

Ne'epapa Ka Hana 2.0
Eighth-Grade Mathematics Resources
STEMD² Book Series

PAPA KUHIKUHI NO NĀ KUMU

E HANA KĀKOU



STEMD² Research & Development Group
University of Hawai'i at Mānoa



STEMD² Research & Development Group
Center on Disability Studies
College of Education
University of Hawai'i at Mānoa

<http://stemd2.com/>

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Ne'epapa Ka Hana Eighth-Grade Mathematics Resources

E Hana Kākou

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'Ōlelo Ha'i Mua

About the STEMD² Book Series

The STEMD² Book Series for eighth-grade mathematics was developed as part of a technology-enabled pedagogical approach (Ne'epapa Ka Hana model) for teaching mathematics in Hawai'i middle schools. This book series provides Hawai'i middle school teachers resources and training to incorporate problem-based learning, social learning and inclusive pedagogy through a culturally relevant mathematics curriculum. The series currently includes:

- Let's Build a Canoe** – Student Activities and Teacher's Guide (Common Core aligned)
- Let's Play the 'Ukulele** – Student Activities and Teacher's Guide (Common Core aligned)
- Let's Go Fishing** – Student Activities and Teacher's Guide (SBAC aligned)
- Let's Make Da Kine / E Hana Kākou** – Student Mini Projects and Teacher's Guide in English and 'Ōlelo Hawai'i (Skill development)

The printed and online resources produced by NKH through STEMD² are fully aligned with the Common Core Standards for Mathematical Practice and Content and the Smarter Balanced Assessments for mathematics. Based on the GO Math!® curriculum structure, the NKH STEMD² book series and social learning platform (community.stemd2.com) is flexible for teachers to implement partially or fully in their classrooms, as a tool to encourage students' interest and achievement in STEM subjects.

Funded by a three-year grant from the Department of Education's Native Hawaiian Education Act Program, Ne'epapa Ka Hana is a project of the STEMD² Research & Development Group in the Center on Disability Studies at the University of Hawai'i at Mānoa. More information about STEMD² is available online at www.stemd2.com.

Nā Hanana o ka Mokuna 1



Hanana 1.1: Ka ‘Imi Palapala ‘Āina

‘Ōlelo Mua:

Ma Hawai‘i i ka wā kahiko, ua mālama nui ‘ia ke kupapa‘u ali‘i nui ke pau kona ola. Kanu ‘ia ke kupapa‘u ma kekahī lua pāpa‘u a uhi ‘ia. Pūholo ‘ia ke kupapa‘u i mea e hemo ai ka pela mai ka iwi. Ho‘āhu ‘ia ka pela a ho‘okomo ‘ia i loko o kekahī ‘umeke a mālama ‘ia na‘e nā iwi i loko o kekahī ‘umeke ‘ē a‘e. Lawe ‘ia kēia mau ‘umeke e ‘elua kānaka a na lāua e **hūnākele** ma kekahī ana huna.

He kahu kekahī o nā kānaka ‘elua no kēlā ana. ‘O ka mālama ‘ana i ka hūnā ‘ana a me kahi i kanu malū ‘ia ai [ke kupapa‘u ali‘i] ke kuleana o kēlā kahu. Ua kapa ‘ia ke kanaka ‘ē a‘e, he “moe pu‘u” ‘o ia ho‘i ke moe pū. Mōhai ‘ia ua moe pu‘u nei e ke kahu no ka mea ua piliwi [ka po‘e] ‘o ke koko ka mea e pale ai ke kupapa‘u i ka ‘ino. He mea kēia e hō‘oia ai ‘o ke kahu wale nō ka mea e ‘ike ai i kahi o ua kupapa‘u nei. I kekahī manawa, pono e loa‘a ke kaula pi‘i mauna no ke komo i ke ana, aia ma ke alo pali a na ke kahu e mōhai i ka moe pu‘u ma ke ‘oki ‘ana i ke kaula pi‘i mauna i mea e kahe ai ke koko ma ka **palipa‘a maoli**.

‘O ke kumu o ka mālama nui i ka hūnā ‘ana i ke **awaloa**, ‘o ia ho‘i ka piliwi o nā Hawai‘i i ka mana i ka iwi kanaka. ‘Oi aku ka mana o ka **pūholoholo** a ‘o ka hana i kekahī mea me nā iwi, he makau a ihe nō paha, ka mea e ‘oi aku ai ka nui mana a me ka pōmaika‘i ma mua o kahi makau a ihe ma‘amau. Inā i lilo nā iwi i nā lima o ke kanaka mana‘o ‘ino, ‘a‘ole nō ia he kāko‘o pū i nā ‘enemi, he hana ‘ino nō ho‘i i ka ‘ohana nāna ka pūholoholo.

Ma kēia hana, e ho‘ohana ‘ia ana ka palapala ‘āina no ka loa‘a o kahi **mea waiwai** hūnā. ‘A‘ole e ho‘ohana ‘ia nei ke ana kino Hawai‘i, ‘o ia ho‘i ka ho‘ohana i nā māhele kino no ke ana.

Nā Lako e Pono Ai:

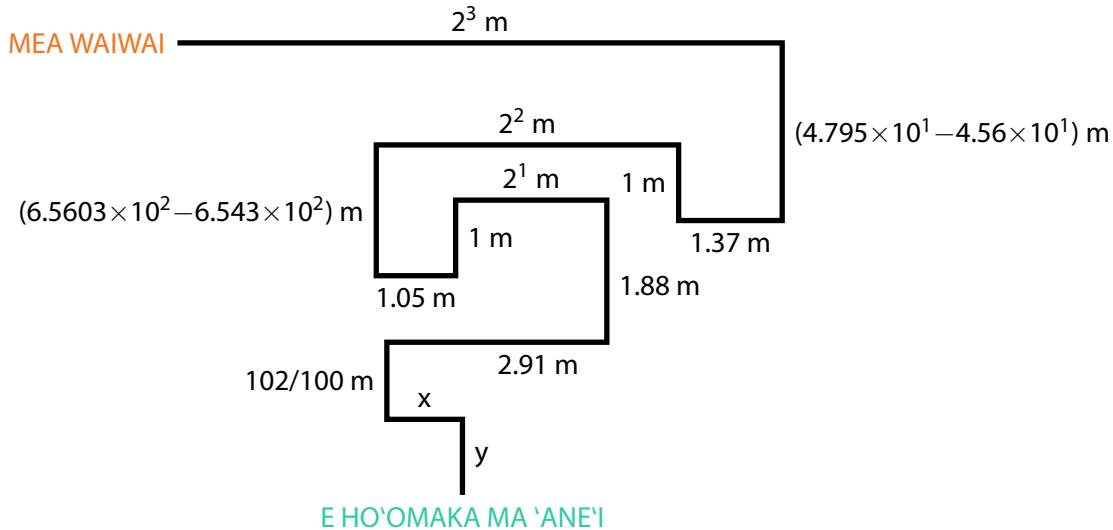
1. Lipine Ana
2. Kaula
3. Kahua
4. Mea Waiwai
5. Kekahi Mau Mea **Ho‘opunihei**

Nā ‘Ōkuhi Ho‘okuene:

1. E ho‘opa‘a mua i ke **kupuna**.
2. E hele i ka hema no 4 mika mai kupuna a e kākau i ka lō‘ihī.
HEMA = _____
3. E hele i mua no 6 mika mai kahi ma mua pono a e kākau i ka lō‘ihī.
IMUA = _____
4. E ho‘omākalakala no $x = \text{HEMA} - 2.77\text{m}$ me $y = \text{IMUA} - 4.95\text{m}$. E ho‘omākaukau mua i kēia mau lō‘ihī ma ka ho‘omaka o kēia hanana.
 $x =$ _____
 $y =$ _____
5. E waiho i ka mea waiwai ma laila.
6. E waiho i nā mea ho‘opunihei ma ‘ō a ma ‘ane‘i ma ke kahua.

