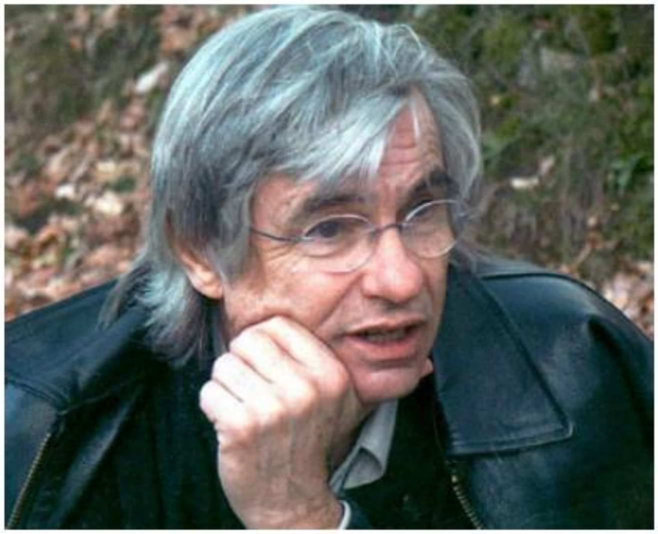
Ubumenyi butagira Imipaka

Itegeko ryo mu 1901 rigenga amashyirahamwe



Jean-Pierre Petit, Perezida w'iri Shirahamwe

Uyu Jean-Pierre Petit, Peresida w'iri shyirahamwe ry'**Ubumenyi butagira Imipaka**, yahoze ari diregiteri w'ubushakashatsi mu kigo cy'inzobere cya CNRS, mu Bufaransa. Akaba kandi inzobere ihanitse muri Fizike y'inyenyeri (Asitorofizike); yahimbye uburyo bushyashya by'inyandiko bita: *Ibitabo by'amashusho by'ubumenyi.* "**Ubumenyi butagira Imipaka**" ni ishyirahamwe ryahimbwe mu 2005 n'abagabo babiri, Jean-Pierre Petit na mugenzi we Gilles d'Agostini. Iri shyirahamwe ryihaye intego yo gukwirakwiza kw'isi hose ubumenyi ku buntu harimwo n'ubumenyi bwa tekinike, ubukorikori n'ikoranabuhanga. Iri shyirahamwe ribeshejweho n'inkunga rihabwa. Izo nkunga nizo ziriha abantu bahindura inyandiko mu zindi ndimi. Buri nyandiko (igitabo cy'amashusho cy'ubumenyi) ihindurirwa mu rundi rurimi ku mafaranga angana n'amayero 150 (150 euros) kuva mu 2007 kugeza ubu. Iri shyirahamwe rinariha amafaranga ajyanye n'iyoherezwa ucishije muri banke ry'ayo mafaranga y'ihinduranya mu zindi ndimi. Abahinduranyi b'indimi bagiye bongera, buri munsi, umubare w'ibyo bitabo bisomwa hose k'ubuntu. (Nko kugeza mu 2007, hari hamaze kuboneka ibitabo magana abiri (200) bikurwa kuri interineti k'ubuntu kandi byanditse mu ndimi makumyabiri n'umunani (28) harimwo ikinyarwanda n'ururimi rwo muri Lawosi).

Biremewe ko iki gitabo gikopororwa cyangwa gifotorwa,cyose cyangwa igice; kinakoreshwa n'abarimu mu masomo ariko mu buryo butari ububyara inyungu z'amafaranga. Gishobora gushyirwa mu masomero y'uturere, y'amashuri cyangwa ya za kaminuza, cyanditse ku mpapuro cyangwa cya shyizwe mu miyoboro y'imbuga z'ikoranabuhanga zigose (intranet).

Uyu mwanditsi w'ibi bitabo yatangiye kwandika ibindi byo byoroshye kandi bigenewe abana bato (bari mu rugero rw'imyaka 12). Ibindi biriho bikorwa n'ibitabo by'amajwi avuga, bigenewe abatazi gusoma cyangwa abashaka kwiga urundi rurimi rutari urwo bakuriyemwo.

Iri shyirahamwe rishaka buri gihe abahinduranyi b'inyandiko bazishyira mu ndimi zabo zakavukire ariko bafite ubuhanga buhagije bwo gutanga inyandiko mpiduranyi nziza z'ibitabo basomye.

Ushatse kugira icyo ubaza cyangwa ugeza kuri iri shyirahamwe, wajya ku rubuga rwaryo ku interinete aha hakurikira: http://www.savoir-sans-frontieres.com

Iranga-konti mu Bufaranse → **Inyandiko ngaragaza mutungo muri (RIB)**

Ikigo	Umwanya wo kwakiriramwo amafaranga	Nimero ya konti	Urufunguzo rwa RIB
20041	01008	1822226V029	88

Aho ikorera: Banki ya Posita
Hagati y'Umujyi wa Marseille
13900 Marseille CEDEX 20
Mu Bufaransa

Mu bindi bihugu → **Ibanki Mpuzamahanga (International Bank) Nimero ya Konti (IBAN):**

IBAN
FR 16 20041 01008 1822226V029 88

→ **N' Inyandikobanga ya banki (BIC) :**

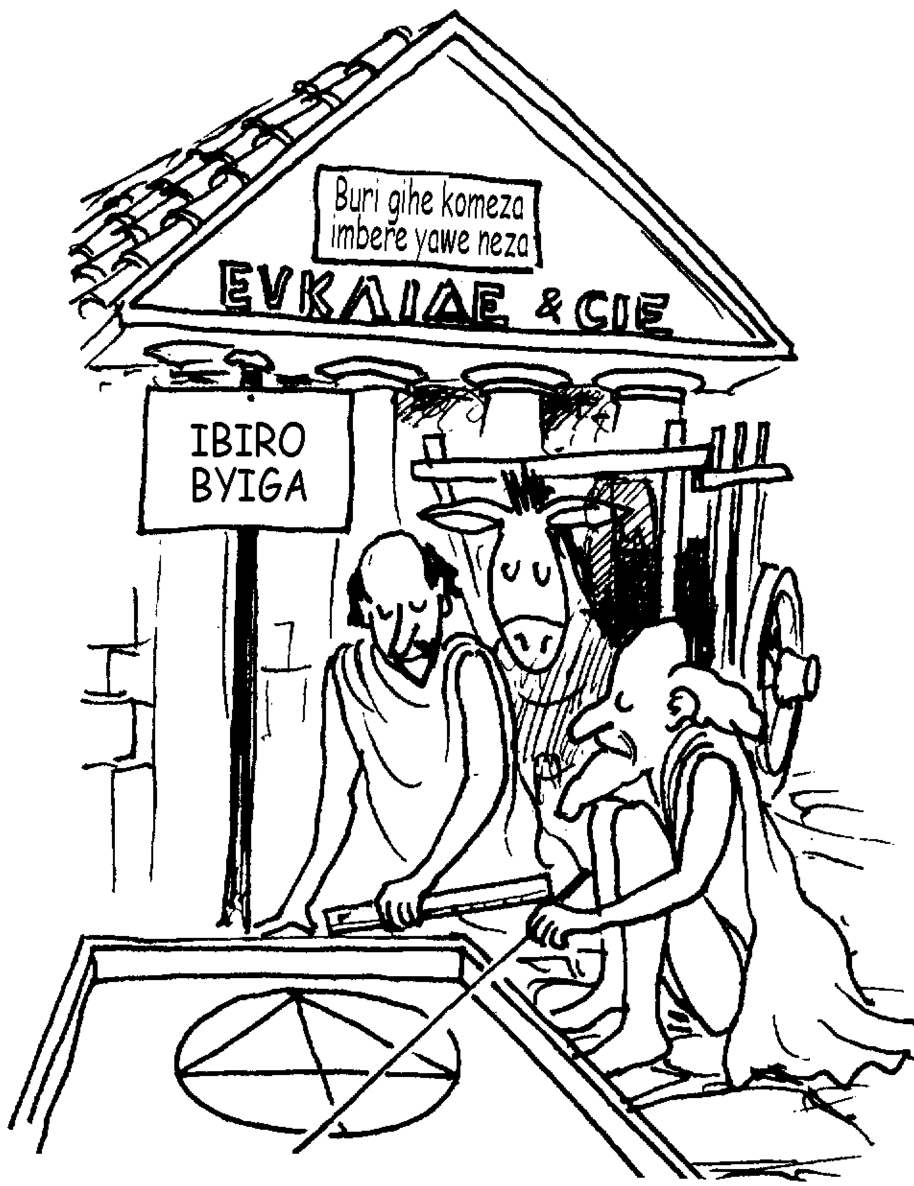
BIC
PSSTFRPPMAR

Amategeko agenga iri shyirahamwe agaragara ku rubuga rwa yo kuri interineti. Imibare ngaragaza mutungo nayo irahari kandi ihora ishyirwa ku gihe. Iri shyirahamwe nta mafaranga na make rikura ku nkunga rihawe uretse ayo kohereza, bicishijwe muri banki, ahemba abahinduranyi b'indimi ku buryo babona abagenewe yose.
Nta munyamuryango w'iri shyirahamwe n'umwe rihemba kuko bose ari abakoranabushake.
Abanyamuryango ubwabo nibo barihira amafaranga ishyirahamwe rikoresha ngo ribeho nk'ayo kwishyura no gukoresha urubuga rwa yo rwo kuri interineti kuko ayo atarihwa n'ishyirahamwe.
Bityo mugaragarizwa neza uko umutungo w'ishyirahamwe ukoreshwa kandi mukibonera ikizere ko, muri iyo "mirimo y'ubwitange mfashamuco", inkunga yose mutanga ikoreshwa neza mu kwishyura abahindura ibitabo mu zindi ndimi.
Dushyira ku rubuga rwa interineti buri kwezi, ugereranije, nk'ibitabo cumi bihinduwe mu zindi ndimi.

Ingyendo nshakisha z'Anselimi Lanturulu

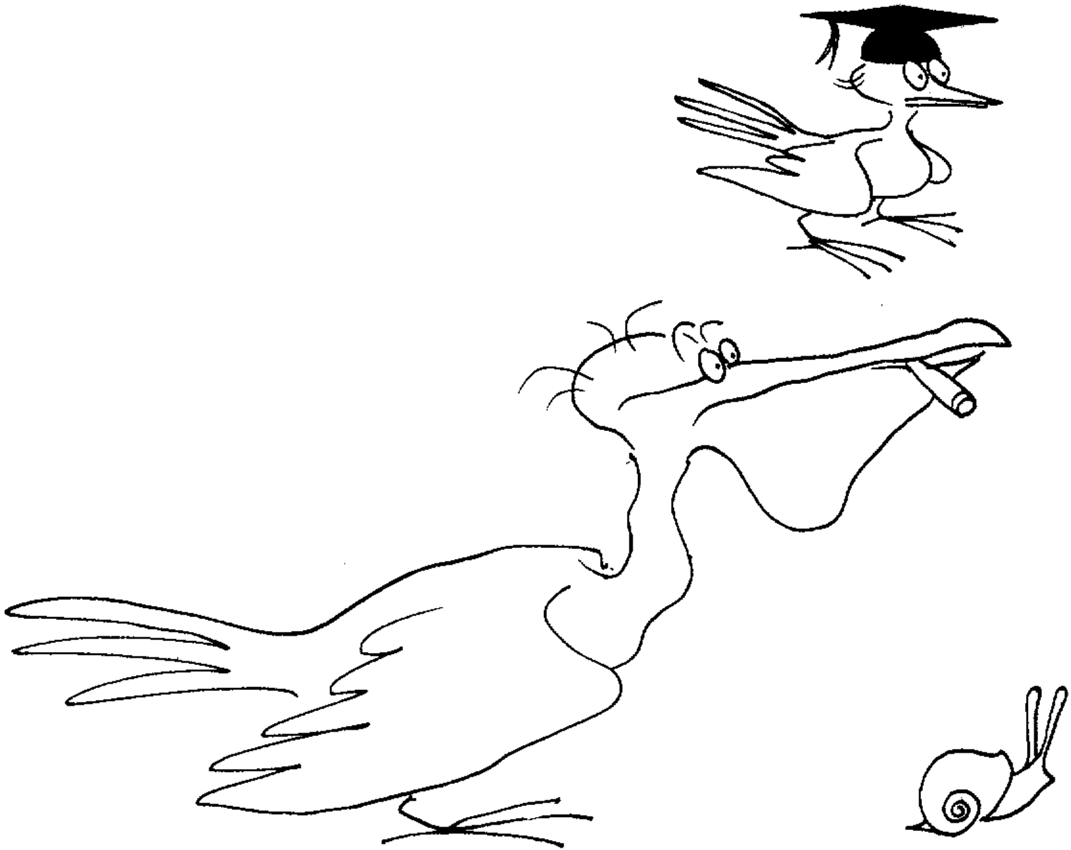
JEWOMETIRIKONI

Johani-Petero Petit



Bihinduwe na:

Mohamed Abdel Aziz Kamanzi

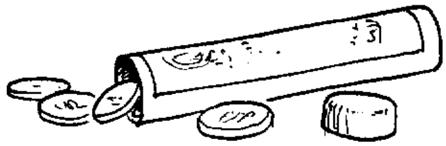


Ese hano muri
iyi nzu hari inzobere
mu mibare?

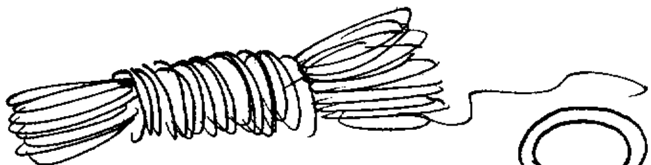
IKITONDERWA

Iki si igitabo, si n'isomo.
Gusa ni inkuru ya Anselimi Lanturulu na rumwe mu ngyendo ze yagize mu gihugu cya jewometiri.
Byaba byiza musomye iyi nkuru mufite:

* Ubwa mbere asipirine

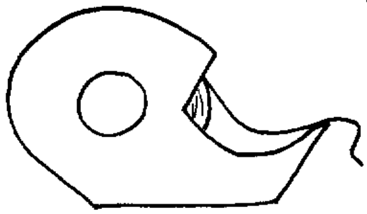


* kandi Akagozi

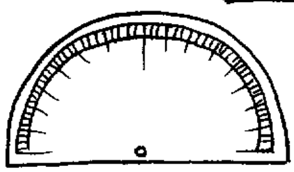


* Imikasi

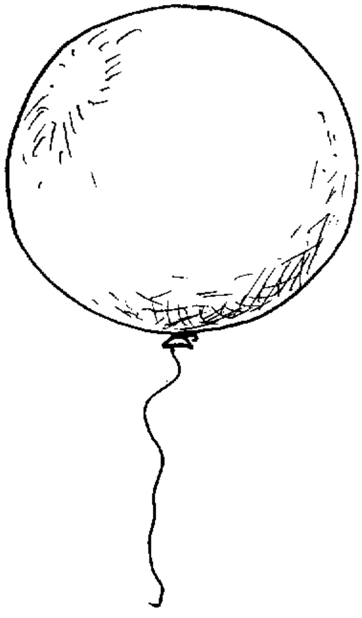
* Igice cy'urupapuro rusizeho ubujeni



* Agacamfuruka



* N'umupira mwiza wo gukina

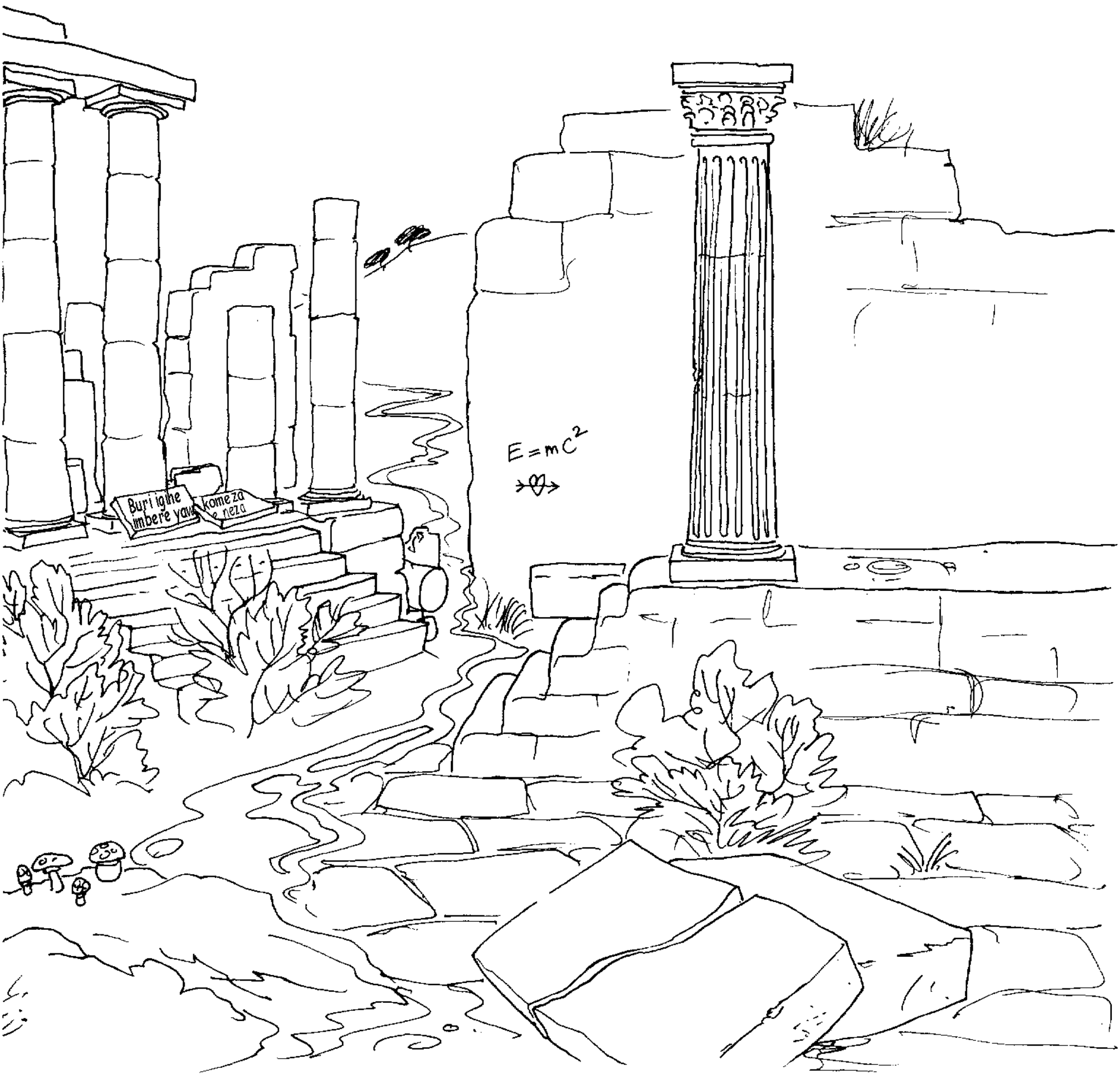


Ubumbye neza...

Ishyirahamwe Ekilide n'ibya ryo byavukiye Alegizandiriya mu kinyejana cya gatatu mbere ya Yezu-Kirisitu. Mu gihe cy'imyaka ibihumbi bibiri na magana abiri, imirimo yagendaga neza. Ibicuruzwa byari bikunzwe, abakiriya barishimaga kandi bahoraga bagaruka.

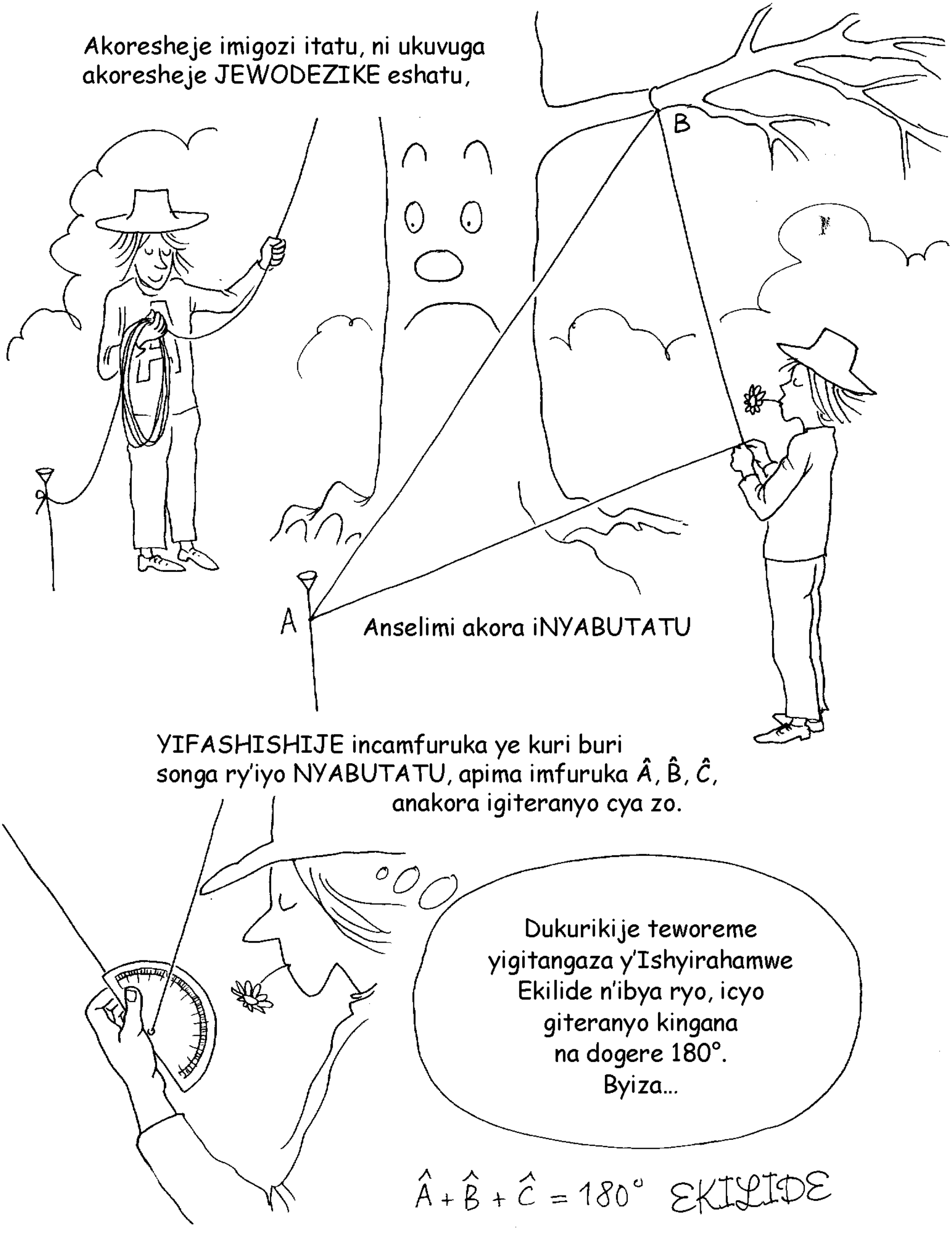
Ariko, buhoro buhoro, abakiriya bagiye bahindura ibyifuzo. Bamwe kyera bahoze ari abakunzi ndahinduka y'ibihakorerwa, baje, nyuma y'amageza menshi, kwibaza bati:
" Ekilide, rwose, niyo kamara hose no kuri byose?"

Uyi rero ni inkuru y'umwe muri abo tugiye kubagezaho.

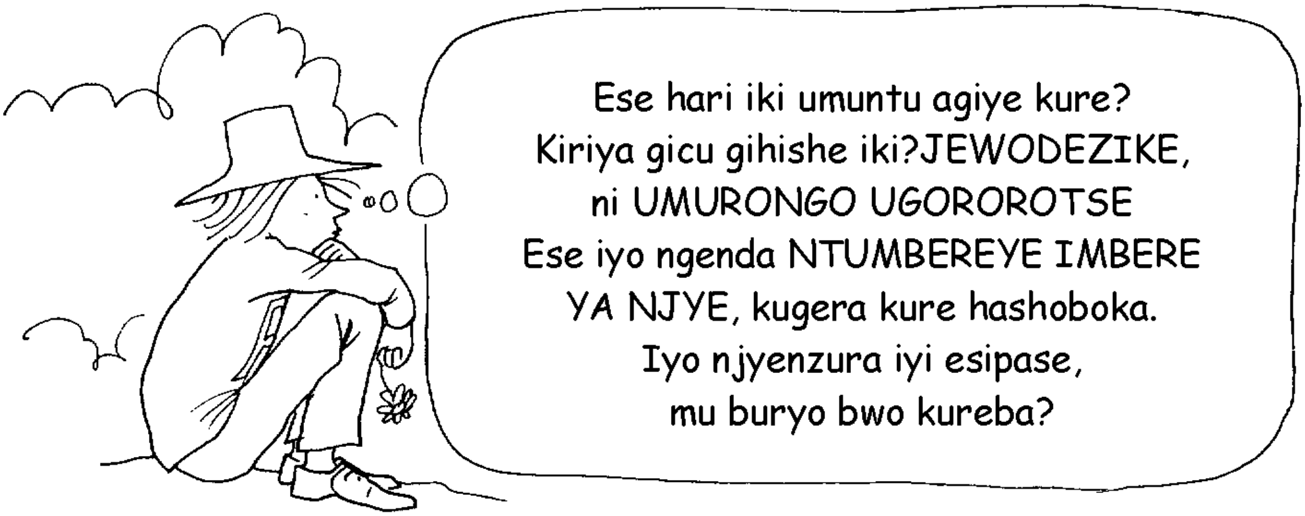


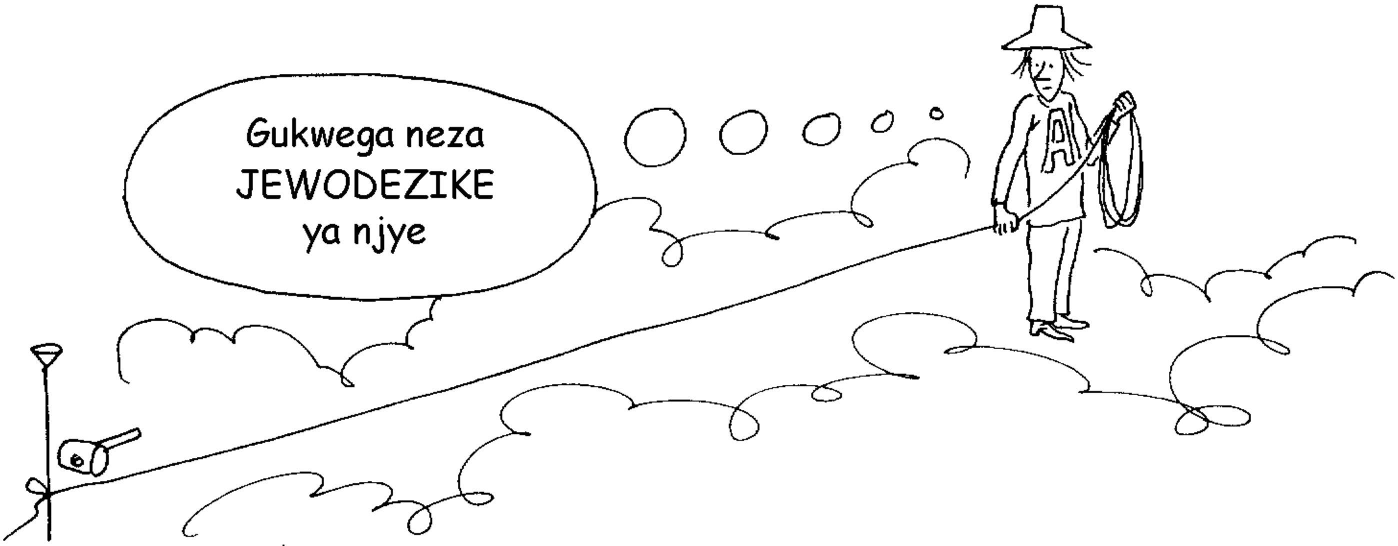
INKOMOKO Y'INKURU :

umunsi umwe Anselimi Lanturulu yiyemeje kurambura
umugozi ukweze hagati y'imambo ebyiri


Akoresheje imigozi itatu, ni ukuvuga akoresheje JEWODEZIKE eshatu,
B
A
Anselimi akora iNYABUTATU
YIFASHISHIJE incamfuruka ye kuri buri songa ry'iyo NYABUTATU, apima imfuruka Â, B̂, Ĉ, anakora igiteranyo cya zo.
Dukurikije teworeme yigitangaza y'Ishyirahamwe Ekilide n'ibya ryo, icyo giteranyo kingana na dogere 180°. Byiza...
Â + B̂ + Ĉ = 180° EKILIDE

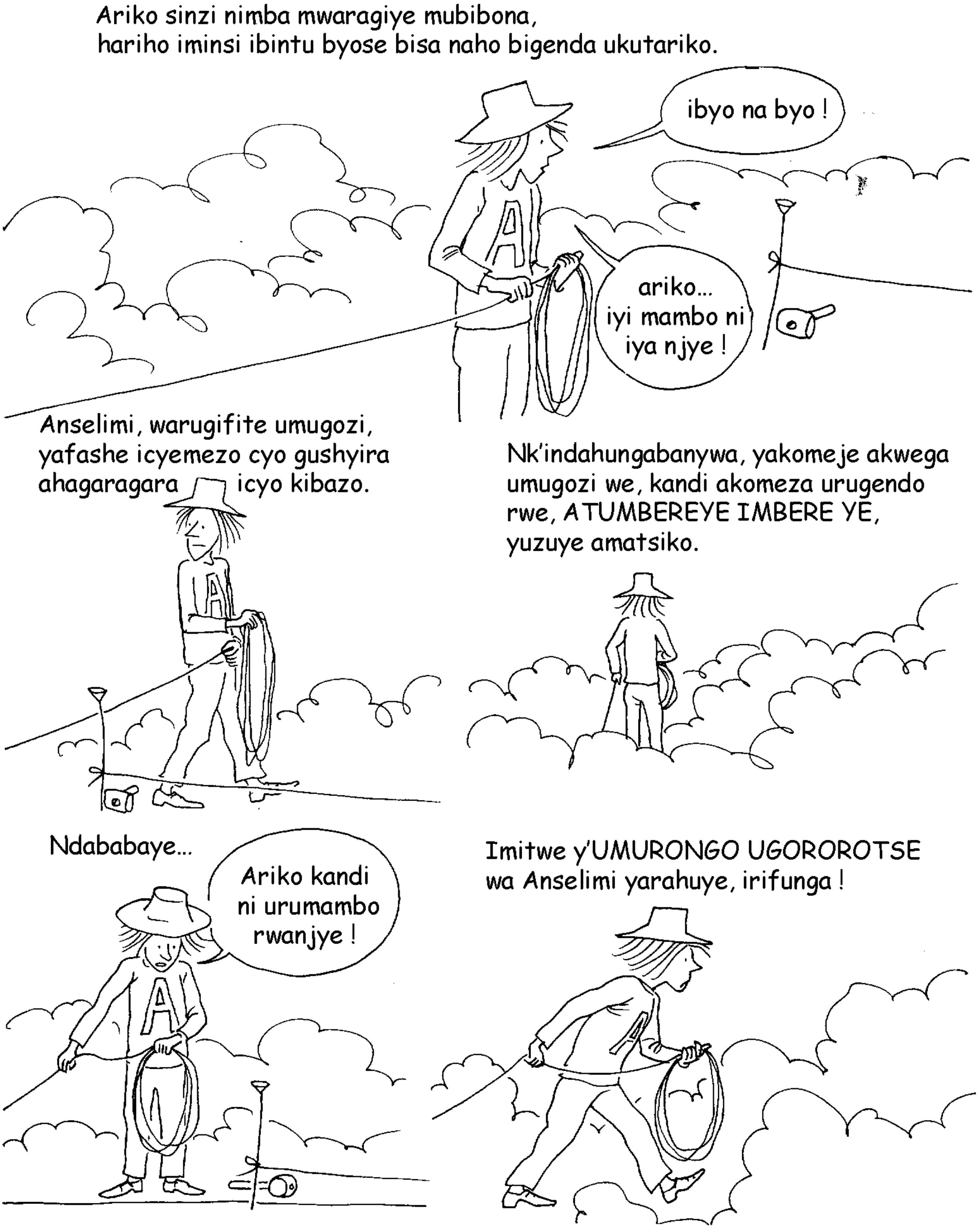
Usi Anselimi yabagamwo yari yuzuye amadayimoni.
Umuntu yari gushobora kwimyiza izuru ry'undi.



