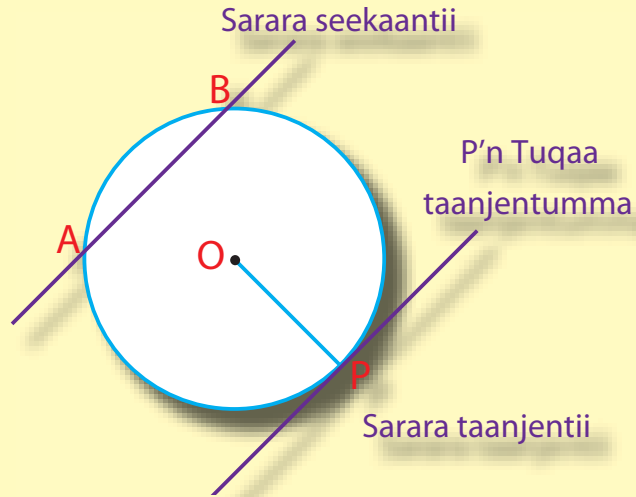


Boqonnaa

5



GEENGOOLEE

Kaayyoo Gooroo

Xumura barnoota boqonnaa kanaa booda:

- ➔ waa'ee geengoo irratti hubannoo ga'aa ni qabaatta.
- ➔ hariiroo sararootaa fi geengolee gidduu jiru addaan ni baasta.
- ➔ yaada kofa handhuuraa fi kofoota itti marfamoo wal qaxxamura koordotaatiin uumaman itti fayyadamuun safaroota isaanii ni barbaadda.

Qabiyyee ijoo

5.1 Waa'ee geengoowwanii Gadifageenyaan

5.2 Kofoota geengoo keessaa

Jechoota ijoo

Cuunfaa boqonnaa

Gilgaala keessa deebii

SEENSA

Geengoon tuuta tuqaalee diriiroo irraa kanneen tuqaa kenname irraa walqixa fagaatanii akka ta'ee fi tuqaan kenname kunis handhuura jedhamuu isaa baratee jirta.

Fageenyi handhuura irraa gara tuqaa kamiittuu jiru raadiyasii jedhamee waamama.

Kompaasiitti fayyadamtee geengoo kaastu bakka qarri kompaasii kee irra taa'uu handhuura yeroo ta'u, golboon qubeessaan kompaasii irra naanna'u ammoo geengoo ta'uu isaa ni yaadata.

Lafa irratti geengoon amaloota addaa baay'ee qaba. Fakkeenyaaf, geengoon walqixa dacha'oo (sameetriki) handhuura isaa irrattii fi diyaameetirii isaa hundaa irratti ni qaba. Akkasumas bocni geengawaa baayiskilii, moobilootaa fi ijaarsa adda addatiif ni gargaara.

5.1. Waa'ee Geengoo Bal'inaan

Kutaa darbaan keessatti waa'ee hiikaa fi ijaarsa geengoo, koordotaa fi perpeendiikulaarii walakkeessaa sarara dhabbataa baratee turte. Kutaa kana keessatti, jechoota tokkoo tokko fi yaada bu'uraa waa'ee koordii, diyaameetirii, marsaa geengoo, golboowwaan, sektarootaa fi golboowwan geengoo ni hubatta.

Itti aansuudhaan waa'ee hariiroo sararaa fi geengoo diriiroo tokko irra jiranii, akkasumas dhuma irratti koordotaan fayyadamanii handhuura geengoo akkaataa itti argisiisan ni baratta.

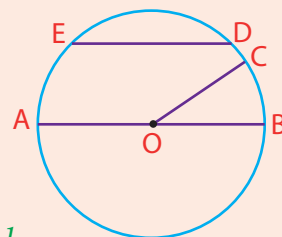
GOCHA 5.1



Kaayyoo: geengoo fakkeessuu fi handhuura geengoo, radiyaasii, koordii fi diyaameetirii addaan baasuu.

Meeshaalee barbaachisan: sarartoo fi kompaasii

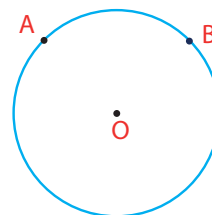
- Danaa 5.1 garagalchuudhaan maqaa tokkoo tokkoo sarara dhaabataa \overline{OC} , \overline{AB} , \overline{ED} ibsi.
- Geengoo radiyaasiin isaa 5cm ta'e fakkeessuun,
 - raadiyaasii
 - diyaameetirii
 - koordii dheerina 8cm fakkeessi
- Marsaan geengoo radiyaasiin isaa yuunitii r ta'e $2\pi r$, $\left(\pi \approx \frac{22}{7}\right)$ yookiin $\pi \approx 3.14$ ta'uu yaadadhu. Marsaa geengoolee radiyaasii armaan gadiin kennaman barbaadi.
 - 1 cm
 - 2.5 cm
 - $\frac{7}{22}$ cm
 - $\frac{1}{\pi}$ cm



Golboo guddaa fi golboo xiqqaa geengoo

Geengoo handhuura O radiyaasiin isaa r ta'e fudhadhu. Haala Danaa 5.2 irratti argisiisameen tuqaalee lama A fi B mul'isi. A fi B'n tuqaalee fiixee diyaameetirii ta'uu hin qabani.

Danaa 5.2

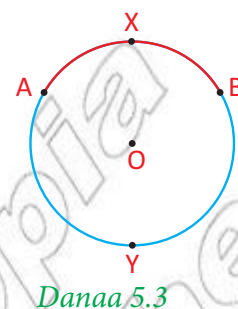


Tuqaaleen A fi B'n geengicha bakka lamatti qoodu. Isaanis golboowwan jedhamanii waamamu.

Golboon halluu diimaatiin marfame, golboo halluu cuquliisaan marfame irra xiqqaa dha. Innis, golboo xiqqaa AB yeroo jedhamu innii guddaan immoo golboo guddaa AB jedhama. Golboo AB'n haala \widehat{AB} tiin mallatteessama.

Akkasumatti golboo AB jechuun golboo ibsuu barbaadame hin ibsu ta'a. Golboo xiqqaa yookiin golboo guddaa AB ta'uu isaa addaan baasuuf rakkisaa dha. Kanaaf, akka **Danaa 5.3** irratti argisiisameen tuqaalee kan biraa A fi B gidduutti barreessuun barbaachisaa dha.

Kanaaf, golboo AXB yeroo jennee barreessinu golboo xiqqaa AB fi golboo AYB'n golboo guddaa AB dha. Karaa biraatiin, \widehat{AXB} 'n golboo xiqqaa AB fi \widehat{AYB} 'n golboo guddaa AB jechuu dha. Danaa 5.3 ilaali.