Hana:

Ua loa'a iā Keoni he palapala 'āina i hiki ke alaka'i iā ia i ka mea waiwai huna. Maopopo iā ia ke kupuna a me ka huli o ka palapala 'āina. Hiki paha ke kōkua iā ia e loa'a i ka mea waiwai huna?



Ka palapala 'āina o Keoni.

Nā 'Ōkuhi:

1. Me ka maopopo i ke kauhelu 'epekema, nā helu RATIONAL, a me nā pāho'onui, e huli a loa'a ka lō'ihi o kēlā me kēia māhele o ka huaka'i.
2. E ana a ho'omāhelehele i ke kaula i kēlā me kēia māhele ma o ke kau i 'āpana leki ma kahi kūpono ma ke kaula.
3. Ma ka hui, e ho'omaka mai ke kupuna. E ho'ohana i ke kaula ma ke 'ano he alaka'i, e palapala i ke ala a e loa'a ka mea waiwai.

Nā Nīnau:

1. No ke aha i hana 'ia ai kēia 'ano palapala 'āina ho'ohuikau?

2. Inā, ua makemake e kōkua aku i kekahi hoaaloa ma ka loa'a 'ana o kēia mea waiwai, he aha kāu mau 'ōkuhi e kākau ai nona?

Hiki ke hō'ulu'ulu 'ia kēia ma 'ōkuhi ma nā 'ano he nui. I la'a me: "Mai kupuna, e hele X + 2.77m hema a laila Y + 4.95m i mua."

3. He aha ka mea waiwai? E hō'ike mai i nā ki'i ma ka papa hō'ike'ike **pa'e'e**.

Nā Hanana o ka Mokuna 2



Hanana 2.1: Oihana Kālepa Hawai'i

'Ōlelo Mua:

Ma Hawai'i, i ka wā kahiko, 'o ke kālepa 'ana ka hana e kū'ai aku kū'ai mai ai nā mea. I kēia wā, loa'a ke kālā ma ke 'ano he **kūlana pa'a** e uku ai, mau nō na'e ke kālepa 'ana i kēia mau lā. Kālepa aku kālepa mai nā haumāna i nā kāleka, nā pogs, nā mea pā'ani, a me nā mea i loko o ka pā'ani wikiō. He kōkua kēia mana'o 'o ke kālepa i ka maopopo i ka waiwai o kekahī mea a me ke kālepa kūpono 'ana.

Nā Pono Hana:

1. Kāleka Pahu (4 a 5 o ka haumāna a i 'ole ka hui)
2. Nā penikala, peni kuni waiho'olu'u

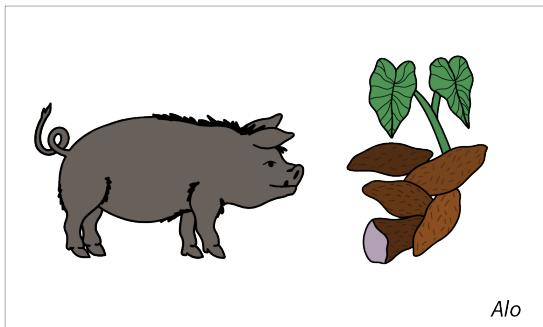
Hana:

E no'ono'o mai, kohu mea lā aia nō 'oe ma Hawai'i i ka wā kahiko loa a ua makemake e mālama i kekahī lū'au no ka 'ohana me nā hoaaloa. Noho kou 'ohana ma kai a 'eleu lākou ma ka lawai'a a makemake na'e e loa'a pū nā pua'a no ka po'e kipa mai no laila, 'imi 'oe i ke kanaka hahai holoholona. 'Ōlelo mai ke kanaka, "E hā'awi au iā 'oe 1 pua'a me 5 kalo no 2 i'a." 'Ae 'oe a māka 'ia kēia kālepa 'ana ma luna o kekahī 'āpana kapa.

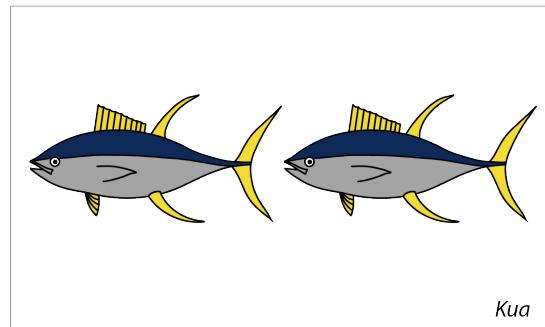
Ma ka hō'ea i ka hale no ka ho'omākaukau i nā i'a no ke kālepa 'ana, ua 'ike i ka nui kānaka e hele mai ana i ka pā'ina a 'a'ole nō 'oe i mana'o pēlā no laila, ho'i aku 'oe i ke kanaka hahai holoholona a 'ae 'o ia he 3 pua'a me 5 kalo no 5 i'a. Māka 'ia kēia kekahī. Mana'o 'oe, ua maika'i loa kēia a ho'i 'oe i kou hale no ka ho'omākaukau i nā i'a.

Ha'i maila kou makuahine e 'oi loa aku ana ka nui po'e e hō'ea mai ana i ka pā'ina no laila, ho'i hou 'oe i ke kanaka hahai holoholona a 'ae 'o ia he 7 pua'a me 5 kalo no 14 i'a. Ua mana'o 'oe, ua pa'a nā mea e pono ai a ho'i i ka hale. Eia kā, he 4 wale pua'a e pono ai ma muli o ke kāpae 'ia o ka hō'ea mai o kekahī mau kānaka i ka pā'ina.

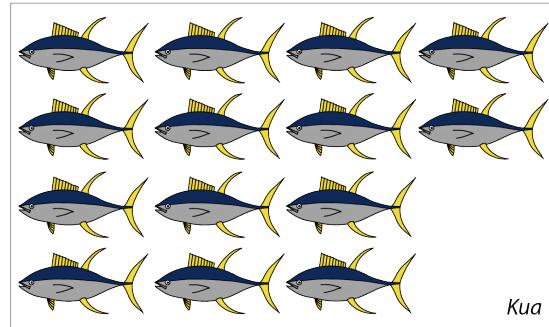
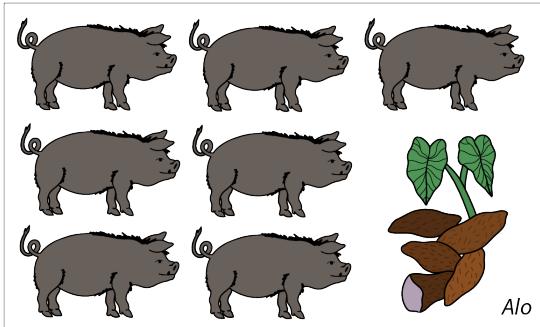
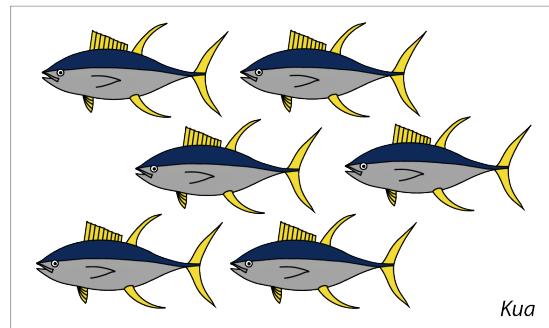
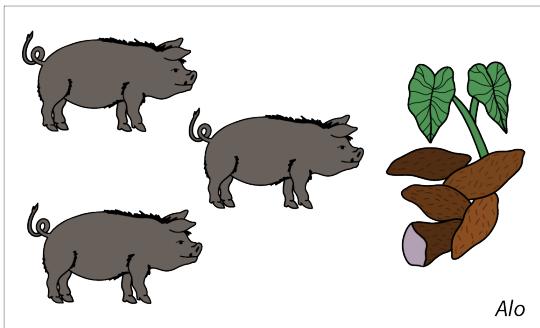
I 'ole e ho'opau manawa ma ka hele hou a wala'au me ke kanaka hahai holoholona, lawe pū 'oe i nā i'a i lawa no ke kālepa. E hō'ulu'ulu pū kākou i ka 'ike pili a hō'ike ma kekahī mau kāleka pahu.