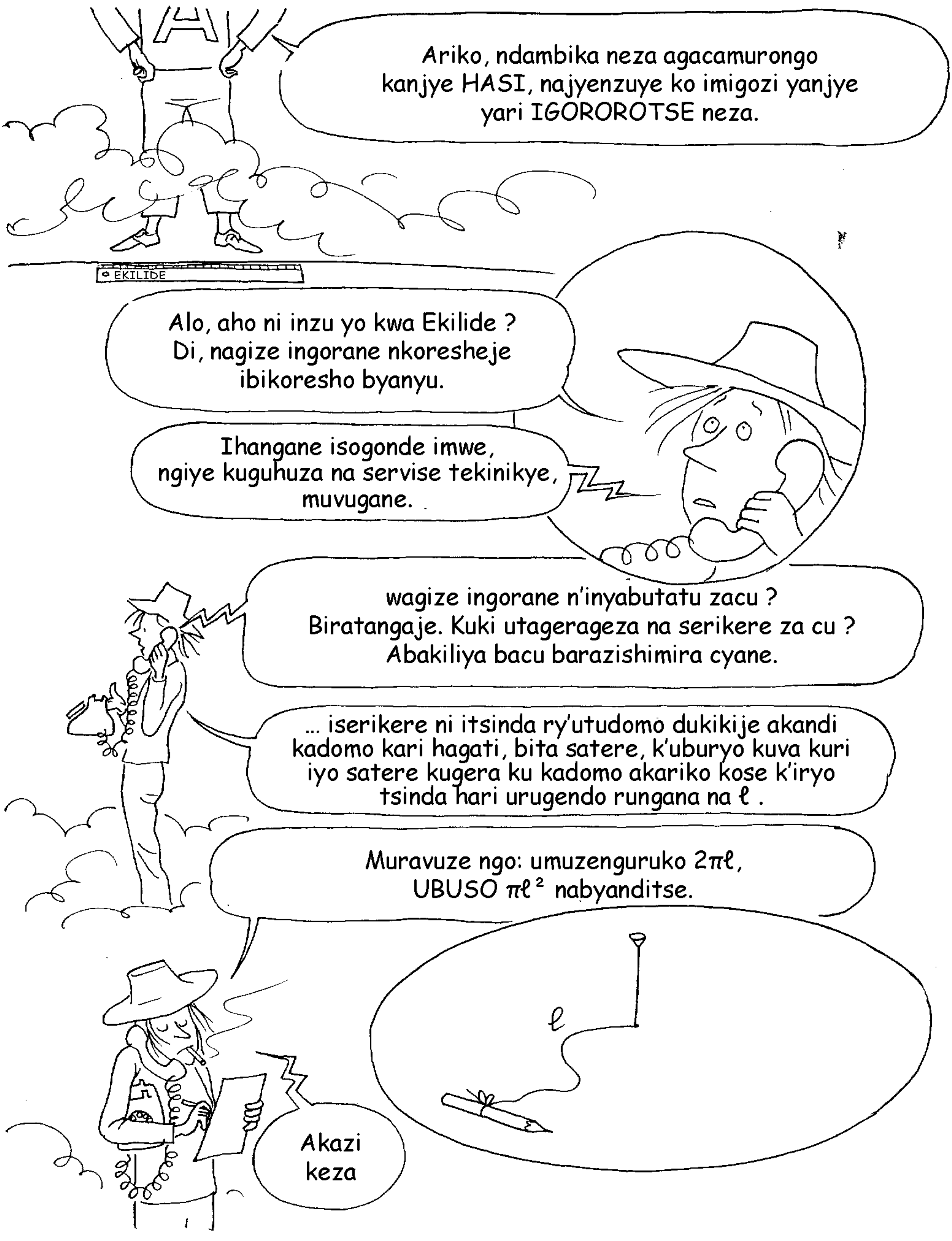


Anselimi ajyenda igihe kirekire cyane, igihe kirekire cyane...

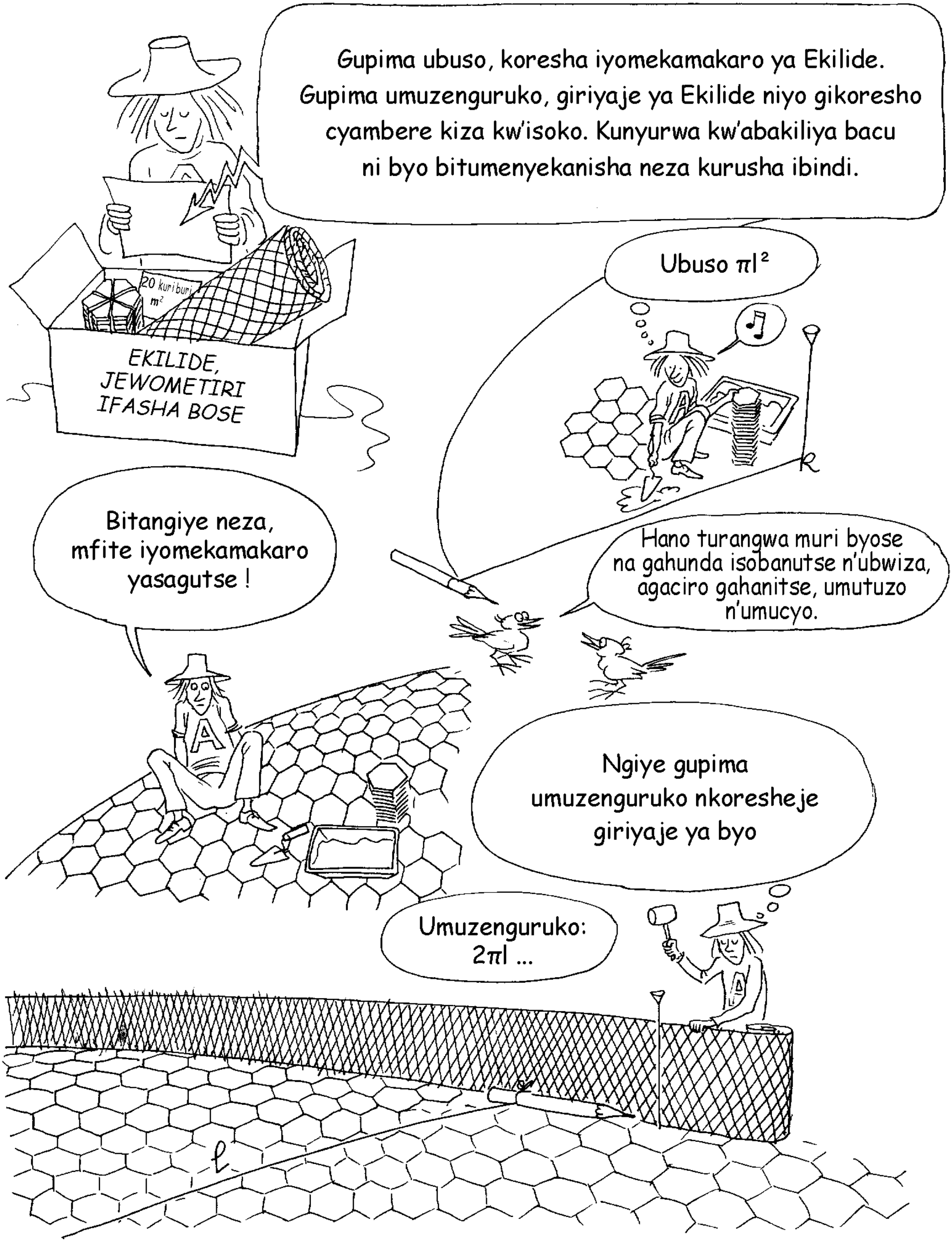
Inyuma ye, wa mugozi wariramburaga, ukweze neza kuburyo atitaga ku dukosa twaturuka ku njyendo ye muri icyo gicu: yakoraga JEWODEZIKE nziza ya ntamakemwa.

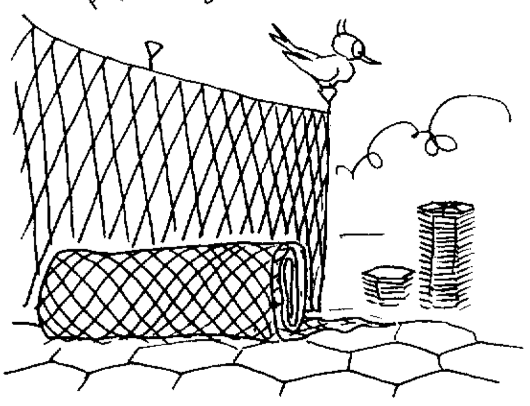

Ariko sinzi nimba mwaragiye mubibona,
hariho iminsi ibintu byose bisa naho bigenda ukutariko.
ibyo na byo !
ariko... iyi mambo ni iya njye !
Anselimi, warugifite umugozi, yafashe icyemezo cyo gushyira ahagaragara icyo kibazo.
Nk'indahungabanywa, yakomeje akwega umugozi we, kandi akomeza urugendo rwe, ATUMBEREYE IMBERE YE, yuzuye amatsiko.
Ndababaye...
Ariko kandi ni urumambo rwanjye !
Imitwe y'UMURONGO UGOROROTSE wa Anselimi yarahuye, irifunga !

? ? ? ? ? ? ? ? ? ? ?
Tugerageze teworeme yo kwa Ekilide. Ngiye gukurura JEWODEZIKE eshatu zinganya uburebure. Ibyo bizampa inyabutatu (tiriyangere); imfuruka eshatu za yo zizaba zifite, imwe yose, dogere 60°, igiteranyo cya zo kingana na 180°. Biranditse ku rupapuro rutangaza.
B 60 A 60 60 C
Â+B̂+Ĉ = 180°
Nyuma, nzamenyesha
RATIO OMNIA VINCIT
A
B
Dore isonga B rya njye rya kabiri. Hasigaye gukwega imigozi yindi ibiri tukabona isonga rya gatatu.
Siyanse ni nziza
B
Ohu koko koko! Imfuruka zirangana neza, ariko imwe yose iraruta dogere 60°.
Ikibazo?
C
A
Igiteranyo cya zo, byumvikane neza, kiraruta dogere 180° !
EKILIDE
JEWOMETIRI YA EKILIDE
EKILIDE!



Ariko, ndambika neza agacamurongo kanjye HASI, najyenzuye ko imigozi yanjye yari IGOROROTSE neza.
EKILIDE
Alo, aho ni inzu yo kwa Ekilide ? Di, nagize ingorane nkoresheje ibikoresho byanyu.
Ihangane isogonde imwe, ngiye kuguhuza na servise tekinikye, muvugane.
wagize ingorane n'inyabutatu zacu ? Biratangaje. Kuki utagerageza na serikere za cu ? Abakiliya bacu barazishimira cyane.
... iserikere ni itsinda ry'utudomo dukikije akandi kadomo kari hagati, bita satere, k'uburyo kuva kuri iyo satere kugera ku kadomo akariko kose k'iryo tsinda hari urugendo rungana na ℓ .
Muravuze ngo: umuzenguruko 2πℓ, UBUSO πℓ² nabyanditse.
ℓ
Akazi keza

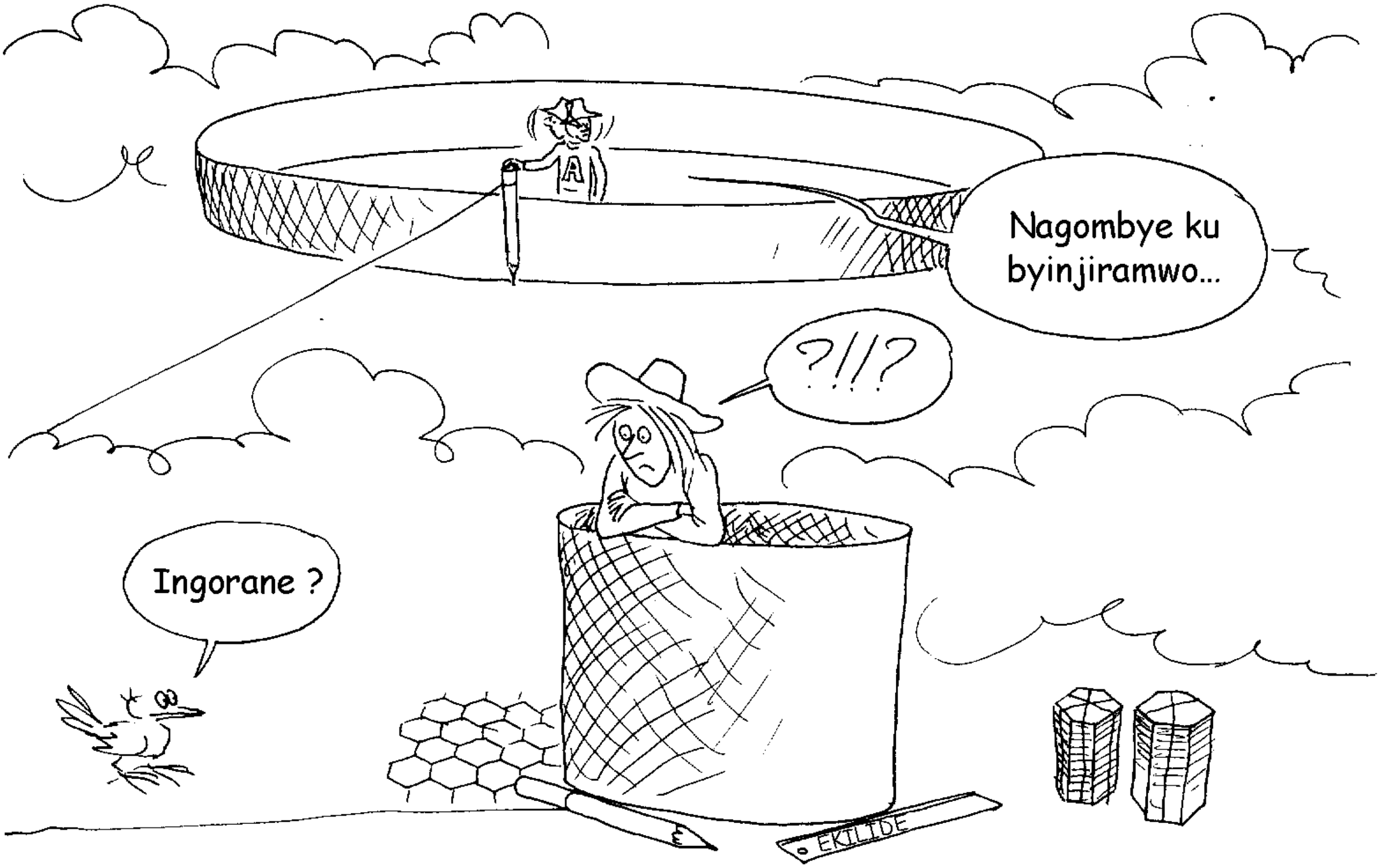

Gupima ubuso, koresha iyomekamakaro ya Ekilide. Gupima umuzenguruko, giriyaje ya Ekilide niyo gikoresho cyambere kiza kw'isoko. Kunyurwa kw'abakiliya bacu ni byo bitumenyekanisha neza kurusha ibindi.
20 kuri buri m^2
EKILIDE, JEWOMETIRI IFASHA BOSE
Ubuso πl^2
Bitangiye neza, mfite iyomekamakaro yasagutse !
Hano turangwa muri byose na gahunda isobanutse n'ubwiza, agaciro gahanitse, umutuzo n'umucyo.
Ngiye gupima umuzenguruko nkoresheje giriyaje ya byo
Umuzenguruko: $2\pi l$ ...



Anselimi yakomeje urugendo dwe ari nako yongera buri gihe rayo ℓ y'uruziga dwe.
Ariko kugwa hasi kw'amakoro kwakomeje kwiyongera.

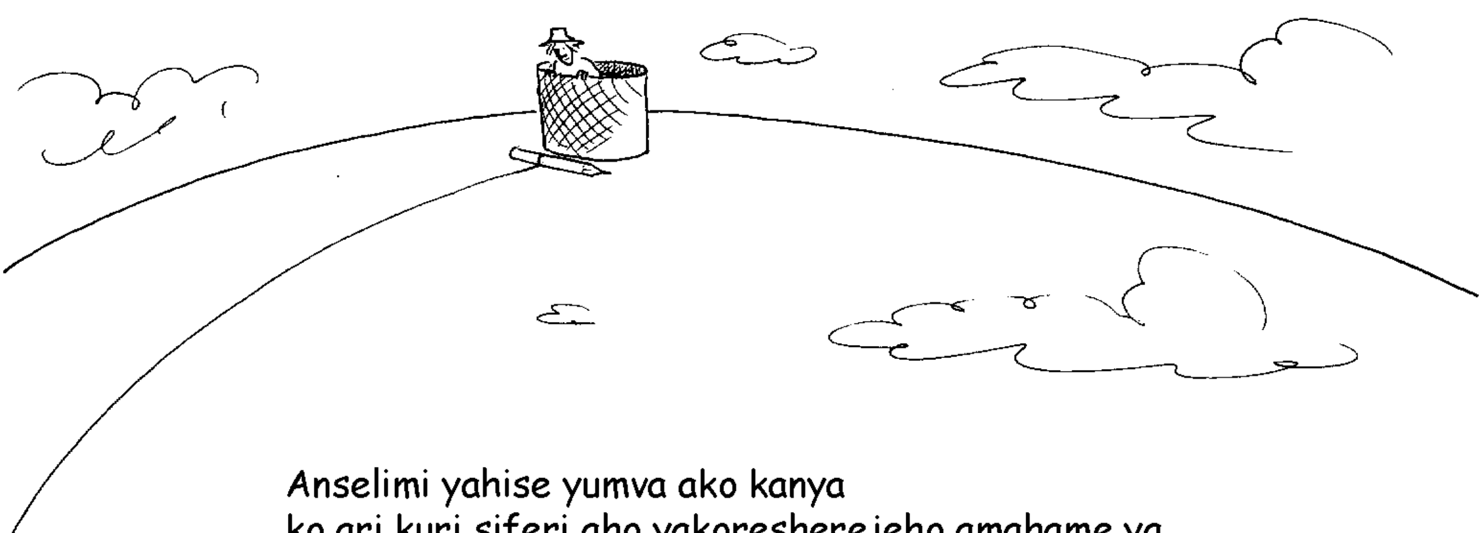
Ibyo na byo, ubu mfite 36 % bya giriyaje y'umurengera ! Noneho kandi hari na 19 % by'amakaro ya sigaye ! Kandi uruziga rwa njye rwahindutse... umurongo UGORORORTSE !
Ndarota cyangwa ?
Mbandoga esipase: Aka gacamurongo karagororotse pe !
EKILIDE
Anselimi yongera kandi reyo ℓ, noneho ubwo....
EKILIDE
Ubuhetame bw'uruziga rwa njye bwagiye ku rundi ruhande
Noneho ubu, iyo NONGEREYE ℓ, umuzenguruko wanjye URAGABANUKA, ni inkuru y'abasazi !

Nyuma y'iyomeka rya nyuma :

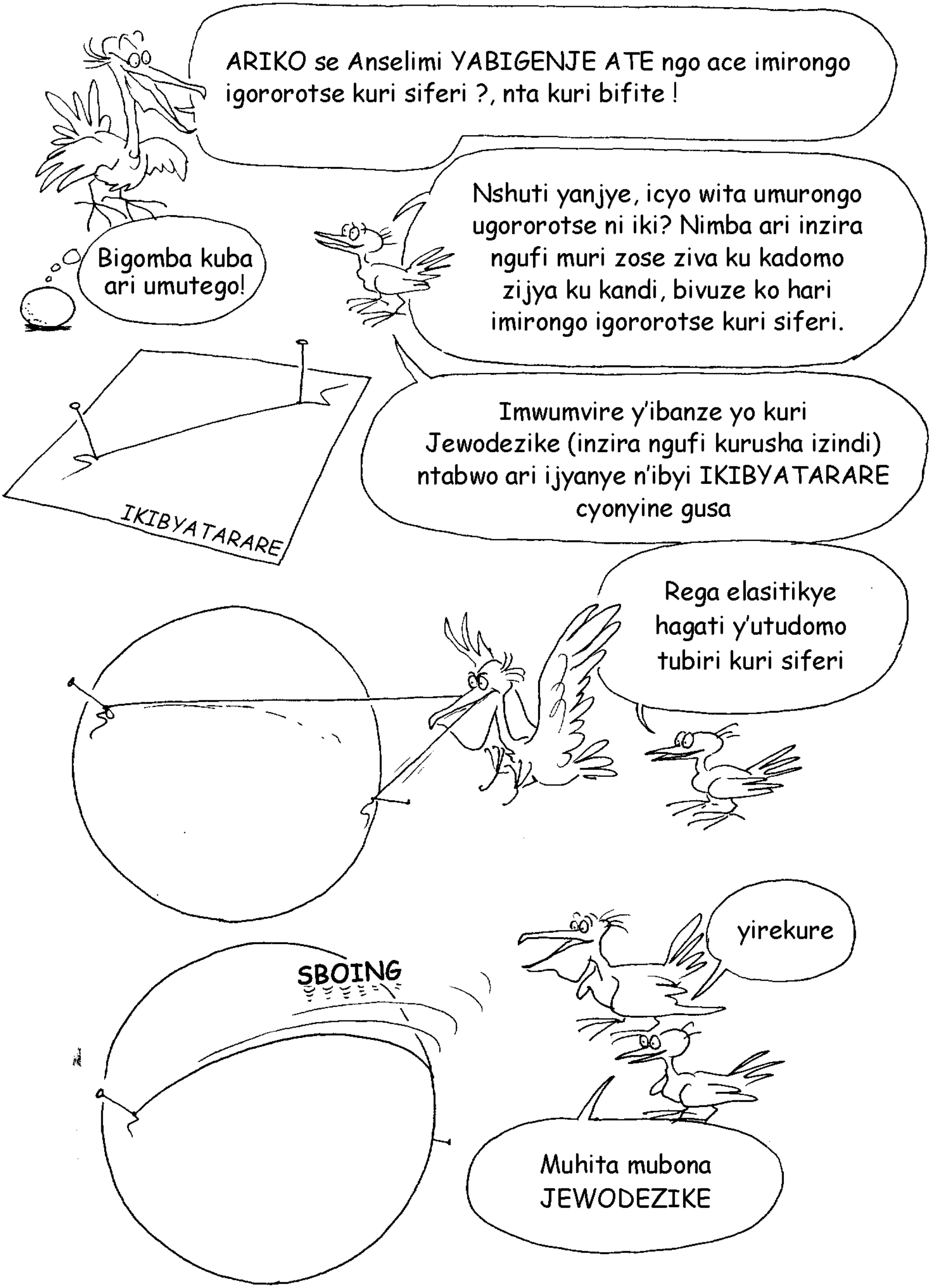


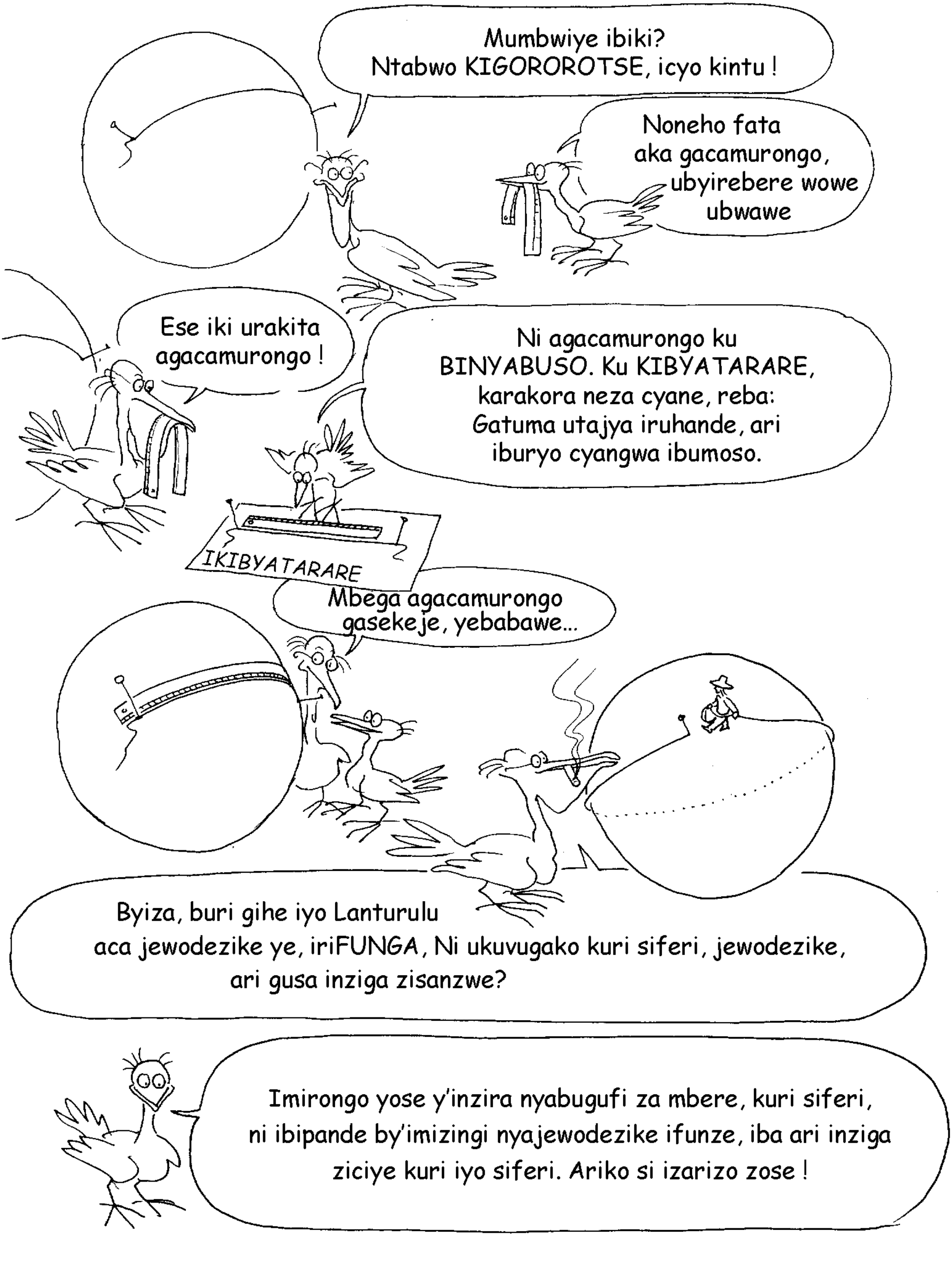
HABAYE IKI ?