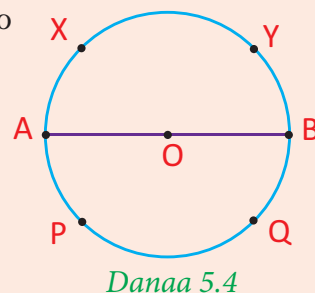


GOCHA 5.2

Kaayyoo: Golboo xiqqaa fi golboo guddaa geengoo murteessuuf:

Meeshaalee barbaachisan: sarartoo, kompaasii fi pirootiraaktarii.

- 1 Golboowwan geengoo armaan gadii ijaari.
 - a Walakkaa geengoo
 - b kurmaana geengoo
 - c Sadii araffaa geengoo
- 2 Hima safara golboo xiqqaa, golboo guddaa fi walakkaa geengoo digiriitiin ibsu barreessi.
- 3 Akka **Danaa 5.4** tiin \widehat{AB} 'n diyaameetirii geengoo yoo ta'u, golboo xiqqaa fi golboo guddaa geengichaa kan ibsuu danda'an yoo xiqqaate sadi sadi barreessi.



Kanneen armaan gadii hiikoo golboo xiqqaa fi golboo guddaa geengoo ti.

O'n handhuura geengoo tokkoo fi A fi B'n ammoo tuqaalee geengoo kanneen fiixee diyaameetirii hin ta'iin haa jennu (**Danaa 5.5** ilaali).

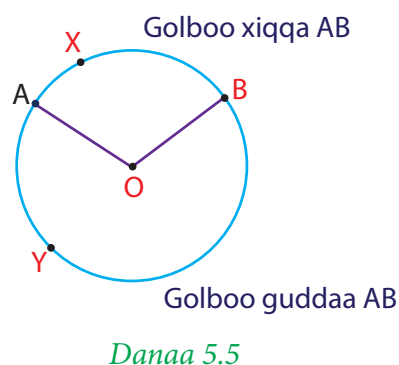
- i Tuutni tuqaalee A, B fi tuqaalee geengichaa A fi B jidduutti argaman hunda qabatee kofa xiqqaa AOB'n hammatame golboo xiqqaa jedhama.

- ii Makaan tuqaalee A fi B fi tuqaalee geengicha irraa kanneen ala $\angle AOB$ golboo guddaa AB jedhama. **Danaa 5.5** ilaali.

\widehat{AXB} 'n golboo xiqqa AB

\widehat{AYB} 'n golboo guddaa AB

O'n hadhuura geengooti.



Sektarii fi Muraa geengoo

Hanga ammaatti, waa'ee raadiyasii, koordii fi golboo geengoo baratteetta.

Kanatti aansuudhaan waa'ee danaalee ji'oomeetirii raadiyasiwwan lamaa fi golboon marfamani akkasumas koordii fi golboowwan isaan hammatan ni baratta.

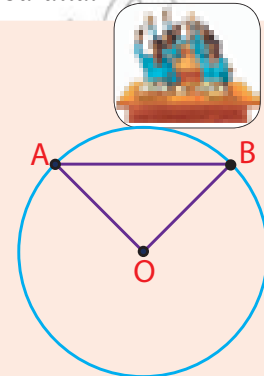
GOCHA 5.3

Kaayyoo: Muraa fi sektarii geengoo argisiisuu:

Meeshaalee barbaachisan: kompaasii fi sarartoo

Danaa 5.6 bakka lamatti fakkeessuun bal'insoota raadiyasoota fi golboowwaniin marsaman halluu dibi.

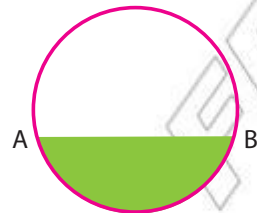
- 1 Golboo xiqqaa AB fi raadiyasoota \overline{OA} fi \overline{OB}
- 2 Golboo guddaa AB fi raadiyasoota \overline{OA} fi \overline{OB}
- 3 Golboo xiqqaa AB fi koordii \overline{AB}
- 4 Golboo guddaa AB fi koordii \overline{AB}



Danaa 5.6

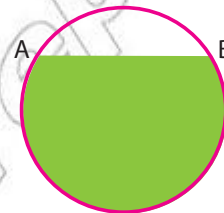
Danaalee ji'oomeetirii gaaffilee 1 fi 2 irratti dibde, tartiibaan sektarii xiqqaa fi sektarii guddaa geengichaa ti.

Danaan gaaffilee 3 fi 4 irrattii dibame ammoo tartiibaan muraa xiqqaa fi muraa guddaa geengichaa ti. **Danaa 5.7** fi **5.8** ilaali



Muraa xiqqaa

Danaa 5.7



Muraa guddaa

Danaa 5.8

Sarara Seekaantii fi Sarara Taanjantii Geengoo

Sarara qajeelaa fi geengoon tokko diriiroo tokkicha irra yoo jiraatan, tuqaa waliinii qabaachuu ni danda'u. Yookiin ammoo sararichii fi geengichi tuqaa waliinii hin qaban ta'a. Kutaa kana keessatti baay'ina tuqaalee sararii fi geengoon itti wal tuqan (wal qaxxaamuran) ilaalta.

GOCHA 5.4

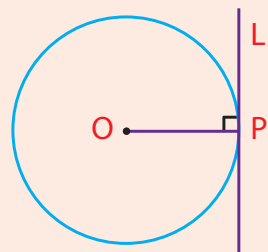
Kaayyoon:- Baay'ina tuqaalee sararii fi geengoon itti waltuqan (tuqaa waliin qabaatan) ni himta.

Meeshaalee barbaachisan: Sarartoo, kompaasii, pirootiraakterii Geengoo fi sararoota qajeeloo diriiroo tokkicha irratti ijaari.

- 1 Sararoota qajeeloo geengoo qaxxaamuran ykn tuqan ijaaruu akka danda'amu ykn akka hin danda'amne ibsi.



- 2 Sararri qajeelaan tokko geengoo kenname kan tuqu yoo ta'e baay'ina tuqaa isaan waliin qabaachuu danda'an murteessi.
- 3 Gaafii 2^{ffaa} tiif deebii argattee akka yaada waliigalaatti baay'ina tuqaalee isaan waliin qabaachuu danda'an barreessi.
- 4 Geengoo handhuurri isaa O ta'e ijaari. Tuqaa P'n geengoo kana irra yoo ta'e, sarara qajeelaa P keessa darbuu fi \overline{OP} tiif parpadiikulaarii ta'e ijaari. **Danaa 5.9** ilaali.



