah oo isku xirta bartamaha goobada iyo meel kasta oo ku taal wareegga (circumference).

Hypotenuse (hypotenuse) waa dhinaca saddexagalka qumman ee ka soo horjeeda xagasha qumman.

Erayada muhiimka ah

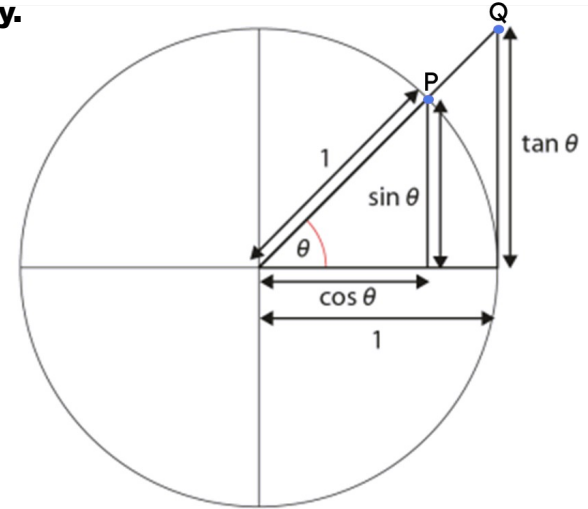
Shaqooyinka trigonometric (trigonometric functions) waxaa badanaa lagu qeexaa saamiyada labada dhinac ee saddexagal xagal qumman leh xagal la bixiyay.

Sine (sine) ee xagal ($\sin(\theta^\circ)$) waa isku-dubbaridka y (y-coordinate) ee dhibicda P ee saddexagalka ka samaysan gudaha goobo halbeeg (unit circle).

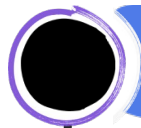
Cosine (cosine) ee xagal ($\cos(\theta^\circ)$) waa isku-dubbaridka x (x-coordinate) ee dhibicda P ee saddexagalka ka samaysan gudaha goobo halbeeg (unit circle).

Tangent (tangent) ee goobo waa xariiq isgooya goobada hal mar oo kaliya.

Tangent (tangent) ee xagal ($\tan(\theta^\circ)$) waa isku-dubbaridka y (y-coordinate) ee dhibicda Q ee saddexagalka ka soo baxa goobo halbeeg (unit circle).



Goobo halbeeg (unit circle)

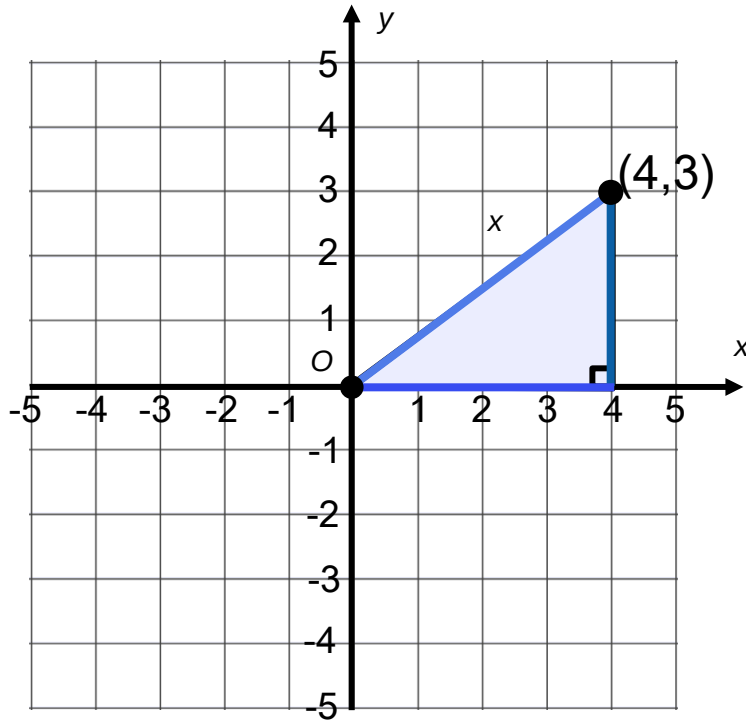


Hordhac ku saabsan sine (sine) iyo cosine (cosine)



Hordhac ku saabsan tangent (tangent)

Intee ayay u jirtaa dhibicda isku-dubbaridkeedu yahay (4, 3) asalka?



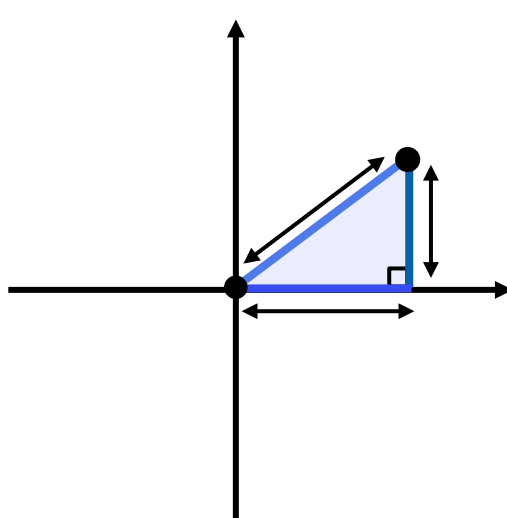
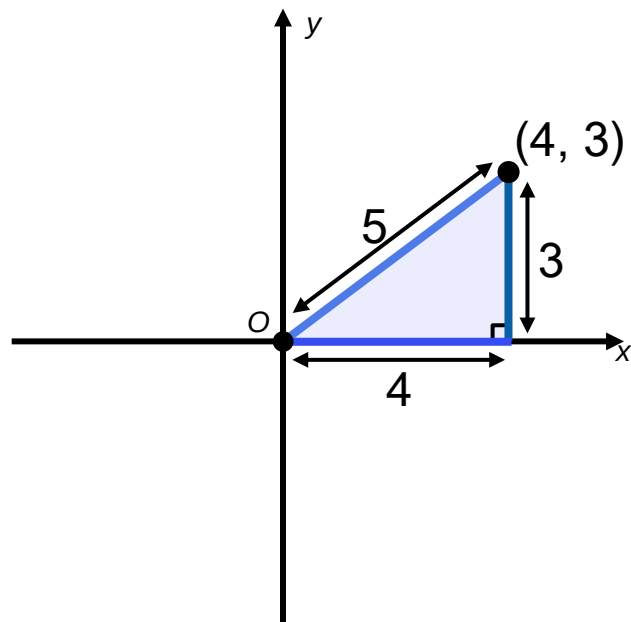
$$x^2 = 4^2 + 3^2$$

$$x^2 = 25$$

$$x = 5 \text{ halbeeg (units)}$$

Dhererka hypotenuse (hypotenuse) waa 5 halbeeg (units) wuxuuna leeyahay gees asalka ah.

Izzy waxay abuurta saddexagal la mid ah shabakad isku-duwayn ah oo leh hypotenuse dhererkiisu yahay 1 halbeeg. Waa maxay isku-duwayaasha barta P?



$$\frac{1}{5}$$
$$\frac{1}{5}$$

$$\frac{1}{5}$$

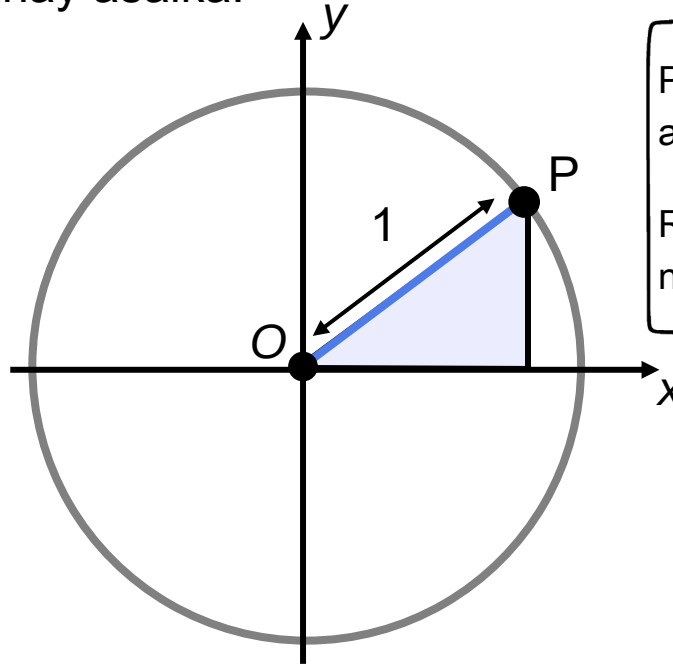
Hordhaca sine iyo cosine

Saddexagalka hoose wuxuu leeyahay hypotenuse dhererkiisu yahay 1 halbeeg, oo mid ka mid ah geesihiisu yahay asalka.

Maxaa dhacaya haddii aan ku hayno hypotenuse dherer go'an oo ah 1 halbeeg oo aan beddelno booska barta P?



Alex



Point P would move in a circle around the origin.

Radius-ka goobada wuxuu noqonayaa 1 halbeeg.

