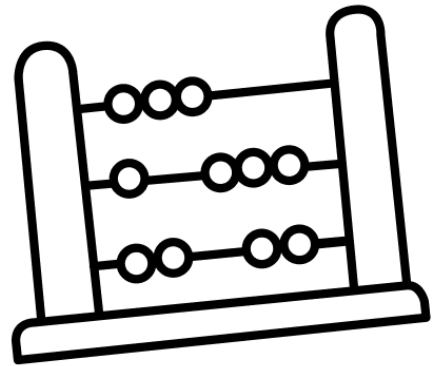


Cilmi-yaqaanka Xiddigaha (Astrophysicist)

Maths

Unit Xisaabta goobta shaqada (Xisaab in the workplace)



Natiijo

Waxaan fahmi karaa sida xisaabta loogu isticmaalo cilmi-yaqaannada xiddigaha (astrophysicists).

Cilmi-yaqaanka xiddigaha (astrophysicist) wuxuu isku dayaa inuu fahmo caalamka iyo waxa ku jira isagoo adeegsanaya sharciyada fiisigiska (physics).

Cilmi-yaqaanka Xiddigaha (Astrophysicist)



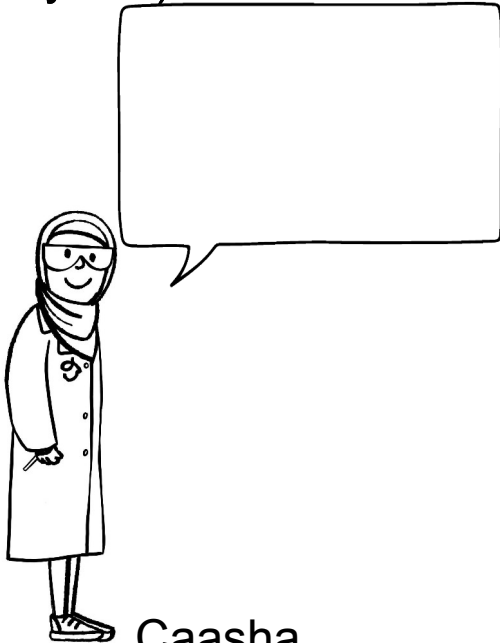
Noqoshada cilmi-yaqaanka xiddigaha (astrophysicist)



Go'aaminta astaamaha dhulka (terrain features)

Noqoshada cilmi-yaqaanka xiddigaha (astrophysicist)

Cilmi-yaqaanka xiddigaha (astrophysicist) wuxuu isku dayaa inuu fahmo caalamka iyo waxa ku jira isagoo adeegsanaya sharciyada fiisigiska (physics).



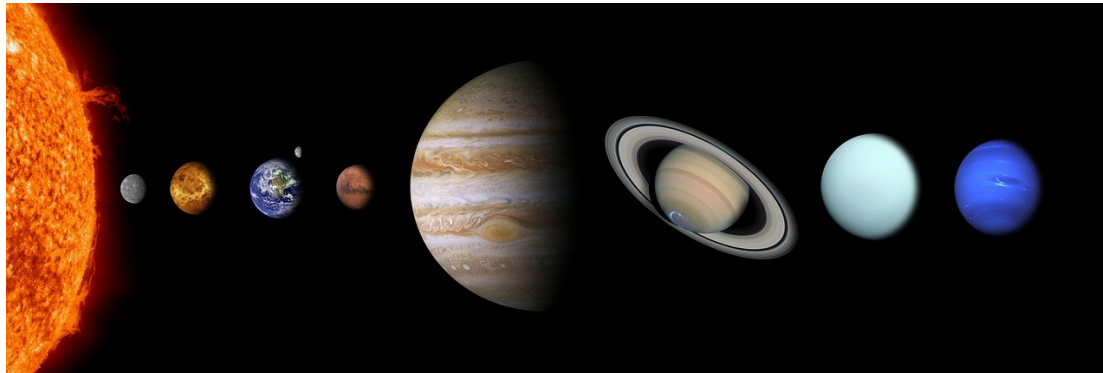
Caasha



Galaxiyada (Galaxies)



Xiddigaha (Stars)



Meeraha (Planets)

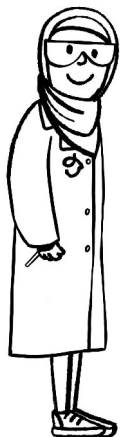
Dayaxa (Moons)
Meesha (Comets)
Asteroids (Asteroids)

Liisku wuu sii socdaa!