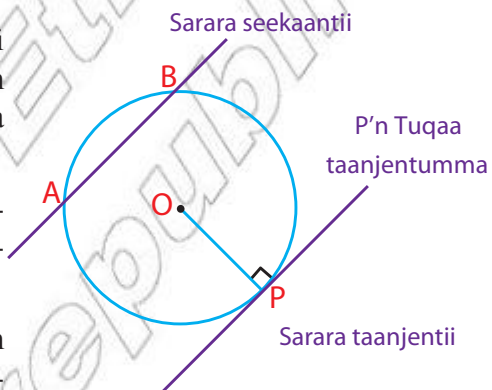
Danaa 5.9

Sararri qajeelaan fi geengoon “O” P malee tuqaa biraa waliin kan hin qabaatne ta'uu irratti mari'adhaa.

Sararrootni geengoo waliin tuqaa waliinii qaban sarara seekaantii yookiin sarara taanjentii jedhamu.

Gocha 5.4 armaan olii irraa sarara qajeelaa fi geengoon tokko diriiroo tokkicha irra yoo jiraatan hariiroowwan armaan gadii keessaa tokko qofa qabachuu ni danda'u.

- Sararri qajeelaan tokko geengoo kenname, wajjiin osoo wal hin tuqiin darbuu ni danda'a.
- Sararri qajeelaan tokkoo fi geengoon kenname bakka lamatti wal tuqu. Sararri akkasii kun sarara **seekaantii** geengoo jedhama.
- Sarara qajeelaan tokkoo fi geengoon tokko tuqaa tokko irratti wal tuqu. Sararri akkasii kun sarara **taanjentii** geengoo jedhama. Tuqaan waliinii bakka sararrii fi geengoon itti wal tuqan kun tuqaa taanjentummaa jedhama.



Danaa 5.10

Hubadhu:

Sararri seekantii kamiyyuu koordii geengoo of keessaa qaba.

Raadiyaasiin geengoo sarara taanjentii kamiifuu tuqaa taanjentummaa irratti parpandiikulaarii dha.

Handhuurri geengoo ijaarsaan akkamitti akka agarsiifamu:

Ijaarsaji' oomeetirii kutaa 5^{ffaa} keessatti sarara dhaabataa kennameef sarara parpandiikulaarii ijaaruu baratteetta.

Koordoota waliif tarree hintaanetti fayyadamuun sarara parpandiikulaarii koordoota kanaaf ijaaruudhaan handhuura geengoo agarsiisuun ni danda'ama. Amma immoo yaada parpandiikulaarii koordota waliif tarree hin ta'iinii lamaaniitti fayyadamuun handhuura geengoo barbaaduu baratta

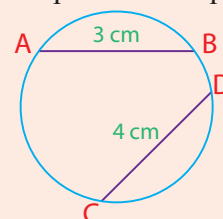
GOCHA 5.5



Kaayyoo: Koordota waltarree hin ta'iin lamatti fayyadamuun handhuura geengoo argachuu

Meeshaaleen barbaachisan, sarartoo, waraqaa furdaa (kaartonii), kompaasii fi maqasii

- 1 Geengoo raadiyeesiin isaa 5cm ta'ee fi koordoota waltarree hin ta'iin dheerinni isaanii 3cm fi 4 cm ta'e ijaaraa. Akka danaa 5.11 irratti agarsiisametti.



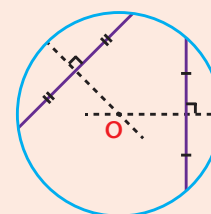
Danaa 5.11

- 2 Geengoo kana kuttee ergaa baasitee booda, A fi B'n akka walirra oolanitti geengoo kana dachaasi. Yeroo lammataaf geengoo kana akka C fi D'n walirra oolanitti dachaasi.

- 3 Bakka itti sararootni dachaafaman waltuqan tuqaa O'n mallatteessi.

- 4 Dheerina AO , BO , CO fi DO safari.

- 5 Walitti dhufeenya tuqaa O fi geengoon waliin qaban himaan barreessuun ibsi?



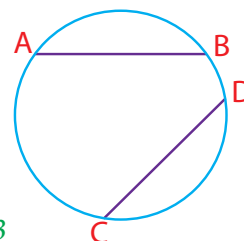
Danaa 5.12

Malli lammaffaan handhuura geengoo tokko itti agarsiifamu, koordoota waltarree hin ta'iiniif sarara bakka walqixatti isaan qooduu fi parpendikulaarii ta'e ijaaruun ta'a.

Kaayyoo:- Koordota lamatti gargaaramuudhaan handhuura geengoo murteessuu

Meeshaaleen barbaachisan: kompaasii fi sarartoo

- 1 Geengoo raadiyasiin isaa 5 cm ta'e akka danaa 5:13 irratti agarsiisameen dabtara kee irratti fakkeessi. Sarara \overline{AB} bakka walqixa lamatti qooduu fi parpandikularii ta'e ijaari.

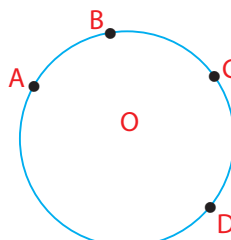


Danaa 5.13

- 2 Sarara \overline{CD} f parpandikularii ta'ee bakka walqixa lammatti qoodu ijaari. Bakki sararootni lamaan itti wal qaxxaamuran handhuura geengichaati. Isas "O" jedhi.

- 3 Sararoota dhaabbataa armaan gadii safari.

\overline{OA} , \overline{OB} , \overline{OC} fi \overline{OD}



Danaa 5.14

- 4 Safara gaaffii sadaffaa irratti argattetti fayyadamuun 'O'n handhuura ta'uu isaa agarsiisi.

Handhuurri geengoo sarara koordii kennameef parpandiikulaarii ta'e irratti argama isa jedhutti fayyadamuun deebii kee ibsi.

GILGAALA 5.1

1 Gaafilee armaan gadiif **Danaa 5.15** fayyadamuun deebii kenni.

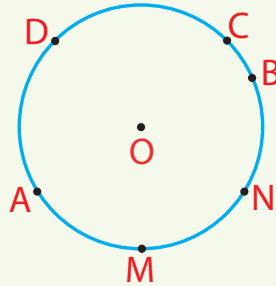
i Tuqaalee fi sararota dhaabatoo armaan gadii moggaasi.

a O

b \overline{AO}

c \overline{AB}

d \overline{BD}



Danaa 5.15

ii Golboowwan armaan gadii halluu adda addaatti fayyadamuun addaan baasi.

a \widehat{MNC}

b \widehat{ANB}

c \widehat{AMN}

d Golboo guddaa AC

e Golboo xiqqaa MN

f Golboo Guddaa CN

iii Sektarootaa fi muraawwan armaan gadii halluu dibuun agarsiisi.

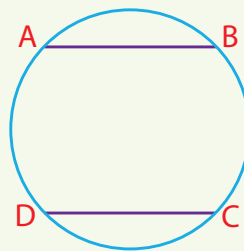
a Sektaroota gurguddoo BOM, AOM fi COA

Sektaroota xixiqqoo BOM, AOM fi COA, (Halluu adda addaa tti fayyadami).

b Muraa guddaa fi xiqqaa AM, MN, AN, AD fi NC.

iv Sarara sekantii M fi C keessa darbuu ijaari.