Kugirango Tubimenye, twirukane ibicu :

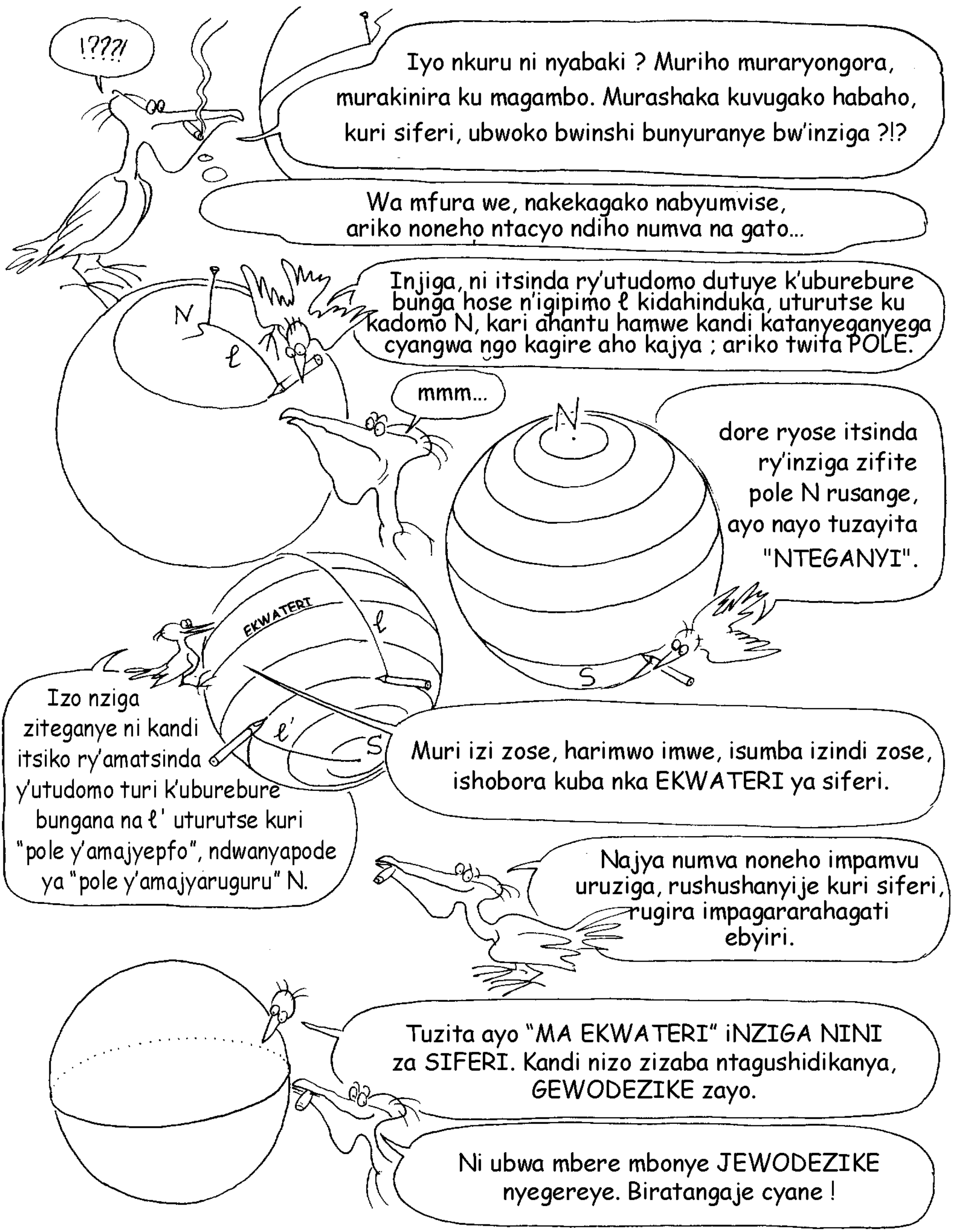


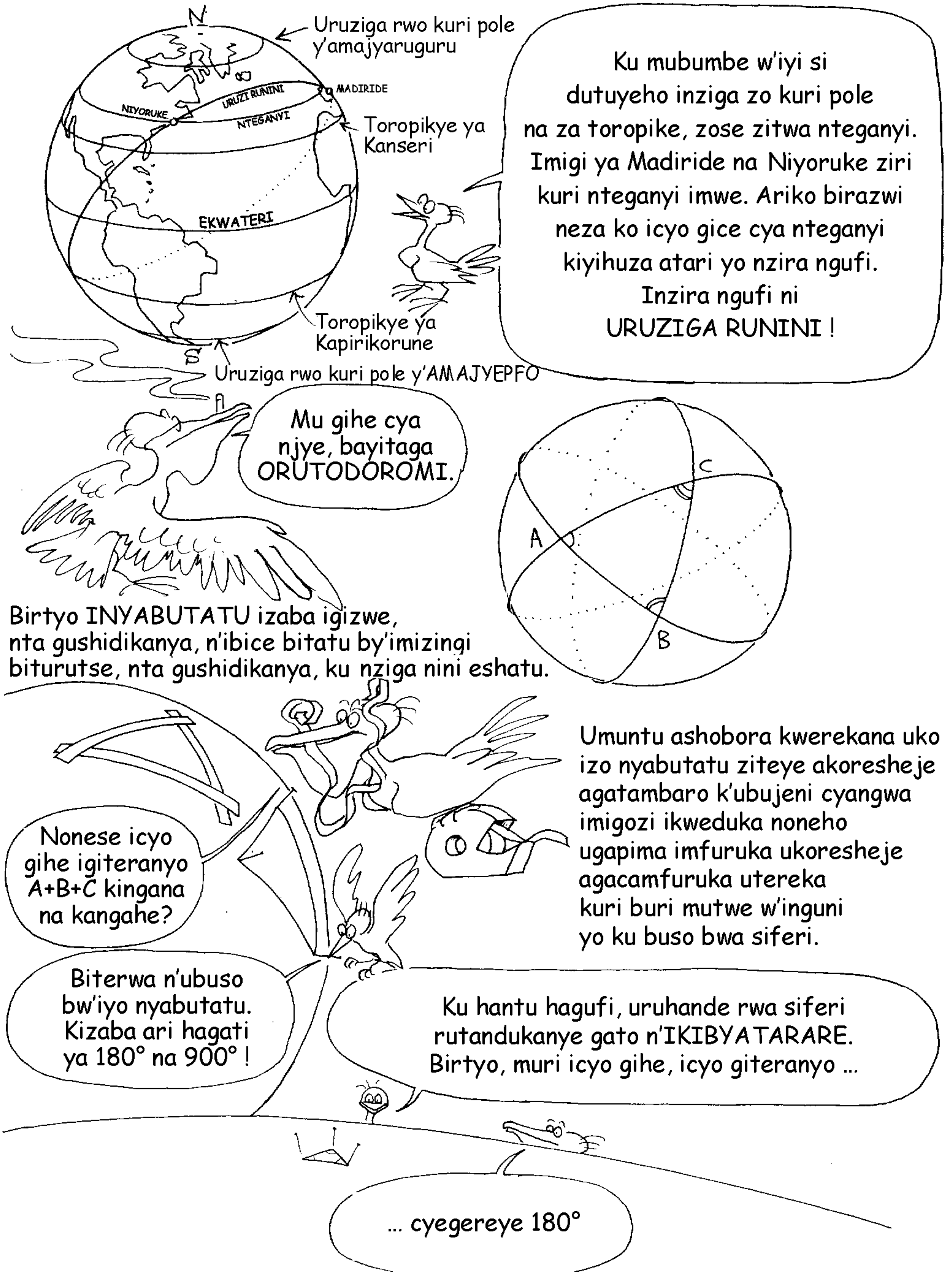
Anselimi yahise yumva ako kanya
ko ari kuri siferi aho yakoresherejeho amahame ya
JEWOMETIRI Y'IKIBYATARARE.

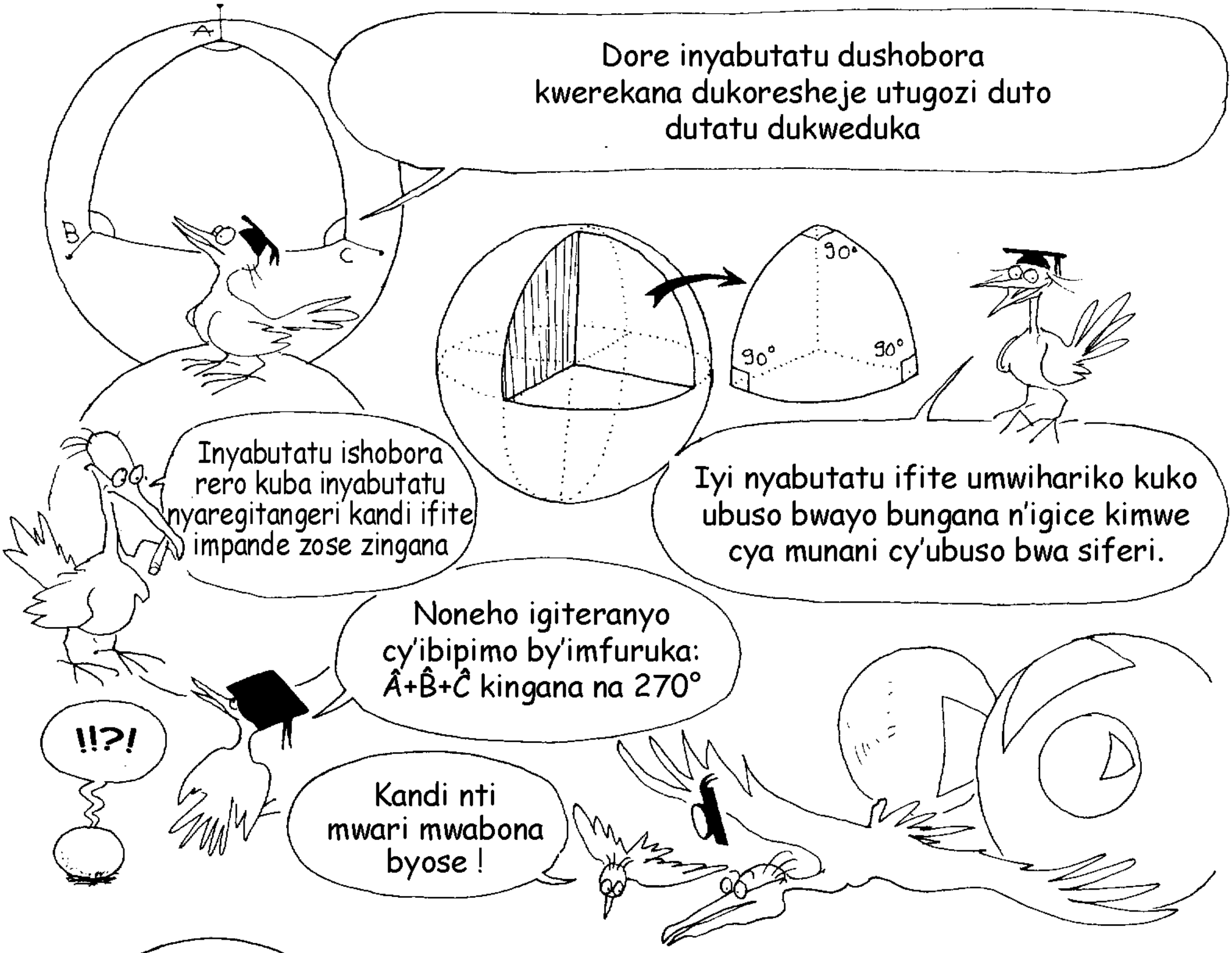

ARIKO se Anselimi YABIGENJE ATE ngo ace imirongo igororotse kuri siferi ?, nta kuri bifite !
Bigomba kuba ari umutego!
Nshuti yanjye, icyo wita umurongo ugororotse ni iki? Nimba ari inzira ngufi muri zose ziva ku kadomo zijya ku kandi, bivuze ko hari imirongo igororotse kuri siferi.
IKIBYATARARE
Imwumvire y'ibanze yo kuri Jewodezike (inzira ngufi kurusha izindi) ntabwo ari ijyanye n'ibyi IKIBYATARARE cyonyine gusa
Rega elasitikye hagati y'utudomo tubiri kuri siferi
SBOING
yirekure
Muhita mubona JEWODEZIKE

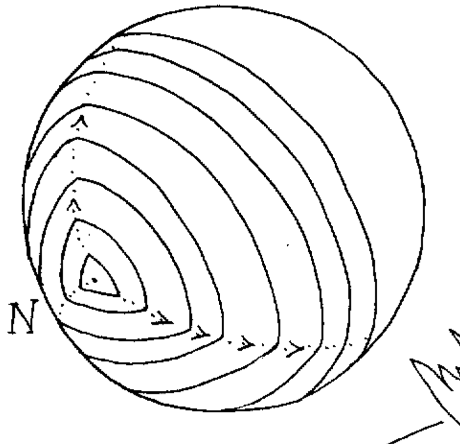


Mumbwiye ibibiki? Ntabwo KIGOROROTSE, icyo kintu !
Noneho fata aka gacamurongo, ubyirebere wowe ubwawe
Ese iki urakita agacamurongo !
Ni agacamurongo ku BINYABUSO. Ku KIBYATARARE, karakora neza cyane, reba: Gatuma utajya iruhande, ari iburyo cyangwa ibumoso.
IKIBYATARARE
Mbega agacamurongo gasekeje, yebabawe...
Byiza, buri gihe iyo Lanturulu aca jewodezike ye, iriFUNGA, Ni ukuvugako kuri siferi, jewodezike, ari gusa inziga zisanzwe?
Imirongo yose y'inzira nyabugufi za mbere, kuri siferi, ni ibipande by'imizingi nyajewodezike ifunze, iba ari inziga ziciye kuri iyo siferi. Ariko si izarizo zose !


!???!
Iyo nkuru ni nyabaki ? Muriho muraryongora, murakinira ku magambo. Murashaka kuvugako habaho, kuri siferi, ubwoko bwinshi bunyuranye bw'inziga ?!?
Wa mfura we, nakekagako nabyumvise, ariko noneho ntacyo ndiho numva na gato...
Injiga, ni itsinda ry'utudomo dutuye k'uburebure bunga hose n'igipimo ℓ kidahinduka, uturutse ku kadomo N, kari ahantu hamwe kandi katanyeganyega cyangwa ngo kagire aho kajya ; ariko twita POLE.
N
ℓ
mmm...
N
dore ryose itsinda ry'inziga zifite pole N rusange, ayo nayo tuzayita "NTEGANYI".
S
EKWATERI
ℓ
ℓ'
S
Izo nziga ziteganye ni kandi itsiko ry'amatsinda y'utudomo turi k'uburebure bungana na ℓ' uturutse kuri "pole y'amajyepfo", ndwanyapode ya "pole y'amajyaruguru" N.
Muri izi zose, harimwo imwe, isumba izindi zose, ishobora kuba nka EKWATERI ya siferi.
Najya numva noneho impamvu uruziga, rushushanyije kuri siferi, rugira impagararahagati ebyiri.
Tuzita ayo "MA EKWATERI" iNZIGA NINI za SIFERI. Kandi nizo zizaba ntagushidikanya, GEWODEZIKE zayo.
Ni ubwa mbere mbonye JEWODEZIKE nyegereye. Biratangaje cyane !


N
Uruziga rwo kuri pole y'amajyaruguru
MADIRIDE
URUZI RUNINI
NIYORUKE
NTEGANYI
Toropikye ya Kanseri
EKWATERI
Toropikye ya Kapirikorune
S
Uruziga rwo kuri pole y'AMAJYEPFO
Ku mubumbe w'iyi si dutuyeho inziga zo kuri pole na za toropike, zose zitwa nteganyi. Imigi ya Madiride na Niyoruke ziri kuri nteganyi imwe. Ariko birazwi neza ko icyo gice cya nteganyi kiyihuza atari yo nzira ngufi. Inzira ngufi ni URUZIGA RUNINI !
Mu gihe cya njye, bayitaga ORUTODOROMI.
C
A
B
Birtyo INYABUTATU izaba igizwe, nta gushidikanya, n'ibice bitatu by'imizingi biturutse, nta gushidikanya, ku nziga nini eshatu.
Umuntu ashobora kwerekana uko izo nyabutatu ziteye akoresheje agatambaro k'ubujeni cyangwa imigozi ikweduka noneho ugapima imfuruka ukoresheje agacamfuruka utereka kuri buri mutwe w'inguni yo ku buso bwa siferi.
Nonese icyo gihe igiteranyo A+B+C kingana na kangahe?
Biterwa n'ubuso bw'iyo nyabutatu. Kizaba ari hagati ya 180° na 900° !
Ku hantu hagufi, uruhande rwa siferi rutandukanye gato n'IKIBYATARARE. Birtyo, muri icyo gihe, icyo giteranyo ...
... cyegereye 180°

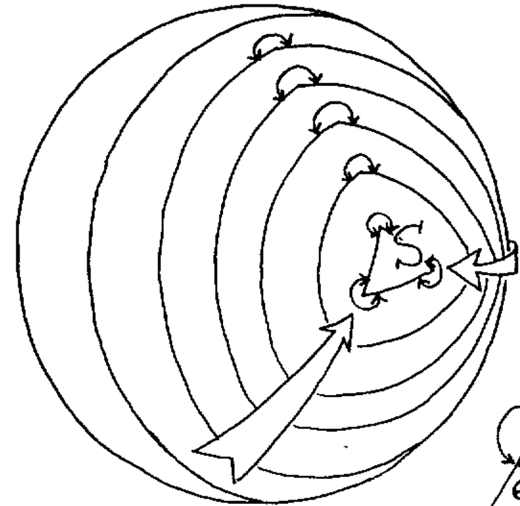




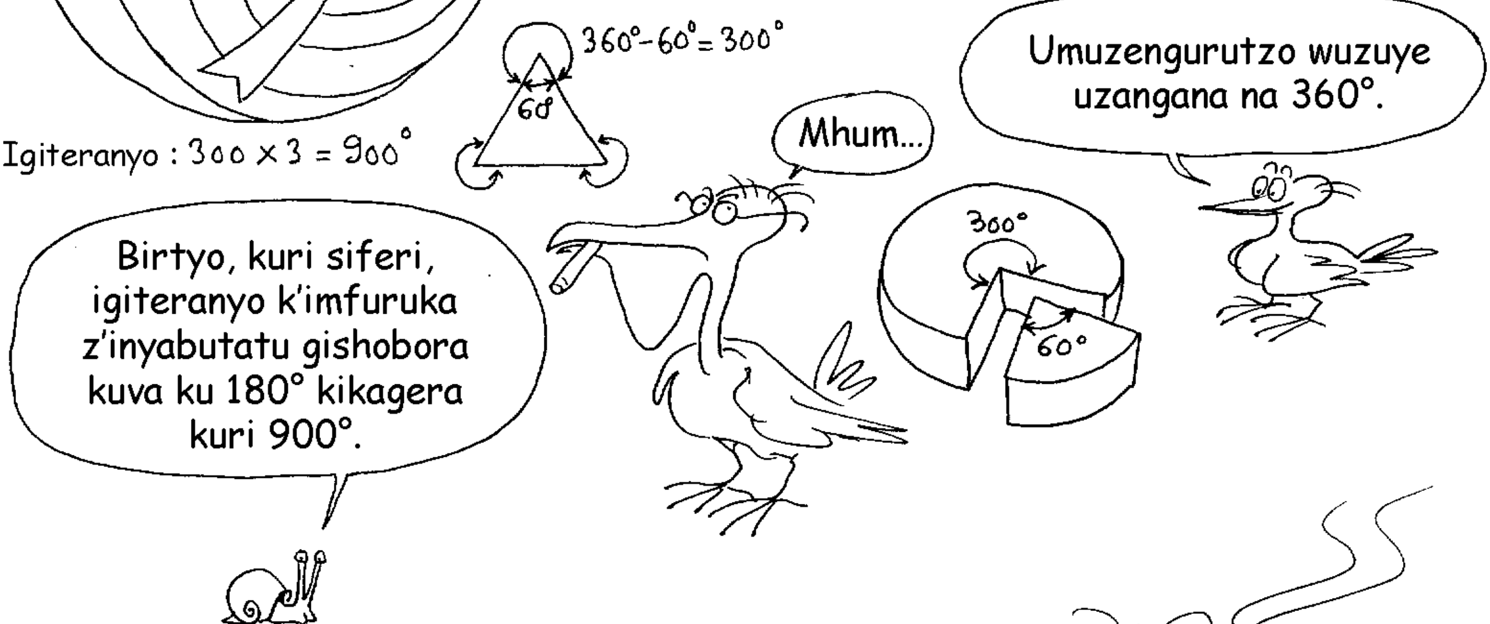
Noneho ubu shyira mu gitekerezo inyabutatu ikomeje igizwe na twa tugozi dukweduka; noneho tugende dutandukanya buhoro buhoro amasonga yatwo. Imfuruka zo kuri ayo masonga zizagenda zikura.

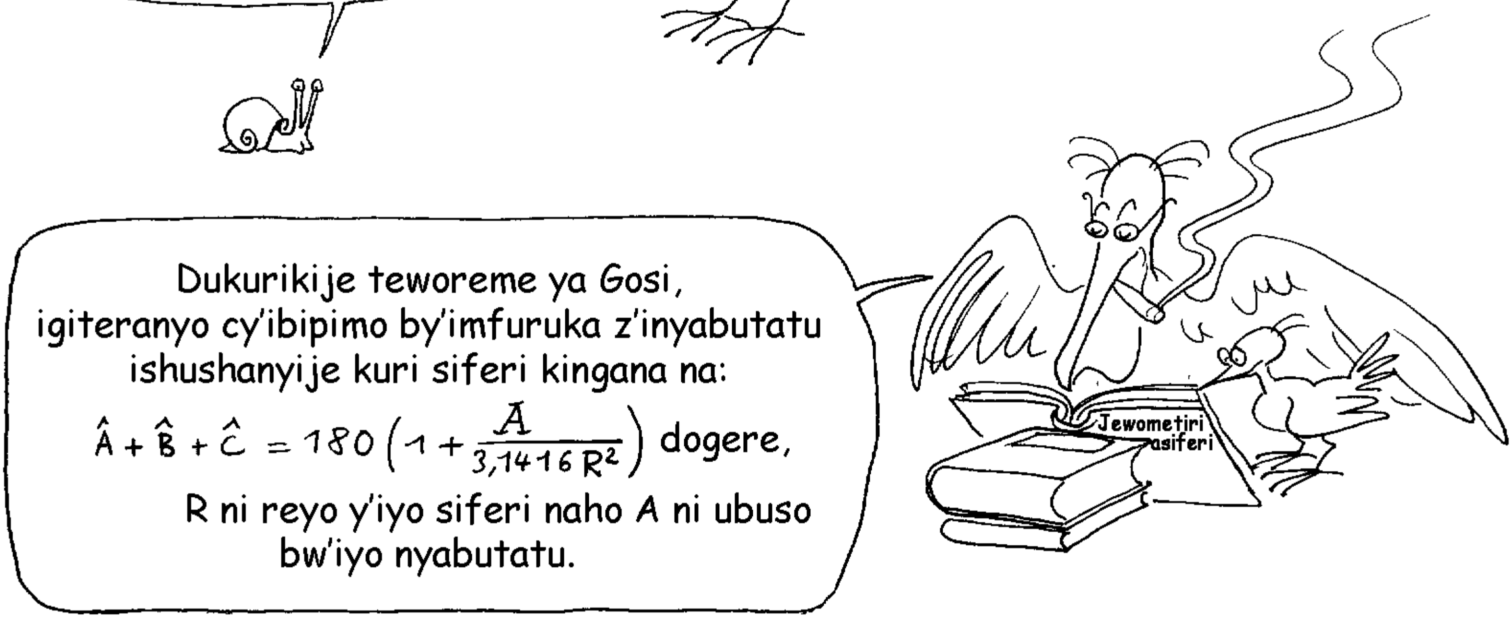
N'igiteranyo k'ibipimo byazo nacyo kiziyongera.

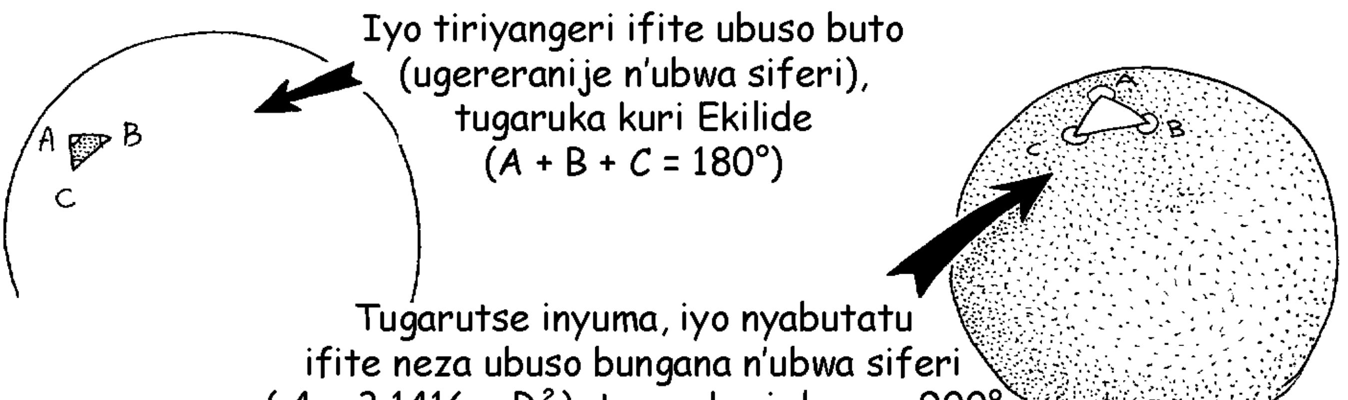
Mu kurangiza, umuntu ashobora gukora k'uburyo ayo masonga atatu aba kuri ekwateri ya siferi. Imfuruka Â, B̂ na Ĉ ziba zishashe rwose kandi zingana na 180°, igiteranyo cyazo na cyo kirazamuka kugera kuri 540° !!...