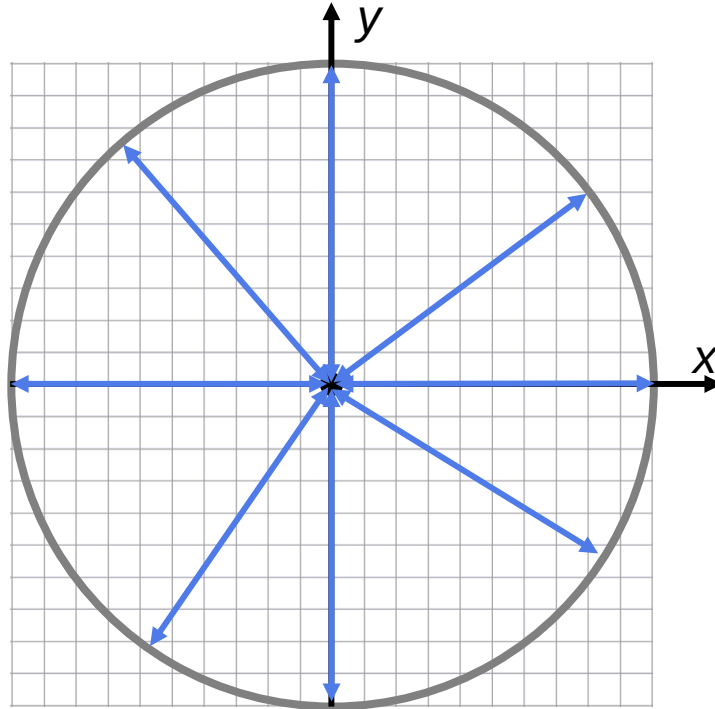


Izzy

Isticmaal linkiga nooca is-dhexgalka ah: saddexagal leh hypotenuse 1 halbeeg 

Hordhaca sine iyo cosine

Goobada halbeegga ah waa goobo ku taal shabakad isku-duwayn

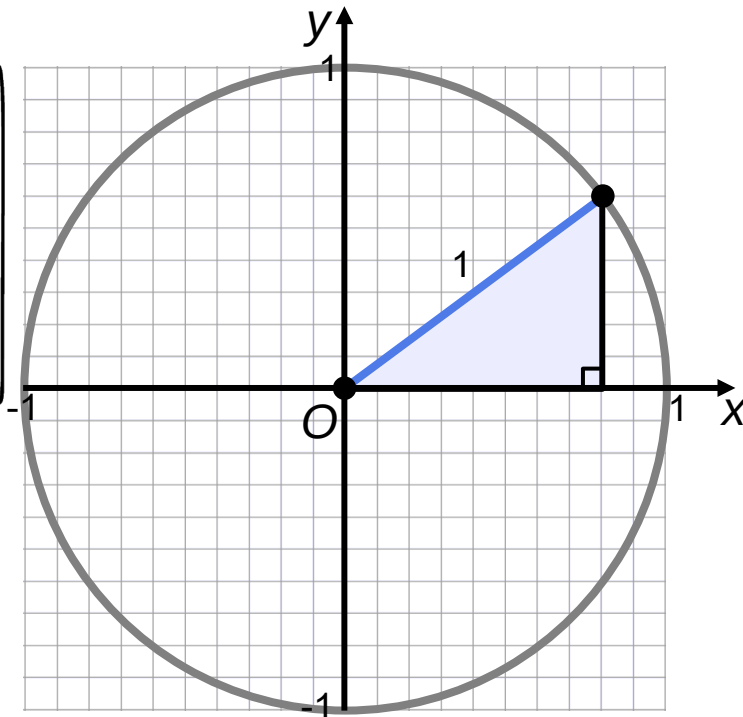


Hordhaca sine iyo cosine

Saddexagal qumman ayaa laga samayn karaa inta u dhaxaysa radius-ka iyo dhidibka x.

Jifaarka saddexagalka waa gacan-ka goobada (radius).

Sidaa darteed, jifaarku wuxuu leeyahay dherer 1 halbeeg.

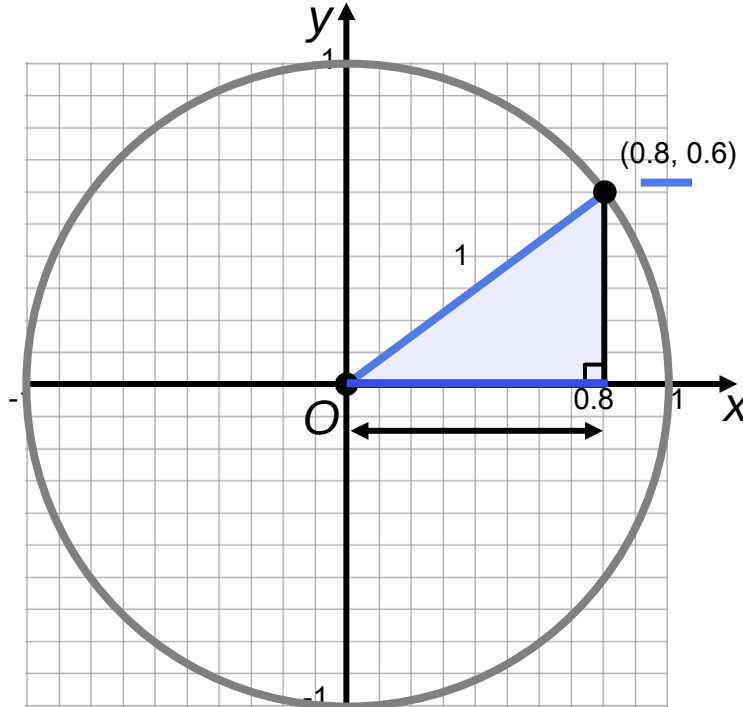


Labada dherer ee kale ee saddexagalka waxaa laga heli karaa isku-duwayaasha (coordinates) barta uu radius-ku ku gooyo goobada.

Dhererka cidhifka jiifka ah ee saddexagalka waxaa laga heli karaa isku-duwayaasha x (x-coordinate).



Lucas



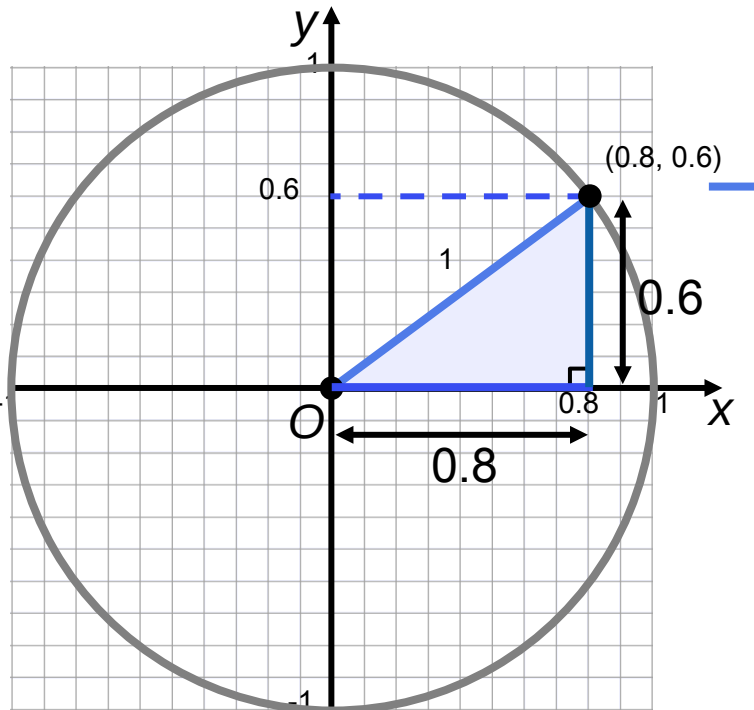
Hordhaca sine (sine) iyo cosine (cosine)

Labada dherer ee kale ee saddexagalka waxaa laga heli karaa isku-duwayaasha barta halka radius (radius) uu ku gooyo goobada.

Dhererka cidhifka toosan ee saddexagalka waxaa laga heli karaa isku-duwayaasha y (y-coordinate).

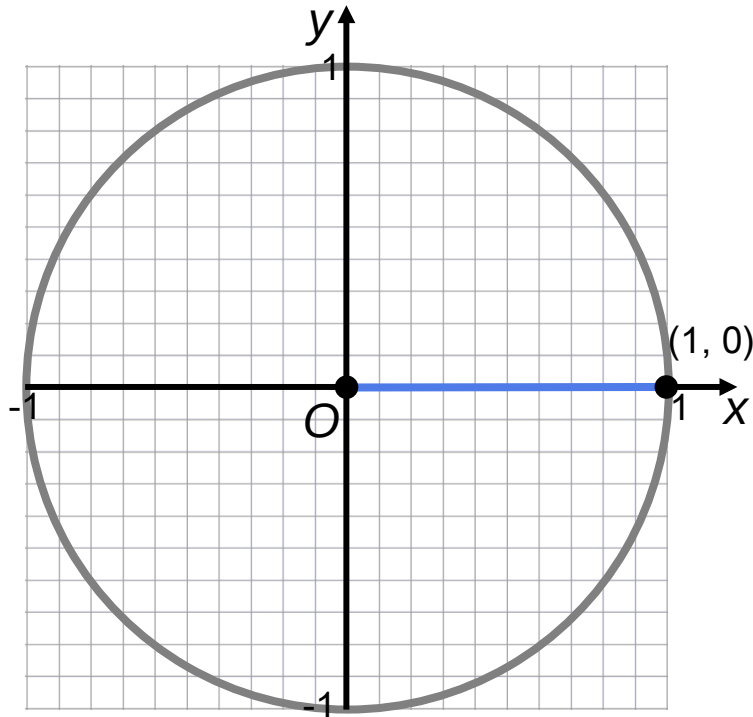


Cabdi



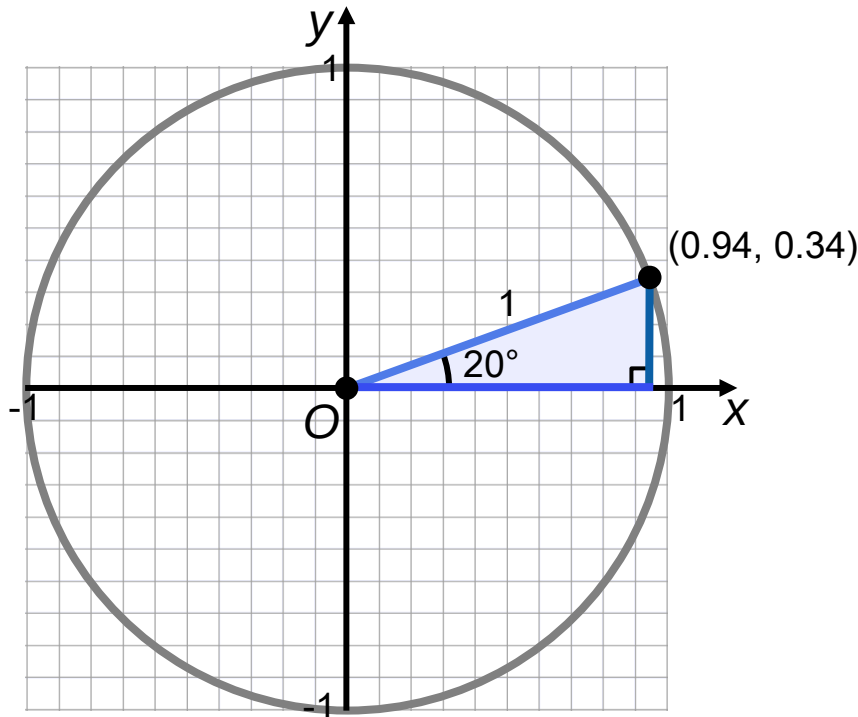
Hordhaca sine (sine) iyo cosine (cosine)

Marka radius (radius) uu ku wareego goobada, waxaan tixgelin karnaa sida xagasha wareeggu u saameeyo dhererka saddexagalka.