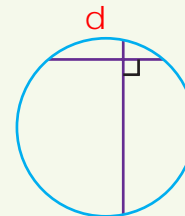
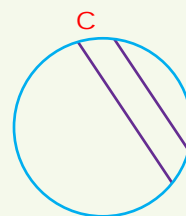
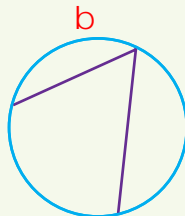
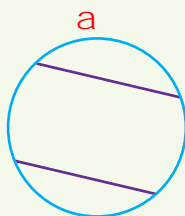
2 Danaa 5.16 keessatti $\overline{AB} \parallel \overline{CD}$ fi $\overline{AB} \cong \overline{CD}$. Handhuura geengoo kanaa agarsiisi.



Danaa 5.16

Yoo $\overline{AB} \parallel \overline{CD}$ ta'ee fi $\overline{AB} \cong \overline{CD}$ ta'e handhuura geengoo kanaa agarsiisuu dandeessaa?

3 Danaa kennaman garagalchuun handhuura isaanii agarsiisi.



Danaa 5.17

5.2. KOFOOTA GEENGOO KEESSAA

Golee darbe keessatti waa'ee koordii geengoo baratteetta. Kana keessatti ammoo waa'ee hariiroon safara kofaa fi safara golboo isa haguuguu yommuu verteksiin kofichaa handhuura geengoo ykn geengoo irra ta'uu fi rogootni isaa koordota geengichaa ta'an maal akka ta'e ni baratta. Akkasumas hariiroo kofoota koordota wal qaxxaamuran lamaanii fi golboowwan isaan haguuganiin uumamanii ni baratta. Waa'ee rog-arfeewwan saaykilikii ta'aniis ni baratta.

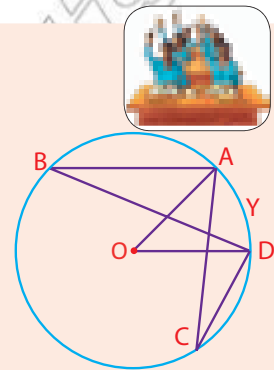
5.2.1 KOFA HANDHUURAA FI KOFA ITTI MARFAMOO

Kofti maal akka ta'e baratteetta. Akkasumas, kutaa armaan olii keessatti golboon geengoo maal akka ta'e keessa deebiin taa'eera. Walitti dufeenyi sarara qajeelaa tokkoo fi geengoo ilaalameera. Kutaa kana keessatti ammoo walitti dhufeenya kofaa fi geengoo giddu jiraachuu danda'u ilaalta.

GOCHA 5.6

Danaa 5.18 ilaaluun, gaaffilee armaan gadiif deebii kenni. "O" 'n handhuura geengooti.

- Walitti dhufeenya geengoo fi $\angle AOD$ akkamiin ibsita?
- Walitti dhufeenya geengoo kennamee fi $\angle ABD$ akkamiin ibsita?
- Walitti dhufeenya geengoo kennamee fi $\angle ACD$ giddu jiru akkamiin ibsita?
- Walitti dhufeenya kofoota sadan armaan olitti gaafatamanii fi golboo AYD giddu jiru akkamiin ibsita?



Danaa 5.18

Walitti dhufeenya geengoo fi kofa armaan olii keessaa gaaffii (i) fi (ii) irratti hundaa'uun hiikoon armaa gadii kennameera.

Hiikoo 5.1

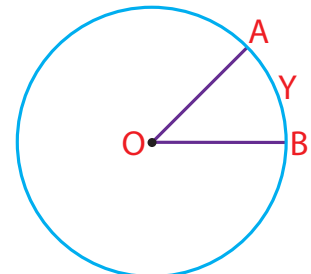
Kofti handhuuraa, kofa verteksiin isaa handhuura geengoo irra ta'ee rogoonni isaa ammoo raadiyesota geengoo ta'anii dha.

Fakkeenya 1:

Danaa 5.19 keessatti yoo O'n handhuura geengoo ta'e, $\angle AOB$ kofa handhuura dha.

Danaa 5.19 irratti $\angle AOB$ 'n golboo AYB **hammate** jenna. Karaa biraa ammoo golboon AYB $\angle AOB$ **aguuge** jenna.

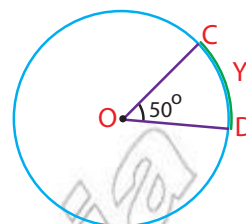
Yemmuu $\angle AOB$ 'n kofa handhuuraa ta'e, safarri kofa ($\angle AOB$) safara golboo (\widehat{AYB}) wajjiin tokko (walqixa dha). Kana jechuunis $s(\angle AOB) = s(\widehat{AYB})$



Danaa 5.19

Fakkeenya 2:

Yoo $s(\angle COD) = 50^\circ$ ta'e, $s(\widehat{CYD}) = 50^\circ$



Danaa 5.20

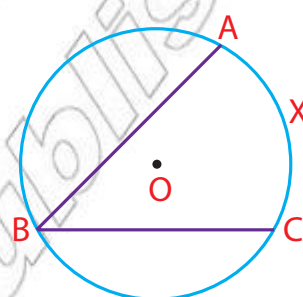
Hiikoo 5.2

Kofti verteksiin isaa geengoo irra ta'ee golboo geengichaatiin aguugame, kofa **itti marfamaa** rogotni isaa koordota lamaa ta'e jedhama.

Fakkeenya 3:

Danaa 5.21 armaan gadii keessatti $\angle ABC$ kofa itti marfamaa dha. Sababiin isaas verteksiin B'n geengoo irra ta'ee rogotni koordota lamaan \overline{BA} fi \overline{BC} dha.

Kanas golboon \widehat{AXC} kofa $\angle ABC$ geengoo O irratti aguuge. Yookiin kofti itti marfamaa $\angle ABC$ golboon \widehat{AXC} geengoo O'n hammate dha. Walitti dhufeenya safara golboon \widehat{AXC} fi safara kofa \widehat{ABC} adda baafachuu qabna.

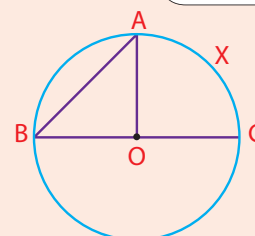


Danaa 5.21

GOCHA 5.7

1 Geengoo kofti handhuuraa fi kofti itti marfamaa golboo gosa tokko \widehat{AXC} qabu ijaaruun, kanneen armaan gadii hojjedhu (yoo O'n handhuura geengichaa ta'e.)

- i Pirootiraakteeriitti fayyadamuun kofa $\angle ABC$ safari.
- ii Pirootiraakteeritti fayyadamuun kofa $\angle AOC$ safari.
- iii Safara kofoota lamaanii waliin madaali. Maal argattee?