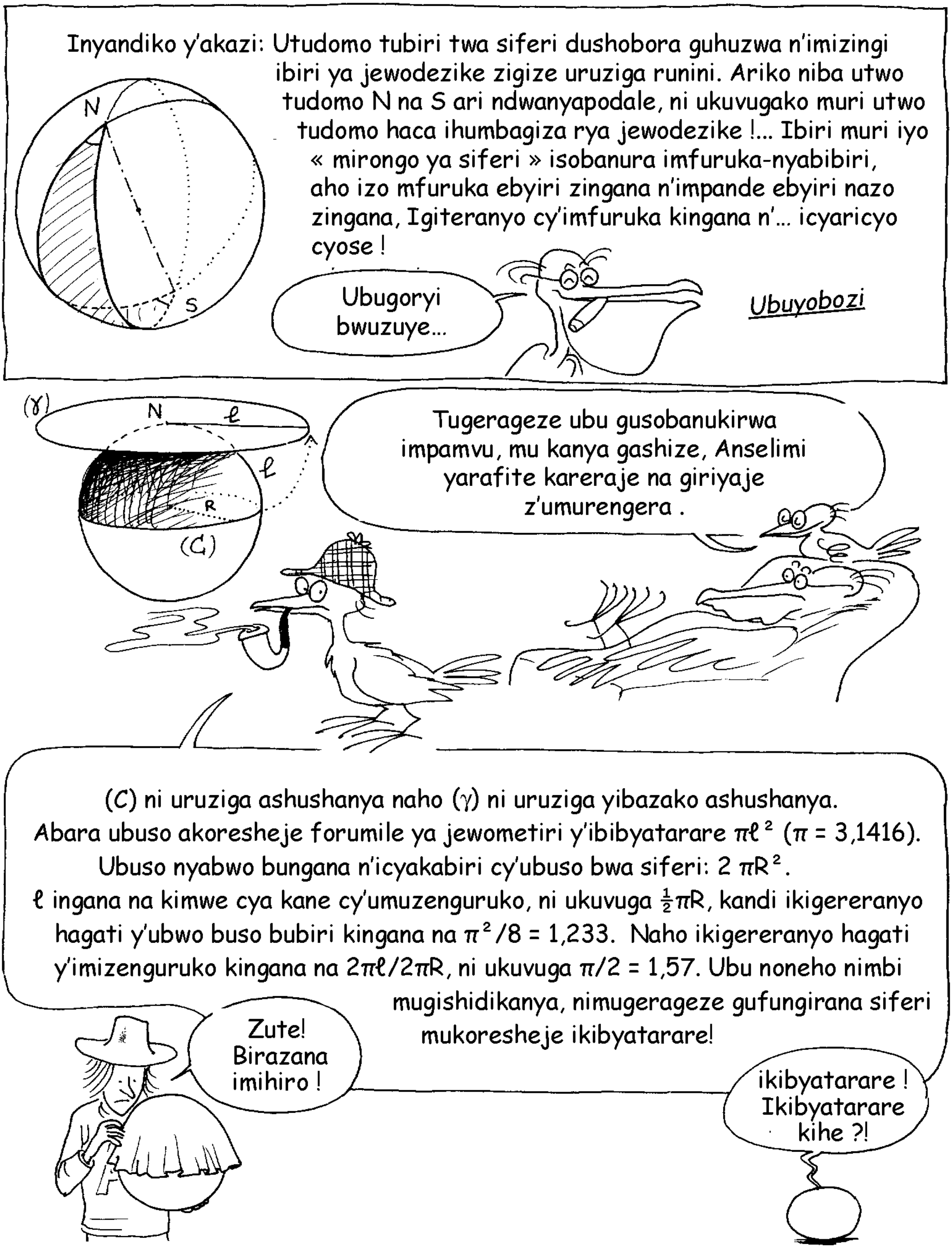


Uwakomeza iryo suhuka ry'amasonga y'inyabutatu arijyana ku iyindi emisiferi, ayo masonga yazaza guhurira mu kadomo ka S, ari na ko ndwanyapodale ya N. Niba tugumanye ubusobanuro bwa mbere duha imfuruka zo mu masonga, imwe yose yo muri izo mfuruka izagira rero igipimo kiruta 180 ° ! Mu buryo busobanutse, imwe yose izangana na 360°-60°=300°

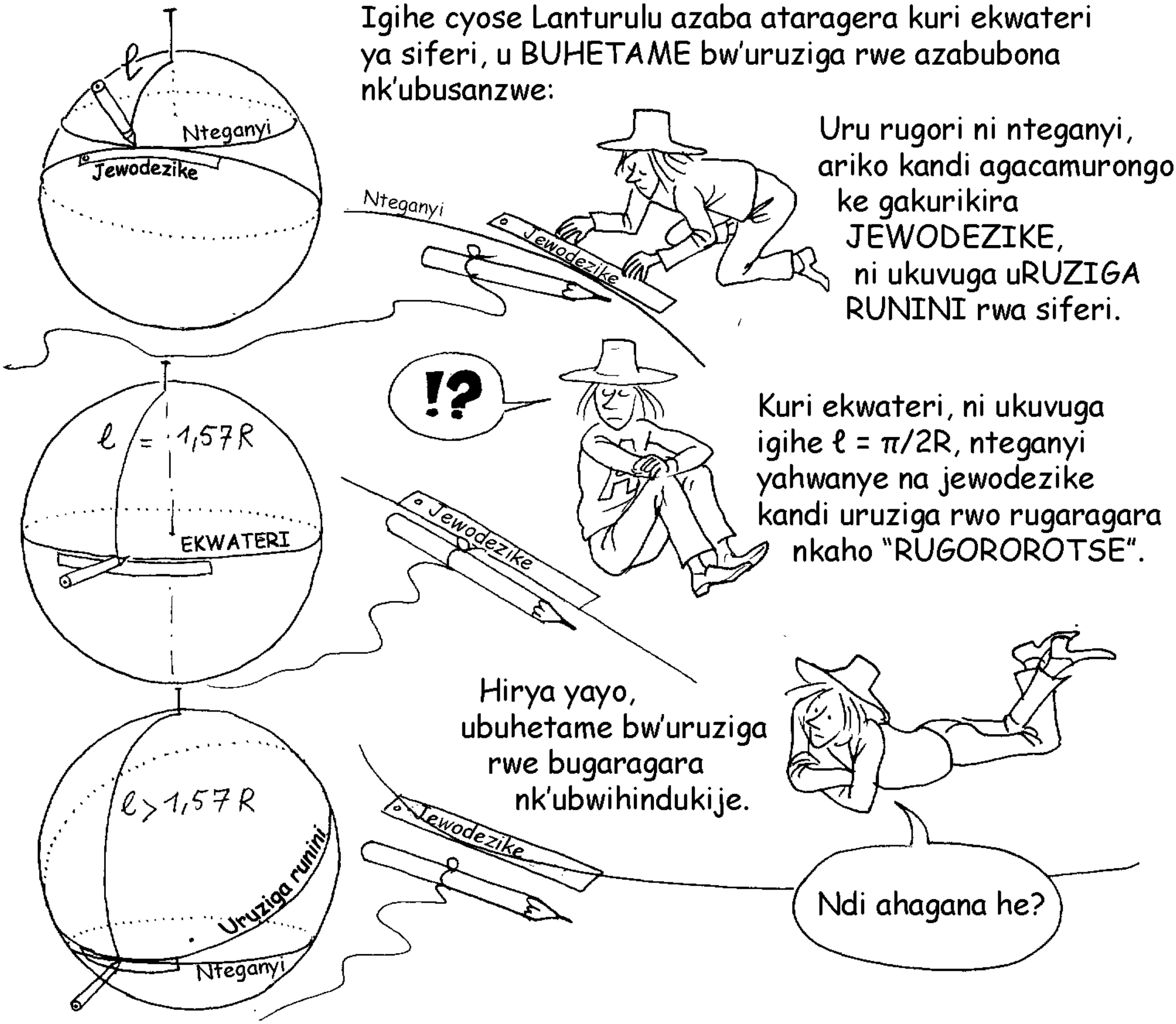




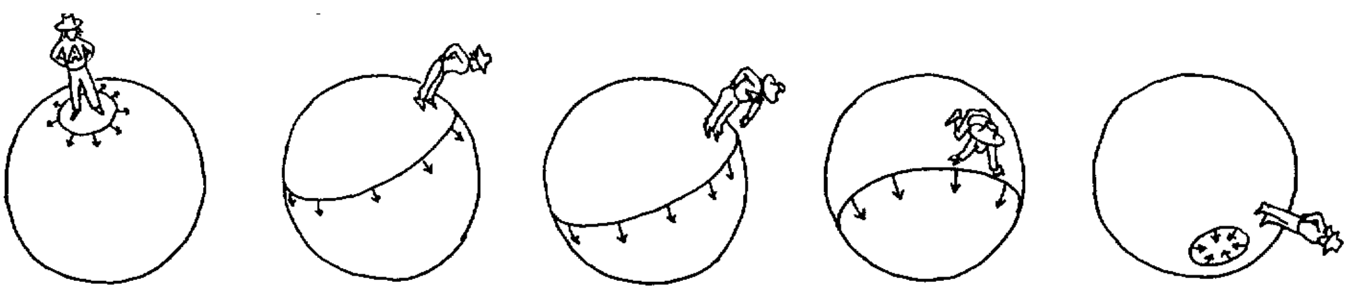




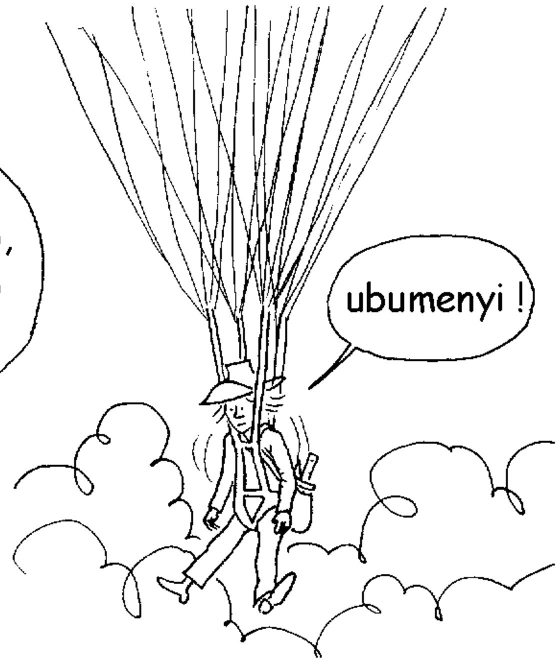
Inyandiko y'akazi: Utudomo tubiri twa siferi dushobora guhuzwa n'imizingi ibiri ya jewodezike zigize uruziga runini. Ariko niba utwo tudomo N na S ari ndwanyapodale, ni ukuvugako muri utwo tudomo haca ihumbagiza rya jewodezike !... Ibiri muri iyo « mirongo ya siferi » isobanura imfuruka-nyabibiri, aho izo mfuruka ebyiri zingana n'impande ebyiri nazo zingana, Igiteranyo cy'imfuruka kingana n'... icyaricyo cyose !
N
S
Ubugoryi bwuzuye...
Ubuyobozi
(γ)
N
ℓ
ℓ
R
(C)
Tugerageze ubu gusobanukirwa impamvu, mu kanya gashize, Anselimi yarafite kareraje na giriyaje z'umurengera .
(C) ni uruziga ashushanya naho (γ) ni uruziga yibazako ashushanya. Abara ubuso akoresheje forumile ya jewometiri y'ibibyatarare $\pi\ell^2$ (π = 3,1416). Ubuso nyabwo bungana n'icyakabiri cy'ubuso bwa siferi: $2\pi R^2$. ℓ ingana na kimwe cya kane cy'umuzenguruko, ni ukuvuga $\frac{1}{2}\pi R$, kandi ikigereranyo hagati y'ubwo buso bubiri kingana na $\pi^2/8$ = 1,233. Naho ikigereranyo hagati y'imizenguruko kingana na $2\pi\ell/2\pi R$, ni ukuvuga $\pi/2$ = 1,57. Ubu noneho nimbi mugishidikanya, nimugerageze gufungirana siferi mukoresheje ikibyatarare!
Zute! Birazana imihiro !
ikibyatarare ! Ikibyatarare kihe ?!



Iryo hame risobanura ukuntu umuntu, abishatse, yakwinjira cyangwa agasohoka mu ruziga, atarurenze, igihe cyose urwo ruziga rushushanyije kuri siferi.
Kugirango ubyumve neza, gereranya urwo ruziga n'impeta ikweduka wajyenda unyereza ku mupira wa siferi.



Anselimi byamufashe igihe kitari gito kugirango asobanukirwe iyo miterere yose yavumbuwe n'inzobere mu mibare Gawusi (1777- 1855). Yafashe icyemezo cyo gukora ubushakashatsi ku mibereho y'i BINYABUSO:

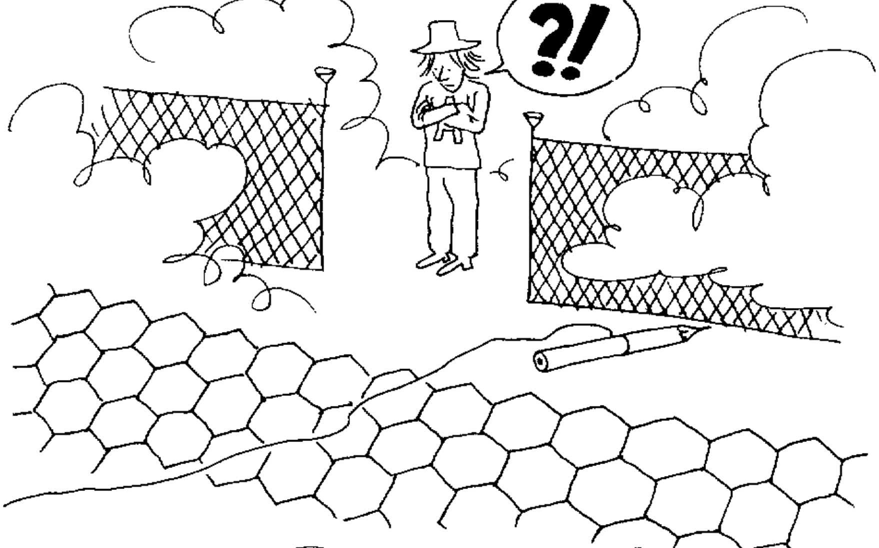


Rimwe na rimwe siyanse ituma ufata ibyemezo bituma wigerezaho.

Ko yaramaze kwinjira mu si nshya, Anselimi yarambuye ku nshuro nshya Ijewodezike, ariko, ubu ho:

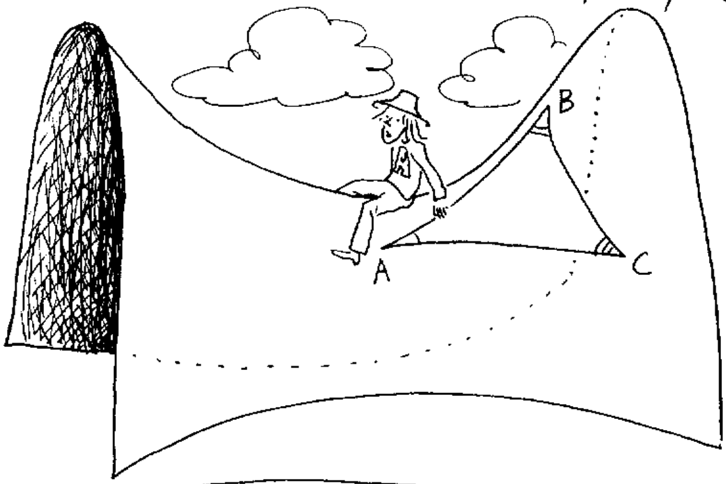
Jewodezike ntiyifunga.

Akoresheje imigozi itatu ireze neza, Anselimi yubatse inyabutatu, ariko igiteranyo cy'ibipimo by'imfuruka zo mu nguni byagaragayeko, ubu ho, ari gito kuri (degere) 180°

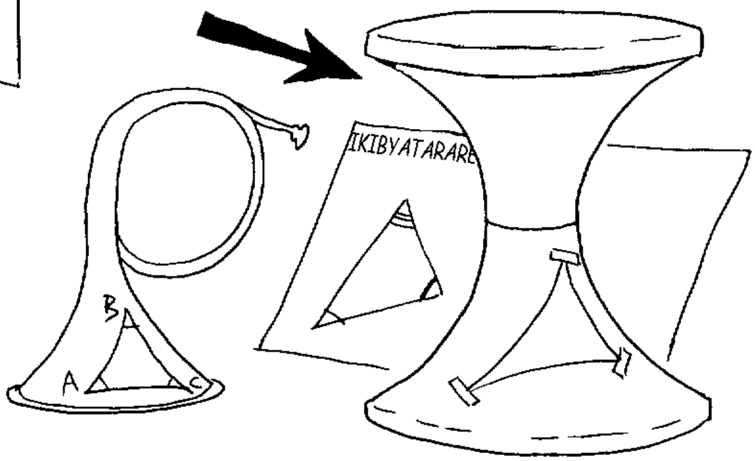


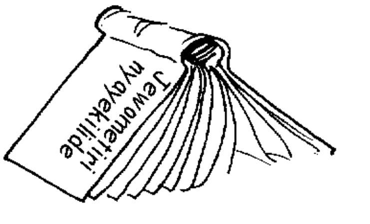
Uruziga ni, buri gihe, ihuriro ry'utudomo dutuye k'uburebure bumwe bungana na ℓ uturutse ku kadomo kamwe kagumahamwe, Lanturulu yabonyeko urwo ruziga, rushushanyije kuri iriya nyabuso nshya, rufite umuzenguruko URUTA $2\pi\ell$, naho ubuso bwayo buruta $\pi\ell^2$.

Dukureho urujijo :



Ubuso, ubu ho, bugaragaza iforoma y'ijosi ry'umusozi cyangwa ubwicaro bwo kw'ifarashi. Ibintu bimwe byo mu buzima bwanyu bwa buri munsi nabyo bishobora gusa na cyo: ikoro y'umuhigo cyangwa ubwoko bw'aka gatebe.





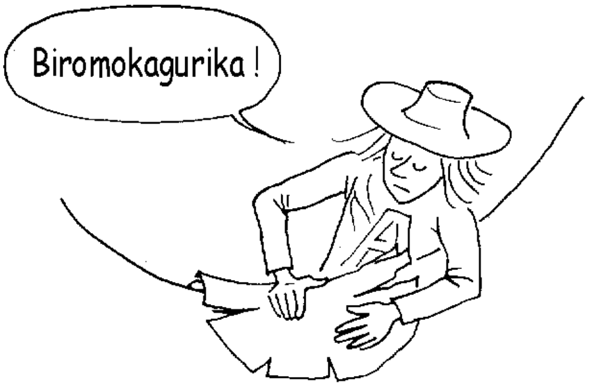
UBUHETAME :

Inyabuso ihetamye ni inyabuso iteye ku buryo teworeme za Ekilide zitahakorera. Ubuhetame bushobora kuba ari pozitifu cyangwa negatifu.

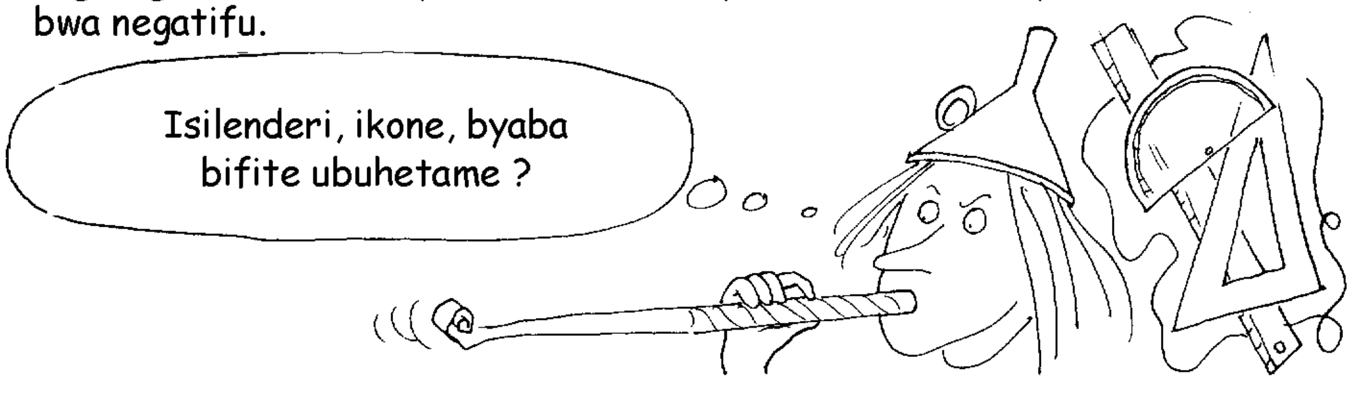
Ku inyabuso Y'UBUHETAME BWA POZITIFU, igiteranyo cy'ibipimo by'imfuruka z'inyabutatu kiruta (dogere) 180°. Iyo ushushanyije uruziga rwa reyo ℓ, ubuso bwayo buba ari buto kuri $\pi\ell^2$ kandi umuzenguruko wa yo uba nawo uri muto kuri $2\pi\ell$.

Ku inyabuso y'UBUHETAME BWA NEGATIFU, igiteranyo cy'ibipimo by'imfuruka z'inyabutatu kiba ari gito kuri dogere 180. Iyo ushushanyije uruziga rwa reyo ℓ, ubuso bwa rwo buba buruta $\pi\ell^2$ kandi umuzenguruko warwo uba uruta $2\pi\ell$.

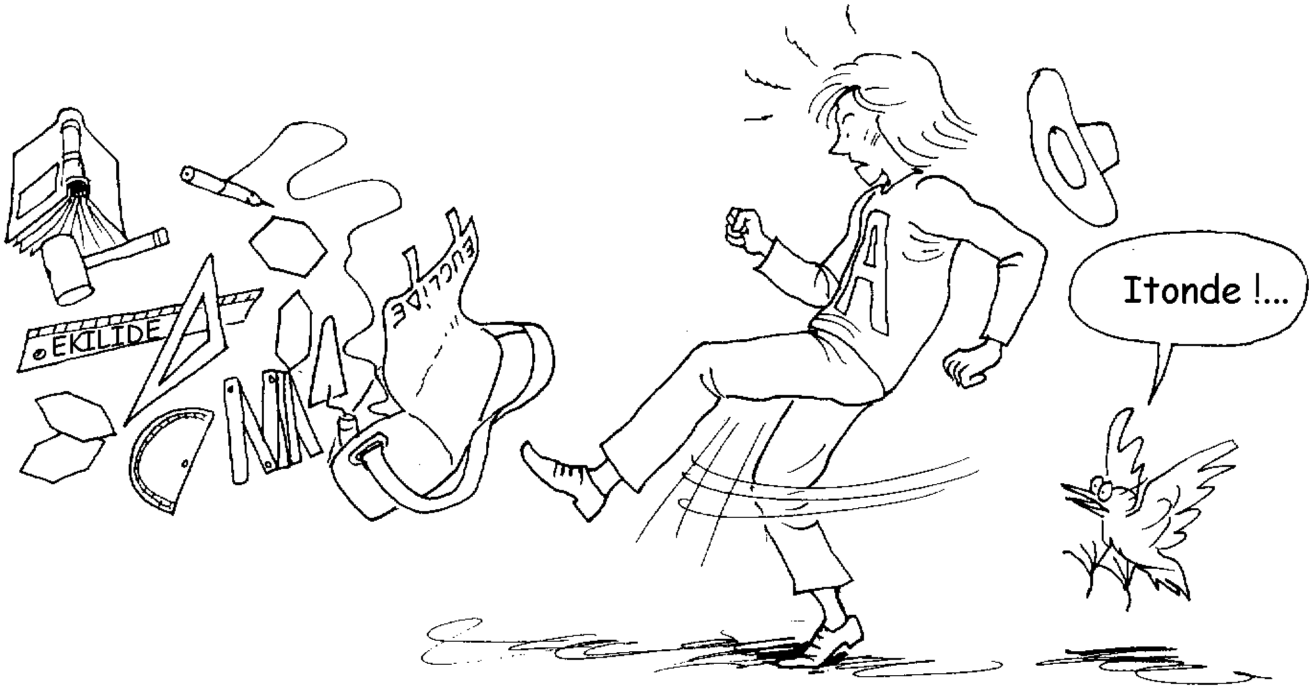
Mu kanya gashize, Aselimi yari yiboneye ko iyo ugerageje gupfuka siferi, inyabuso y'ubuhetame pozitifu, ukoresheje ikintu kibyataraye, kiripfunyapfunya. Nanone gupfuka womekeranije inyabuso y'ubuhetame bwa negatifu ntibishoboka : igipfuko gitangira komokagurika. Icyo gipimo cyo gupfuka ni cyo cyoroshye mu bindi byose kugirango ushobore kumenya nimba ubuhetame ari pozitifu cyangwa negatifu.



Nkuko umuntu ashobora kubibona kuri paje ihise, inyabuso zishobora kugaragaza ibihimba by'ubuhetame bwa pozitifu, n'ibindi by'ubuhetame bwa negatifu.



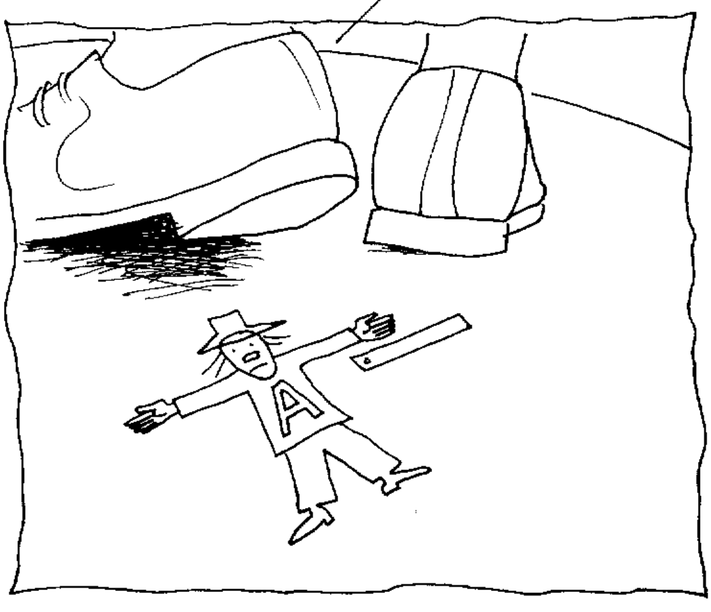
Igipimo cyo gupfuka
Isilenderi, umutemeri, bipfukwa neza n'ikibyatarare !
Ntabwoba. Ndomeka imigozi ikweduka itatu, ni ukuvuga jewodezike eshatu, kuri silenderi yanjye nkoresheje agatambaro kariho ubujeni...
B
A
C
Ubu ndashushanya jewodezike zanjye KU nyabuso...
Ndarambika neza silenderi yanjye HASI
!...
B
A
C
Ukurikije ubusobanuro bwacu, za silenderi n'imitemeri, zubahiriza jewometiri YA EKILIDE, ni INYABUSO ZIBWATARAYE !!!



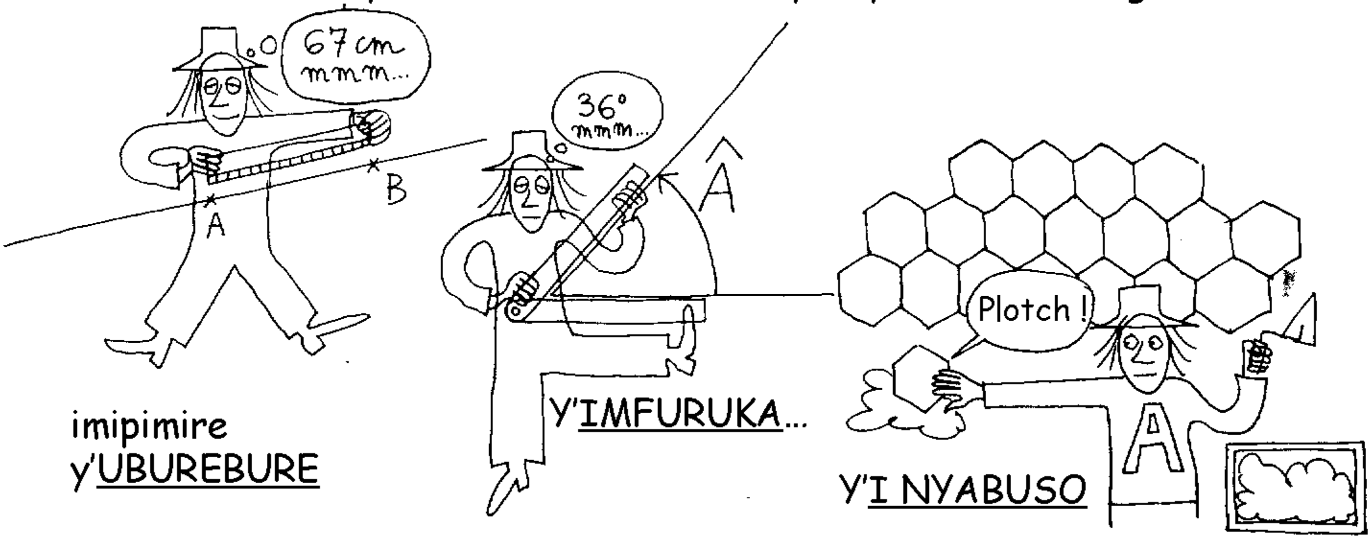
UBUMENYI KURI ESIPASE :

Mu mwanya ushize, ibicu byabujije Anselimi kubona kure y'umutwe w'izuru rye... cyangwa hafi ya ryo. Iyo bitaba ibyo yari kuba yabonye UBUHETAME bwa ESIPASE NYA SIFERI ye.