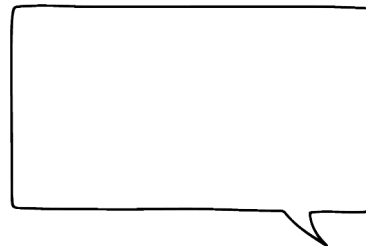
Astrophysicist wuxuu isku dayaa inuu fahmo universe-ka iyo waxa ku jira isagoo adeegsanaya:

- a** sharciyada bayoolajiga (biology)
- b** shuruucda chemistry-ga (laws of chemistry)
- c** shuruucda dhaqaalaha (laws of economics)
- d** shuruucda physics-ka (laws of physics) ✓

Astrophysicists iyo
astronomers ma isku
mid bay yihiin?



Caasha



Isra

Astrophysics waa laan ka mid ah astronomy-ga.

Astronomers waxay bartaan universe-ka iyagoo adeegsanaya farsamooyin indho-indhayn (observational techniques) si ay u qiimeeyaan oo u kala saaraan jirrada samada (celestial bodies) kala duwan.

Astrophysicists waxay leeyihiin diiradda dheeri ah. Waxay bartaan physics-ka universe-ka sida sida jirrada samada isu dhexgalaan ama hababka kale ee jirka (physical processes).

Astrophysicists waxay inta badan u baahan yihiin inay fasiraan xogta (data). Tani waxay ku lug yeelan kartaa beddelka noocyada kala duwan ee cutubyada cabbiraadda (units of measurement) iyo isticmaalka qaaciidooyinka (formulas) si loo helo xog cusub.

Qaabka caadiga ah (standard form) ayaa laga yaabaa in la isticmaalo haddii qiimaha la qoray uu aad u weyn yahay.

Qaabka caadiga ah (standard form) waa marka lambar lagu qoro qaabkan:

a $A \times 10^n$ (halkaas oo $0 \leq A < 10$ iyo n uu yahay tiro isku dhafan (integer)).

b $A \times 10^n$ (halkaas oo $1 \leq A < 10$ iyo n uu yahay tiro isku dhafan (integer)).

c $A \times 10^n$ (halkaas oo $1 < A \leq 10$ iyo n uu yahay tiro isku dhafan (integer)).

d $A \times 10^n$ (halkaas oo $0 < A \leq 9$ iyo n waa tiro (integer)).

Dooro qaabka saxda ah ee loo qoro 5 834 000 000 000 qaabka caadiga ah (standard form).

a

$$5.834 \times 10^{12}$$



b

$$5 \times 10^{12}$$

c

$$5.834 \times 10^{-12}$$

d

$$5834 \times 10^{-12}$$

1) Buuxi meelaha bannaan.

____ waa laan ka mid ah astronomy (xiddigiska). ____ waxay bartaan universe (caalamka) iyagoo isticmaalaya ____ ____ si ay u qiimeeyaan oo u kala saaraan ____ jirrada (bodies). Astrophysicists waxay leeyihiin diirad ____ ah. Waxay bartaan physics-ka universe (caalamka) sida siday u ____ ____ ama hababka ____ kale.

Astrophysics

bodies (jirro)

narrowed (cufan)

physical (jireed)

Astronomers (xiddigiyayaal)

celestial (cirka)

observational (indho-indhayn)

techniques (farsamooyin)

2) a) Jadwalka hoose wuxuu muujinayaa masaafooyinka celceliska ee u dhow ee dhulka ilaa meelo ka mid ah meerayaasha kale ee nidaamka qorraxda. U qor masaafooyinka qaabka caadiga ah (standard form).

Laga bilaabo	Ilaa	Masaafada (km)	Qaabka caadiga ah (standard form)
Dhulka	Mercury	91 691 000	
Dhul (Earth)	Waxar (Venus)	41 400 000	
Dhul (Earth)	Farax (Mars)	78 340 000	
Dhul (Earth)	Cirjeex (Jupiter)	628 730 000	
Dhul (Earth)	Saxal (Saturn)	1 275 000 000	

2) b) Sannadkii 2021, xawaaraha ugu dheereeyay ee dayaxgacmeedku qabtay wuxuu ahaa 163 km/s. Adigoo isticmaalaya xawaarahaas iyo qaacidada

$$\text{Masaafu (Distance)} = \text{Xawaare (Speed)} \times \text{Waqti (Time)}$$

Xagga (To)	Masaafu (km)	Waqti (maalmaha)
Meerkuri (Mercury)	91 691 000	
Waxar (Venus)	41 400 000	
Farax (Mars)	78 340 000	

Xisaabi inta ay qaadanayso, maalmaha, in laga safro Dhulka (Earth) una gaaro meere kasta.