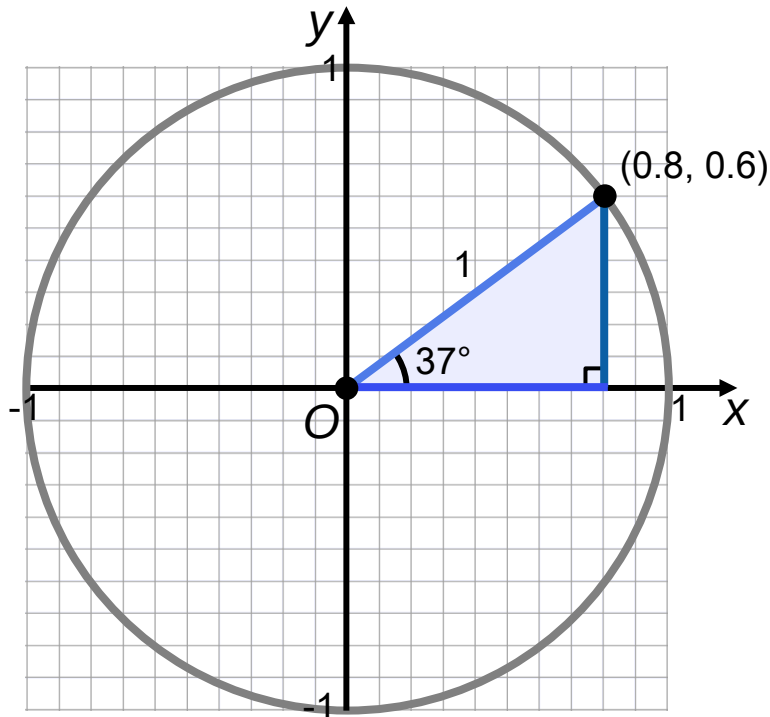
Hordhaca sine (sine) iyo cosine (cosine)

Marka radius (radius) uu ku wareego goobada, waxaan tixgelin karnaa sida xagasha wareeggu u saameeyo dhererka saddexagalka.



Hordhaca sine (sine) iyo cosine (cosine)

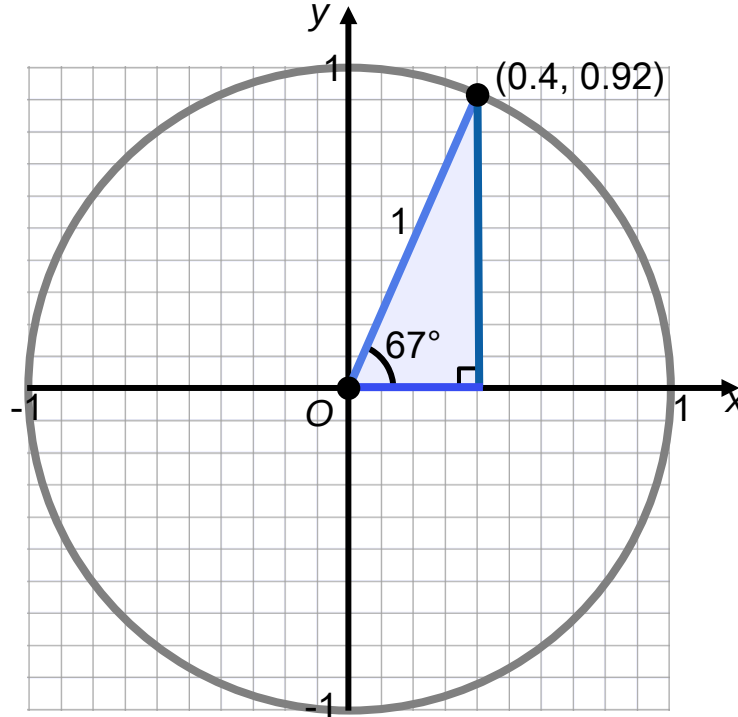
Marka radius (radius) uu ku wareego goobada, waxaan tixgelin karnaa sida xagasha wareeggu u saameeyo dhererka saddexagalka.



Marka radius (radius) uu ku wareego goobada, waxaan tixgelin karnaa sida xagasha wareeggu u saameeyo dhererka saddexagalka.

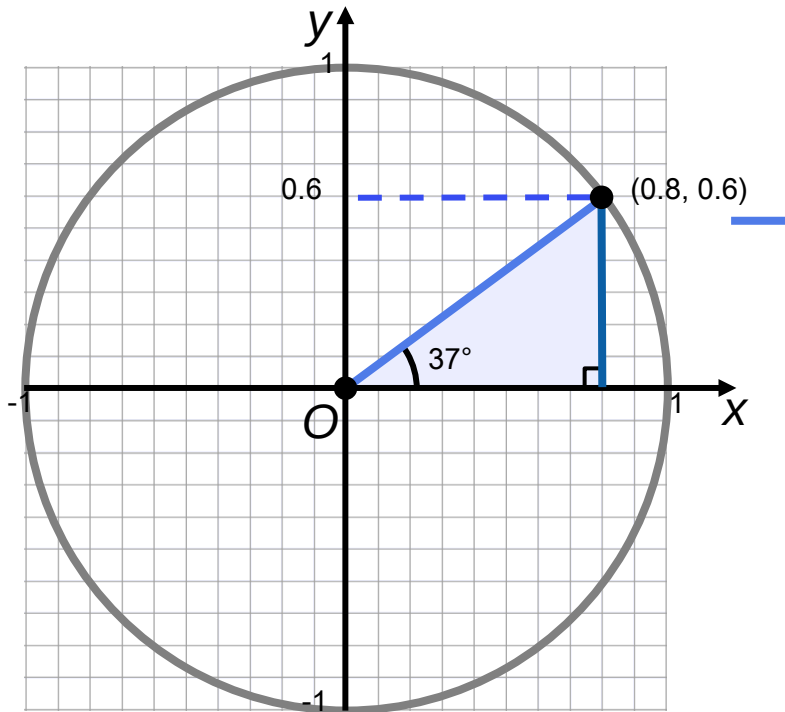
Dhererka cidhifyada jiifka iyo tooska way kala duwan yihiin.

Dhererka hypotenuse (hypotenuse) had iyo jeer waa 1 halbeeg (unit).



Hordhaca sine (sine) iyo cosine (cosine)

Marka radius (radius) uu ku wareego goobada, xagasha wareeggu waxay saameysaa isku-duwayaasha y (y-coordinate) ee barta goobada.



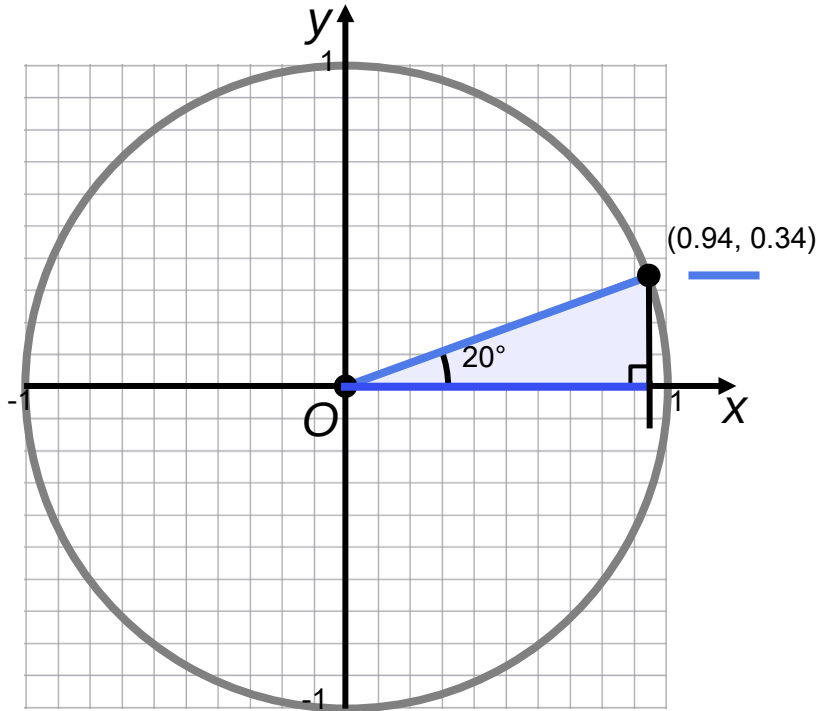
Sine (sine) ee xagal waa isku-duwayaasha y (y-coordinate) ee barta halka radius (radius) loo wareejiyay xagashaas.

Tusaale: Sine (sine) ee 37° waa 0.6.

Ku xidh nooca isdhexgalka: goobo halbeeg (unit circle) (sine iyo cosine) 

Hordhac ku saabsan sine iyo cosine

Marka gacan-radius uu ku wareego goobta, xagasha wareejinta waxay saameyn ku yeelataa isku-duwayaasha x (x-coordinate) ee dhibcaha goobta.

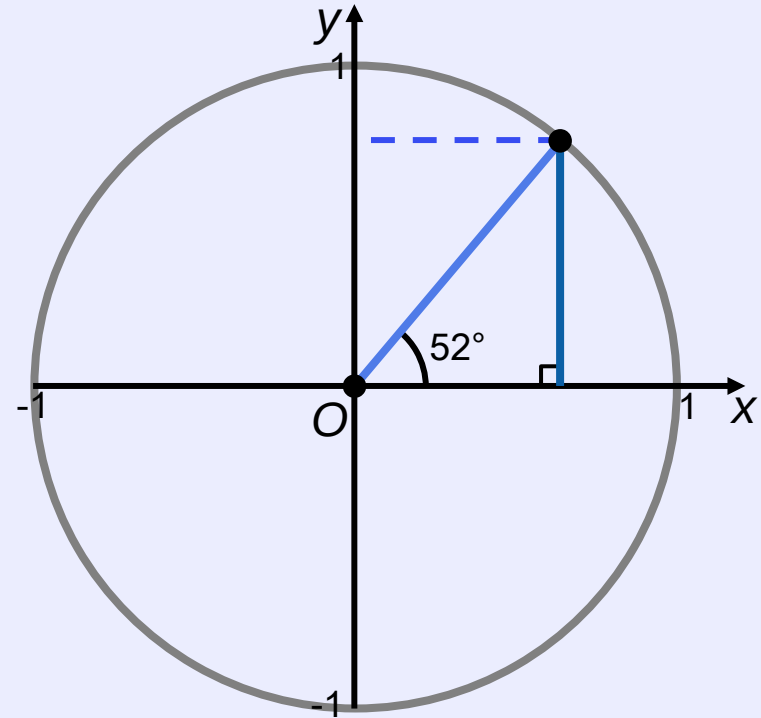


Cosine-ka xagal la siiyay waa isku-duwayaasha x (x-coordinate) ee dhibcaha halka gacan-radius loo wareejiyay si uu u sameeyo xagashaas.