Alo



Kua



Mai kēia mau kāleka, hiki ke kuapo 1 pua'a no 2 i'a 'oiai, pālua 'ia ka nui i'a no ho'okahi pua'a no laila, inā makemake 4 pua'a, pono e hā'awi aku i 8 i'a i ke kanaka hahai holoholona. E loa'a ana 5 kalo keu kekahi!

E haku 'oe i kekahi hana no kou mau hoapapa e hana ai, e kuhi ai lākou i ka waiwai pono no ke kālepa kūpono. 'A'ole pono ka pua'a me ka i'a, nāu nō e haku. E kuhi 'oe i ka mana'o o nā hoapapa no ka waiwai o nā mea. A laila, e no'ono'o ho'i, 'o wai ka hoapapa kūpono loa e lālepa pū ai.

Hanana 2.2: Ka Mākoi a me Ke Ko'a

'Ōlelo Mua:

He pilina ikaika loa ko nā kānaka Hawai'i me ka wai a me ke kai. Mālama nui lākou i ka wai 'oiai, mālama pū mai ka wai i nā kānaka. He mau i'a ka hapanui o ka 'i'o ma ka 'ai Hawai'i. Akamai nā Hawai'i i ka lawai'a 'ana. Ma kēia hana, e hana kākou i kekahi mākoi.

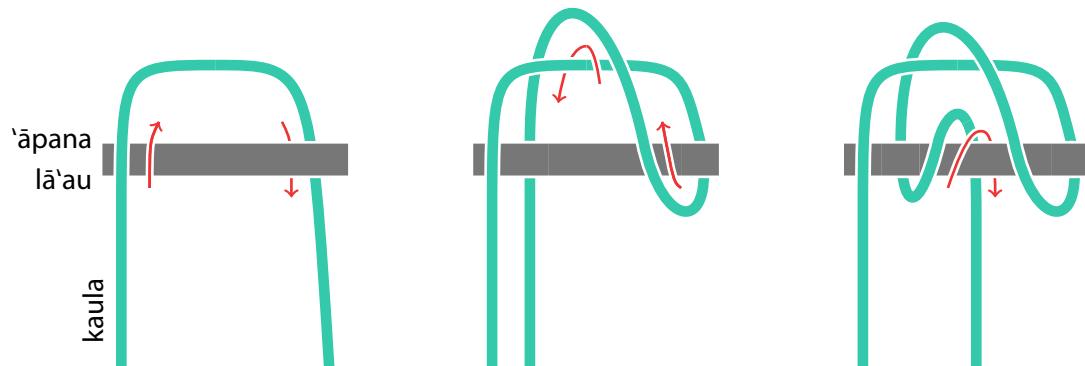
Nā Pono Hana:

1. He 'āpana lā'au, ma kahi o 5 kapua'i u ka lō'ihi
2. He kaula, ma kahi o 12 kapua'i ka lō'ihi
3. Ka leki (*duct a i 'ole masking*)

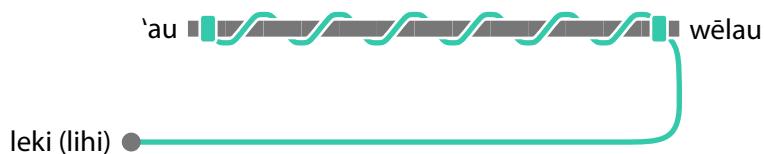
No ho'okahi wale nō haumāna kēia papa pono hana. E ana maika'i. Maika'i ka 'ohe ma ke 'ano he mākoi a hiki ke loa'a mai ka Hale kū'ai.

Hana:

E nāki'i i ka hīpu'u penei (ma lalo) no ka ho'opa'a i kekahi wēlau o ke kaula a i ke kumu ('au) o ka 'āpana lā'au.



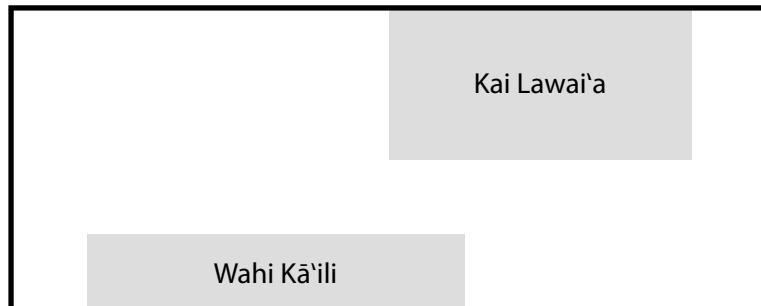
A laila, e wili i ke kaula mai ke kumu ('au) a ka wēlau o ka lā'au a koe 4 a 5 paha kapua'i kaula ma ka wēlau o ka 'āpana lā'au. E ho'opa'a i ke kaula ma ka wēlau o ka 'āpana lā'au me ka hīpu'u like, (aia nō ma luna). Pono e pa'a kūpono ke kaula i wili 'ia ma ka mākoi. Inā 'a'ole i pa'a kūpono, e wili hou i ke kaula a 'oi aku ka pa'a a e leki i nā hīpu'u i 'ole e hemo.



'O ka hope, e leki i kekahi wēlau o ke kaula a hana i "lihi" i 'oi aku kona nuipa'a.

Hiki i ka lawai'a mākaukau ke kā'ili i ka makau ma ke kai lawai'a me ka ma'alahi. 'O ia ho'i, 'a'ole i pa'a a i 'ole i moku ke aho. 'A'ole ho'i e hihia ke aho me kekai aho 'ē a'e.

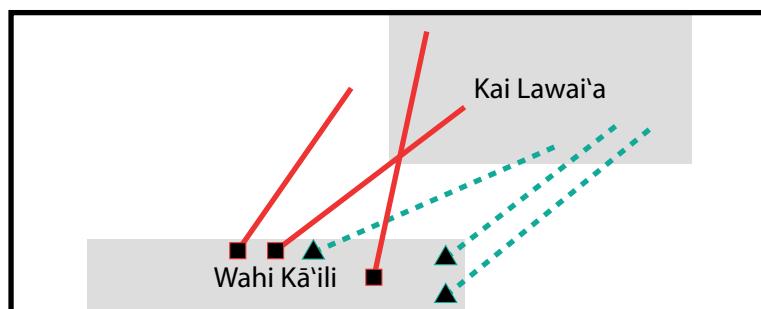
Me kēia hanana, e ho'oka'awale mua i nā haumāna a 'elua a 'oi kime. A laila, e māka ke kumu i kekahi māhele o ka papahēle he **Kai Lawai'a** a i kekahi māhele 'ē a'e o ka papahēle he **Wahi Kā'ili**.