Danaa 5.22

Gocha armaan olii keessatti safarri kee sirrii yoo ta'e, safarri $\angle ABC$ walakkaa safara $\angle AOC$ ti.

Sababiin isaas safarri $\angle AOC$ safara golboon \widehat{AXC} tiin walqixa waan ta'eef.

Tiyooramii armaan gadii qabaanna.

Tiyooramii: safarri kofa itti marfamaa walakkaa safara golboon isa aguugeeti.

Fakkeenya 4:

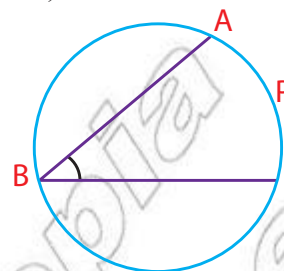
Danaa armaan gadii keessatti yoo $s(\widehat{APC}) = 80^\circ$ ta'e, $s(\angle ABC)$ barbaadi.

Furmaata

$s(\widehat{APC}) = 80^\circ$ kan kenname.

$s(\angle ABC) = \frac{1}{2} s(\widehat{APC})$, Tiyooramii armaan oliitiin

$s(\angle ABC) = \frac{1}{2} (80^\circ) = 40^\circ$



Danaa 5.23

Fakkeenya 5:

Danaa armaan gadii irratti yoo $s(\angle PQR) = 35^\circ$. Safara golboo \widehat{PTR} barbaadi.

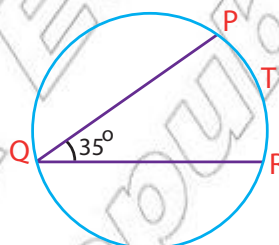
Furmaata

$s(\angle PQR) = 35^\circ$ (kan kenname)

$s(\angle PQR) = \frac{1}{2} s(\widehat{PTR})$ (Tiyooramiiin)

$35^\circ = \frac{1}{2} s(\widehat{PTR})$

$s(\widehat{PTR}) = 2(35^\circ) = 70^\circ$



Danaa 5.24

Fakkeenya 6:

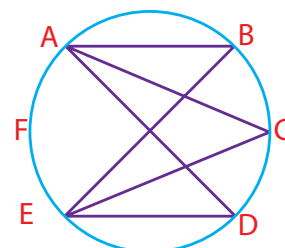
Danaa armaan gadii irratti yoo $s(\angle ABE) = 60^\circ$, yoo ta'e safara $(\angle ADE)$ fi $(\angle ACE)$ barbaadi.

Furmaata

kan kenname $s(\angle ABE) = 60^\circ$

Kanaafuu $s(\widehat{EFA}) = 2(60^\circ) = 120^\circ$

$s(\angle ADE) = \frac{1}{2} s(\widehat{EFA}) = \frac{1}{2} (120^\circ) = 60^\circ$



Danaa 5.25

Sababuma wal fakkaatuun $s(\angle ACE) = 60^\circ$ arganna.

Hubadhu

Geengoo tokko keessatti, kofootni itti marfamoo ta'an yoo golboo tokkichaagan aguugaman safarri isaanii walqaxa.

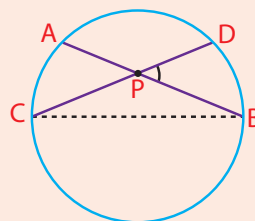
5.2.2 KOFOOTA KOORDOTA WALQAXXAAMURAN LAMAAN UUMAMAN

Golee kana keessatti walitti dhufeenya safara kofa koordotni walqaxxaamuran uumanii fi safara golboo ittiin aguugamanii gidduu jiru ilaalta. Kanaafuu gochaa armaan gadii hojjechuun gaarii dha.

GOCHA 5.8



Geengoo armaan gadii keessatti koordotni \overline{AB} fi \overline{CD} 'n tuqa'P' irratti walqaxxaamuru. P'n tuqaa geengoo keessatti argamu kamiyyuu garuu handhuura geengootii ala yoo ta'e, geengoo akkasii dabtara kee irratti ijaaruun kanneen armaan gadii hojjedhu.



Danaa 5.26

- 1 Sarartootti fayyadamuun \overline{CB} ijaari.
- 2 $\angle ABC$ fi $\angle DCB$ pirootiraaktariitiin safari.
- 3 Safara lammaffaa irratti argattetti fayyadamuun safara golboota xixiqqoo \widehat{DB} fi \widehat{CA} barbaadi.
- 4 $\angle DPB$ safari.
- 5 Hariiroo safara $\angle DPB$ fi ida'ama $s(\widehat{DB})$ fi $s(\widehat{CA})$ waliin madaali.

Gocha armaan olii irratti yoo safarri kee sirrii ta'e, safarri kofa $\angle DPB$ walakkaa ida'ama safara golboowwan isaan aguuganiiti.

$$\text{Kunis, } \frac{1}{2} s(\widehat{DB}) + s(\widehat{CA}) = s(\angle DPB)$$

Fakkeenya 7:

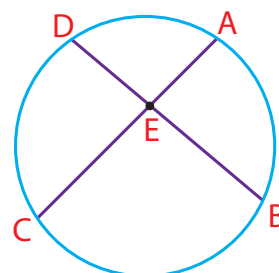
Danaa 5.27 armaan gadii keessatti yoo safarri $\widehat{AB} = 90^\circ$ fi $s(\widehat{CD}) = 80^\circ$ ta'e safara $(\angle AEB)$ barbaadi.

Furmaata

Akkaataa gocha 5.8 armaan oliin

$$s(\angle AEB) = \frac{1}{2} (s(\widehat{AB}) + s(\widehat{CD}))$$

$$\therefore s(\angle AEB) = \frac{1}{2} (90^\circ + 80^\circ) = \frac{1}{2} (170^\circ) = 85^\circ$$



Danaa 5.27

Fakkeenya 8:

Danaa 5.28 armaan gadii keessatti yoo koordotni \overline{RP} fi \overline{SQ} tuqaa T irratti walqaxxaamuranii fi $s(\angle PTQ) = 60^\circ$, $s(\widehat{RS}) = 70^\circ$ ta'e $s(\widehat{PQ})$ barbaadi.