Ku xidh nooca is-dhexgalka ah: goobta halbeegga (unit circle) (sine iyo cosine) 

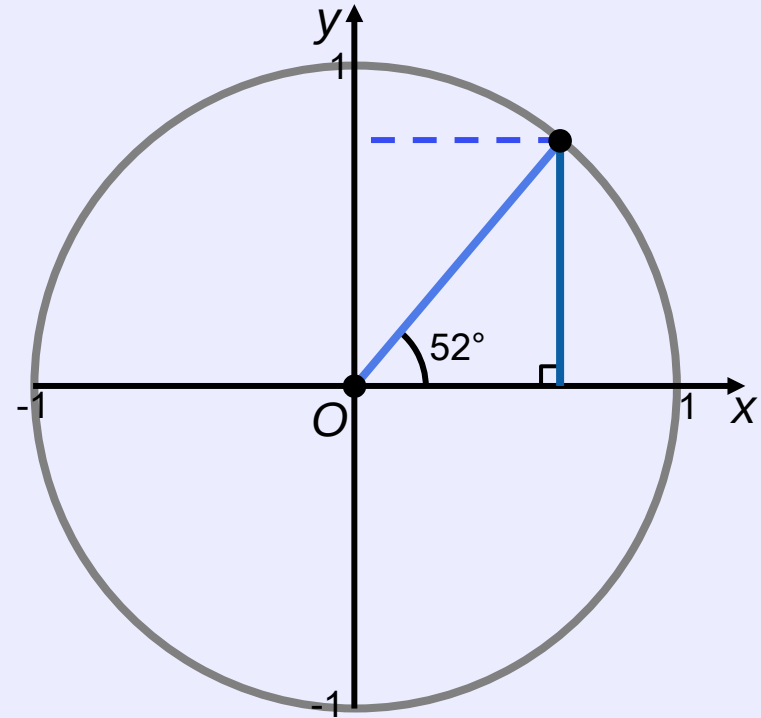
Hordhac ku saabsan sine iyo cosine

xagal waa isku-duwayaasha y (y -coordinate) ee dhibcaha halka gacan-radius loo wareejiyay xagashaas.

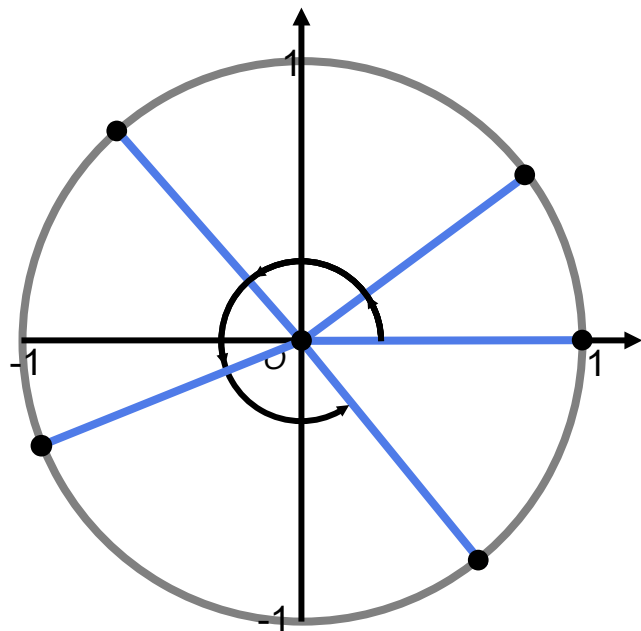


Hordhac ku saabsan sine iyo cosine

Cosine-ka xagal waa ee dhibcaha halka gacan-radius loo wareejiyay xagashaas.



Xagasha waxaa lagu matali karaa xarafka Giriigga ah θ (“theta”).



Gudaha goobta halbeegga (unit circle), θ waa xagasha gacan-radius uu ku wareejiyo si ka soo horjeeda saacadda (anticlockwise) laga bilaabo barta bilowga ah ee $(0, 1)$.

Qaab gaaban oo loo qoro “sine-ka xagasha” waa $\sin(\theta)$, halkaas oo $\sin$ macneheedu yahay sine iyo θ waa xagasha.

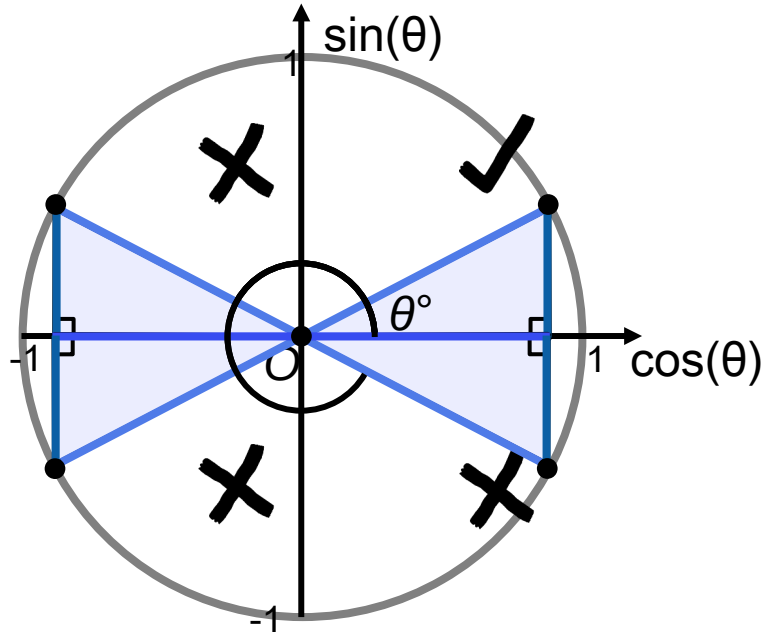
Qaab gaaban oo loo qoro “cosine-ka xagasha” waa $\cos(\theta)$, halkaas oo $\cos$ macneheedu yahay cosine iyo θ waa xagasha.

Hordhac ku saabsan sine iyo cosine



Sharaxaad

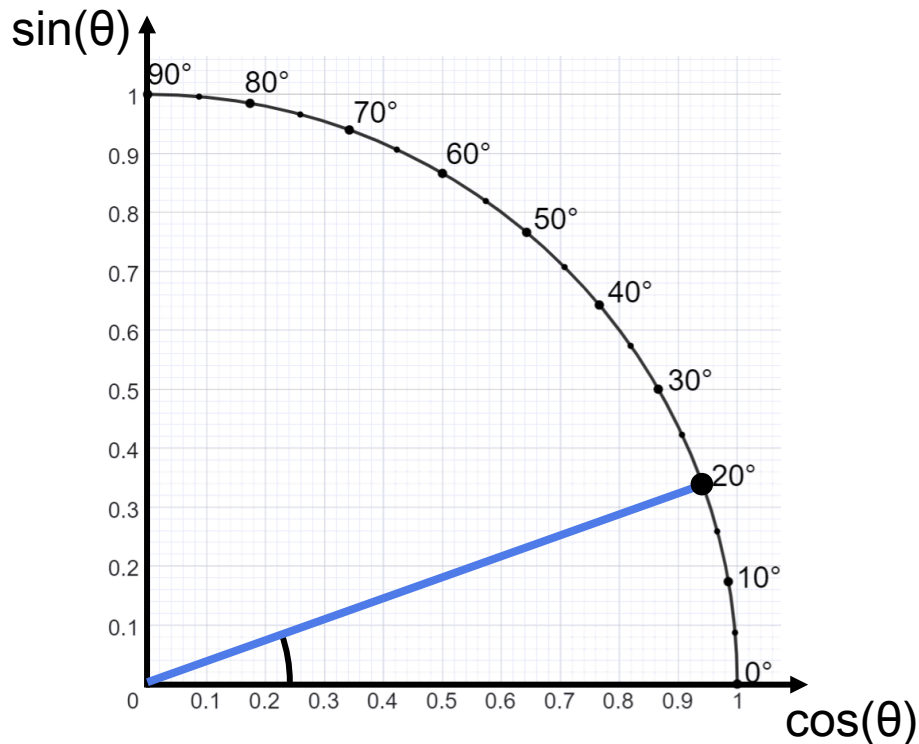
Saddexagallada (triangles) ma laha dherer taban. Sidaa darteed, saddexagallada gudaha goobta halbeegga (unit circle), $\sin(\theta)$ waxay la mid tahay dhererka toosan (vertical length) kaliya marka qiimihiisu yahay mid togan.



Sidoo kale, $\cos(\theta)$ waxay la mid tahay dhererka jiifka (horizontal) kaliya marka qiimihiisu (value) yahay mid togan.

Rubacyada (quadrants) ee $\sin(\theta)$ iyo $\cos(\theta)$ labaduba qiime (value) togan ku yeeshaan?