Pono nā haumāna a pau e kā'ili aku i ke aho mai loko aku o ka Wahi Kā'ili. Ke 'ōlelo ke kumu e ho'omaka, e kā'ili aku nā haumāna i nā kaula i ke Kai Lawai'a. A hala **'elima kekona**, pono nā haumāna a pau e waiho i nā mākoi ma ka papahēle. Lilo ka 'ai i kekahi kime ke:

1. komo kekahi lihi i loko o ke kai lawai'a **a**
2. hihia 'ole ke aho me kekahi aho.

Eia ka la'ana!



Ma ke ki'i o luna, ua lilo 2 'ai i ke kime ▲ a 'a'ohe 'ai i ke kime ■ no kēia puni.

E pā'ani no kekahi mau puni a lanakila kekahi kime.

Na 'oukou nō ka ho'ololi i nā lāli'i no ka ho'nohonoho a kūpono no ka papa. He la'ana, hiki ke 'ae 5 a 'oi kekona no ke kā'ili aku me ka mākoi no ka haumāna i 'ano pupū. Hiki pū ke nui a li'il'i i ke kai lawai'a a me ka wahi kā'ili i nui a emi mai ka pa'akikī no kēia banana.

Nā Hanana o ka Mokuna 3



Hanana 3.1: Ke Kaua ma Ke Kai

'Ōlelo Mua:

'O Kamehameha Pai'ea ke kanaka mua i ho'ohui pū i ka pae 'āina o Hawai'i a aupuni mō'i. No ka ho'ohui 'ana i ka pae 'āina, pono e mākaukau ke alaka'i i ke alaka'ina i ka 'au moku wa'a kaua a pae i kahi o ka 'enemi me ke kaupale pū i nā 'enemi. Ma kēia hanana, e ho'ohana kākou i nā ha'ihehu lālani no ke kūpale i ko kākou kahakai mai ka hoapapa ho'ouka kaua.

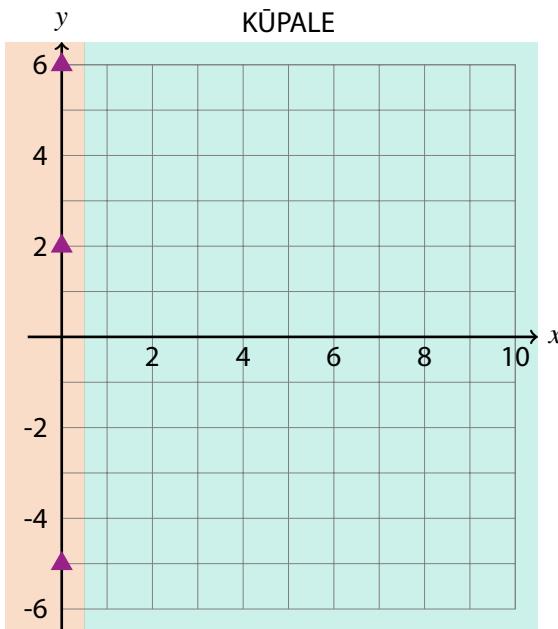
Nā Pono Hana:

1. Peni/Penikala
2. Pepa hakahaka

Hana:

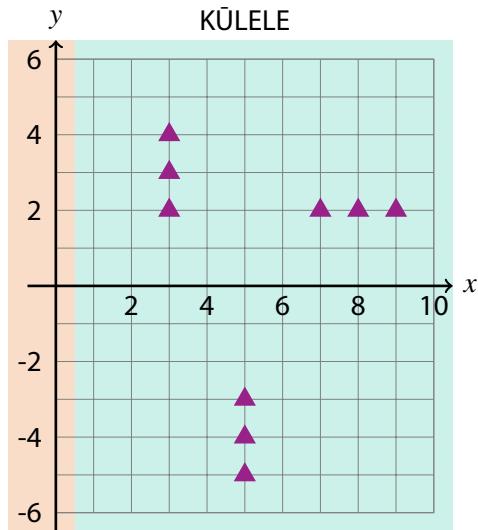
1. E 'imi i hoa paio a e pa'i i 'elua kope o ka papa pā'ani, ho'okahi nou a ho'okahi no ka hoa paio. Aia ka papa pā'ani ma ka hopena o kēia mau 'ōkuhi.
2. E noho ma kekahī wahi i hiki 'ole ke 'ike i ka papa pā'ani a ka hoa paio. E ho'okū paha i kekahī puke nui i waena ou a me ke hoa.
3. Hö'ike ka 'ao'ao KŪPALE i kou kahakau, a me kou mau kia'i a me ke kai āu e kūpale ai.
4. Ma ka 'ao'ao KŪPALE, e koho i 3 wahi ma ka iho-y no ka waiho i nā kīa'i. E māka i kēia mau wahi me kekahī huinakolu. Maka'ala: e ho'ohana i nā helu piha wale nō no nā wahi o kou mau kia'i (Maika'i 'o (0,2) a me (0,-3). 'A'ole 'o (0, 2.5)).

Lā'ana:



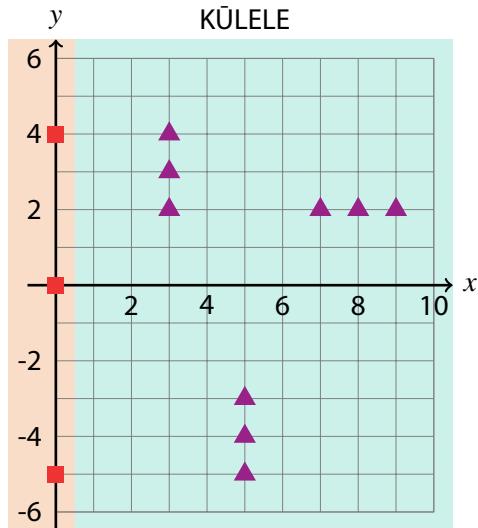
5. Hō'ike ka 'ao'ao KŪLELE i kahakai o ka hoa paio a me kahi āna e ho'ouna ai i nā wa'a kaua.
 6. Ma ka 'ao'ao KŪLELE, e koho i 3 wahī e waiho ai i 'ekolu wa'a kaua. Aia 3 koa ma luna o kēlā me kēia wa'a kaua pākahi no laila, pono e ho'olalani ma ka lālani a i 'ole e ho'olalani ma ke kolamu. E māka i nā wahi o nā koa me kekahī huinakolu. Mana'o: e like me ma mua, e ho'ohana i nā helu piha wale nō.

Lāana:



7. E ho'oka'a'i ke i nā wahi o nā kīa'i i ka hoa paio a e loa'a nā wahi o nā kīa'i o ka hoa paio iā 'oe. E māka i nā wahi o nā kīa'i o ka hoa paio ma kāu palapala 'āina KŪLELE me kekahī huinahā.

Lāana: Inā, aia nā kīa'i o ka hoa paio ma $y = -5, 0, \text{ and } 4$ e like ana ka nānā o ka palapala 'āina me kēia.