Furmaata

$$s(\widehat{RS}) = 70^\circ \text{ fi } s(\angle PTQ) = 60^\circ$$

$$s(\widehat{PQ}) = ?$$

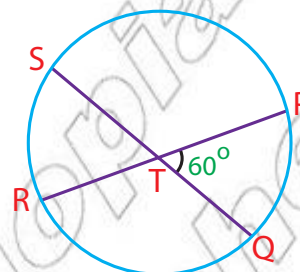
$$s(\angle PTQ) = \frac{1}{2} [s(\widehat{PQ}) + s(\widehat{RS})]$$

$$60^\circ = \frac{1}{2} (s(\widehat{PQ}) + 70^\circ)$$

$$120^\circ = s(\widehat{PQ}) + 70^\circ$$

$$s(\widehat{PQ}) = 120^\circ - 70^\circ = 50^\circ$$

$$\text{Kanaafuu, } s(\widehat{PQ}) = 50^\circ$$



Danaa 5.28

Hubadhu:

Gocha 5.8 armaan olii keessatti yoo \overline{AB} fi \overline{CD} ijaarte $\angle CAB$, $\angle ACD$ fi $\angle APD$, safari. Safara $\angle APD$, safara (\widehat{BC}) + safara (\widehat{AD}) waliin madaali.

Maal argatte?

Kan argamu:

$$s(\angle APD) = \frac{1}{2} (s(\widehat{AD}) + s(\widehat{BC}))$$

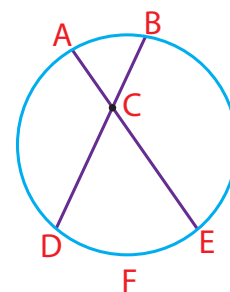
Fakkeenya 9:

Danaa 5.29 armaan gadii keessatti, yoo safarri $(\widehat{AB}) = 50^\circ$ fi $s(\widehat{DFE}) = 110^\circ$, ta'e $s(\angle ACB)$ barbaadi.

Furmaata

$$s(\angle ACB) = \frac{1}{2} (s(\widehat{AB}) + s(\widehat{DFE}))$$

$$s(\angle ACB) = \frac{1}{2} (50^\circ + 110^\circ) = 80^\circ$$



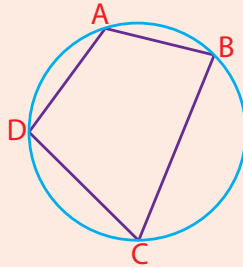
Danaa 5.29

5.2.3 ROG - AFREE SAAYIKILIKII

GOCHA 5.9



- 1 Ida'amni safara kofoota rog-sadee tokkoo hammami?
- 2 Ida'amni safara kofoota rog-afree tokkoo hammami?
- 3 Danaa armaan gadii keessatti yoo rog-afree $ABCD$ geengoon almarfame yookiin yoo geengoon verteeksii rog-afree keessa darbe kanneen armaan gadii hojjedhu.
 - i Safara $\angle ABC$, $\angle BCD$, $\angle CDA$ fi $\angle DAB$ barbaadi.
 - ii $s(\angle DAB) + s(\angle BCD)$ barbaadi.
 - iii $s(\angle CDA) + s(\angle ABC)$ barbaadi.
 - iv Ida'ama lamaan ii fi iii irratti argattan waliin madaalaa. Maal argattani?



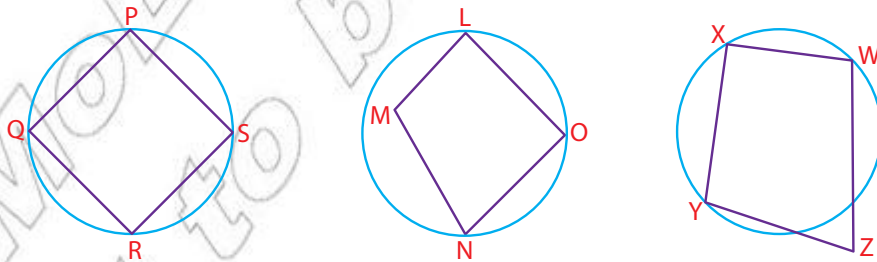
Danaa 5.30

Hiikoo 5.3

Rog-afreen geengoon almarfamee **rog-afree saayikiliikii** jedhama (Rog-arfeen keessamarfatoo geengoo ta'e)

Fakkeenya 10:

Danaa 5.31 armaan gadii keessatti, rog-afreen $PQRS$ saayikiliikii dha. Garuu rog-afreen $LMNO$ fi $WXYZ$ saayikiliikii miti.



Danaa 5.31

Yoo safarri kee **Gocha 5.9** lakkoofsa 3^{ffaa} sirrii ta'e,
 $s(\angle DAB) + s(\angle BCD) = s(\angle ABC) + s(\angle CDA) = 180^\circ$.

Kunis akka armaan gadiin ibsameera.

Tiyooramii

Yoo rog-afreen tokko saaykiliikii ta'e, kofootni fuullee waliif hirkoo ta'u (kofoonni fuullee kofoota hirkoo ta'u).

Tiyooramii kana mirkaneessuuf yaadota dhuga armaan gadii lamantu barbaachisa.

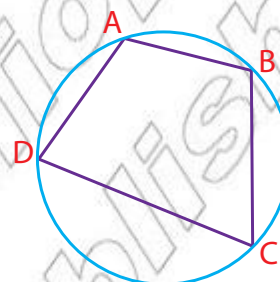
- i Safarri kofa itti marfamaa walakkaa safara golboo isa aguugee ti.
- ii Safarri geengoo guutuu 360°

Kanaafuu rog-afreen saaykiliikiin $ABCD$ Danaa 5.32 irratti kenname, $\angle ADC$ fi $\angle ABC$ hirkoo walii ta'uu agarsiisuuf:

Mirkaneessuu:

$$s(\angle ADC) = \frac{1}{2} (s(\widehat{ABC})) \text{ fi } s(\angle ABC) = \frac{1}{2} (s(\widehat{ADC}))$$

$$\begin{aligned} s(\angle ADC) + s(\angle ABC) &= \frac{1}{2} (s(\widehat{ABC})) + \frac{1}{2} (s(\widehat{ADC})) \\ &= \frac{1}{2} (s(\widehat{ABC}) + s(\widehat{ADC})) \\ &= \frac{1}{2} (360^\circ) \text{ (Malliif?)} \\ &= 180^\circ \end{aligned}$$



Danaa 5.32

Kanaafuu $\angle ADC$ fi $\angle ABC$ hirkoo waliiti. Haaluma walfakkaatuun $\angle DAB$ fi $\angle DCB$ hirkoo walii ta'uu agarsiisi.

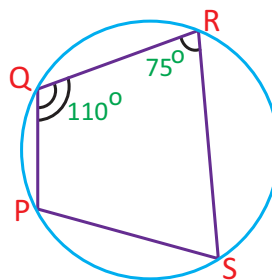
Fakkeenya 11:

Danaa 5.33 keessatti yoo $PQRS$ rog-afree saaykiliiki ta'e, $s(\angle QPS)$ fi $s(\angle PSR)$ barbaadi.