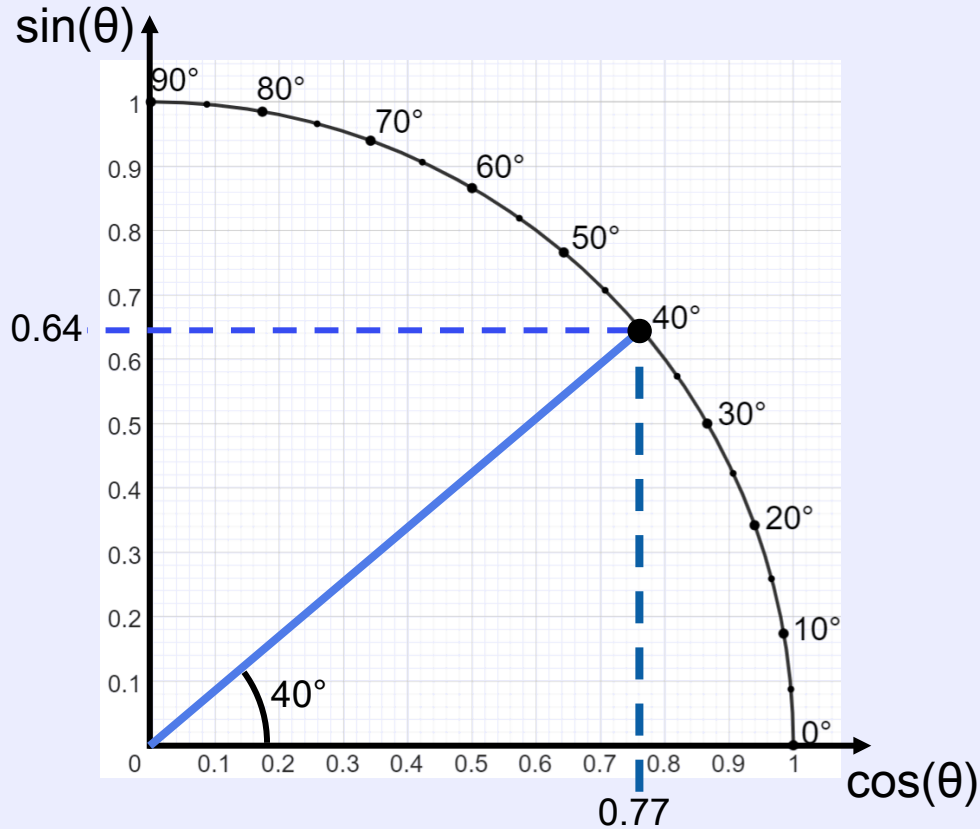
Jaantusku (diagram) wuxuu muujinayaa qaybta goobada cutubka (unit circle) ee ku taal rubaca (quadrant) koowaad.



Dhibcaha ku wareegsan wareegga (circumference) waxay muujinayaan xagasha (angle) wareegga (θ) ee ka imanaysa dhidibka jifka (horizontal axis) ilaa gacan-dhererka (radius) ee dhibic kasta.

Ku xidh nooc isdhexgal ah: goobo cutub (unit circle) oo ku taal rubaca (quadrant) koowaad

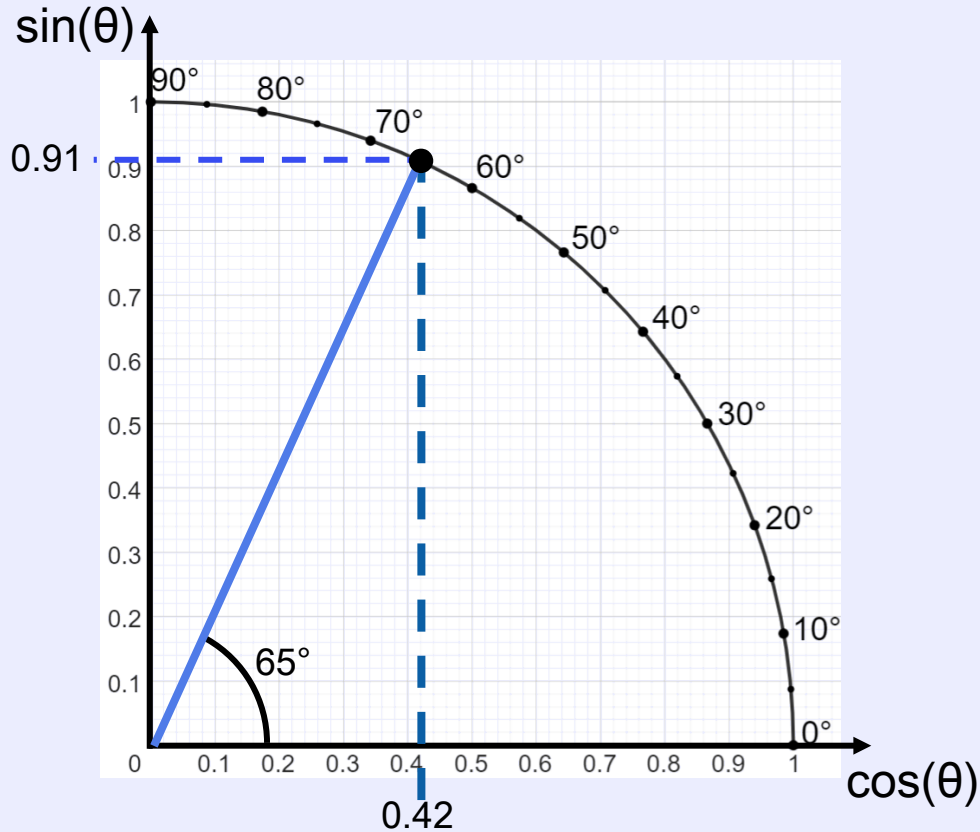
Hordhaca sine iyo cosine



Waa maxay sine ee 40° ?

$$\sin(40^\circ) = 0.64$$

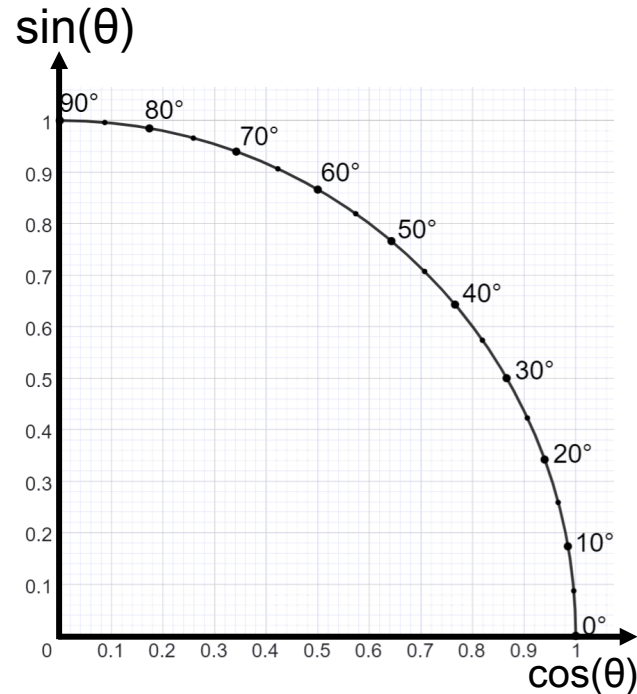
Hordhaca sine iyo cosine



Waa maxay cosine ee 65° ?

$$\cos(65^\circ) = 0.42$$

1) Jaantusku wuxuu muujinayaa qaybta goobada halbeegga (unit circle) ee ku taal rubuca koowaad.



a) Isticmaal jaantuska si aad u buuxiso shaxda.

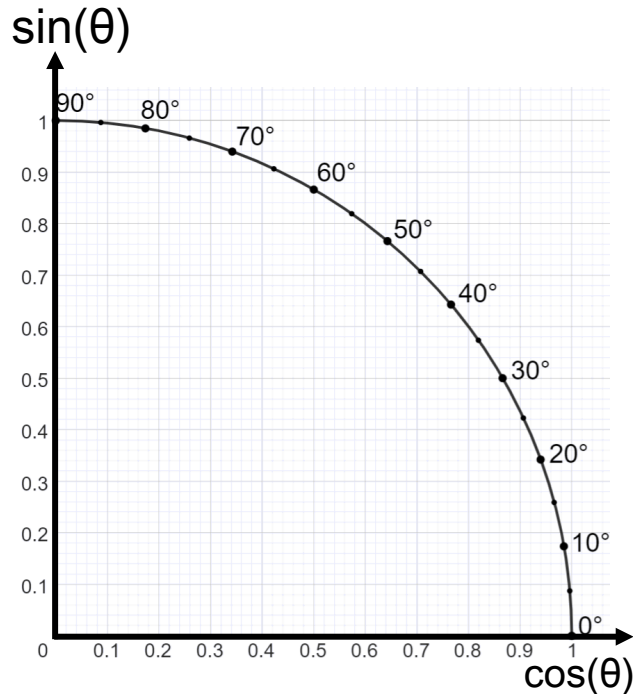
θ°	0	10	20	30	40	50	60	70	80	90
$\sin(\theta)$										

b) Maxaa ku dhaca qiimaha (value) $\sin(\theta)$ marka xagasha (angle) ay kordho rubucan?

c) Isticmaal shaxdaada si aad u hesho xagasha (angle) halka $\sin(\theta) = 0.5$.

d) Isticmaal jaantuska si aad u hesho xagasha (angle) halka $\sin(\theta) = 0.8$.

2) Jaantusku wuxuu muujinayaa qaybta goobada halbeegga (unit circle) ee ku taal rubuca koowaad.



a) Isticmaal jaantuska si aad u buuxiso shaxda.

θ°	0	10	20	30	40	50	60	70	80	90
$\cos(\theta)$										

b) Maxaa ku dhaca qiimaha (value) $\cos(\theta)$ marka xagasha (angle) ay kordho rubucan?

c) Raadi xagasha (angle) halka $\cos(\theta) = 0.5$.

d) Raadi qiimaha (value) θ halka $\cos(\theta) = \sin(40^\circ)$.

e) Raadi xagasha (angle) halka $\cos(\theta) = \sin(\theta)$.

1) Jaantusku wuxuu muujinayaa qaybta goobada halbeegga (unit circle) ee ku taal rubuca koowaad.

a) Isticmaal jaantuska si aad u buuxiso shaxda.

θ°	0	10	20	30	40	50	60	70	80	90
$\sin(\theta)$										

Jawaabuhu waxay kala duwanaan karaan wax yar iyadoo ku xiran sida saxda ah ee loo akhriyay garaafka.

Isticmaal linkiga nooca is-dhexgalka ah: goobta (unit circle) rubuc-koowaad 

b) Maxaa ku dhaca qiimaha (value) $\sin(\theta)$ marka xagasha (angle) ay kordho rubucan?