Ku soo wareeji jawaabtaada si ku habboon maalinta ugu dhow.

1) Buuxi meelaha bannaan.

Astrophysics waa laan ka mid ah astronomy.

Astronomers waxay bartaan universe iyagoo isticmaalaya farsamooyin indho-indhayn (observational techniques) si ay u qiimeeyaan (value) oo u kala saaraan jirrada samada (celestial bodies) kala duwan.

Astrophysicists waxay leeyihiin diirad dheer. Waxay bartaan physics-ka universe sida sida jirrada samada (celestial bodies) isu dhexgalaan ama hababka kale ee jirka (physical processes).

2) a) Jadwalka hoose wuxuu muujinayaa masaafooyinka celceliska ee u dhow ee dhulka ilaa qaar ka mid ah meerayaasha kale ee nidaamka qorraxda. U qor masaafooyinka qaabka caadiga ah (standard form).

Laga bilaabo	Ilaa	Masaafo (km)	Qaabka caadiga ah (standard form)
Dhulka	Mercury	91 691 000	9.1691×10^7
Dhulka	Venus	41 400 000	4.14×10^7
Dhulka	Mars	78 340 000	7.834×10^7
Dhulka	Jupiter	628 730 000	6.2873×10^8
Dhulka	Saturn	1 275 000 000	1.275×10^9

2) b) Sannadkii 2021, xawaaraha ugu dheereeyay ee uu diiwaangeliyay dayaxgacmeed wuxuu ahaa 163 km/s. Adigoo isticmaalaya xawaarahaas iyo qaacidada (formula)

$$\text{Masafo (Distance)} = \text{Xawaare (Speed)} \times \text{Waqti (Time)}$$

To	Masafo (Distance) (km)	Waqti (Time) (maalmaha)
Mercury	91 691 000	
Venus	41 400 000	
Mars	78 340 000	
Jupiter	628 730 000	
Saturn	1 275 000 000	

$$\frac{91691000}{163} \times \frac{1}{60} \times \frac{1}{60} \times \frac{1}{24} = 6.5 \text{ days}$$

Waxay qaadan doontaa in ka badan 6 maalmood, marka waxaan ku soo wareejinaynaa 7 maalmood.

2) b) Sannadkii 2021, xawaaraha (speed) ugu dheereeyay ee uu duuliyaha (spacecraft) qabtay wuxuu ahaa 163 km/s. Iyadoo la isticmaalayo xawaarahaas iyo qaacidada (formula)

$$\text{Masafo (Distance)} = \text{Xawaare (Speed)} \times \text{Waqti (Time)}$$

To	Masafo (Distance) (km)	Waqti (Time) (maalmaha)
Mercury	91 691 000	7
Venus	41 400 000	3
Mars	78 340 000	6
Jupiter	628 730 000	45
Saturn	1 275 000 000	91

Cilmi-yaaqa xiddigiska (Astrophysicist)



Noqoshada astrophysicist



Go'aaminta astaamaha dhulka (terrain features)

Dagashadii ugu horreysay ee Dayaxa waxay dhacday 1969. Maadaama aadanuhu ay ku socon karaan Dayaxa, waxay la macno tahay in cabbiro laga qaadi karo dusha Dayaxa.



Waa kuwee cabbiro (measurements) nooc ee ah oo faa'iido u yeelan kara in la qoro?

Xisaabinta dhererka astaamaha kala duwan (sida buuraha) waxaa badanaa lagu sameeyaa iyadoo la adeegsanayo laser altimeter.

Si kastaba ha ahaatee, ma aha dhammaan howlaha hawada sare (space missions) inay leeyihiin mid.

Xaaladahaas, waxaan weli ku ogaan karnaa qiyaas dhererka astaamaha kala duwan iyadoo la adeegsanayo trigonometry.