Hariho ubundi buryo bwo kubuza Lanturulu kubona ubwo buhetame: ni ubwo kumutuza muri iyo nyabuso, gukora ku buryo aba uwayo.



Ni ukumenyako ubwo buturire bushyashya butabuza nagato



Naho rwose yafungiwe MU nyabuso, Anselimi yashoboraga neza kwibonera ubwo buhetame kandi agasobanura ikimenyetso cyabwo (pozitifu cyangwa negatifu), kandi akanabupima ; ibyo ntibivuze ko yari kuba yashobora KUBUBONA.

Niba igiteranyo cy'ibipimo by'imfuruka z'inyabutatu kingana na dogere 180°, ubuhetame ni pozitifu kandi Anselimi ashobora gushaka reyo y'ubuhetame bwaho ari akoresheje iyi forumire :

$A + B + C = 180\,(1 + A/3{,}14R^2)$

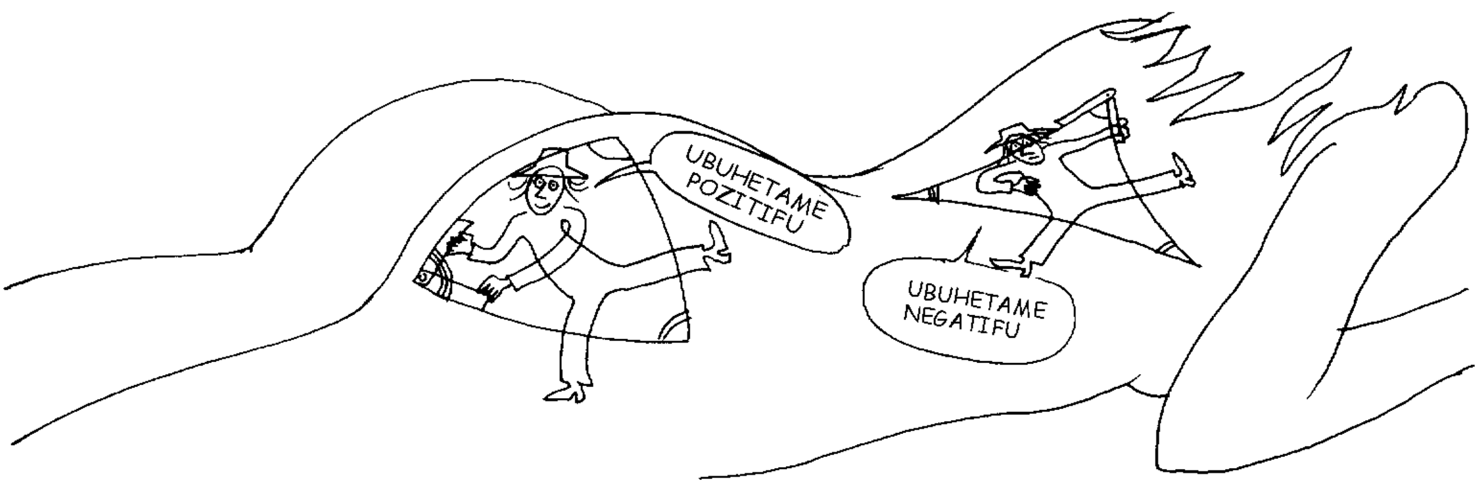
iza iri muri dogere kandi aho A ni ubuso bw'inyabutatu.

Niba icyo giteranyo ari gito kuri dogere 180°, umuntu ashobora gusobanura reyo y'ubuhetame R bwatanzwe akoresheje iyi forumire :

$A + B + C = 180\,(1 - A/3{,}14R^2)$ ariko ntifite ubusobanuro bugaragara busanzwe.

Uzamenye ko IKIBYATARARE gishobora kugereranywa n'inyabuso ifite reyo y'ubuhetame R bwinshi bw'agahumbagiza.

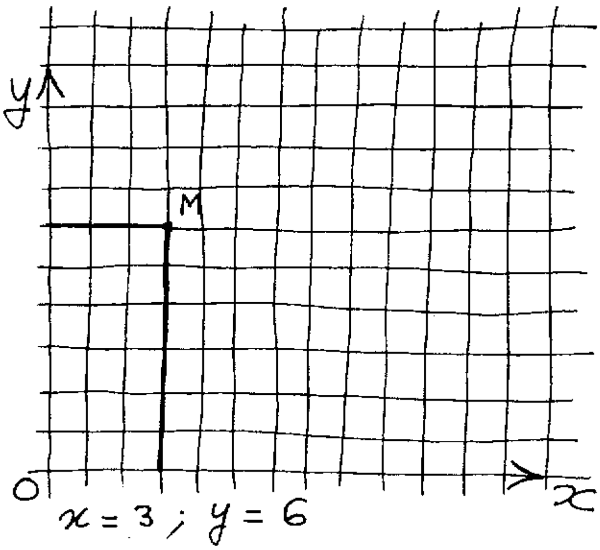
Duhita tubona kandi teworeme zose za Ekilide.

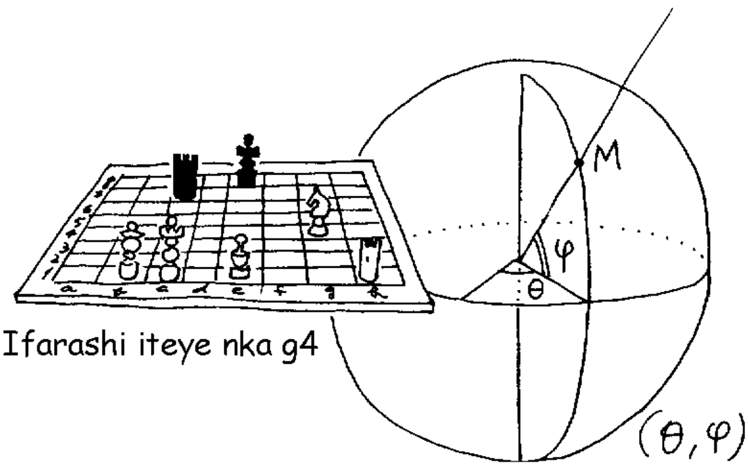


IGITEKEREZO CYA DIMANSIYO

Umubare wa dimansiyo ungana n'umubare w'ibintu, wa korudone, umuntu agomba kwiha, muri esipase iyariyo yose, kugirango ayisobanuremwo Akadomo.

I NYBUSO ni ibyerekeranyamwo bya esipase za dimansiyo ebyiri.
Ibintu bibarwa byifashishwa mu kugaragaza imiturire, bishobora kuba imirongo, imibare, imfuruka....

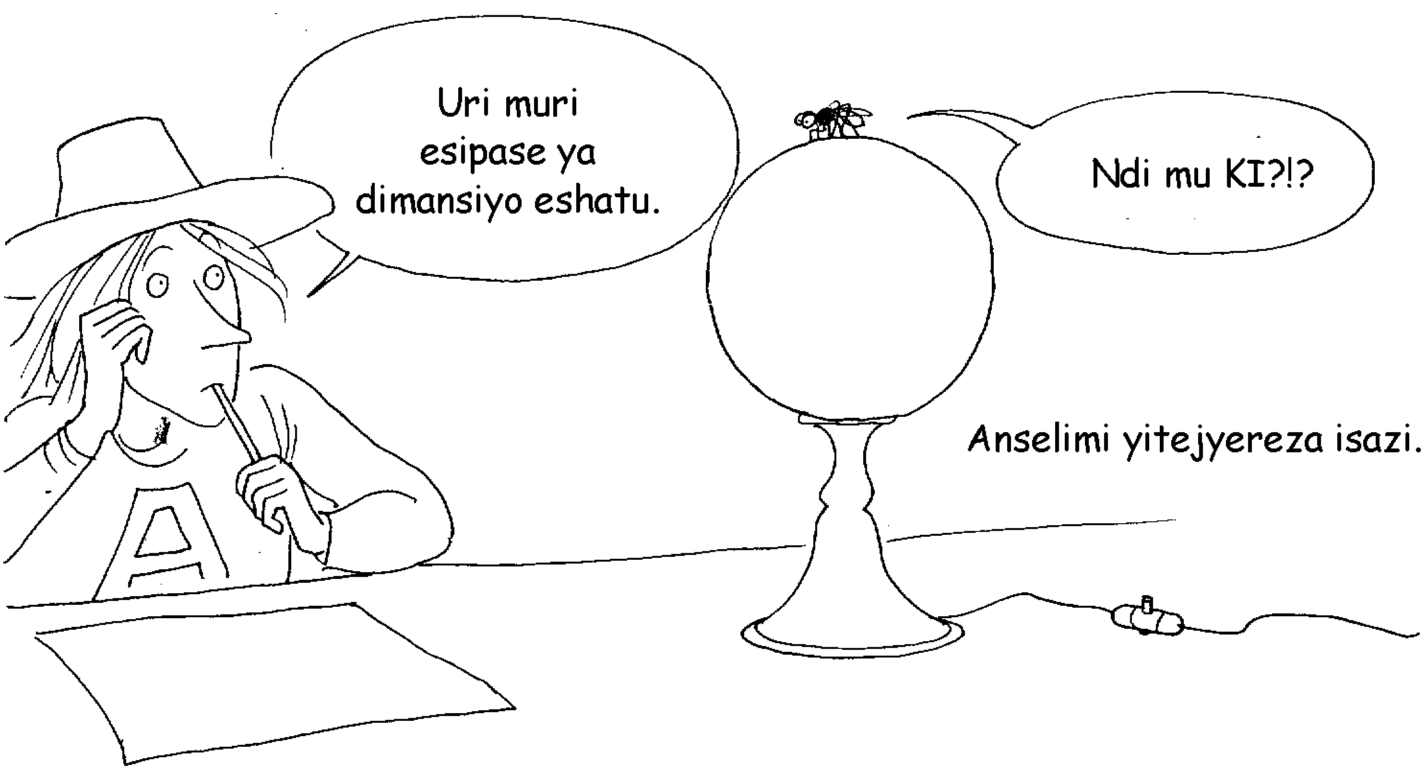


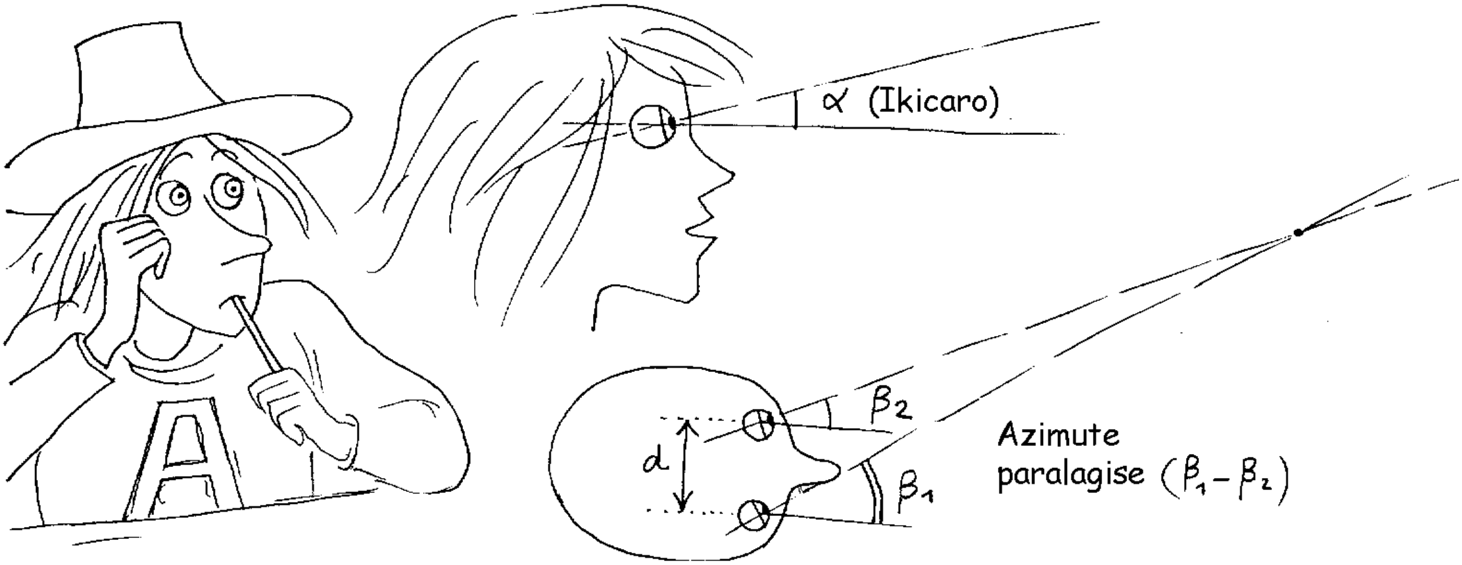


Ifarashi iteye nka g4

Lonjitide, latitude

Dufite akamenyero ko kufunga ko esipase yacu, ukuyemwo igihe, ifite dimansiyo eshatu.



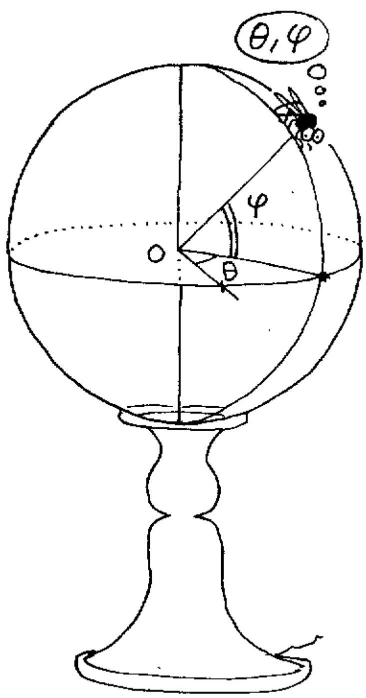


Anselimi apima ikicaro k'ibintu agereranije n'umubyimba we, n'umutwe we. Ikicaro cy'ikintu gifatika kimenyekana wifashishe IMFURUKA eshatu: intumbero n'ubwigireyo buhagaze bw'amaso ye abiri: β1 na β2.

Ubutandukanya bw'imfuruka β1 - β2 bwitwa paralagise.

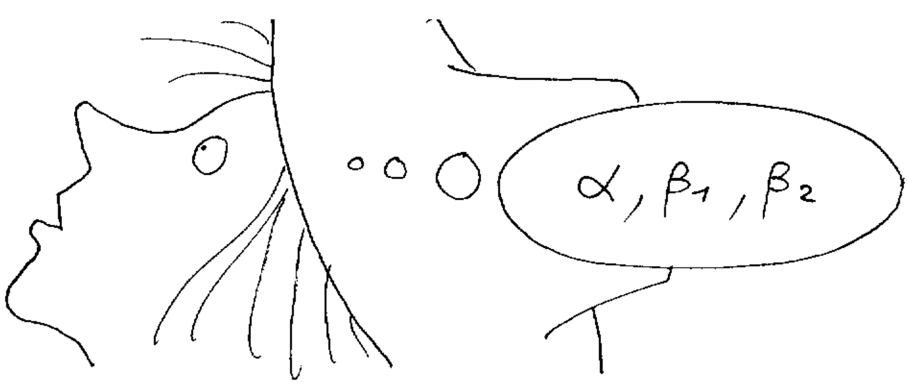
Mu bwonko bwa Anselimi, habera ihishuka rihindura iyo paralagise m'uburebure.

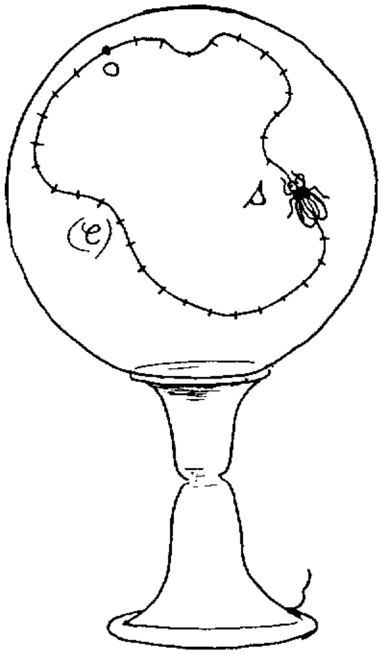
UBWINIKE :



Ariko isazi yo irazamuka no ku mubumbe nyasiferi w'itara aho ikicaro cyayo, muri iyo esipase nyadimansiyo-ebyiri, gishobora kugaragazwa ukoresheje imfuruka ebyiri θ na φ (ubutambikye n'ubuhagarikye).

Tuzavuga ko esipase yacu ya dimansiyo ebyiri YINITSE muri esipase ya dimansiyo eshatu.



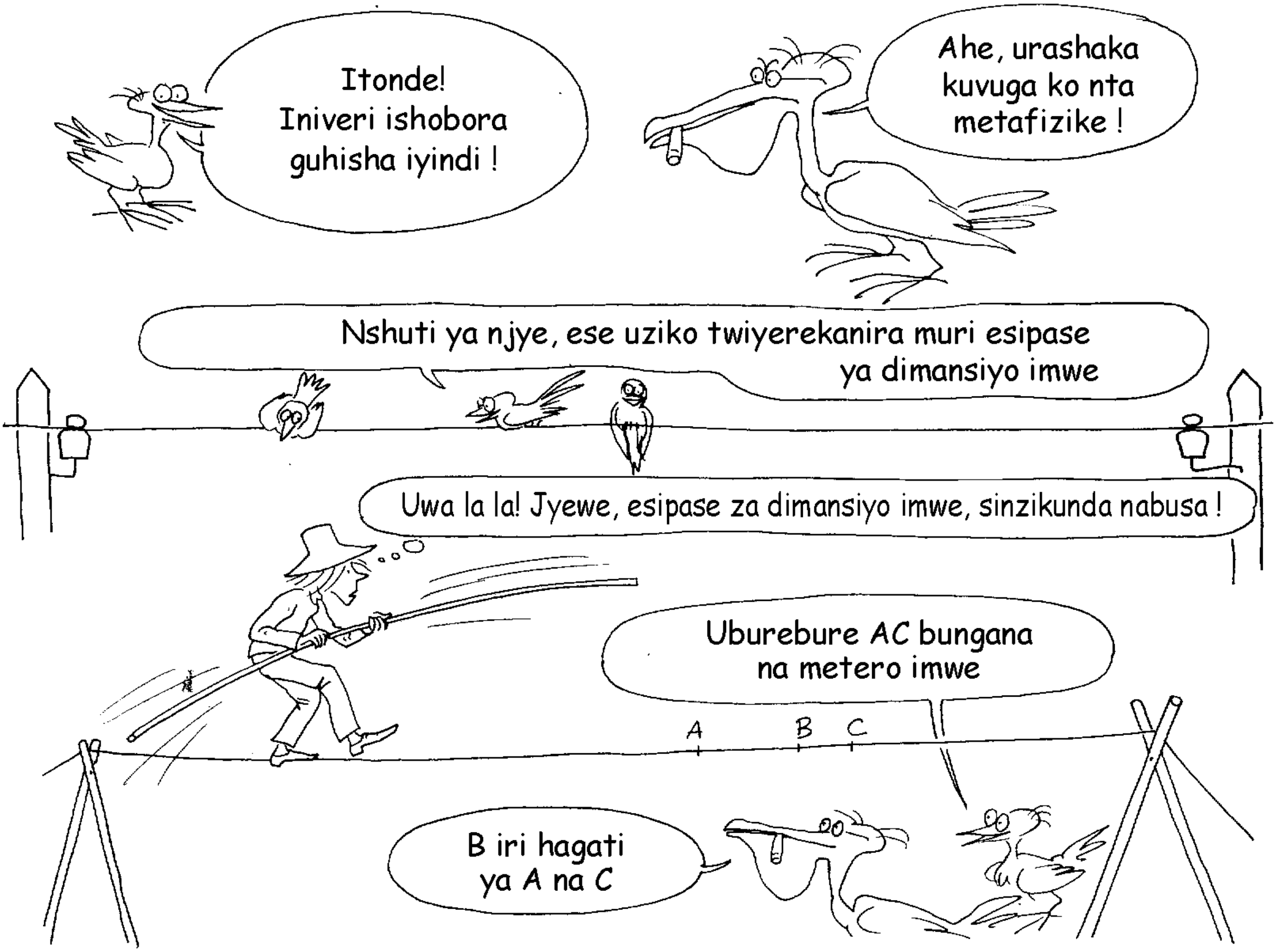


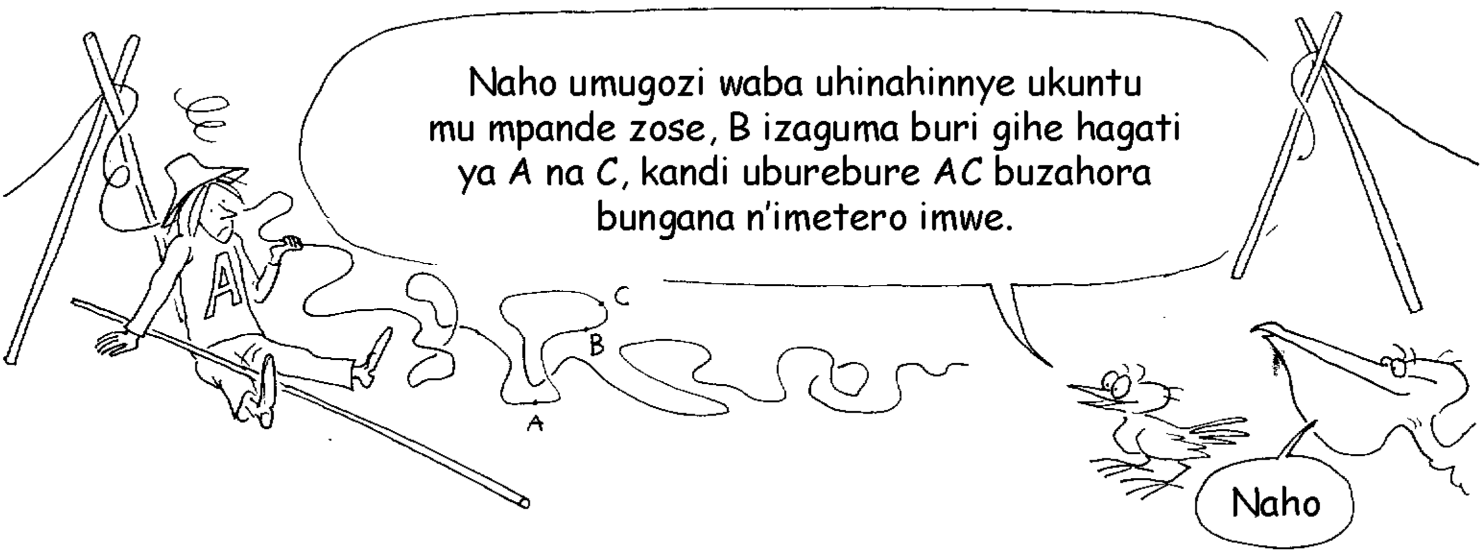
Reka twemereko isazi igendera ku muzingi (φ) ushushanyije kuri siferi. Abantu bazashobora kandi kwerekana ikicaro cya yo bifashishije korudone imwe gusa (urugendo s, rupimye mu buryo bwa aligebure, uhereye ku kadomo ntangiriro ukagera ku kicaro k'iyo sazi.)

Umuzingi ni ishusho ya esipase ya dimansiyo IMWE.

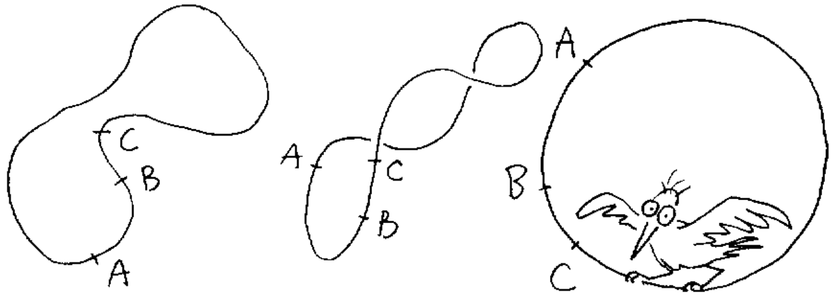
Iyi esipase nyadimansiyo-imwe yinitse muri esipase nyadimansiyo-ebyiri (siferi), nayo ubwayo YINITSE muri esipase nyadimansiyo-eshatu.

Birtyo esipase tubamwo ishobora kwinikwa muri esipase ya dimansiyo nini kuburyo kandi twebwe tutabimenya.





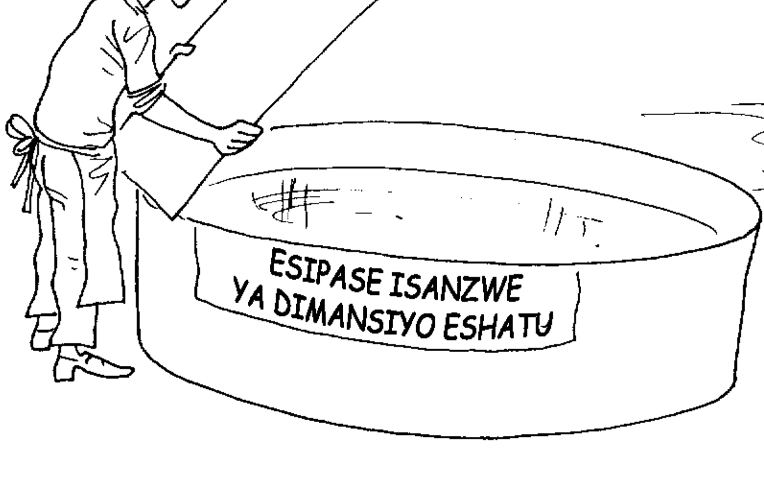
Ibi bidutera gutekereza ko uburanga bumwe na bumwe bushobora kuba ntaho buhuriye n'uburyo iri yinikwa rikorwa.

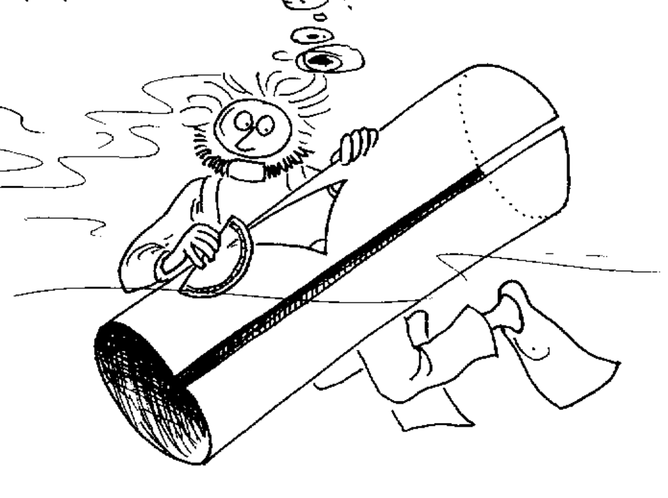


Dore uburyo butandukanye bwo KWINIKA u MUZINGI UFUNZE muri esipase isanzwe.
Ubu BUFUNJYE ni uburanga butagira aho buhuriye n'iyinika.

Ariko pe twirinze gukwedura cyangwa guhinahina umugozi, kugirango ntiduhindure UBUREBURE hagati y'utudomo dukurikiranye. Noneho tugiye KWINIKA iNYABUSO muri esipase isanzwe ya dimansiyo eshatu.

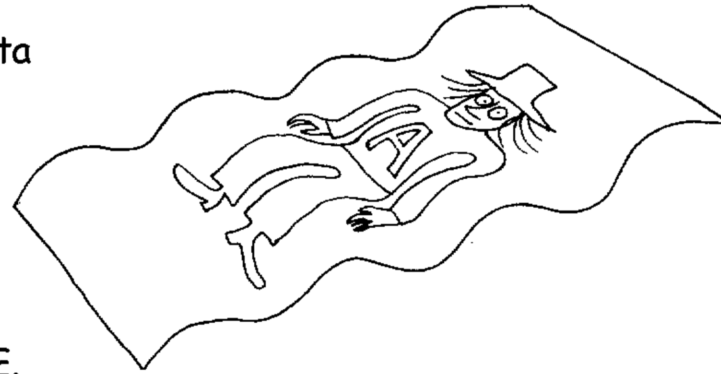
Iyo TWINITSE ikibyatarare muri esipase isanzwe ya dimansiyo eshatu, dushobora kuyisunika, kuyizengurukisha, tutarinze guhindura JEWOMETIRI yayo.