Waa kordhaa. Qiimihiisa (value) ugu hooseeya waa 0, kan ugu sareeya waa 1.

c) Isticmaal shaxdaada si aad u hesho xagasha (angle) halka $\sin(\theta) = 0.5$.

d) Isticmaal jaantuska si aad u hesho xagasha (angle) halka $\sin(\theta) = 0.8$.

2) Jaantusku wuxuu muujinayaa qaybta goobta (unit circle) ee ku taal rubuc-koowaad.

a) Isticmaal jaantuska si aad u buuxiso shaxda.

θ°	0	10	20	30	40	50	60	70	80	90
$\cos(\theta)$										

Jawaabuhu waxay kala duwanaan karaan wax yar iyadoo ku xiran sida saxda ah ee loo akhriyay garaafka.

Isticmaal linkiga nooca is-dhexgalka ah: goobta (unit circle) rubuc-koowaad 

b) Maxaa ku dhaca qiimaha (value) $\cos(\theta)$ marka xagasha (angle) ay kordho rubucan?

Waa yaraadaa. Qiimihiisa (value) ugu hooseeya waa 0, kan ugu sareeya waa 1.

c) Raadi xagasha (angle) halka $\cos(\theta) = 0.5$.

d) Raadi qiimaha θ halka $\cos(\theta) = \sin(40^\circ)$.

e) Raadi xagasha (angle) halka $\cos(\theta) = \sin(\theta)$.

Goobta (unit circle)



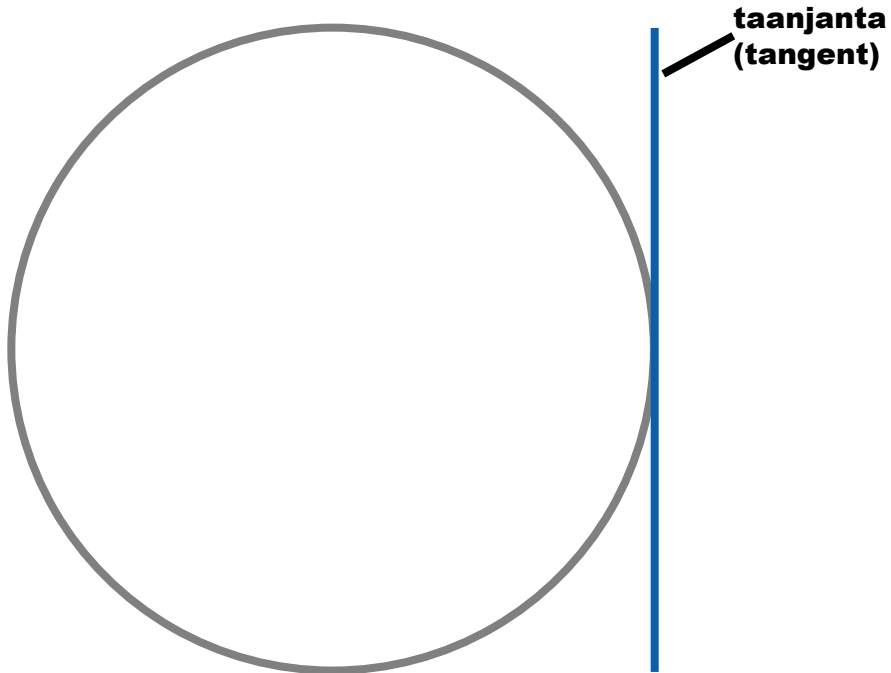
Hordhaca sine iyo cosine



Hordhaca tangent

Hordhaca taanjanta (tangent)

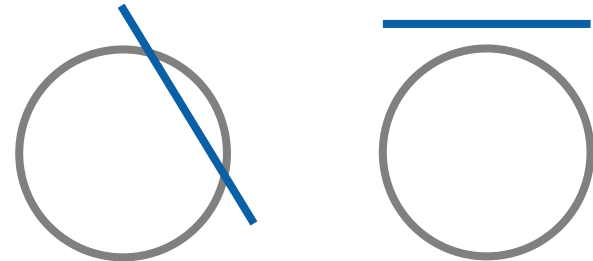
Tangent-ka goobta (circle) waa xariiq ku gooya goobta hal mar oo kaliya.



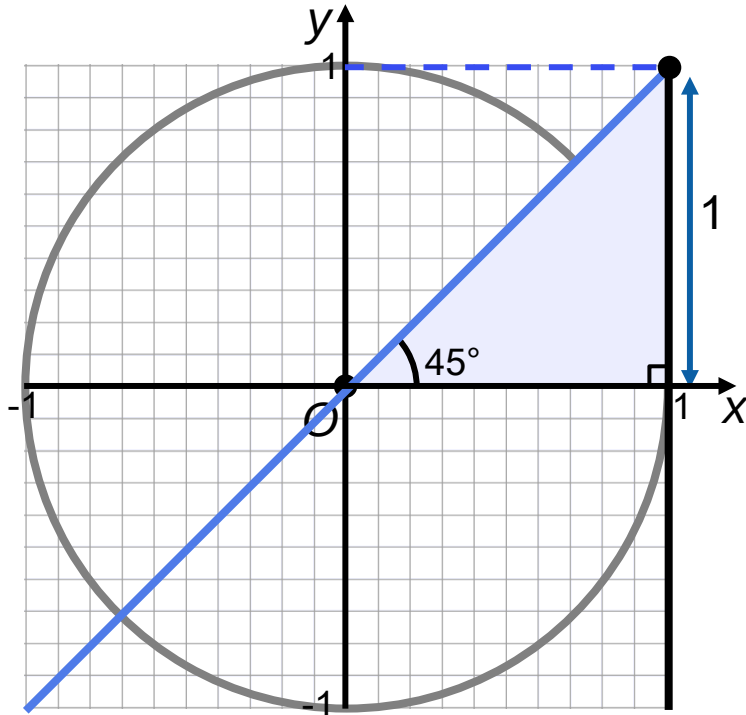
taanjanto (tangents):



ma aha taanjanto (tangents):



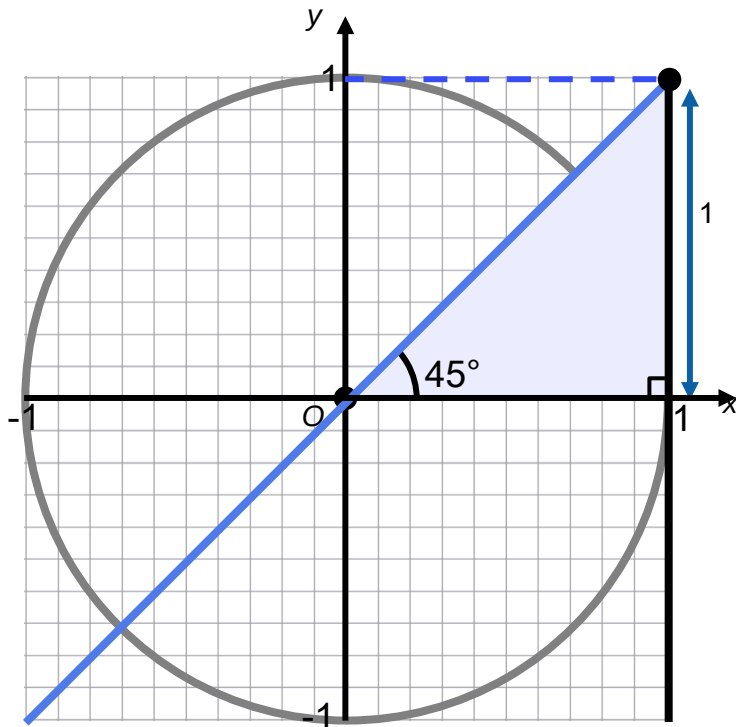
Hordhaca taanjanta (tangent)



Taanjanta (tangent) xagal waa isku-dubbarid-y (y-coordinate) meesha xariiqda (jibaabka saddex-xagalka) ay ku goyso xariiqda taanjanta (tangent line).

Tusaale: Taanjanta (tangent) 45° waa 1.

Xiriirka nooca is-dhexgalka ah: goobada cutubka (taanjanta (tangent))



Qaab gaaban oo loo qoro "taanjanta (tangent) xagalka" waa

$\tan(\theta)$

Soo-gaabinta taanjanta
(tangent)

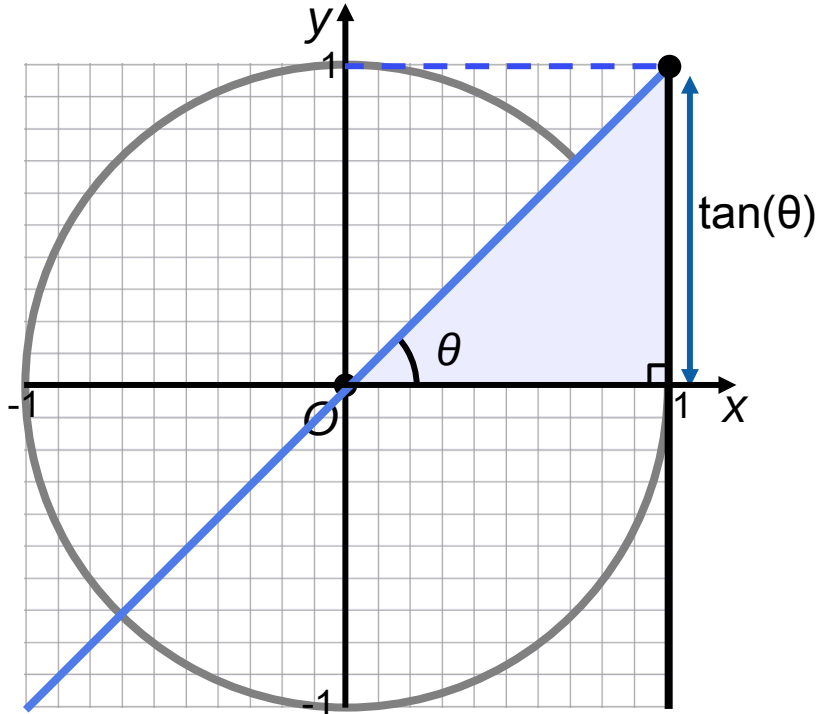
Xagasha wareegga
(Angle of rotation)

Tusaale: $\tan(45^\circ) = 1$

Xiriirka nooca is-dhexgalka ah: goobada cutubka (taanjanta (tangent))

Hordhaca taanjanta (tangent)

Isticmaal nooca is-dhexgalka si aad u sahamiso waxa dhaca marka θ isbeddelo



Waan la yaabanahay waxa ku dhaca qiimaha (value) $\tan(\theta)$ marka xagashu isbeddesho.