Jilitaanka (Simulations) waxaa lagu samayn karaa Dhulka si loo barto astaamaha jidhka kale ee meeraha (planetary bodies).



Kani waa Professor Veronica Bray, PhD.

Iyadu waa borofisar cilmi-baaris la xiriirta (associate research professor).

Waxay u labisan tahay sidan sababtoo ah waxay la samaynaysaa jilitaan (simulation) asxaabteeda.

Go'aaminta astaamaha dhulka (terrain features)



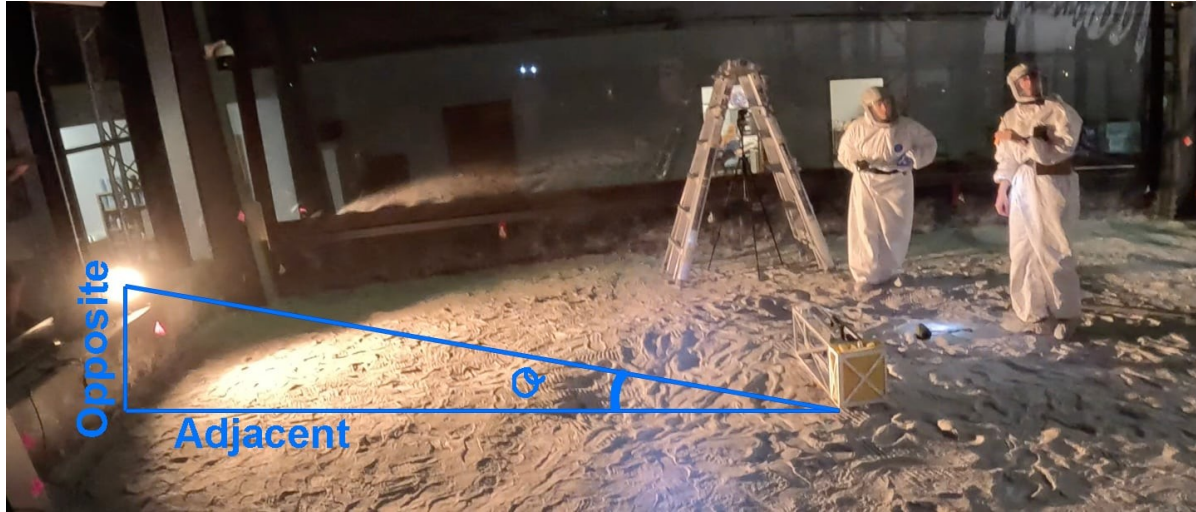
Sharaxaad



Waxay jilayaan xaaladaha astronaut-ka Artemis ee Koofurta Pole ee Dayaxa.

Professor Bray iyo asxaabteeda waxay dib u abuuraysaa xaaladaha iftiinka saxda ah ee tababarka astronaut-ka.

Go'aaminta astaamaha dhulka (terrain features)

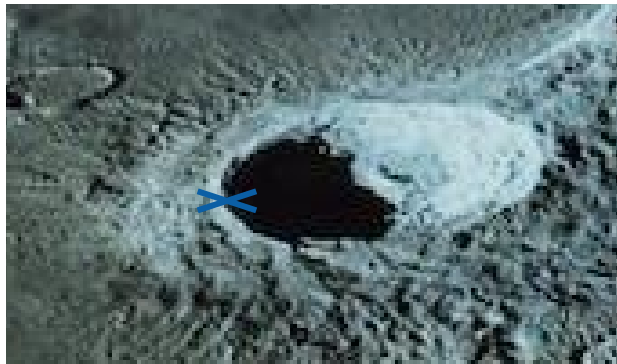


Waxay u baahan yihiin inay ogaadaan xagasha qorraxda (θ°) si ay u xisaabiyaan saamiga saxda ah ee dhererka (opposite) isha iftiinka iyo masaafada (adjacent) ee astaamaha.

Buuraha Dayaxa waxaa la sameeyay iyada oo loo marayo saameyn weyn oo asteroid ah. Saameyntaas waxay keentay godadka (craters) aan arki karno. Derbiyada godadka waxay noqon karaan kuwo aad u sarroova.