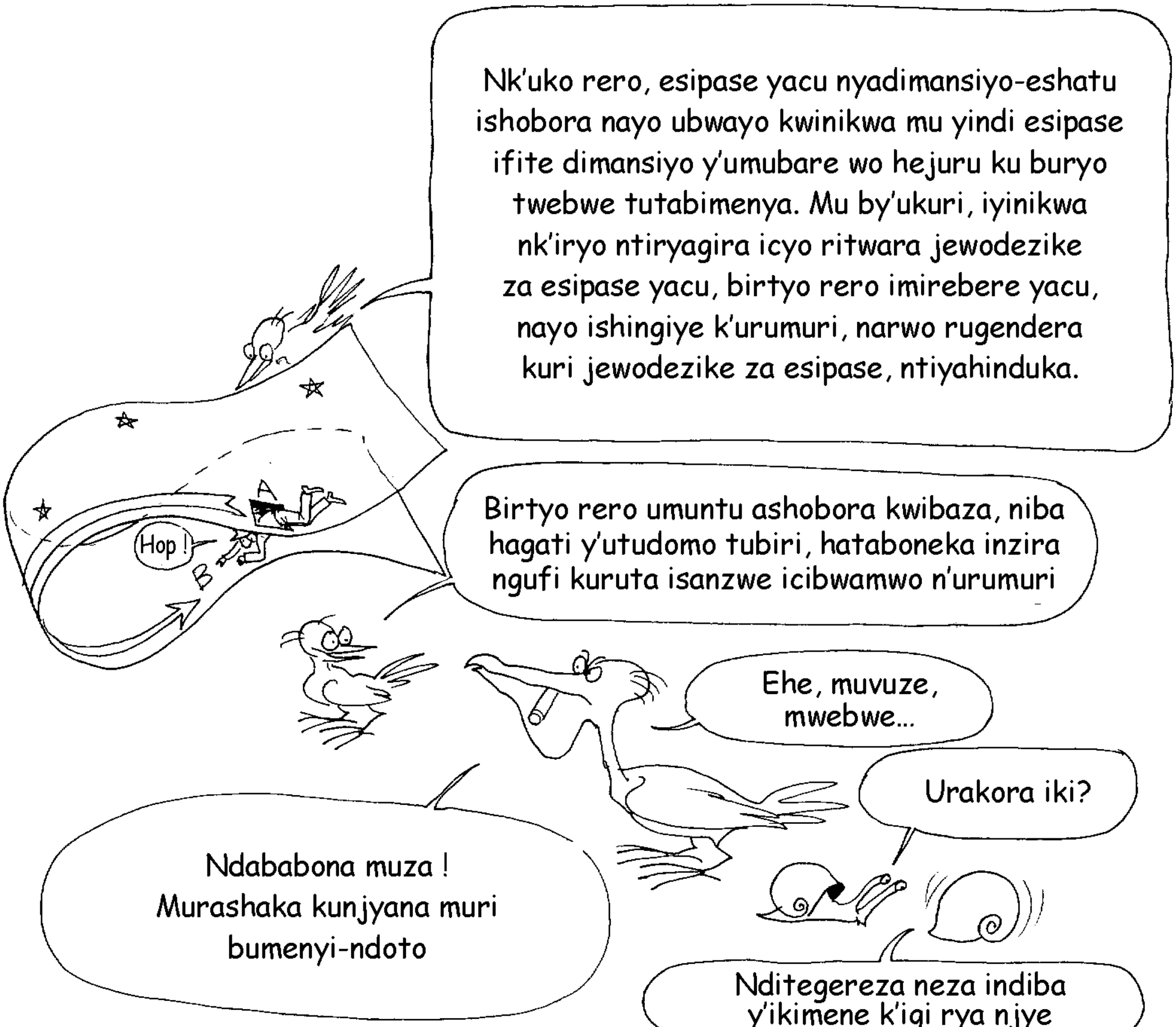


Twabonye ko igikorwa cyo guheta ikibyatarare ukurikije umutemeri bidahindura jewodezike cyangwa imfuruka.

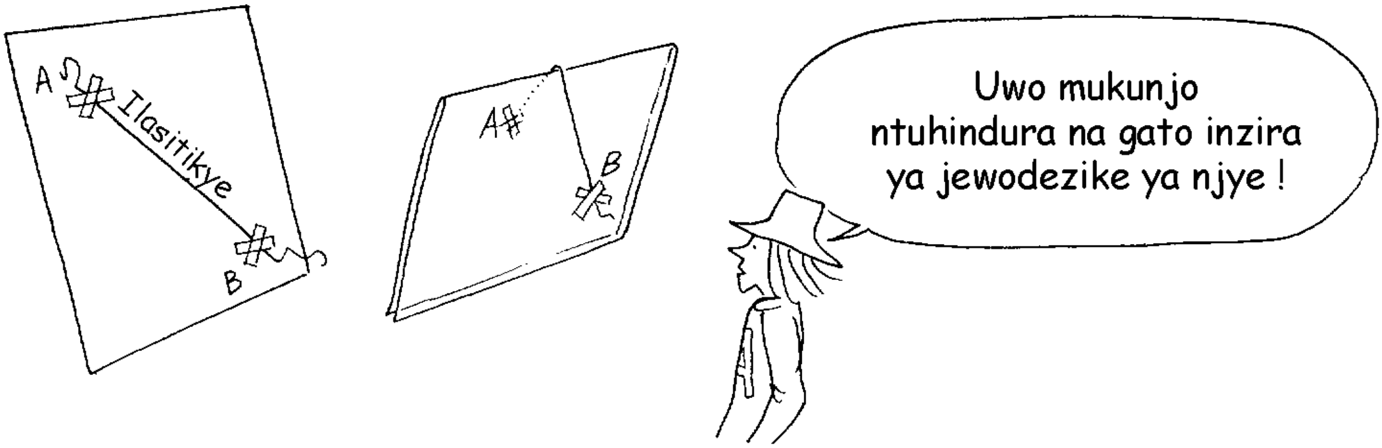
Ni muri iyo ntumero, ibati ry'imihiro rigumana buri gihe imiterere yaryo ya jewometiri Y'IBIBYATARARE, NYAYEKILIDE.



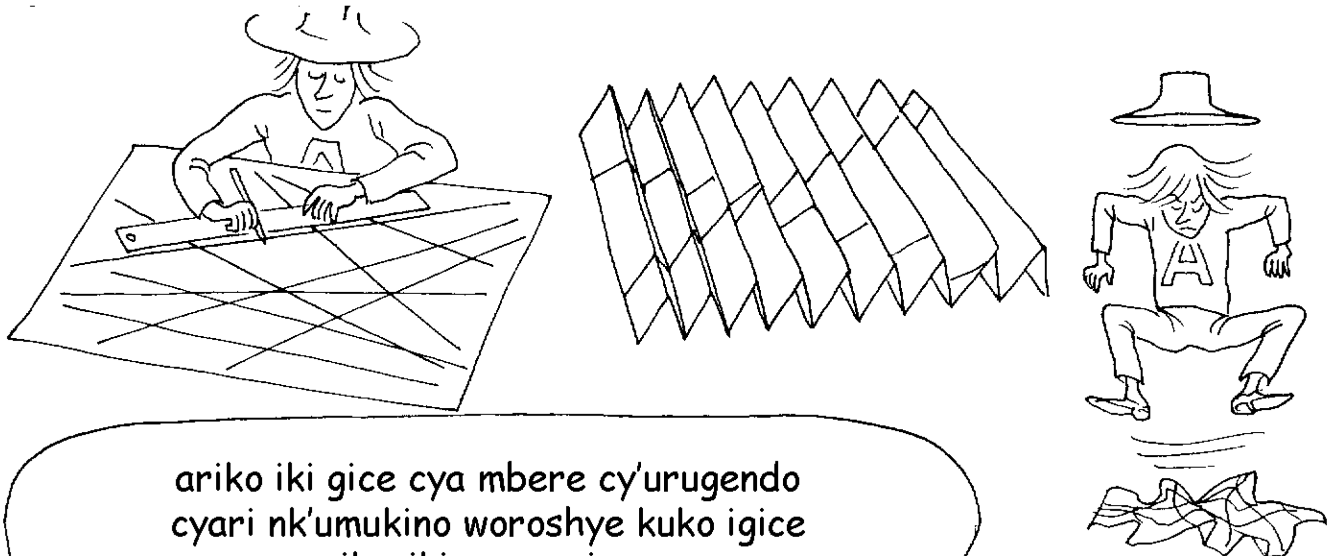
Umuturage wo muri esipase nk'iyo nyadimansiyo-ebyiri, nyayekilide, nta gitekerezo na kimwe azagira kijyanye n'iminyerererere, imizengurukire cyangwa imikunjame izaba isa gusa n'imihindure y'uburyo by'imyinikire muri esipase nyadimansiyo-eshatu.



Dufate igice k'ikibyatarare hanyuma tugikunje :



Wifashishije agacamurongo, ca, k'urupapuro, imirongo na za jewodezike nyinshi hanyuma urukunjakunje. Nurangiza uribonerako za jewodezike zo kuri iyo nyabuso, zaba zirambuye cyangwa zikunje, zikiriho.



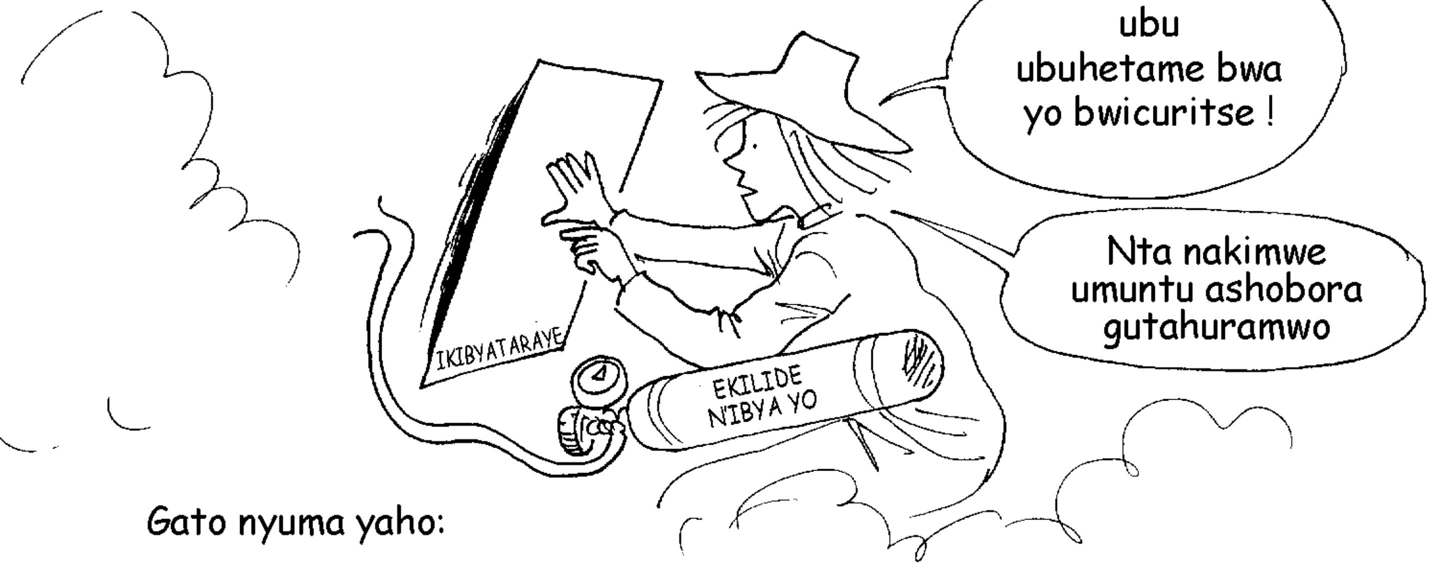
Bwana Lanturulu ?
Ni koko
Jye mpagarariye ikigo EkIlide n'ibya cyo. Tuzi ko mwagize... ehee... ingorane zimwe na zimwe ziturutse ku bikoresho byacu.
EKILIDE N'IBYA CYO
Mfite hano ibigurishwa bishyashya, ubu ho rwose, bigomba kugushimisha
Byerekane se
Ibyejo hazaza bishingiye ku nyadimansiyo eshatu. Murabibona namwe ko jewometiri ya dimansiyo ebyiri hari ukuntu isa naho ... itakigezweho, n'iyataye igihe
IBITEMBA BYO MURI KOSIMOSI IGIPIMO CYA ESIPASE
Ikintu cyacu gishyashya mu bijyanye na jewodezike...
... kigizwe n'inkoni zikomeye, imwe icomekanwa neza n'indi.
zitakwemerera gukata yaba ari iburyo, ibumoso, hejuru, hasi, uretse gukomeza IMBERE YAWE GUSA !

Naho mubyerekeranye no gupima ubuso, koresha iri rangi. Igarama ijana kuri metero kare imwe, birahwana neza.
Bikoranye ubuhanga buhanitse !
Mu bijyanye nogupima za volime, wakoresha ibi. Uzuzamwo umwuka, ubundi ugasoma akokanya igipimo kuri debimetero y'IGIPIMO CYA ESIPASE
Kandi ibuka: ubuso bwa siferi: 4πℓ², volume 4/3πℓ³
Nabyumvise
EKILIDE N'IBA YO
Mbega umwuga !
Ubuho Anselimi yaguye muri esipase nyadimansiyo-eshatu kandi tugiye kumukurikira mu bushakashatsi bwe

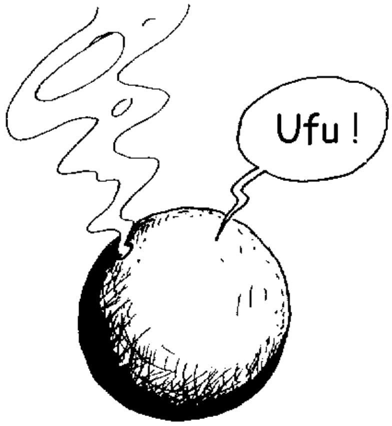
Ibikoresho byiza.
Kandi ibi bicimbu bipima
neza I metero
Ariko, nyuma yo gushinga ibicimbu byinshi...
byahageze, biratangiye
nko mukanya gashize !
jewodezike
yanjye yifungiye kuri
yo ubwayo !
Esipase nyadimansiyo-eshatu ifunze?
Ni iherezo
rya byose
Anselimi, wari wahagaze ngo
amenere igishishwa kuri asiteroyide,
yafashe icyemezo cyo kugaruka
gukoresha ububyo bw'igipimo
cy'imfuruka.
EKILIDE NIBYA YO
Nko
mumwanya ushize,
ngiye gukoresha
JEWODEZIKE
eshatu,
kugirango nkore
INYABUTATU

?!?
jewodezike zanjye zinjiranyemwo neza, kandi ariko igiteranyo k'imfuruka zanjye eshatu kiruta 180° !!...
Byiza
IGIPIMO CYA ESIPASE
FSCHHHHHHHH
Ngiye gukora imwe kandi nzapima volime n'ubuso bwa yo
Siferi ya reyo ℓ ni ihuriro ry'utudomo dutuye k'uburebure ℓ uturutse ku kadomo katanyeganyega, twakwita N
Ubuso bwo ni buto kuri 4πℓ²
Dore ahubwo rero volime ya yo ni ntoya kuri 4/3πℓ³ !
Nongeye kandi kwita mu mutego

Yonjyeye kandi yonjyeye...



Gato nyuma yaho:



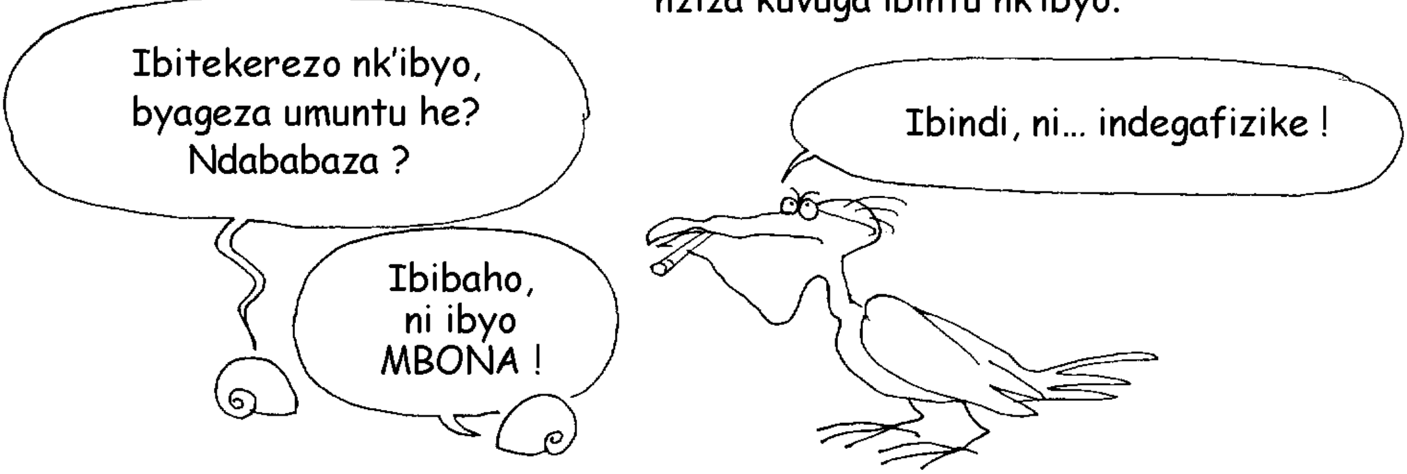
Bityo, ahaga umupira atabizi muri esipase nyadimansiyo-eshatu, Lanturulu yaruhiye kwisanga arimwo... INDANI !

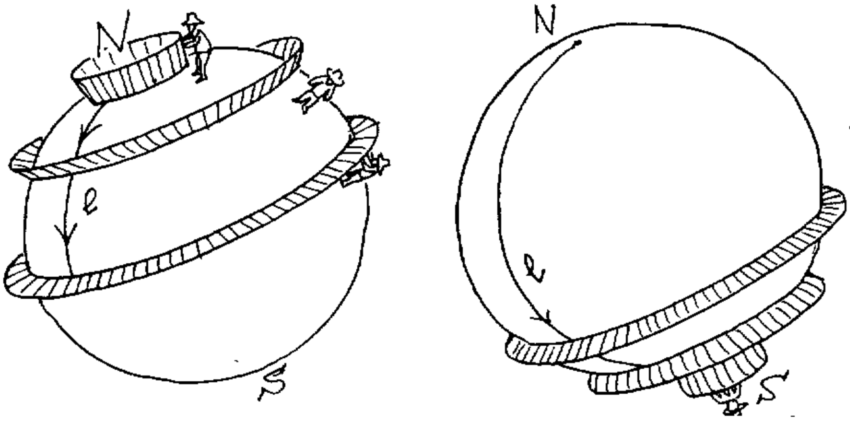
Iyo ataza kuba yakase icupa ku gihe, yari gupfa akandagiwe, nkuko yaje kwisanga afungiye mu rugo rwe, paje 13.

Naho waba ufite ubushake bw'isi yose, ntushobora ubu KWEREKANA u BUHETAME bw'iriya esipase nyadimansiyo-eshatu. Jewodezike za yo zirifunga kandi na volime ya yo igaragaza umubare URANGIYE wa metero cyibe, nk'uko ubuso bwa palanete yacu, inyabuso ifunze, itanga gusa umubare URANGIRA wa metero kare.

Igiteranyo cy'imfuruka z'inyabutatu, y'iyi esipase ya dimansiyo eshatu, iruta 180°. Kugirango "UREBE" ubuhetame bwayo, ugomba kuba ushobora kuburebera muri dimansiyo enye.

Umuntu ashobora buri gihe kuvugako INIVERI yacu ya dimansiyo eshatu ari INYAHIPERIBUSO, yinitse muri esipase ya dimansiyo ennye, iyo nayo ubwayo ishobora kuba INYAHIPERIBUSO yinitse muri ya dimansiyo eshanu, birtyo birtyo, ... Ariko, muri ino minsi yacu, ntabwo ari imvugo nziza kuvuga ibintu nk'ibyo.



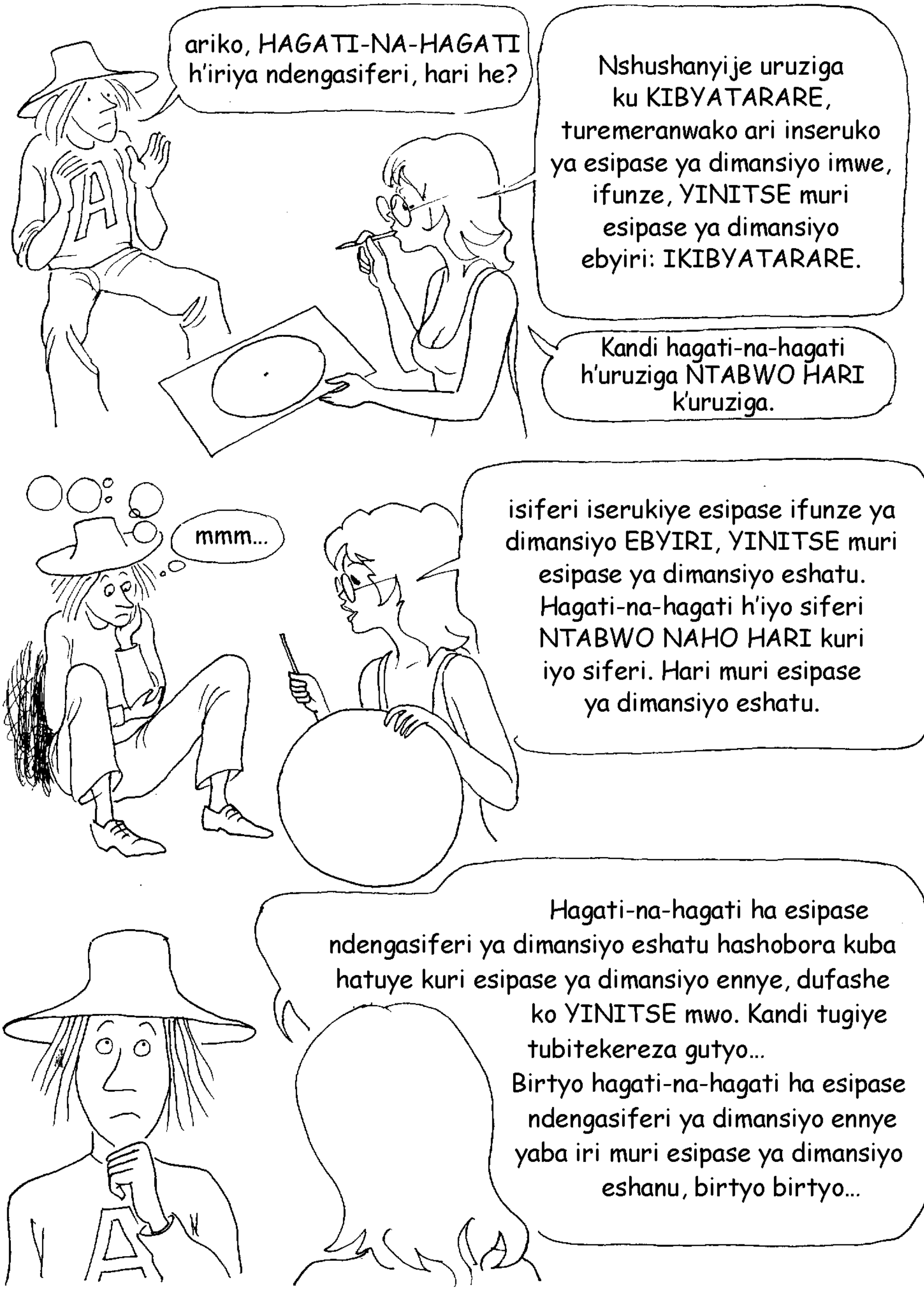


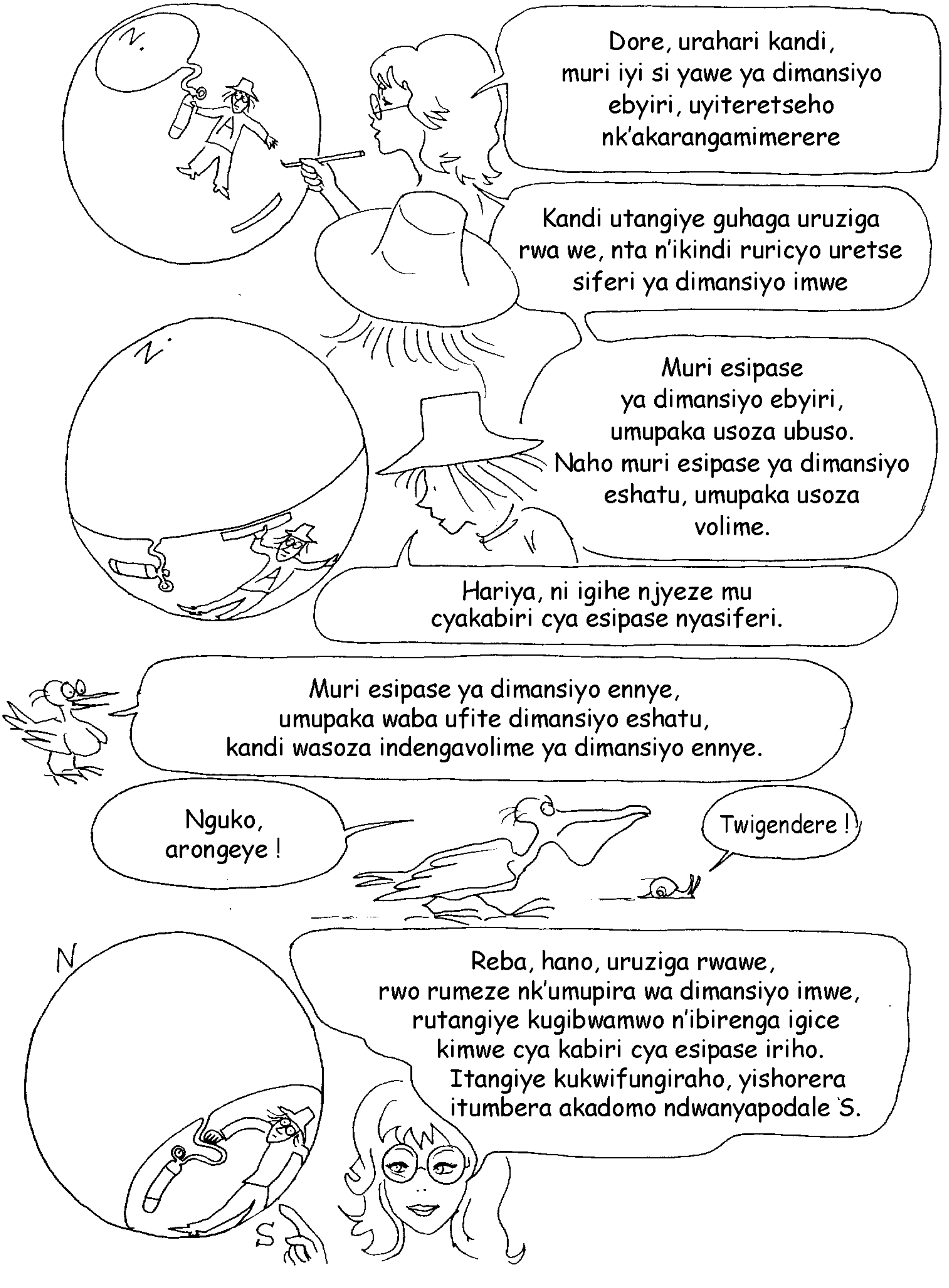
Kuri siferi, wongereye reyo ℓ ya domene yayo, Lanturulu yaje kwisanga kuri ndwanyapode S ya kadomo N, hagati na hagati y'uruziga rwe, kandi yabujijwe ubuhumekero n'uruzitiro rwe.