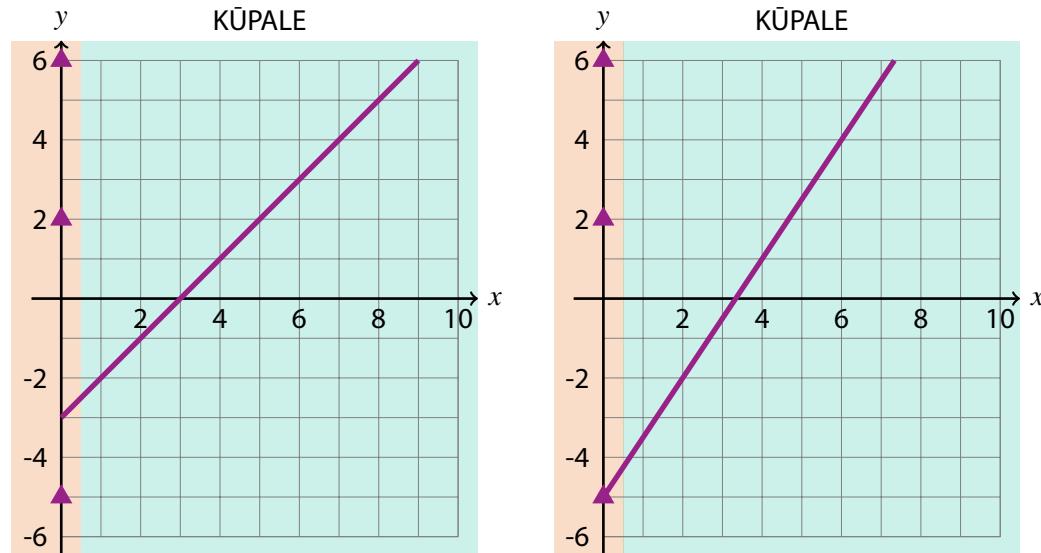
8. E janken po no ka 'ike i ka mua e hele. E māhele manawa ma ke kūpale i kou kahakai ma ke 'ō'ō ihe 'ana i ke kai i nā koa e ho'ouka kaua ana.
 9. **'O ka mea mua e pau ai nā koa o ka hoa paio ka lanakila.**

Ma kou manawa e 'ō'ō ihe ai:

1. E ha'i aku i kekahī ha'ihe lu lālani i hui me kekahī o nā kī'ai. Ma ia lālani e lele ai ka ihe.

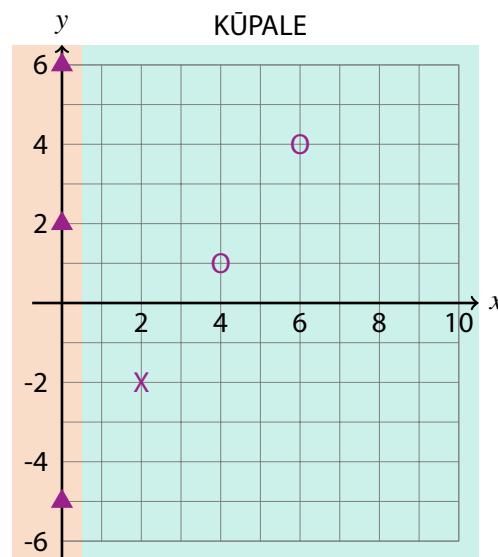
Lā'ana:

'A'ole 'o $y = -3 + x$ he ha'ihe lu lālani maika'i no ka mea, 'a'ole e hui ka lālani me kahī o ke kī'a'i no laila, 'a'ole i hiki i ke kī'a'i ke 'ō'ō aku i kāna ihe.



2. E nīnau aku inā aia kekahī mau koa ma nā wahi e hui ai ka lālani o ka ihe ma ka maka'aha. Inā hui, e māka i X ma ke KŪPALE a e māka i O inā 'a'ole hui.

Lā'ana: Hui wale nō 'o $y = -5 + \frac{3}{2}x$ ma ka maka'aha ma (2, -2), (4, 1), a me (6, 4). Inā 'ōlelo mai kou hoa paio, ua pā ke koa ma (2, -2), akā 'a'ole i pā ma (4, 1) a me (6, 4), a laila e māka e like me kēia.



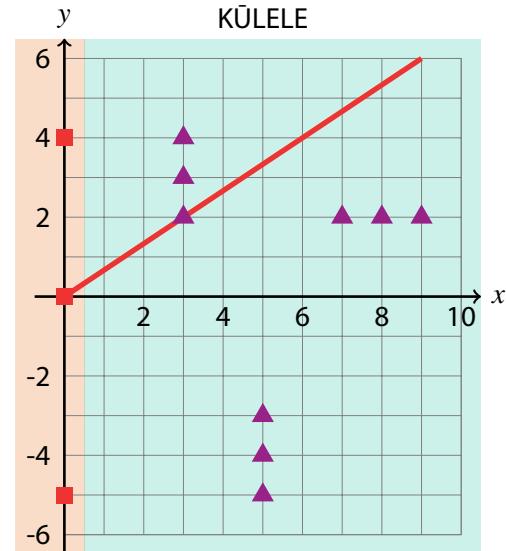
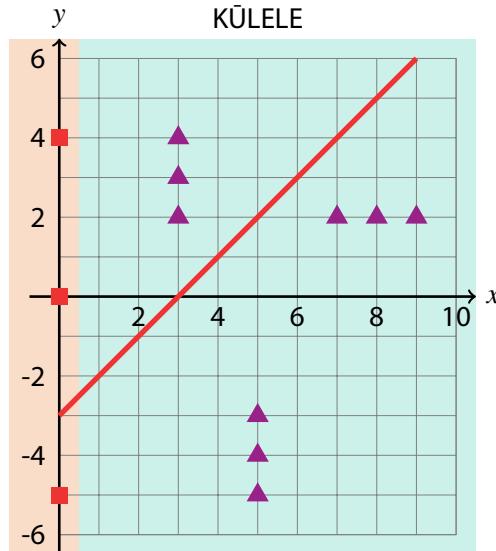
Ma ka manawa o ka hoa paio e 'ō'ō ihe ai:

1. E hō'ōia mua inā hiki ke 'ō'ō 'ia ka ihe. Inā 'a'ole, hala kona manawa.

Lā'ana:

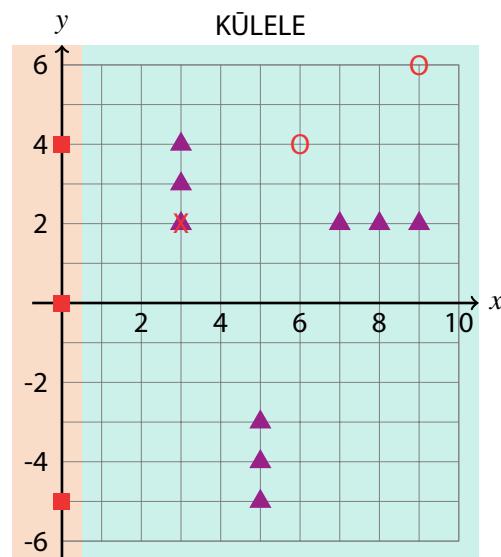
'A'ole 'o $y = -3 + x$ he ha'ihe lu lālani maika'i no ka mea, 'a'ole e hui ka lālani me kahi kīa'i no laila, 'a'ole hiki i ke kīa'i ke 'ō'ō i kēia ihe. No laila, hala kona manawa.