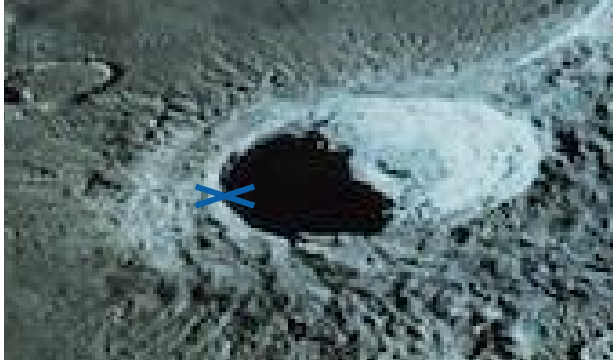
Si loo qiyaaso dhererka derbiga godka (crater wall) ee barta la doortay, waxaan u isticmaali karnaa trigonometry.



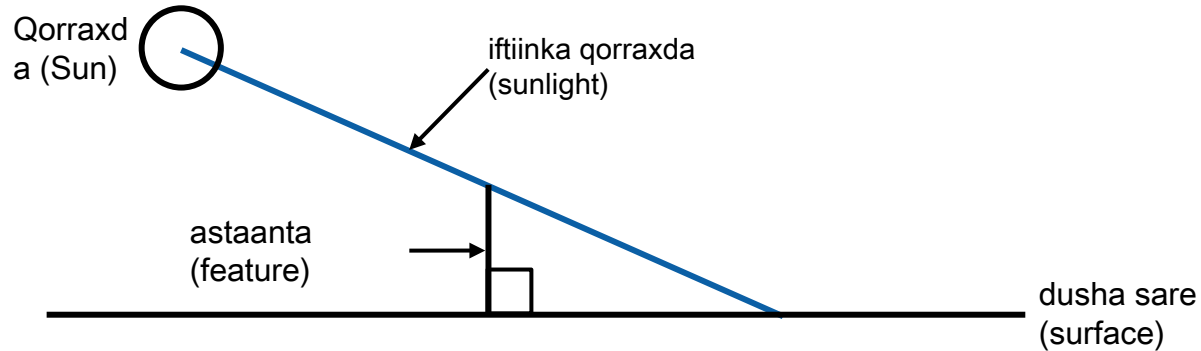
Waxaan u baahan doonnaa inaan ogaanno:

- dhererka hooska (shadow)
- xagasha (angle) qorraxdu ku jirto

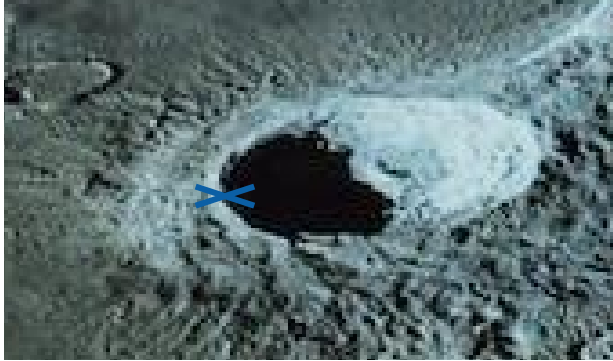
Go'aaminta astaamaha dhulka (terrain features)



Sawir qaab dhimeed (sketch) wuxuu fududeyn doonaa waxa aan tixgelinayno.