Furmaata

$$\begin{aligned} \text{i } s(\angle QPS) + s(\angle QRS) &= 180^\circ \\ \angle s(\angle QPS) &= 180^\circ - s(\angle QRS) \\ &= 180^\circ - 75^\circ \\ &= 105^\circ \end{aligned}$$

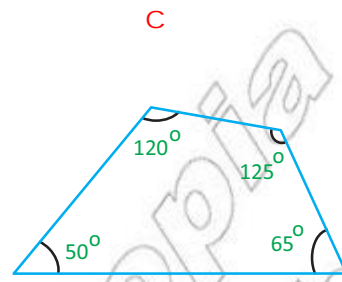
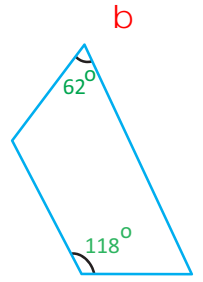
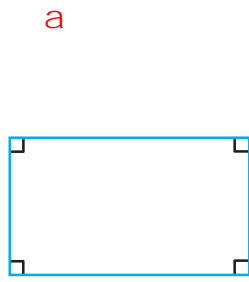
$$\begin{aligned} \text{ii } s(\angle PQR) + s(\angle PSR) &= 180^\circ \\ \angle s(\angle PSR) &= 180^\circ - s(\angle PQR) \\ &= 180^\circ - 110^\circ \\ &= 70^\circ \end{aligned}$$



Danaa 5.33

Fakkeenya 12:

Kanneen armaan gadii keessaa kan rog-afree saayikiliikii ta'e kami?



Danaa 5.34

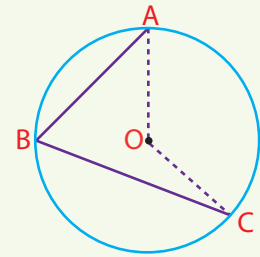
Furmaata

Rog-afreewwan a fi b irratti kennaman saayikiliikii dha. Sababni isaas, kofootni fuulle hirkoo walii waan ta'aniif. Garuu rog-afree c irratti kenname saayikiliikii miti ($120^\circ + 65^\circ = 185^\circ \neq 180^\circ$)

GILGAALA 5.2

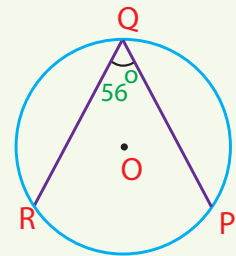
- 1 Danaa kenname keessatti $s(\widehat{AC}) = 132^\circ$, yoo ta'e $s(\angle AOC)$ fi $s(\angle ABC)$, barbaadi, 'O'n hunduura geengoo ti.

Danaa 5.35

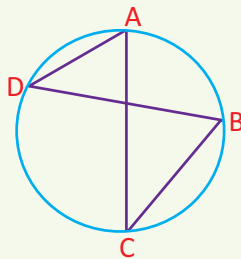


- 2 Danaa armaan gadii keessatti yoo $s(\angle PQR) = 56^\circ$ ta'e, $s(\widehat{PR})$ barbaadi 'O'n handhuura geengooti.

Danaa 5.36



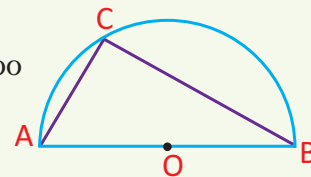
- 3 Danaa armaan gadii keessatti, yoo $s(\angle ADB) = 40^\circ$ ta'e, $s(\angle ACB)$ barbaadi.



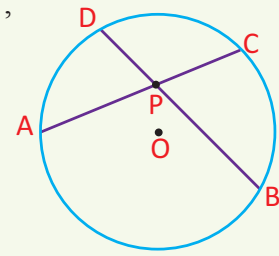
Danaa 5.37

- 4 Danaa armaan gadii keessatti, \widehat{AB} 'n diyaameetirii geengoo yoo ta'e, $\angle BCA$ 'n kofa sirrii ta'uu mirkaneessi.

Danaa 5.38

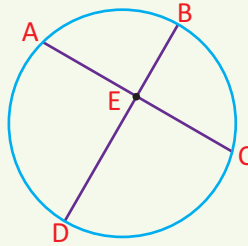


- 5 Danaa armaan gadii keessatti $s(\widehat{CB}) = 100^\circ$ fi $s(\widehat{AD}) = 70^\circ$, yoo ta'e $s(\angle CPB)$ barbaadi.



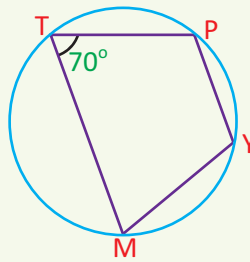
Danaa 5.39

- 6 Danaa armaan gadii keessatti, $s(\angle AED) = 95^\circ$ fi $s(\widehat{BC}) = 83^\circ$, $s(\widehat{DA})$ barbaadi.



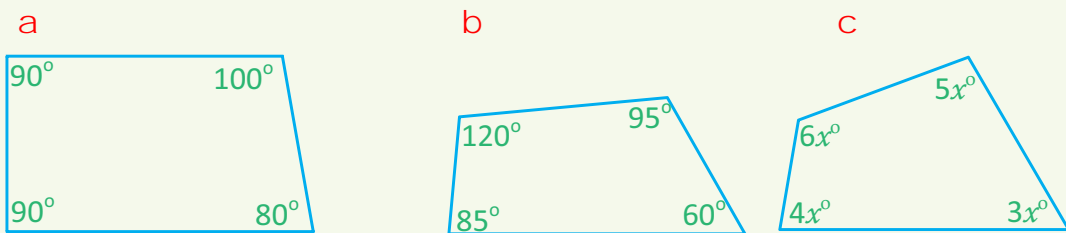
Danaa 5.40

- 7 Danaa armaan gadii keessatti, $s(\angle PTM) = 70^\circ$, yoo ta'e $s(\angle PYM)$ barbaadi. Waa'ee $s(\angle TPY)$ fi $s(\angle TMY)$ maal jechuu dandeessa?



Danaa 5.41

- 8 Rog-afreewwan armaan gadii keessaa rog-arfee saayikiliikii kan ta'e isa kami?



Danaa 5.42

- 9 Kanneen armaan gadii keessaa kamtu soba? Maaliif?
- Iskuweeriin hundi saayikiliikii dha.
 - Rektangiliin hundi saayikiliikii dha.
 - Paraalaloogiraamiin hundi saayikiliikii dha.



Tarmoota Ijoo



→ Geengoo	→ Golboo	→ Golboo guddaa
→ Golboo xiqqaa	→ sarara seekaantii	→ koordii
→ sarara taanjeentii	→ kofa itti marfamaa	→ golboo hammatame
→ kofa handhuuraa	→ rogarfee saayikiliikii	→ sektarii geengoo
→ golboo haguuge	→ muraa geengoo	



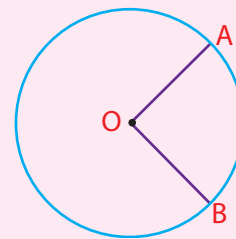
Guduunfaa Boqonnaa



- Safarri kofa handhuuraa walqixa safara golboo haguugee ti.