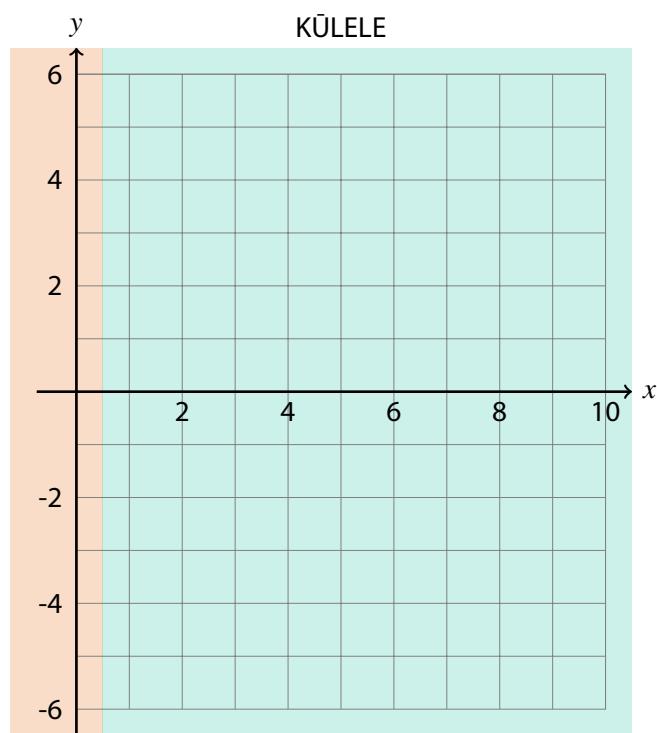
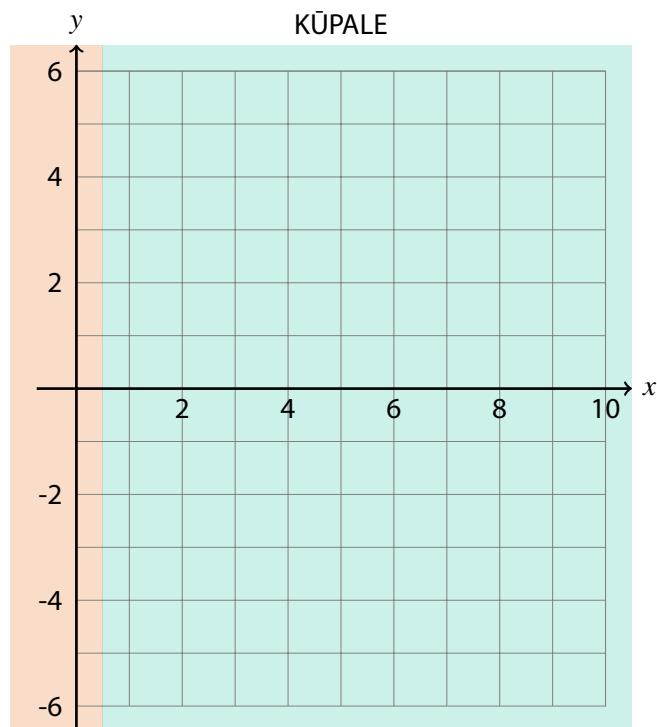
He ha'ihe lu lālani maika'i 'o $y = \frac{2}{3}x$ no ka mea, he lālani no ia, a hui ia me kekahi kīa'i a hiki i ke kīa'i ke 'ō'ō aku i kāna ihe. E ho'omau ka hoa paio.



2. E ho'oka'a'i ke ma ka hoa paio inā aia kekahi mau koa ma nā wahi e hui ai nā ihe ma ka maka'aha. Inā aia kekahi koa ma laila e māka i X ma kou KÜLELE a he O inā 'a'ohe.

Lā'ana: Hui wale nō 'o $y = \frac{2}{3}x$ ma ka maka'aha ma (3, 2), (6, 4) a me (9, 6). E 'ōlelo aku i ka hoa paio, ua pā ke koa ma (3, 2), akā 'a'ole i pā ma (6, 4) a me (9, 6), a laila e māka e like me kēia.



Ke Kaua ma Ke Kai: Papa Pā'ani

Nā Hanana o ka Mokuna 4



Hanana 4.1: He Lau Ali'i

'Ōlelo Mua:

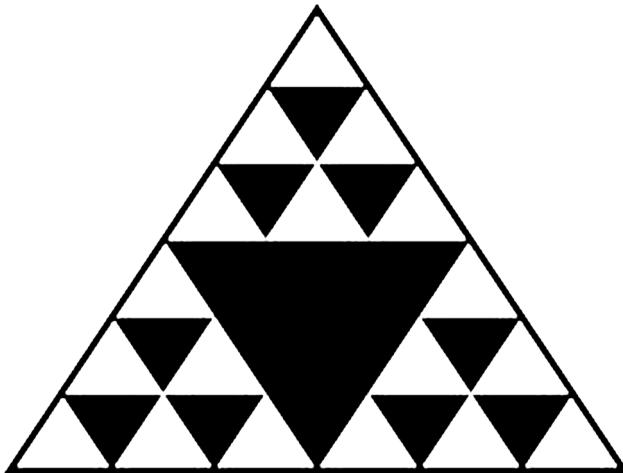
Makemake 'o Koa he 'ahu hou me kāna lau pono'ī. Ma kēia hanana, e 'ike nō i ka ho'onui 'ana i kāna ki'i li'il'i no ka ho'owehi 'ana i kona 'ahu.

Nā Pono Hana:

1. Peni kuni
2. Lula
3. 'Eke pepa māku'e (no kahi moena)
4. Leki

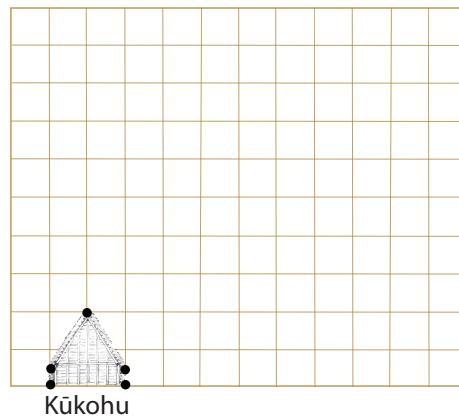
Hana:

Makemake 'o Koa e pākolu ka nui o kāna lau (ma lalo) a pa'i ma luna o kāna moena. E no'ono'o 'oe no ka ho'onui 'ana i kāna lau a pākolu ka nui ma luna o kona 'ahu.

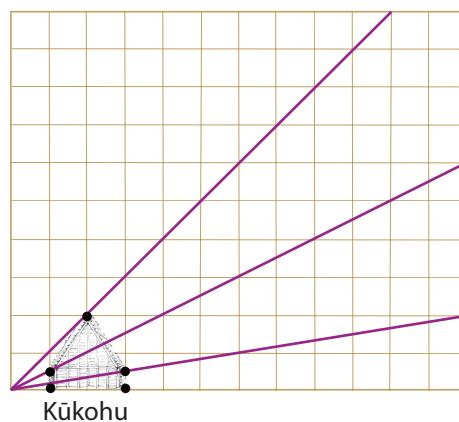


'A'ole maopopo iā Koa kāna hana e hana nei no laila, 'imi 'o ia i kona 'anakē i kōkua. He loea 'o 'Anakē Lani ma kēia 'ano hana, no laila kipa 'o Koa iā ia a nānā 'o Koa i ko 'Anake Lani ho'onui 'ana i kekahī ki'i (he hale) ma luna o kāna moena.