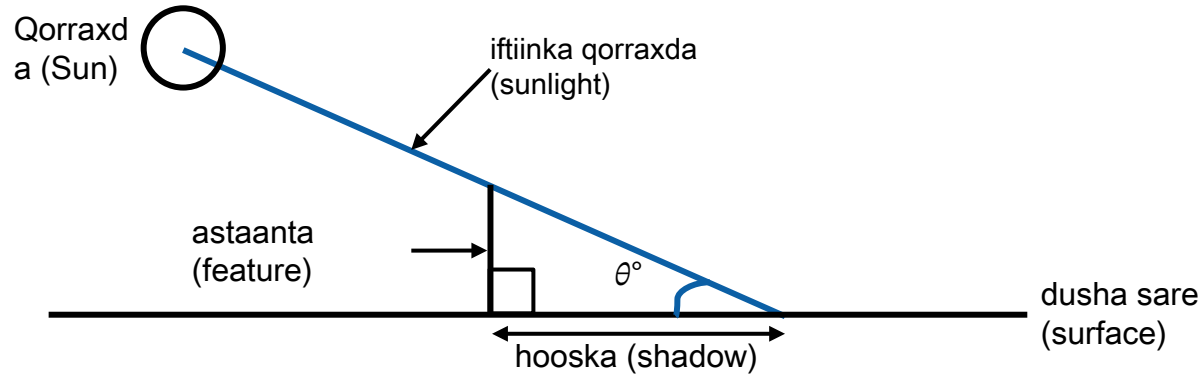


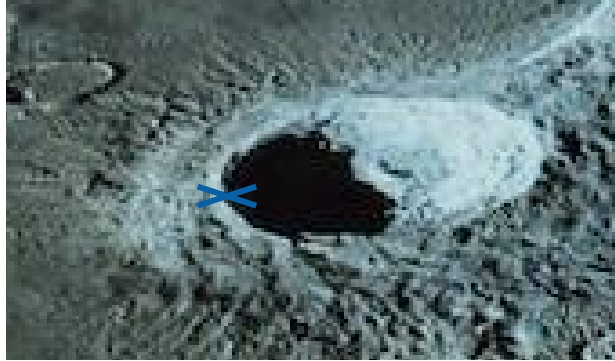
Go'aaminta astaamaha dhulka (terrain features)



Waxaan u baahan doonnaa inaan ogaanno:

- dhererka hooska (shadow)
- xagasha (angle) qorraxdu ku jirto





Dhererka hooska (shadow) waxaa laga cabbiri karaa sawir ilaa inta cabbirka (scale) la ogyahay.

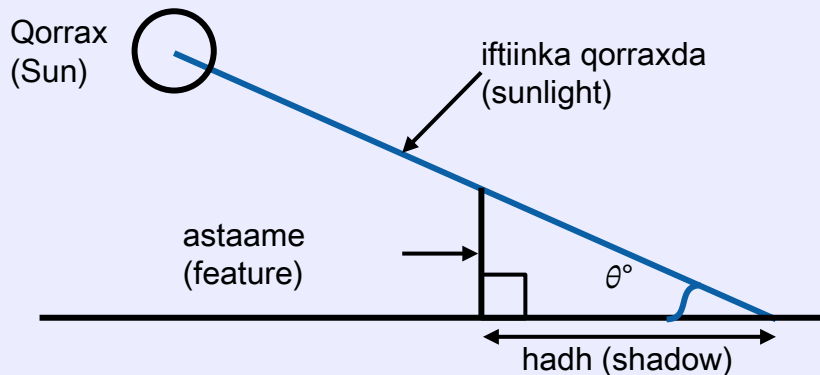
Xagasha (angle) qorraxda waxaa la go'aamin karaa haddii aan ogaanno goorta sawirka la duubay.

Marka la ogaado dhererka hadhka iyo xagasha qorraxda, maxaa loo isticmaali karaa in lagu go'aamiyo dhererka astaamaha?

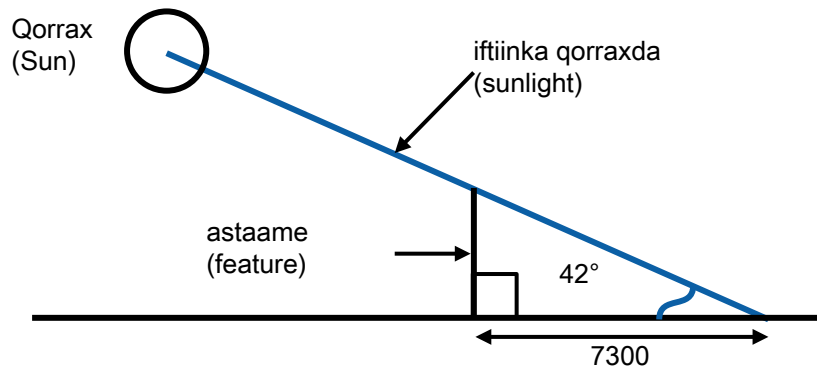
a Aragtida Pythagoras (Pythagoras' theorem)

b Saddexagallo isku mid ah (Similar triangles)