Muri esipase nyadimansiyo-eshatu y'ubuhetame pozitifu, ni kimwe. Muri iyi esipase nyadimansi-ebyiri ariyo siferi, Anselimi yahuye na EKWATERI igihe yaramaze kuzitira igice cya kabiri cy'ubuso buhari.
EKWATERI ya esipase NDENGASIFERI nyadimansiyo-eshatu nayo ibaho. Anselimi yabijyezeho igihe umupira we warucumbitse mu gice kimwe cya kabiri cya volime ihari. Kuri siferi, ekwateri ruziga yo yagaragaraga nk'UMURONGO. Birtyo, muri esipase ndengasiferi, "ekwateri mupira" yagaragaraga kuri we nk'IKIBYATARARE.

Hirya ya ekwateri, UBWINJIREMWO bw'umupira buricurika hanyuma ikizana ubwayo kwitereka ku kadomo ndwanyapodale S y'akadomo N, hagati na hagati y'umupira.

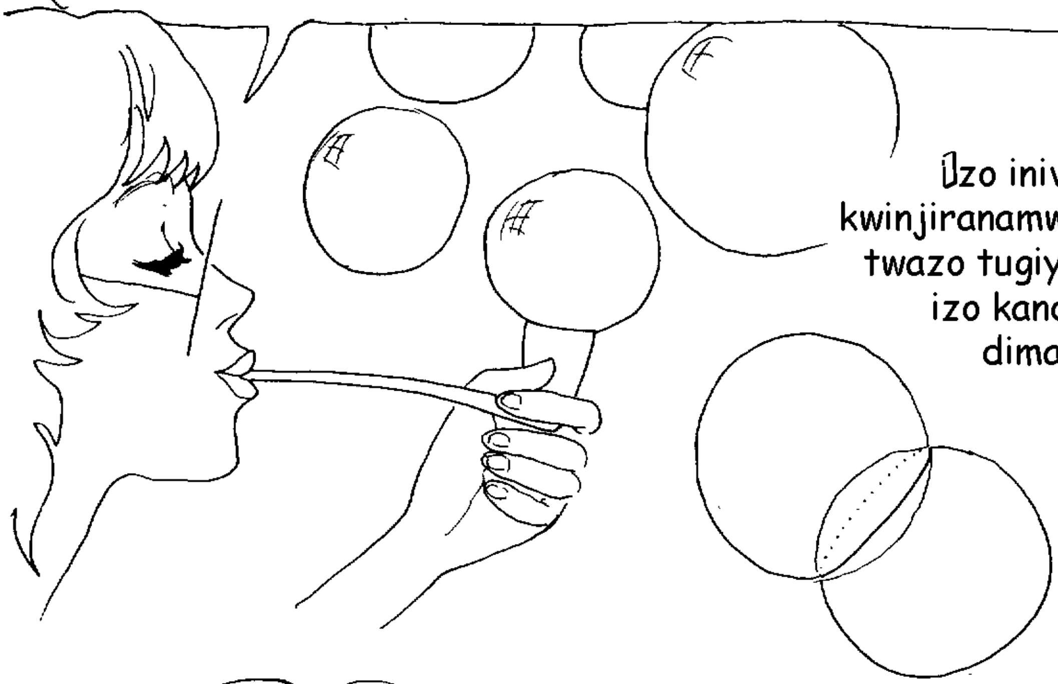
Ingorane ?
Ni ukuvuga, hewu... ibintu byose birivangavanga mu mutwe wanjye.
Nitwa Sofiya. Ubuhetame mu buryo ubwaribwo bwose ni ibintu bya njye.
Injyendo muri za ndengasiferi, ziratungura gato buri gihe ukibitangira. Umuntu agomba kwirinda kwifungirana. Umuntu agenda abimenyera buhoro buhoro.
muwi...
Ndasa n'uwayobye...


ariko, HAGATI-NA-HAGATI h'iriya ndengasiferi, hari he?
Nshushanyije uruziga ku KIBYATARARE, turemeranwako ari inseruko ya esipase ya dimansiyo imwe, ifunze, YINITSE muri esipase ya dimansiyo ebyiri: IKIBYATARARE.
Kandi hagati-na-hagati h'uruziga NTABWO HARI k'uruziga.
mmm...
isiferi iserukiye esipase ifunze ya dimansiyo EBYIRI, YINITSE muri esipase ya dimansiyo eshatu. Hagati-na-hagati h'iyo siferi NTABWO NAHO HARI kuri iyo siferi. Hari muri esipase ya dimansiyo eshatu.
Hagati-na-hagati ha esipase ndengasiferi ya dimansiyo eshatu hashobora kuba hatuye kuri esipase ya dimansiyo ennye, dufashe ko YINITSE mwo. Kandi tugiye tubitekereza gutyo... Birtyo hagati-na-hagati ha esipase ndengasiferi ya dimansiyo ennye yaba iri muri esipase ya dimansiyo eshanu, birtyo birtyo...

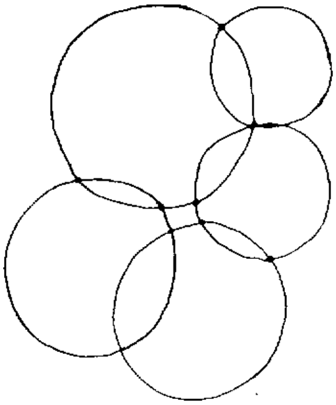

N.
Dore, urahari kandi, muri iyi si yawe ya dimansiyo ebyiri, uyiteretseho nk'akarangamimerere
Kandi utangiye guhaga uruziga rwa we, nta n'ikindi ruricyo uretse siferi ya dimansiyo imwe
N.
Muri esipase ya dimansiyo ebyiri, umupaka usoza ubuso. Naho muri esipase ya dimansiyo eshatu, umupaka usoza volime.
Hariya, ni igihe njyeze mu cyakabiri cya esipase nyasiferi.
Muri esipase ya dimansiyo ennye, umupaka waba ufite dimansiyo eshatu, kandi wasoza indengavolime ya dimansiyo ennye.
Nguko, arongeye !
Twigendere !
N
Reba, hano, uruziga rwawe, rwo rumeze nk'umupira wa dimansiyo imwe, rutangiye kugibwamwo n'ibirenga igice kimwe cya kabiri cya esipase iriho. Itangiye kukwifungiraho, yishorera itumbera akadomo ndwanyapodale S.
S

Ni nk'uko rero, muri esipase yanjye ya dimansiyo eshatu, iyo ninjijemwo ibirenga igice kimwe cya kabiri cya volime yose, umupira unyifungiraho, wishorera utumbera akadomo ndwanyapodale.
Nabyumvise !
Kuko siferi, muri iyo esipase yikunje nyadimansiyo-eshatu, ifite byigaragaza utudomo hagati-na-hagati tubiri, twa ndwanyapodale.
?!!?
Mu kurangiza, sinzi neza icyo numvise, ariko mfite ikizere ko hari ikintu natahuyemwo
Mbega agahinda !
ariko oya, Anselimi, iyo hari dimansiyo zirenze eshatu, GUSOBANUKIRWA NI UKURENGA IMYUMVIRE ISANZWE
Ndarenga imyumvire isanzwe ntabizi
Igishushanyo, ni mwebwe mugiye kugikora... mu mutwe wanyu !

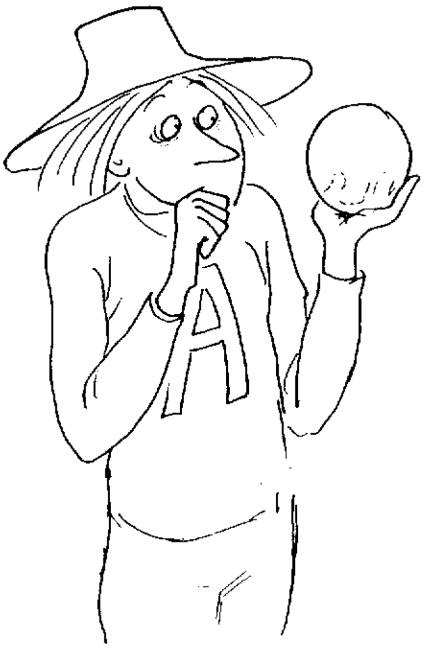
Ubu, ndafata esipase ya dimansiyo eshatu nyishyiremwo siferi za dimansiyo ebyiri, uturundo twa twa iniveri twa dimansiyo ebyiri.



Izo iniveri zishobora kwinjiranamwo. Utudomo rusangi twazo tugiye dutuye ku nziga, izo kandi ni ibintu bya dimansiyo imwe.



Birtyo. Inziga, ibintu bya dimansiyo imwe, zishyizwe ku igice cy'urupapuro (dimansiyo 2) zacanamwo mu TUDOMO. (Abantu bakunze kuvuga ko AKADOMO gafite dimansiyo ingana n'ubusa.)



Siferi izafatwa rero nk'inyuranamwo ry' "ibitonyanga" bibiri nya dimansiyo-eshatu, byibera muri esipase ya dimansiyo ennye.

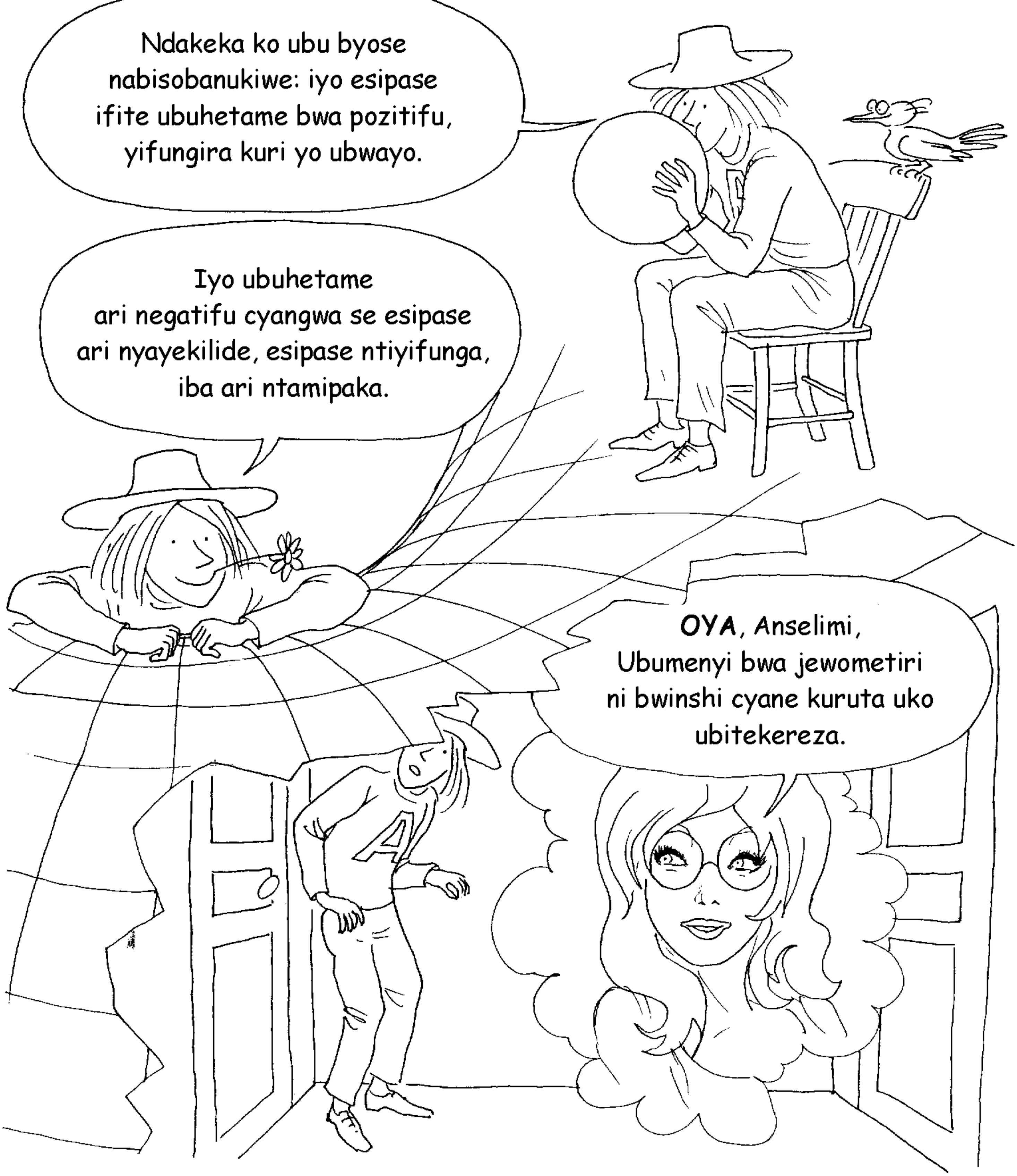
Noneho rero dukomeje durtyo: esipase yigonze nyadimansiyo-eshatu, nyandengasiferi, ishobora yo ubwayo kuzafatwa nk'inyuranamwo ry'ibitonyanga by'isabune bibiri bya dimansiyo ennye, byibera muri esipase y'eshanu.

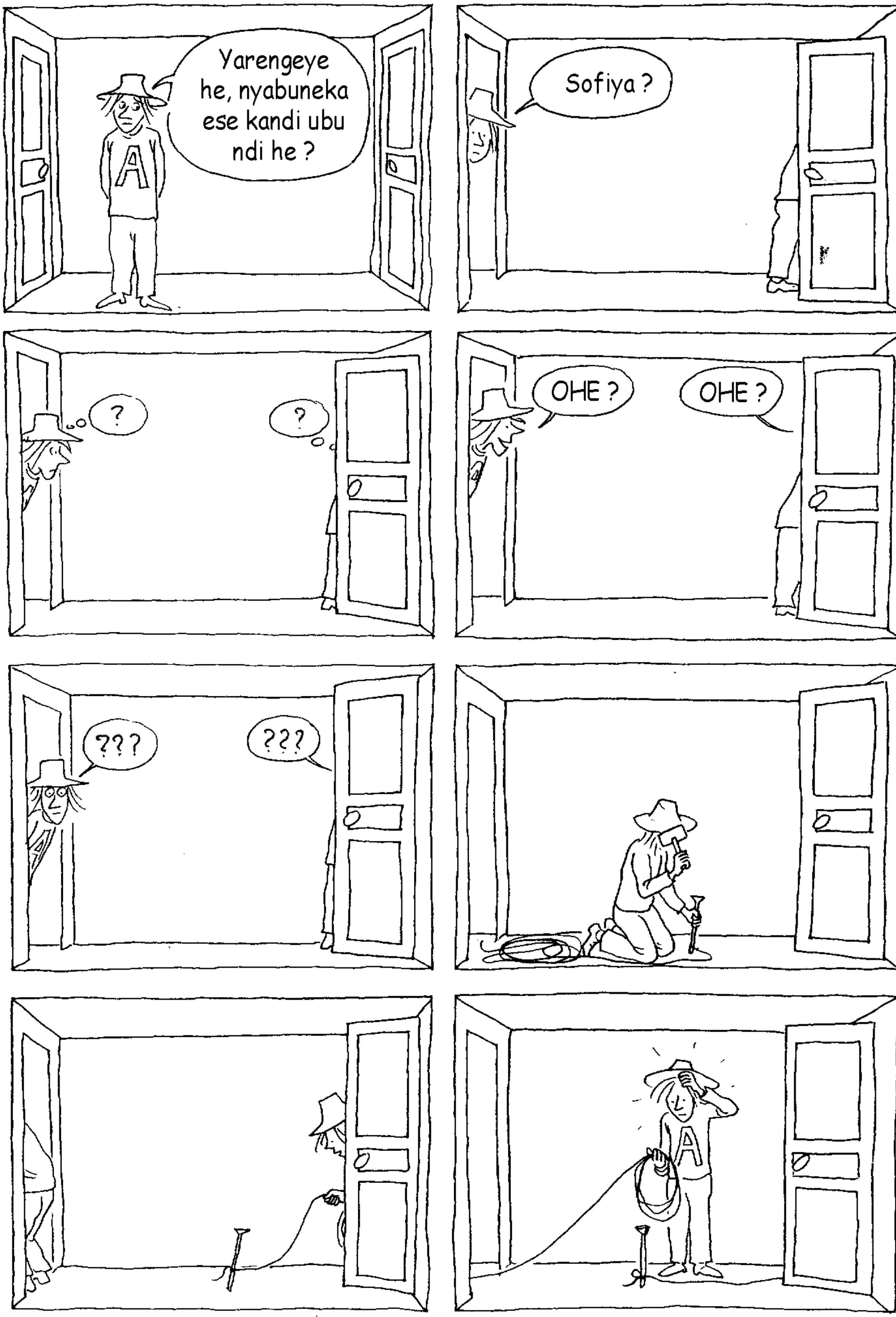
Anselimi na Sofiya, bamaze kugira isereri y'iryo nkweduramitekerereze, bakomeje ishakisha ry'andi ma si nyadimansiyo-eshatu.
Imibare ntikiri icyo yahoze
Urareba, iki ni agatambaro k'ubujeni nyadimansiyo-eshatu, gakoreshwa kuri za jewodezike. Igipande kimata kiri k'umusozo... ni ibigaragarira uwariwe wese
Ariko se, muri iyi esipase, jewodezike zisa n'izitifunga. Kandi ubu iyo mpaze umupira wa NGYERAGYEZASIPASE, volime isohorwa iba iruta 4/3πℓ³, naho ubuso buba buruta 4πℓ². Ku ibijyanye n'igiteranyo k'ibipimo by'imfuruka za nyabutatu, kiri hasi ya 180°
Wowe ibuka, paje 23, uri kandi muri esipase y'ubuhetame NEGATIFU.

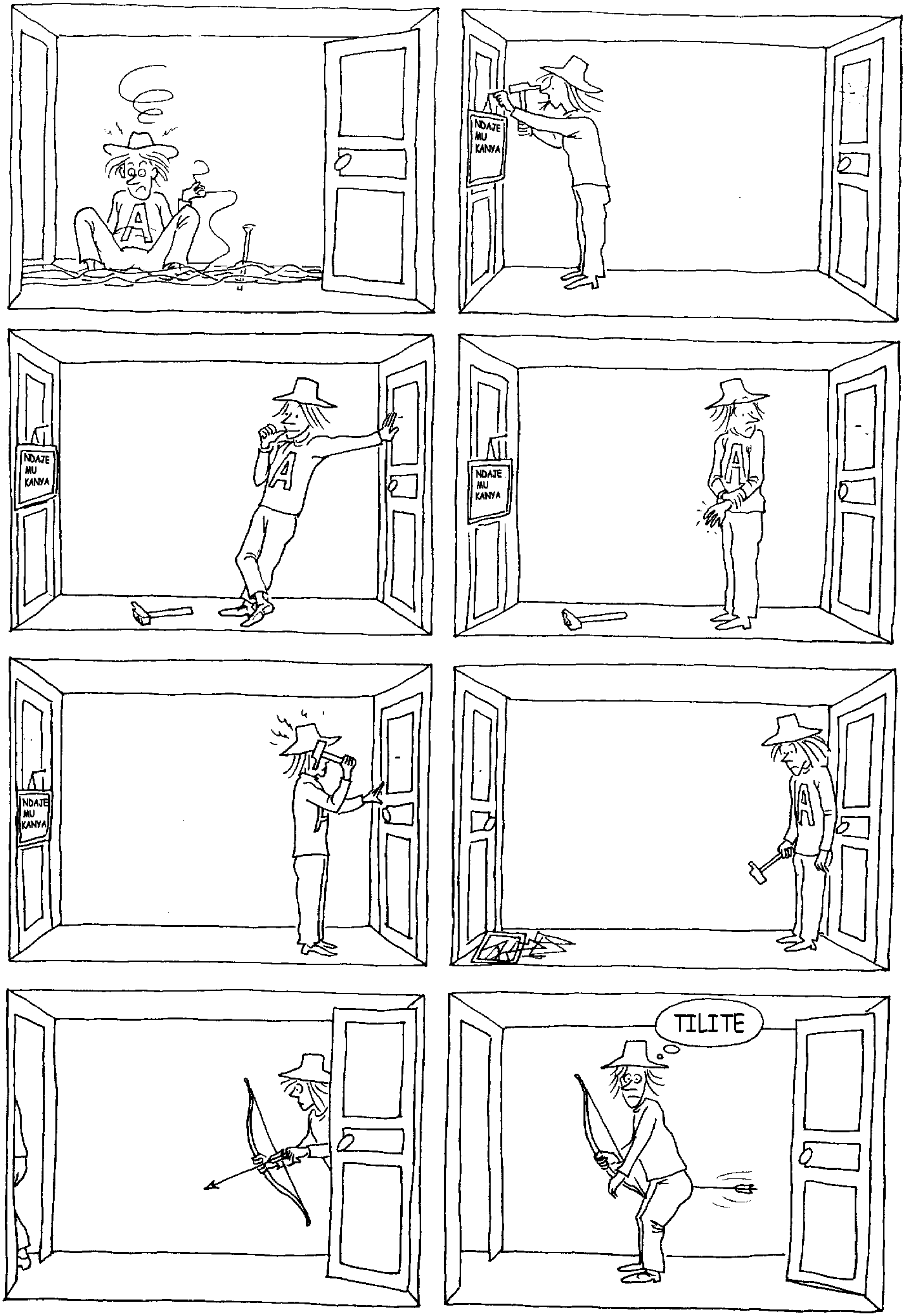
INCAMAKE :

Muri za esipase za dimansiyo eshatu, ibintu byinshi bishobora gushyika, nako urabizi. Ni kimwe no kubijyanye n'ibinyabuso, byo ni esipase za dimansiyo ebyiri. Birtyo, iyo igiteranyo k'imfuruka za NYABUTATU, muri esipase ya dimansiyo eshatu, kiruta dogere 180°, tuzavuga ko ubuhetame ari pozitifu. Nuhabumbira siferi ya reyo ℓ, uzagera, ubifashijwemwo na NGYERAGYEZASPASE, volime nto kuri $4/3\pi\ell^3$ n'ubuso buto kuri $4\pi\ell^2$. Iyo esipase, yitwa NDENGASIFERI, izifungira kuri yo ubwayo. Iyo igiteranyo k'imfuruka za nyabutatu, muri esipase nyadimansiyo-eshatu, ari gito kuri dogere 180°, ubwo rero ubuhetame buzaba negatifu. Volime ya siferi ya reyo ℓ izaruta $4/3\pi\ell^3$ kandi ubuso bwa yo buzaruta $4\pi\ell^2$. Iyo esipase izagira ubukweduke bw'umurengera.

HAKWIYE KO ESIPASE IBA IKINGUYE CYANGWA SE IFUNZE!...

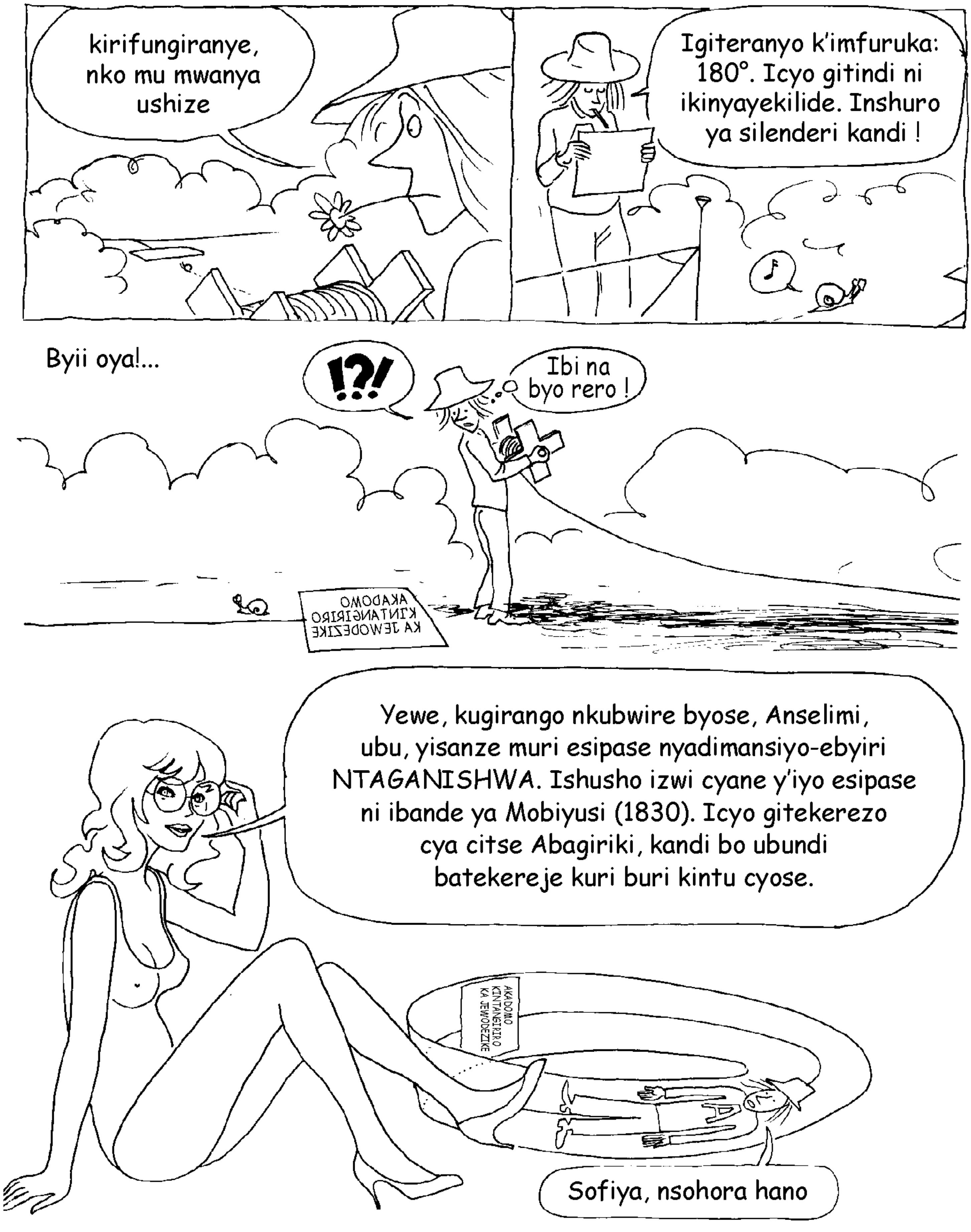



Yarengeye he, nyabuneka ese kandi ubu ndi he ?
Sofiya ?
?
?
OHE ?
OHE ?
???
???

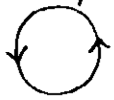

NDAJE MU KANYA
NDAJE MU KANYA
NDAJE MU KANYA
NDAJE MU KANYA
TILITE

Eh yego, Lanturulu yari yasunikiwe muri esipase nyasilenderi ya dimansiyo eshatu. Naho yari nyayekilide, itagira ubuhetame, (igiteranyo k'imfuruka za nyabutatu zaho kingana na dogere 180°; iyi si irifungira kuri yo ubwayo.
TILITE
Ni byiza, reka twemereko ... amasi nyasiferi, ndengaparabole, nyasilenderi. Twazihetuye zose, si byo se ?
JEWOMETIRI
Murabyemera ?
Tuzenguruke gato mu ruhongore rwa za nyadimansiyo-ebyiri.
He !?
IBICU

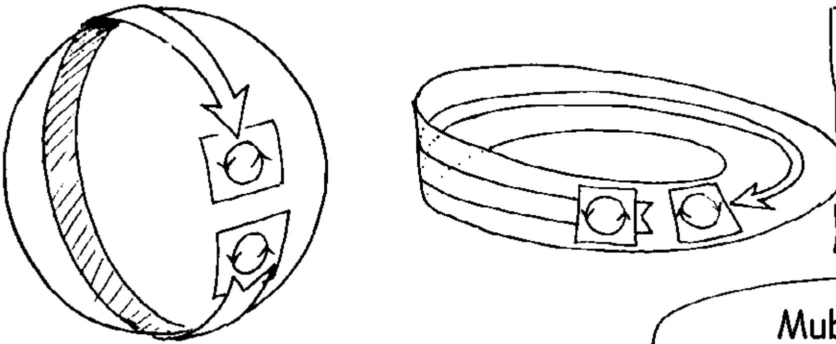
NTA HASI, NTA HEJURU :


kirifungiranye, nko mu mwanya ushize
Igiteranyo k'imfuruka: 180°. Icyo gitindi ni ikinyayekilide. Inshuro ya silenderi kandi !
Byii oya!...
!?!
Ibi na byo rero !
Yewe, kugirango nkubwire byose, Anselimi, ubu, yisanze muri esipase nyadimansiyo-ebyiri NTAGANISHWA. Ishusho izwi cyane y'iyo esipase ni ibande ya Mobiyusi (1830). Icyo gitekerezo cya citse Abagiriki, kandi bo ubundi batekereje kuri buri kintu cyose.
Sofiya, nsohora hano

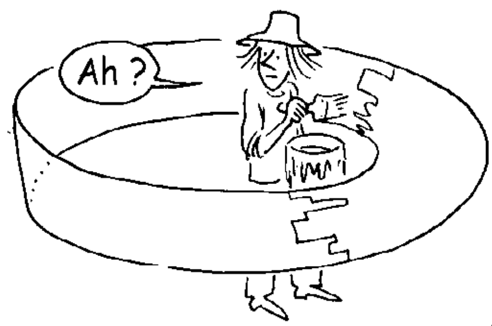
Duce uruziga ku nyabuso, tuyihe intumbero iyariyo yose dukoresheje agashushanyo k'umwambi.
Shyira mu gitekerezo ko urwo ruziga ari akarangamimerere dushobora



kunyereza uko dushatse kuri iyo nyabuso.
Niba urwo ruziga ruzengurukijwe iyo nyabuso warangiza ugasanga rugisa n'uruziga rusanzwe, tuzavugako iyo nyabuso ari NGANISHWA (ni byo biba kuri siferi, ku mutemeri, ku kibyatarare, n'ibindi, n'ibindi...). Ariko iyo ako karangamimerere kanyerejwe ku rugori rwa Mobiyusi, bivamwo ibindi:



Buri gihe iyo kazengurutse iyo iniveri ya dimansiyo ebyiri, urwo ruziga ruhindura intumbero.