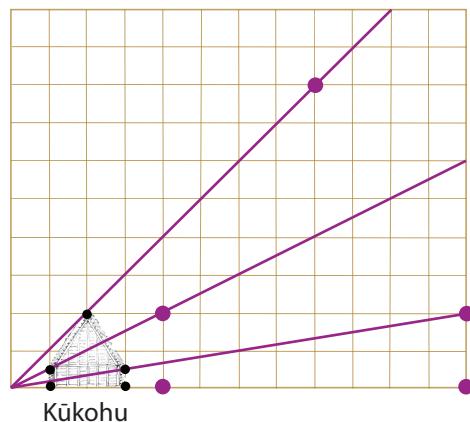
1. Koho 'o 'Anakē Lani i nā wahi ko'iko'i ma ke kūkohu, 'o ia nā kihi'aki. Kaha 'o ia i mau kiko ma luna o ia mau wahi ko'iko'i (nā kihi'aki).



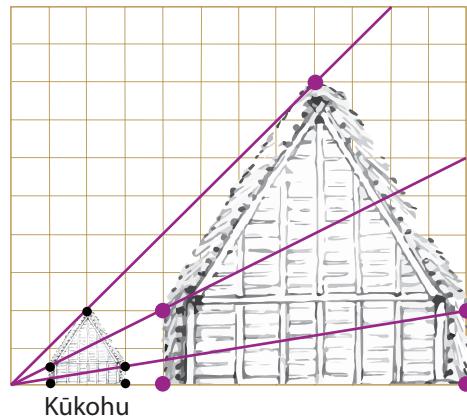
2. Ho'ohana 'o 'Anakē Lani i ke kaula no ke kaha 'ana i mau laina mai ke kumu ('o ke kū'ono o lalo ma ka hema) ma o nā wahi ko'iko'i 1.



3. Ho'one'e 'o 'Anakē Lani i nā wahi mai ka 'anu'u 1 ma nā aina mai ka 'anu'u 2 me ka maka'ala pono no ka pololei. *Enānā pono i ka ho'olālanī ia o nā kiko ma ka papakū a me ka papamoe.*



4. 'Oiai, a maopopo 'o 'Anakē Lani i ka hopena o nā wahi kūikawā, ma'alahi ka ho'opa'a i ke koena.



E ho'opili i ka hana ā 'Anakē Lani ma ka ho'onui 'ana i kā Koa lau ma luna o ka 'ahu. E 'oki i nā 'eke pepa māku'e i lawa ka papa no ke kaha ki'i 'ana a leki a lawa no ka 'ahu. E kau i ka lōkō ma ka hema o ka 'ahu 'eke pepa a e ho'onui. E ho'ā'o e pākolu ka nui ma ke kumu.

Hanana 4.2: Ka Waiata Poi

'Ōlelo Mua:

Ma Aotearoa, hana ka po'e Maori i kahi hana no'eau i kapa 'ia 'o Poi. He hula nani 'o Poi me kekahī kinipōpō ma kekahī kaula. Ho'ohana pū 'ia ka 'āpana lā'au i kekahī manawa.

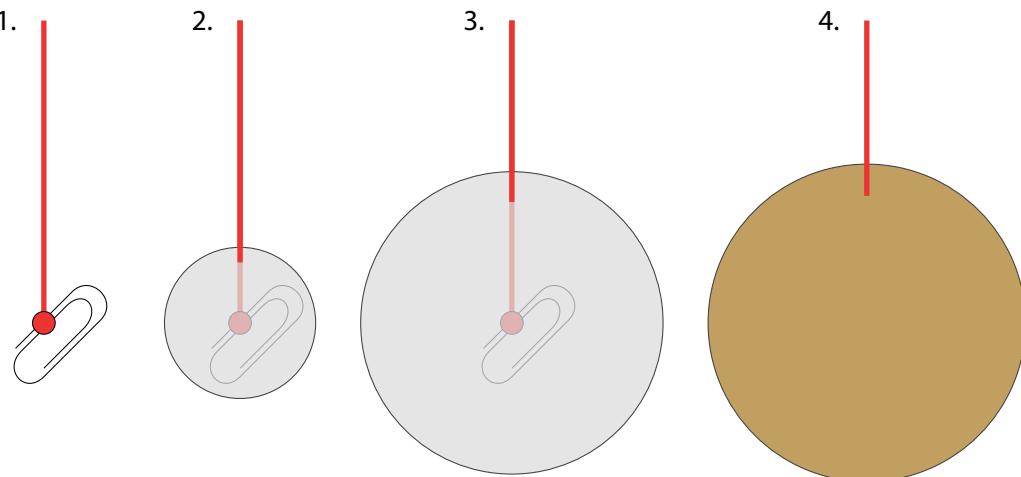
Nā Pono Hana:

1. Kaula mānoanoa (he lopi huluhulu paha)
2. 'Ūpā
3. 'Ūmi'i pepa
4. Ka pepa hakahaka he nui a i 'ole he nūpepa
5. Leki *masking*
6. Peni kuni

'O ka ma'amau, he iwilei ka lō'ihi o ke kaula ma ka pōpō Poi. Hiki ke 'eha i ka pōpō inā kā i ke kaula i kekahī haumāna. Inā he hopohopo ma ka lumi papa, e 'oki i 'āpana kaula pōkole no ka haumāna. Emi nui mai ka ikehu ke kā. 'A'ole holo kēia hanana me kekahī 'ano leki 'ē a'e. 'O a leki masking ka maika'i loa no kēia hanana.

Hana:

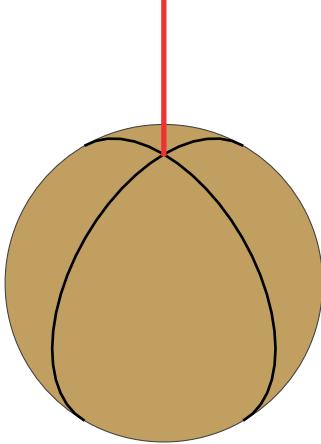
1. 'O ka mua, e ho'ohui i ka pōpō Poi i ke kaula. E nāki'i i hīpu'u nui a ikaika i ka 'ūmi'i pepa.
2. E ho'omaka i ka pōpō Poi ma ka nahae 'ana i ka pepa a e laulau a puni ka 'ūmi'i pepa.
3. Ke nui a'e ka pōpō Poi, hiki ke 'oi aku ka nui o nā 'āpana pepa i nahae 'ia. E ho'omau a like ka nui me 'elua pu'upu'u lima e pili pū ana.
4. Ke lawa ka nui o ka poepoe poi, e uhi me ka leki *masking*.



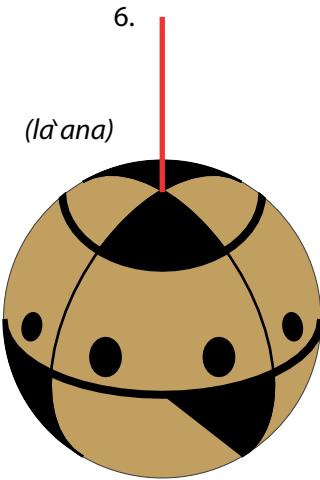
5. E kaha ki'i i 'elua pō'ai ma ka pōpō Poi, e like me ke ki'i 5 ma lalo nei. E hō'opia i ka hui 'ana o nā pō'ai ma ke kaula ma ma luna, a ma ka hulina alo o ke kaula ma lalo. E ka'awale ana ka poepoe poi ma 'ehā māhele e like me ke 'oki 'ana i kekahi 'alani.