c Trigonometry (Trigonometry) ✓

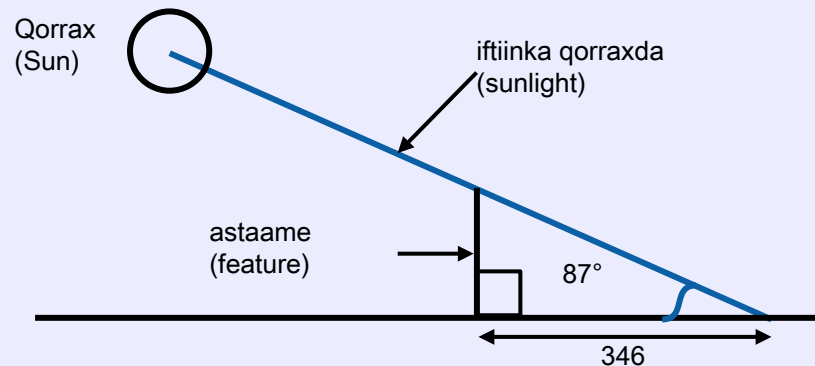


Marka xagasha qorraxdu tahay 42° , dhererka hadhka waxaa lagu qoray 7300 m. Waa maxay dhererka gidaarka godka (crater wall)?



$$7300 \times \tan(42^\circ) = 6572.9495... \\ \approx 6.6 \text{ km}$$

Marka xagasha qorraxdu tahay 87° , dhererka hadhka waxaa lagu qoray 346 m. Waa maxay dhererka gidaarka godka (crater wall)?



$$346 \times \tan(87^\circ) = 6602.0732... \\ \approx 6.6 \text{ km}$$

1) Xisaabi qiimaha (value) (ilaa 1 d.p.) ee cabbirka aan la garanayn kiis kasta.

a) $\theta^\circ = 19^\circ$, $a = 56$ cm, $b =$

b) $\theta^\circ = 56^\circ$, $a = 19$ cm, $b =$

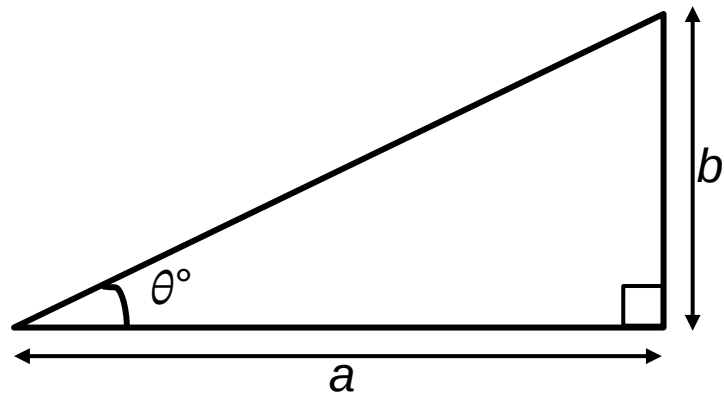
c) $\theta^\circ = 19^\circ$, $b = 56$ cm, $a =$

d) $\theta^\circ = 56^\circ$, $b = 19$ cm, $a =$

e) $a = 56$ cm, $b = 19$ cm, $\theta^\circ =$

f) $a = 19$ cm, $b = 56$ cm, $\theta^\circ =$

Loo sawirin si sax ah (Not drawn accurately)



2) Gidaarka godka (crater) ee Mars waa 1.2 km dheer. Marka uu gidaarku sameeyo hooska (shadow) dhererkiisu yahay 557 m, waa xagal intee (ilaa 1 d.p.) ayuu Qorraxdu ku jirtaa?

3) God kale oo Mars ah ayaa leh gidaar sameeya hooska dhererkiisu yahay 21 m. Tani waxay dhacdaa marka Qorraxdu xagal 67° tahay. Waa maxay dhererka (ilaa 2 d.p.) gidaarkan?

4) Godka ugu weyn ee dhinaca dhow ee Dayaxa waxaa loo yaqaan Clavius. Gidaarada godkani waa 6.6 km dheer.

Xisaabi saddex lamaane (pairs) oo qiimayaal ah oo xagasha Qorraxda iyo dhererka hooska u dhigma ee uu sameeyo gidaarka godka.

Tusaale: Marka xagasha Qorraxdu tahay 42° , dhererka hooska waxaa la qoraa 7300 m.

Marka xagasha Qorraxdu tahay 87° , dhererka hooska waxaa la qoraa 346 m.

5) Si loo xisaabiyo qiyaas (estimate) dhererka gidaarka godka, waxaan soo saarnay qaab/jaantus (model/sketch) xaaladda.

Sheeg malo (assumption) aan sameynay oo laga yaabo inay saameeyso saxnaanta qiimaha aan qiyaasnay.