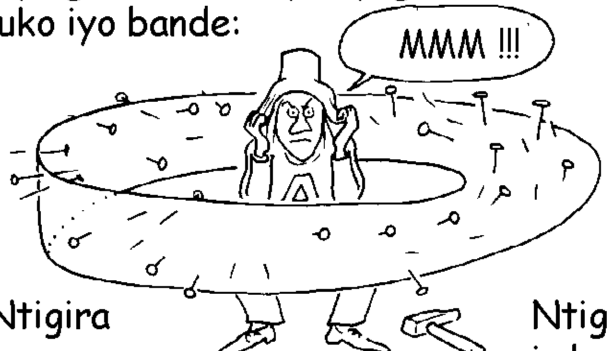
Ni gurtyo rero utanashobora gusiga bande ya Mobiyusi irangi ry'amabara abiri atandukanye: igira gusa uruhande rumwe, ni INYARUHANDE RUMWE.

Inagira n'UMUSOZO umwe:

Umuntu ashobora kuyigunira rimwe !

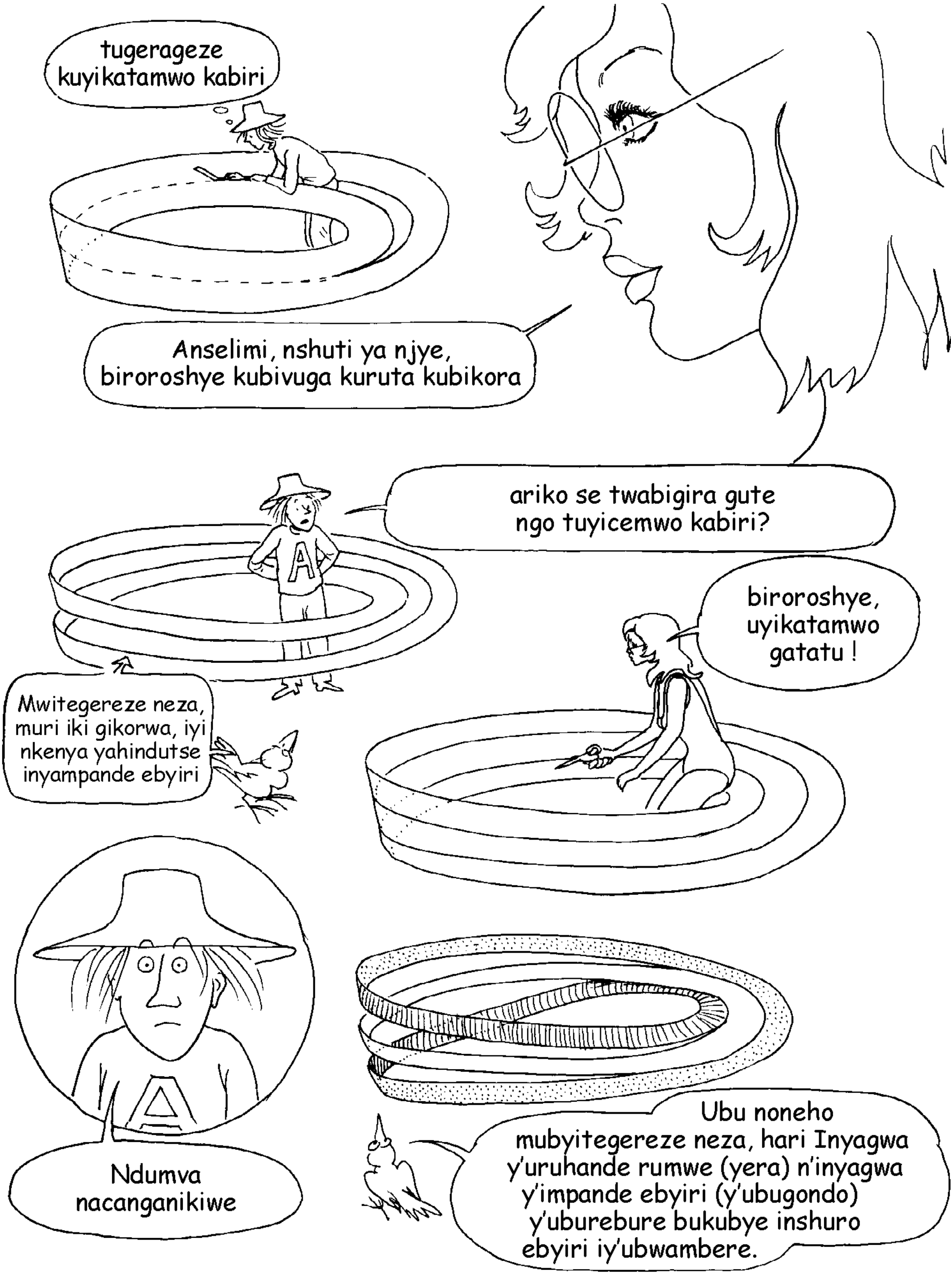
Anselimi yafashe ikyemezo cyo guteramwo imisumari kugirango yerekane imbere n'inyuma

Icyo gikorwa ntacyo cyagezeho, kuko iyo bande:



Ntigira inyuma

Ntigira imbere !

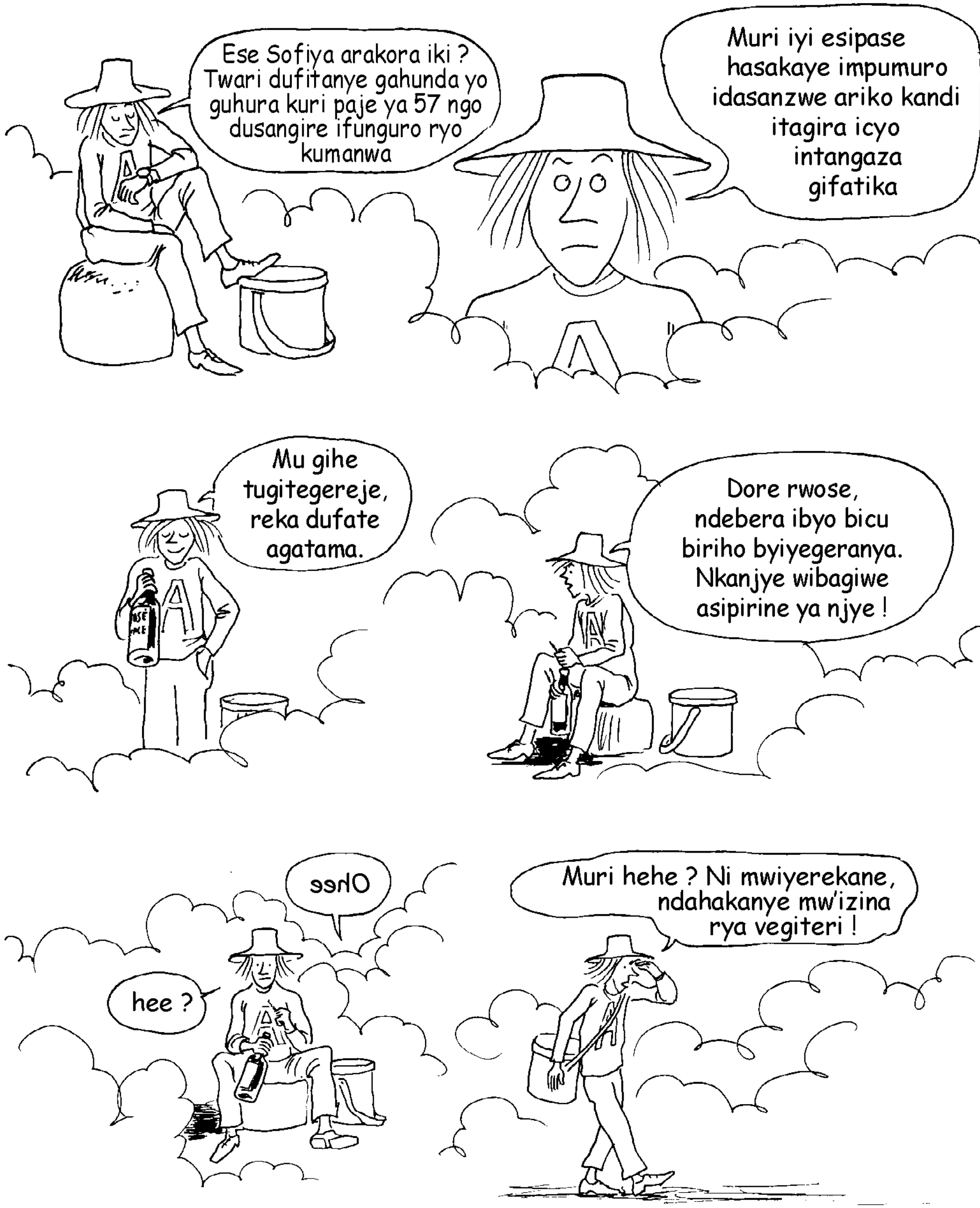


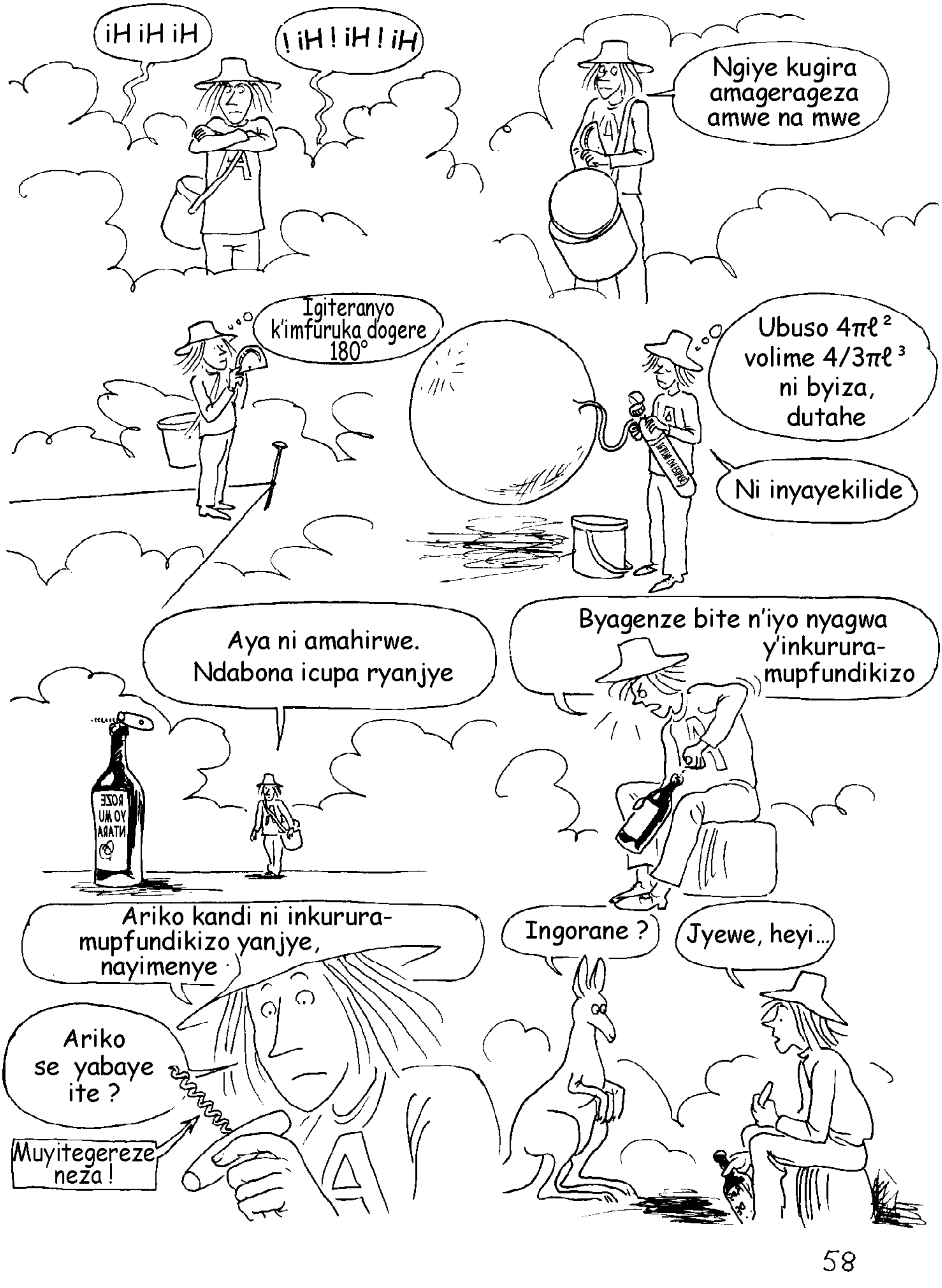
tugerageze kuyikatamwo kabiri
Anselimi, nshuti ya njye, biroroshye kubivuga kuruta kubikora
ariko se twabigira gute ngo tuyicemwo kabiri?
biroroshye, uyikatamwo gatatu !
Mwitegereze neza, muri iki gikorwa, iyi nkenya yahindutse inyampande ebyiri
Ndumva nacanganikiwe
Ubu noneho mubyitegereze neza, hari Inyagwa y'uruhande rumwe (yera) n'inyagwa y'impande ebyiri (y'ubugondo) y'uburebure bukubye inshuro ebyiri iy'ubwambere.

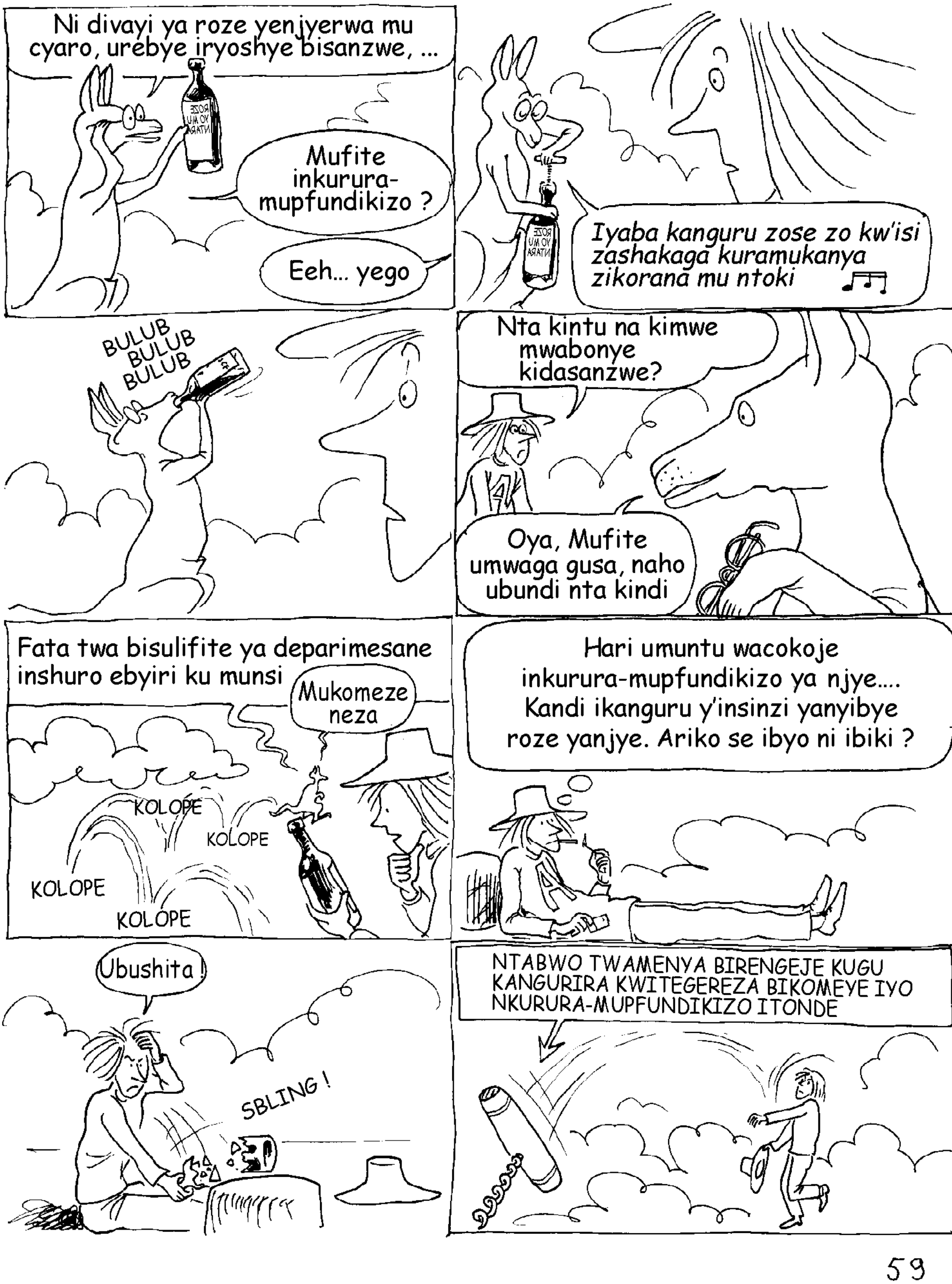
Nyuma y'iryo tembera ku bande ya Mobiyusi, reka twigarukire muri za esipase nyayekilide (zitagira ubuhetame) za dimansiyo eshatu:

IGANISHA RYA ESIPASE :

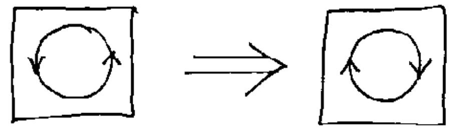
Duherekeze Lanturulu mu rugendo-nshakisha rwe rw'isi nshyashya nyayekilide ya dimansiyo eshatu (itagira ubuhetame)



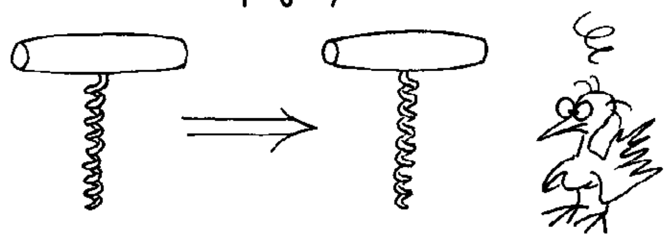

iH iH iH
! iH ! iH ! iH
Ngiye kugira amagerageza amwe na mwe
Igiteranyo k'imfuruka dogere 180°
Ubuso 4πℓ²
volime 4/3πℓ³
ni byiza, dutahe
Ni inyayekilide
Aya ni amahirwe. Ndabona icupa ryanjye
ROZE YO MU NTARA
Byagenze bite n'iyo nyagwa y'inkurura-mupfundikizo
Ariko kandi ni inkurura-mupfundikizo yanjye, nayimenye
Ariko se yabaye ite ?
Muyitegereze neza !
Ingorane ?
Jyewe, heyi...


Ni divayi ya roze yenjyerwa mu cyaro, urebye iryoshye bisanzwe, ...
ROZE YO MU NTARA
Mufite inkurura-mupfundikizo ?
Eeh... yego
Iyaba kanguru zose zo kw'isi zashakaga kuramukanya zikorana mu ntoki
BULUB BULUB BULUB
Nta kintu na kimwe mwabonye kidasanzwe?
Oya, Mufite umwaga gusa, naho ubundi nta kindi
Fata twa bisulifite ya deparimesane inshuro ebyiri ku munsi
Mukomeze neza
KOLOPE
KOLOPE
KOLOPE
KOLOPE
Hari umuntu wacokoje inkurura-mupfundikizo ya njye.... Kandi ikanguru y'insinzi yanyibye roze yanjye. Ariko se ibyo ni ibiki ?
Ubushita !
SBLING !
NTABWO TWAMENYA BIRENGEJE KUGU KANGURIRA KWITEGEREZA BIKOMEYE IYO NKURURA-MUPFUNDIKIZO ITONDE

I bande ya Mobiyusi (esipase ntaganishwa ya dimansiyo ebyiri) ifite rero icyo bisa cya dimansiyo eshatu. Igihe rwa ruziga rw'akarangamimerere rwakoraga , k'urugori rwa Mobiyusi, "umuzenguruko" w'iyo esipase nyayekilide, intumbero yako yarahindutse :



Reba kuri paje ya 54

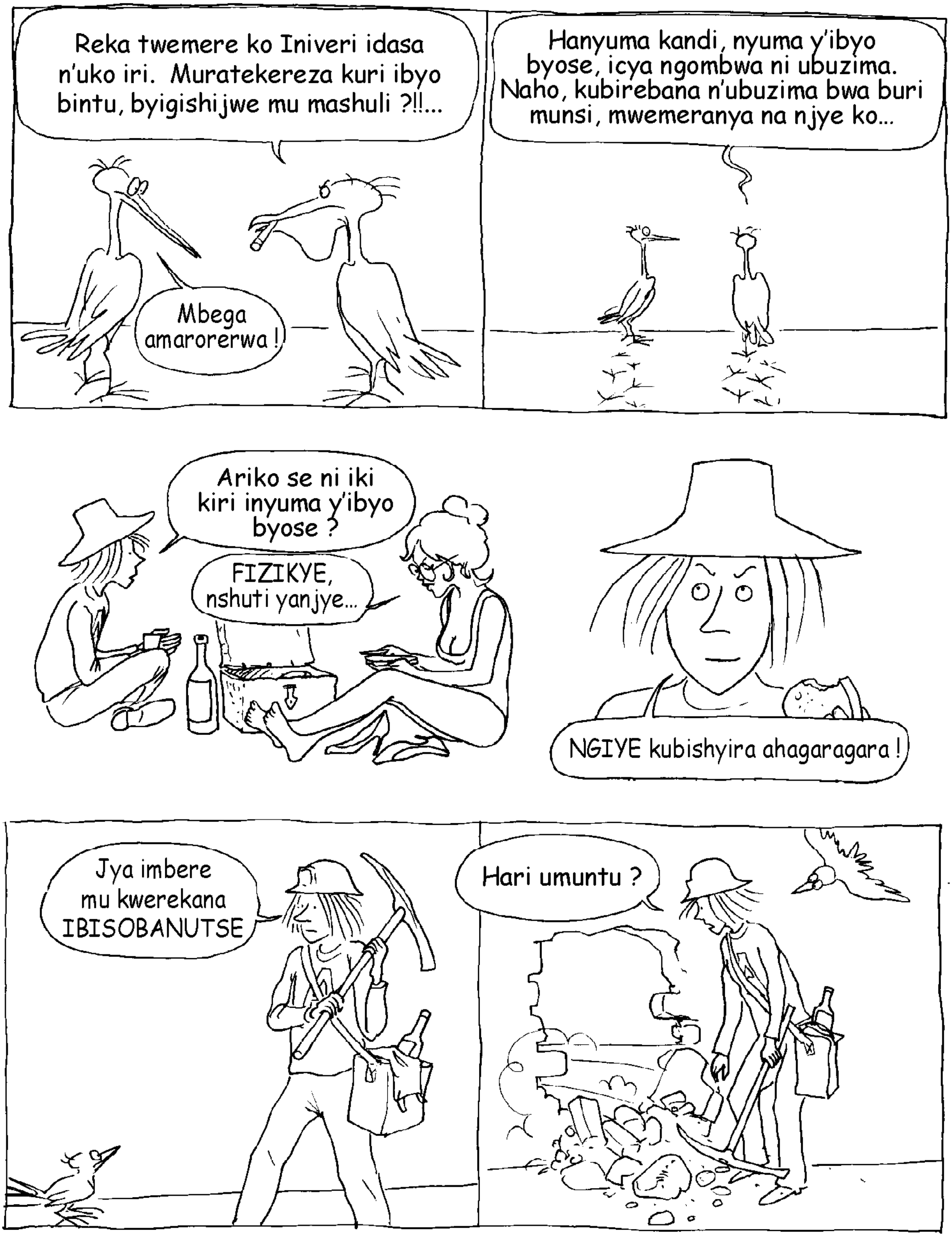


Muzibonerako ibyo bintu biteganye nko mu "ndorerwamu".

Inkurura-mupfundikizo, cyangwa Anselimi ubwe, bishobora gufatwa nk' "uturangamimerere twa dimansiyo ebyiri". Igihe cyose ikintu gikoze umuzenguruko w'iyi esipase nyadimansiyo-eshatu, intumbero yayo irihindukiza. Nk'uko twabaye nk'abaherekeje Lanturulu mu rugendo dwe rw'inzengurukasipase, ni ibisanzwe ko twisanga hamwe na we, icupa risa nk'iryo mundorerwamu n'inkurura-mupfundikizo yinjiza mu buryo budasanzwe. Uwundi "muzenguruko" w'iyi iniveri wazaduha ikindi kitegerezo k'ibanze cy'ibintu (ibyo byaterwa n'uko twagumiza ibintu mu mwanya wa byo).

Anselimi na kanguru (yo mu bwoko bwa ndwanyapode) batuye kuri esipase imwe ariko batandukanyijwe n'uko ikiri "aho kanguru ituye" aricyo kiri "aho Lanturulu atuye ariko gihindukije", kandi byose ni uko bimeze.

IMBANZIRIZAMUSOZO :
Ibintu byose bigiye binyuranye. Nta buryo, nta bumoso, nta mbere nta nyuma. Ese ibyo byageza he umuntu ? Ese ahubwo ni iyihe nzira yo kunyuramwo ?
Igikwiye, Anselimi, ni ugukurikira za jewodezikye; za jewodezikye z'ubuzima bwawe.
Jye, ntawuzashobora kunyemeza ko Iniveri ifite amahembe abiri. Ibyo ni indoto z'abanyamibare.
Ni igitabo-bishushanyo !
Kuki umuntu yatekereza cyane kuri ibyo bintu, cyane cyane ko bigaragarira uwariwe wese ko iyo esipase ARI nyayekilide (*)
(*) Amagambo yavuzwe na Ositorogaradisiki, Umuporofeseri wikirangirire mu kicaro k'imibare i Petorogarade, nyuma yo gusoma ibikorwa by'ubushakashatsi bwa Riyemani na Lobacevisiki.


Reka twemere ko Iniveri idasa n'uko iri. Muratekereza kuri ibyo bintu, byigishijwe mu mashuli ?!!...
Mbega amarorerwa !
Hanyuma kandi, nyuma y'ibyo byose, icya ngombwa ni ubuzima. Naho, kubirebana n'ubuzima bwa buri munsi, mwemeranya na njye ko...
Ariko se ni iki kiri inyuma y'ibyo byose ?
FIZIKYE, nshuti yanjye...
NGIYE kubishyira ahagaragara !
Jya imbere mu kwerekana IBISOBANUTSE
Hari umuntu ?

... niba uburemere bwo hagati na hagati bwa matsiyeri muri iniveri buri munsi ya 10^{-29} garama kuri buri cm^3...
?
... noneho rero iniveri izagira ubuhetame bwa negatifu kandi izagira ubukweduke bw'umurengera, budashira...
... ibiramambo, iyo uburemere buruta 10^{-29} g/cm^3
!..
....Iniveri izaba ari ndengerasiferikye kandi izifungira kuriyo ubwayo...
Ariko niba ubwo buremere bungana na 10^{-29} g/cm^3, rero Iniveri izaba ari inyayekilide
HUM...
Dogiteri Eyinshiteyine, ndakyeka?
muwuu?....
UMUSOZO