$s(\angle AOB) = s(\widehat{AB})$, O'n handhuura geengichaa yoo ta'e.

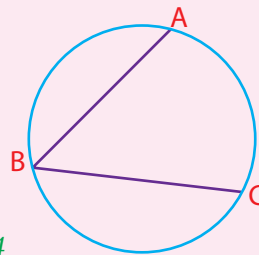
Danaa 5.43



- Safarri kofa itti marfamaa, walakkaa safara golboo isa aguugeti.

Kana jechuunis: $s(\angle ABC) = \frac{1}{2} s(\widehat{AC})$

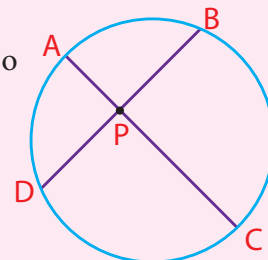
Danaa 5.44



- Safarri kofootni koordotni lama geengoo keessatti wal qaxxaamuruun uumamu walakkaa ida'ama safara golboo gamaa gamanaan hammatamaniiti

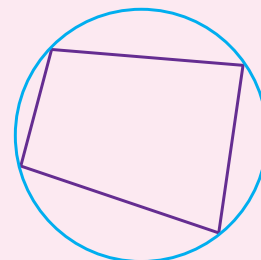
Kunis, $s(\angle BPC) = \frac{1}{2} (s(\widehat{BC}) + s(\widehat{DA}))$

Danaa 5.45



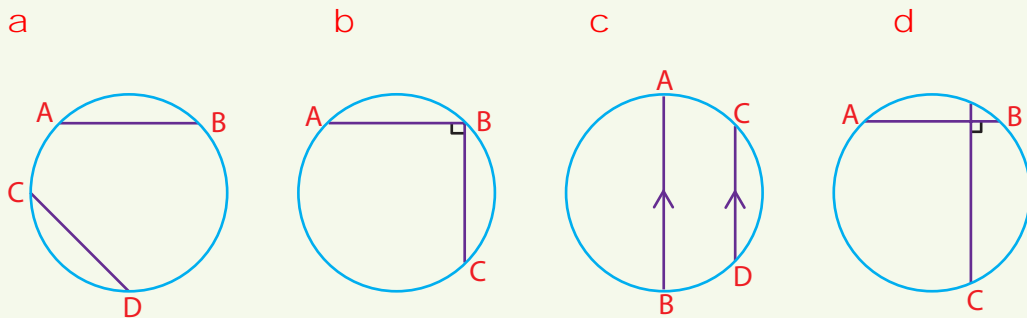
- Rog-afree saayikiliikiin, rog-afree verteeksotni isaa hundi geengoo tokko irratti argamani dha.
- Yoo rog-afreen tokko saayikiliikii ta'e, kofootni fuullee waliif hirkoo dha.

Danaa 5.46



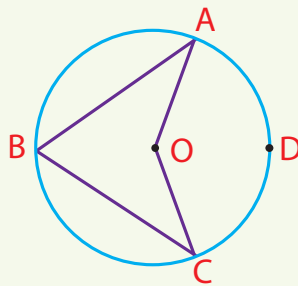
GILGAALA KEESSA DEEBII

- 1 Danaalee armaan gadii dabtarii kee irratti garagalchuun handhuura isaanii barbadi.



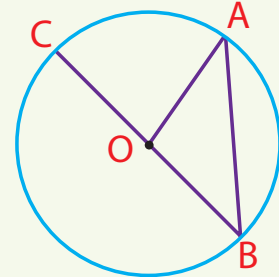
Danaa 5.47

- 2 Danaa gara mirgaa irratti $s(\angle AOC) = 140^\circ$. O'n handhuura geengichaa yoo ta'e, $s(\angle ABC)$ fi $s(\widehat{ADC})$ barbaadi.



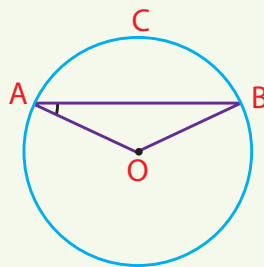
Danaa 5.48

- 3 Danaa gara mirgaa irratti $s(\angle AOC) = 80^\circ$ O'n handhuura geengichaa yoo ta'e, $s(\angle CBA)$ barbaadi.



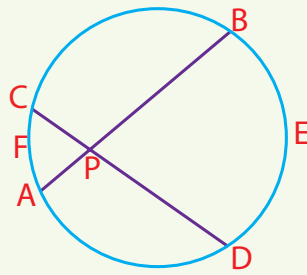
Danaa 5.49

- 4 Danaa gara mirgaa irratti $s(\angle BAO) = 25^\circ$. O'n handhuura geengichaa yoo ta'e, $s(\widehat{ACB})$ barbaadi.



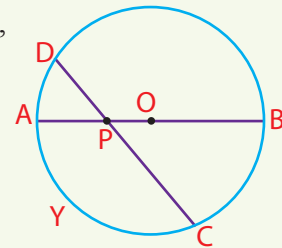
Danaa 5.50

- 5 Danaa armaan gadii irratti, koordotni \overline{AB} fi \overline{CD} tuqaa P irratti wal qaxxaamuru. $s(\angle BPD) = 75^\circ$ fi $s(\widehat{BED}) = 110^\circ$ yoo ta'an $s(\widehat{AFC})$ barbaadi.



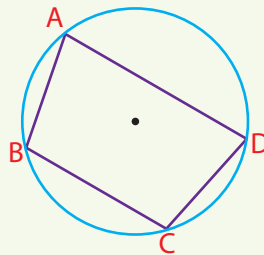
Danaa 5.51

- 6 Danaa armaan gadii irratti $s(\widehat{AD}) = 40^\circ$ fi $s(\angle DPB) = 130^\circ$, O'n handhuura geengichaa yoo ta'e, $s(\widehat{CYA})$ barbaadi.



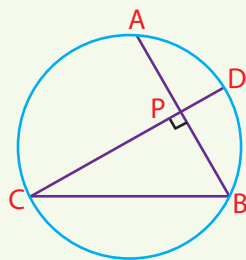
Danaa 5.52

- 7 Danaa gara mirgaa irratti $s(\angle A) = 80^\circ$ fi $s(\widehat{ABC}) = 140^\circ$. Verteksootni rog-afree hundi geengoo irra yoo ta'an $s(\angle D)$, $s(\angle C)$ fi $s(\angle B)$ barbaadi.



Danaa 5.53

- 8 Danaa gara mirgaa irratti $\overline{AB} \perp \overline{CD}$ fi $s(\widehat{DB}) = 60^\circ$. $s(\angle ABC)$ barbaadi.



Danaa 5.54