1) Xisaabi qiimaha (value) (ilaa 1 d.p.) ee cabbirka aan la garanayn kiis kasta.

a) $\theta^\circ = 19^\circ$, $a = 56$ cm, $b = 19.3$ cm

b) $\theta^\circ = 56^\circ$, $a = 19$ cm, $b = 28.2$ cm

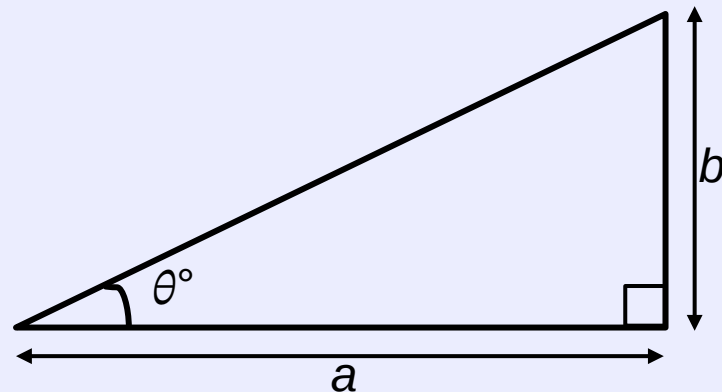
c) $\theta^\circ = 19^\circ$, $b = 56$ cm, $a = 162.6$ cm

d) $\theta^\circ = 56^\circ$, $b = 19$ cm, $a = 12.8$ cm

e) $a = 56$ cm, $b = 19$ cm, $\theta^\circ = 18.7^\circ$

f) $a = 19$ cm, $b = 56$ cm, $\theta^\circ = 71.3^\circ$

Lama sawirin si sax ah
(Not drawn accurately)



2) Gidaarka godka (crater) ee Mars waa 1.2 km dheer. Marka gidaarku uu tuuro hooska (shadow) dhererkiisu yahay 557 m, waa maxay xagasha (ilaa 1 d.p.) qorraxdu ku jirto?

$$\tan^{-1} \left(\frac{1200}{557} \right) = 65.1^{\circ}$$

3) God kale oo Mars ah ayaa leh gidaar hooskiisu dhererkiisu yahay 21 m. Tani waxay dhacdaa marka qorraxdu xagasha 67° tahay. Waa maxay dhererka (ilaa 2 d.p.) gidaarkan?

$$21 \times \tan(67) = 49.47 \text{ m}$$

4) Godka ugu weyn ee dhinaca u dhow ee Dayaxa waxaa loo yaqaan Clavius. Gidaarada godkan waa 6.6 km dheer.

Xisaabi saddex lammaane oo qiimayaal ah (value) oo xagasha qorraxda iyo dhererka hooska (shadow) ee uu tuuro gidaarka godka.

Waxaa jira lammaane aan xad lahayn oo halkan ku shaqaynaya. Si aad u hubiso in qiimayaashaagu sax yihiin, samee xisaabtan:

$$\text{dhererka hooska} \times \tan(\text{xagasha qorraxda})$$

Jawaabtaadu waa inay ku wareegtaa 6.6 (haddii km) ama 6600 (haddii m).

5) Si loo xisaabiyo qiyaasta dhererka gidaarka godka, waxaan soo saarnay qaab/sawir (model/sketch) xaaladda.

Sheeg malo (assumption) aan samaynay oo laga yaabo inay saameeyso saxnaanta qiimaha (value) aan qiyaasnay.

Malo suurtagal ah:

Waxaan u qaadnay in dusha meeraha ay tahay mid siman (flat) halka ay dhab ahaan qalloocan tahay (curved).

Cilmi-yaqaanka xiddigiska (astrophysicist) wuxuu isku dayaa inuu fahmo caalamka iyo waxa ku jira isagoo adeegsanaya sharciyada fiisigiska (physics).

Cilmi-yaqaannada xiddigiska (astrophysicists) waxay inta badan u baahan yihiin inay fasiraan xogta (data). Tani waxay ku lug yeelan kartaa beddelka noocyada kala duwan ee cutubyada cabbiraadda (units of measurement) iyo isticmaalka qaaciidooyinka (formulas) si loo helo xog cusub.

Trigonometry waxaa loo isticmaali karaa in lagu qiyaaso dhererka astaamaha dhulka ee kala duwan ee jirrada kale ee samada (celestial bodies).