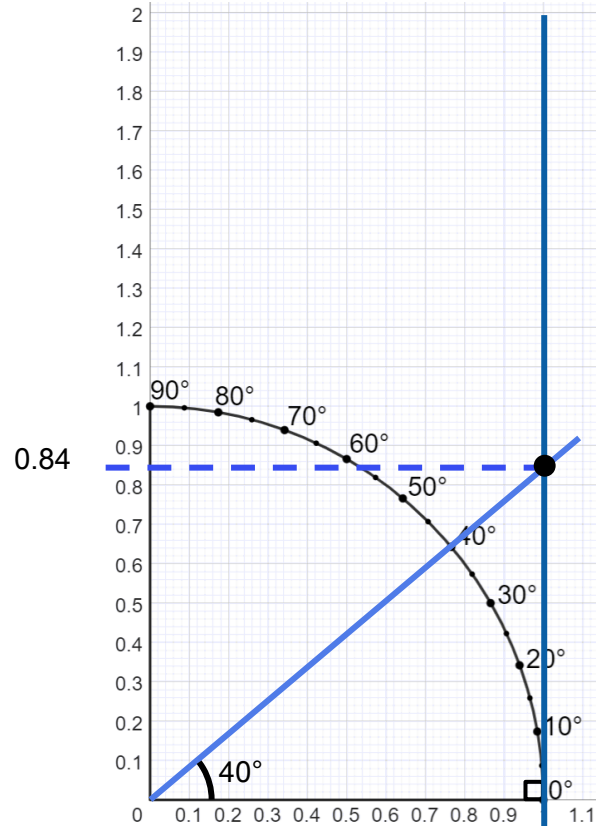
Caasha

Xiriirka nooca is-dhexgalka ah: goobada cutubka (taanjanta (tangent))🔗

Hordhaca taangent (tangent)



Sharaxaad



Jaantusku wuxuu muujinayaa qaybta (sector) goobada cutubka ee ku jirta rubuca koowaad (first quadrant).

Adoo sawiraya taangent (tangent) $x = 1$, waxaan heli karnaa taangent (tangent) xaglo ka mid ah goobada halbeegga (unit circle).

$$\text{Tusaale: } \tan(40^\circ) = 0.84$$

Ku xidh nooc isdhexgal ah: goobada halbeegga (unit circle) rubucda koowaad

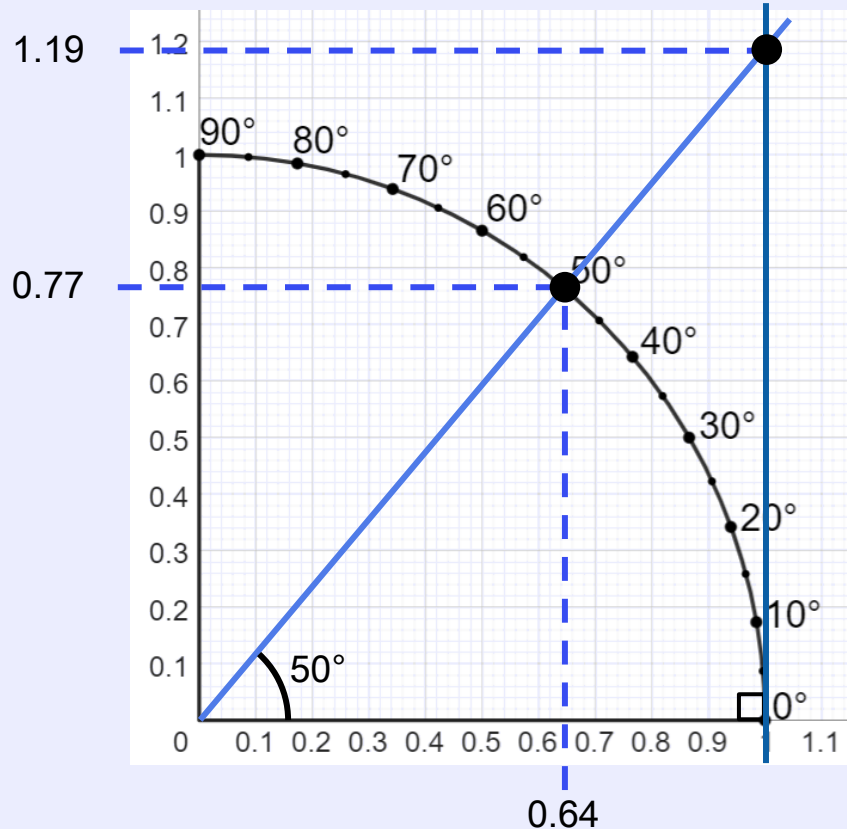
Hordhaca taangent (tangent)

Waa maxay qiimaha (value) $\tan(50^\circ)$?

a 1.19 ✓

b 0.77

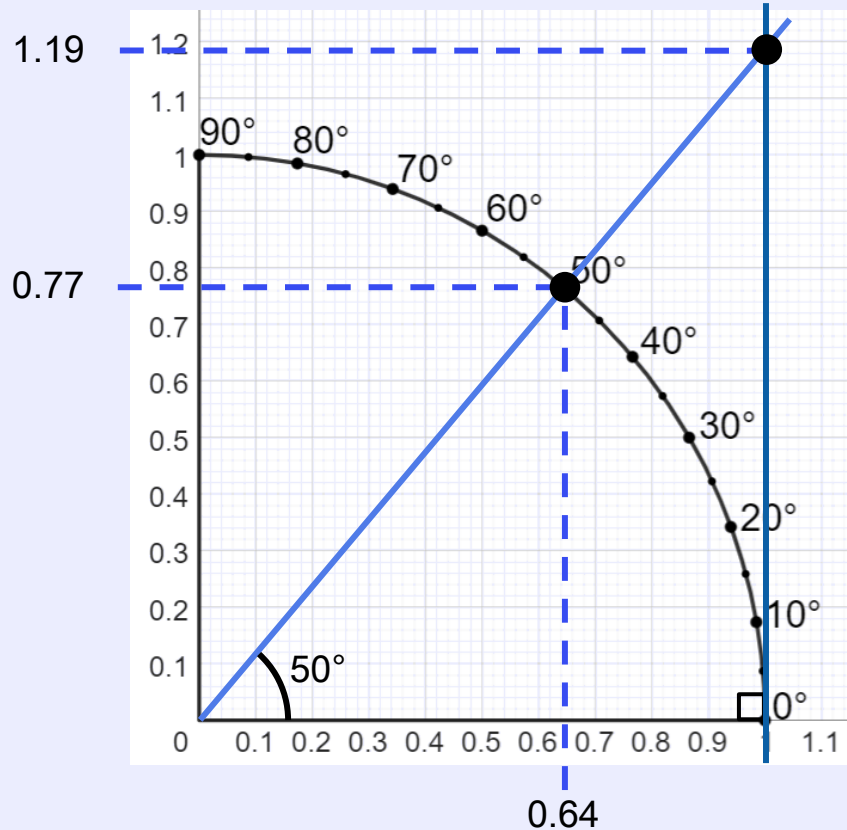
c 0.64



Hordhaca taangent (tangent)

Waa maxay qiimaha (value) $\sin(50^\circ)$?

- a** 1.19
- b** 0.77 ✓
- c** 0.64



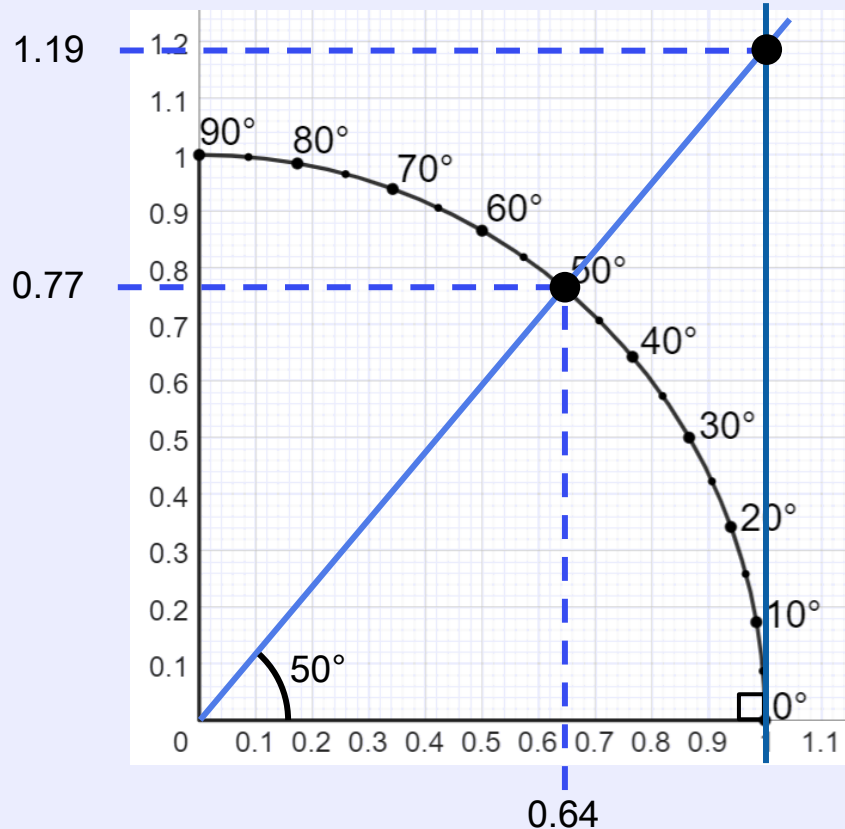
Hordhaca taangent (tangent)

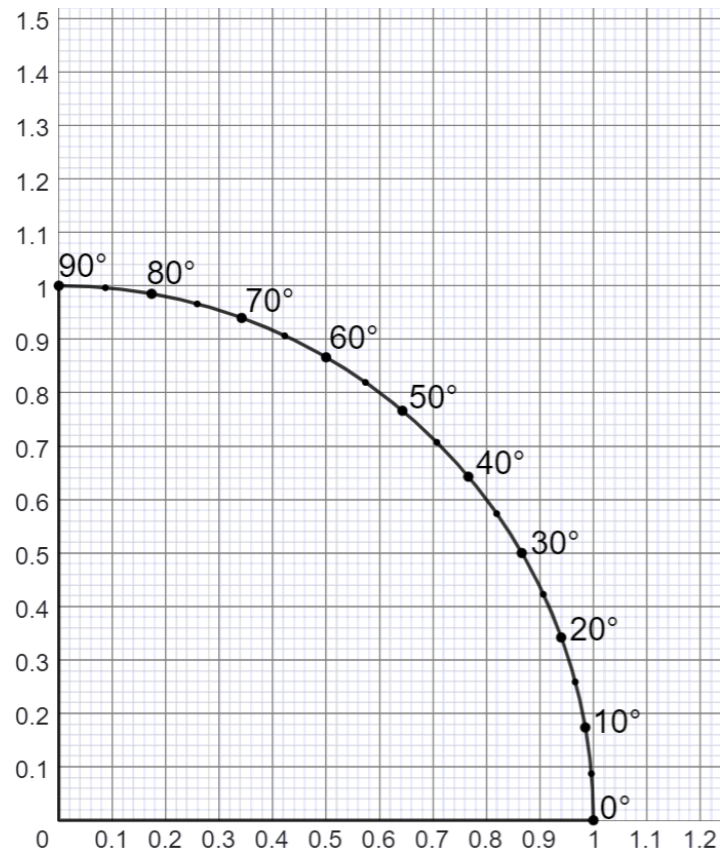
Waa maxay qiimaha (value) $\cos(50^\circ)$?

a 1.19

b 0.77

c 0.64 ✓





1) Jaantusku wuxuu muujinayaa rubucda koowaad ee goobada halbeegga (unit circle).

a) Sawir taangent (tangent) $x = 1$.

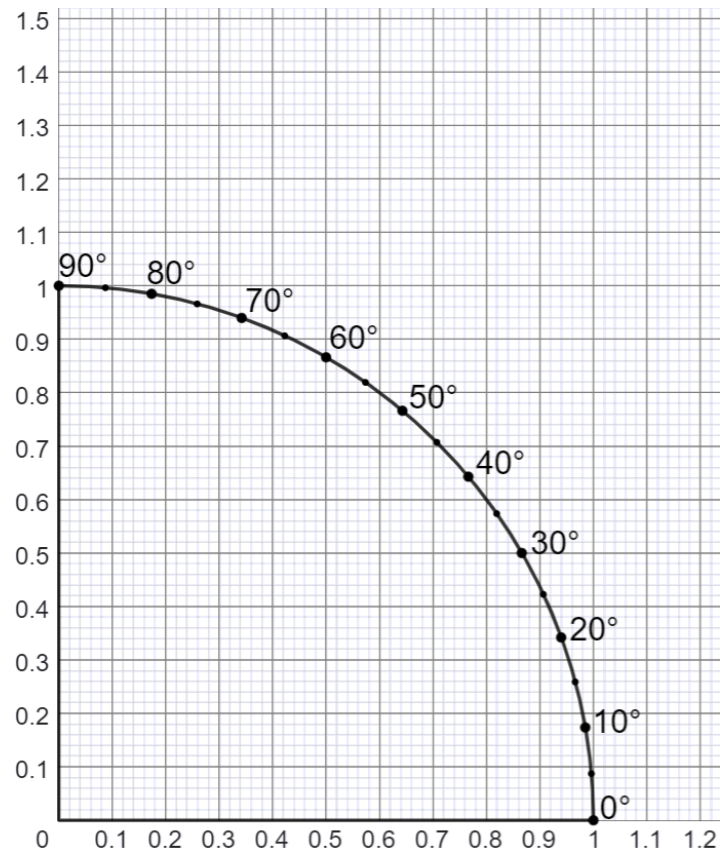
b) Raadi qiimaha (value) $\tan(35^\circ)$

c) Raadi qiimaha (value) $\tan(55^\circ)$

d) Isticmaal jaantuska si aad u hesho xagasha halka $\tan(\theta) = 1$.

e) Isticmaal jaantuska si aad u hesho xagasha halka $\tan(\theta) = 0.5$.

Nooc isdhexgal ah oo jaantuska ah, guji linkiga: goobada halbeegga (unit circle) rubucda koowaad 

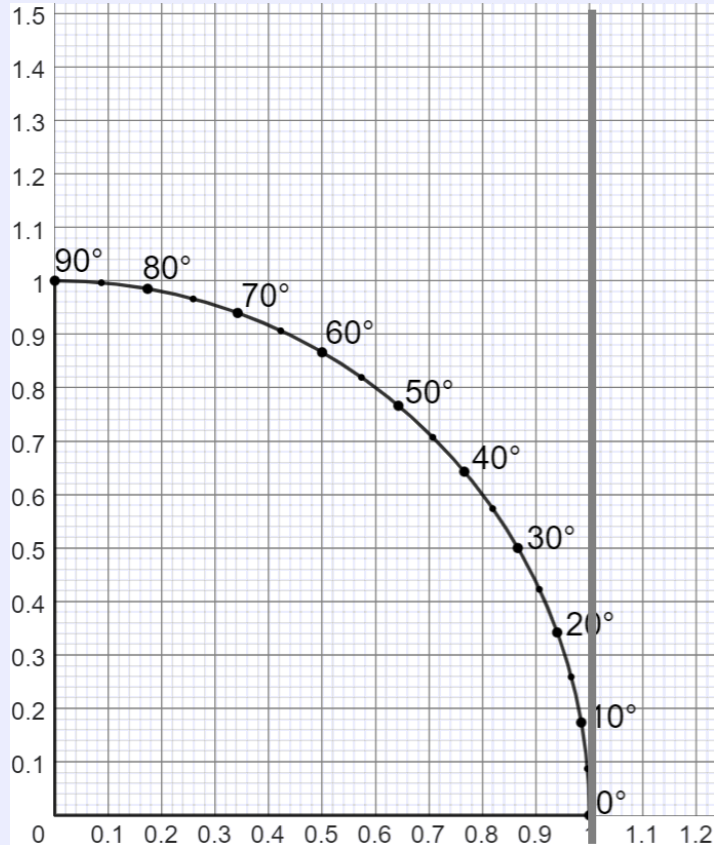


2) a) Buuxi shaxda.

θ°	30	40	50
$\sin(\theta)$			
$\cos(\theta)$			
$\tan(\theta)$			

b) Xagal kasta, u qaybi qiimaha $\sin(\theta)$ qiimaha $\cos(\theta)$. Maxaad dareemeysaa?

For an interactive version of the diagram, click the link: [u nit circle in first quadrant](#)



1) Jaantusku wuxuu muujinayaa rubuca koowaad ee goobada halbeegga (unit circle).

a) Draw a tangent at $X = 1$.

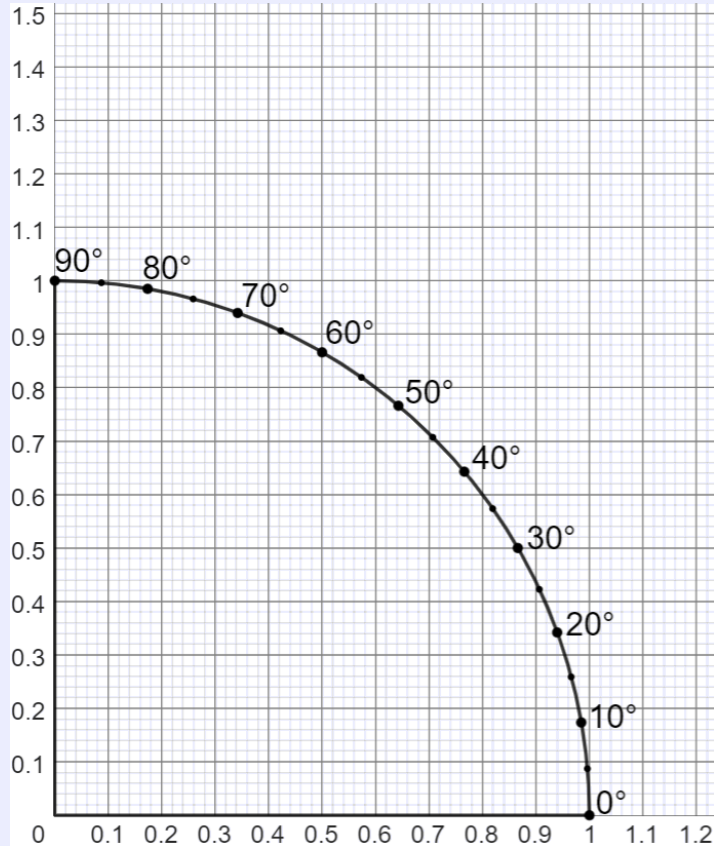
b) Raadi qiimaha $\tan(35^\circ)$

c) Raadi qiimaha $\tan(55^\circ)$

d) Isticmaal jaantuska si aad u hesho xagasha $\tan(\theta) = 1$.

e) Isticmaal jaantuska si aad u hesho xagasha $\tan(\theta) = 0.5$.

Jawaabuhu waxay kala duwanaan karaan wax yar iyadoo ku xiran sida saxda ah ee loo akhriyo jaantuska.



2) a) Complete the table.

θ°	30	40	50
$\sin(\theta)$	0.5	0.64	0.77
$\cos(\theta)$	0.87	0.77	0.64
$\tan(\theta)$	0.58	0.84	1.19

Answers may vary depending on accuracy.

b) Xagal kasta, u qaybi qiimaha $\sin(\theta)$ qiimaha $\cos(\theta)$. Maxaad dareemeysaa?

Natiijada qayb kasta waxay u dhowdahay qiimaha $\tan(\theta)$.

Soo koobid Goobada halbeegga (unit circle)

Goobta halbeegga (unit circle) waa goobo leh radius 1 halbeeg.

Goobta halbeegga waxay ku taallaa asalka (origin).

Sine-ka xagasha waa isku-duwayaasha y ee barta halka radius-ka loo wareejiyay xagashaas.

Cosine (cos) ee xagal waa isku-duwayaasha x (x-coordinate) ee barta halka radius (radius) loo wareejiyay xagashaas.

Tangent (tan) ee xagal waa isku-duwayaasha y (y-coordinate) ee barta halka radius (radius) la dheereeyay uu ku gooyo tangent (line) ee goobada halbeegga (unit circle) ($x = 1$).