6. Me ka ho'ohana 'ana i nā pō'ai ma ke 'ano he alaka'i, e kaha ki'i i nā lau me nā peni kuni! E kaha i nā laina a me nā kinona a lilo he lau. E ho'ohana i ka translation, rotation, ke aka aniani, a me ka ho'ohui ke hiki.

5.



6.



Nā Hanana o ka Mokuna 5



Hanana 5.1: Ke Kūkulu Hō'opia o ka Mana'oha'i 'o Paekakoleo

'Ōlelo Mua:

Pa'akikī ka loa'a o nā pono kūkulu hale ma ka moana Pākīpika. He pōmaika'i na'e ka 'ike a ka po'e Pākīpika i ka ho'ohana i nā mea mai ko lākou 'āina. I la'a me kēia, kūkulu ka po'e Maikonekia i ka wa'a nui me ka humu a nāki'i 'ana i nā 'āpana lā'au li'il'i a pa'a. Ulana ka po'e Hawai'i i nā lau li'il'i i nā moena nunui a me nā pe'a wa'a. Ma kēia hanana, e a'o kākou i ka ho'onui i kekahi huinahā like ma o ka ho'ohana i 'elua huinahā like li'il'i me ka 'uha'uha 'ole i nā pono. E a'o pū kākou i ka Mana'oha'i 'o Paekakoleo.

Nā Pono Hana:

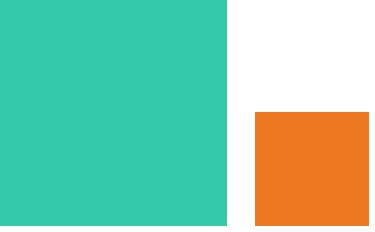
1. 2 'Āpana pepa, he huinahā ke kinona, 'oko'a ka nui
2. Penikala/Peni
3. Lula
4. Leki
5. 'Ūpā

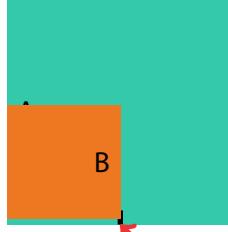
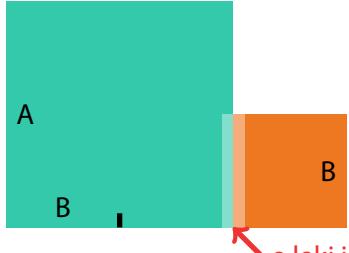
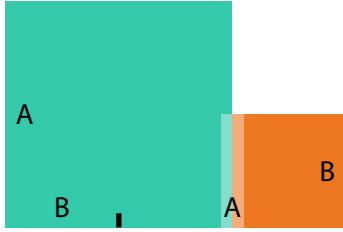
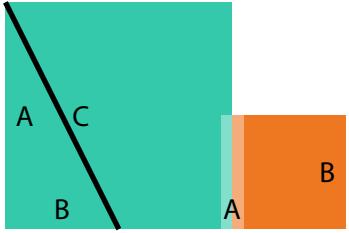
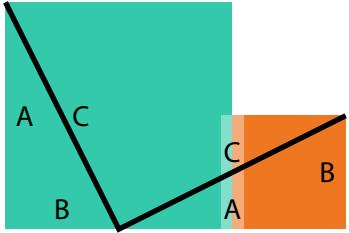
'O ka pa'akikī o kēia hanana, 'o ia ka lawe i 'elua huinahā, e 'oki'oki a e leki a loa'a ho'okahi huinahā nui. Pono e like ka 'ili o ka huinahā hope me ka huinanui o nā huinahā mua 'elua, 'o ia ho'i, 'a'ohe hakahaka, 'a'ohe 'āpana kaulapa a 'a'ohe pepa ho'ohana 'ole 'ia. E aho ka hana mua ma ke ka'awale ma mua o ka nānā i ka hā'ina ma lalo.

Hana:

Wehewehe kēia Mana'oha'i 'o Paekakoleo inā 'o A, B, me C nā lō'ihī o ka huinakolu kūpono, a 'o C ka lō'ihī o ka lala kūpono, a laila $A^2 + B^2 = C^2$. E hō'opia kākou i kēia hanana.

1. 'O ka mua, e hana i 'elua huinahā. 'O A ka lō'ihī o nā 'ao'ao o ka huinahā nui, a 'o A^2 kona 'ili. 'O B ka lō'ihī o nā 'ao'ao o ka huinahā li'il'i, a 'o B^2 kona 'ili.
2. A laila, e hana i huinakolu kūpono me ka lō'ihī o nā 'ao'ao A, B, a me C a 'o C ka lō'ihī o ka lala kūpono.
3. A laila, e 'oki i nā huinahā 'elua a e leki hou a pili a loa'a ho'okahi huinahā nui me ka 'ili C^2 .

'Anu'u 1: E 'oki i nā huinahā 'elua. 'A'ole pono e 'oko'a ka nui akā, 'oi aku ka hoihoi o kēia hana inā 'oko'a.	'Anu'u 2: E lepili i ke 'ao'ao hema o ka huinahā nui 'o A a me ka 'ao'ao 'ākau o ka huinahā li'il'i 'o B.
	

<p>'Anu'u 3: E ho'ohana i ka huinahā li'il'i e māka ai iā lalo o ka huinahā nui he B ka lō'ihi mai ka 'ao'ao hema.</p>	<p>'Anu'u 4: E lepili i kēia lō'ihi B.</p>
 <p>e māka iā 'ane'i</p>	
<p>'Anu'u 5: Eleki i ka 'ao'ao hema o ka huinahā li'il'i iā lalo o ka 'ao'ao 'ākau o ka huinahā nui.</p>	<p>'Anu'u 6: E lepili i ka lō'ihi ma waena o ka māka a me ka 'ao'ao 'ākau o ka huinahā li'il'i A. E kūkākūkā me nā hoapapa no ka hō'opia i ke kumu no ka lō'ihi o A.</p>
 <p>e leki iā 'ane'i</p>	
<p>'Anu'u 7: Kūpono nā ka'e A a me B ma ka 'ao'ao hema a hiki ke ho'ohana i ka lula no ke kaha 'ana i ka lala kūpono C.</p>	<p>'Anu'u 8: Kūpono nā ka'e A a me B ma ka 'ao'ao hema no laila, hiki ke ho'ohana 'ia ka lula no ke kaha 'ana i kekahi kūpono C. E kūkākūkā me nā hoapapa no ka hō'opia i ke kumu o ka like 'o C me ka mea ma mua.</p>
	

<p>'Anu'u 9: I kēia manawa, e 'oki ma nā lālā kūpono a loa'a 'elua huinakolu kūpono.</p>	<p>'Anu'u 10: E ho'ohana i ka <i>translation, rotation</i>, a me ke aka aniani no ka ho'one'e i nā huinakolu a loa'a kekahi huinahā nui. Nui nā hana e hana ai no ka loa'a o kēia.</p>
<p>'Anu'u 11: E leki i nā 'āpana.</p>	<p>'Anu'u 12: Ua pa'a! Ua ho'omaka me 'elua huinahā me nā 'ili A^2 a me B^2.</p>

He aha ka 'ili o ka huinahā hope loa? He aha ka pilina o kēia 'ili me nā 'ili o nā huinahā mua?

Hanana 5.2: Ka 'Upena Paekakoleo

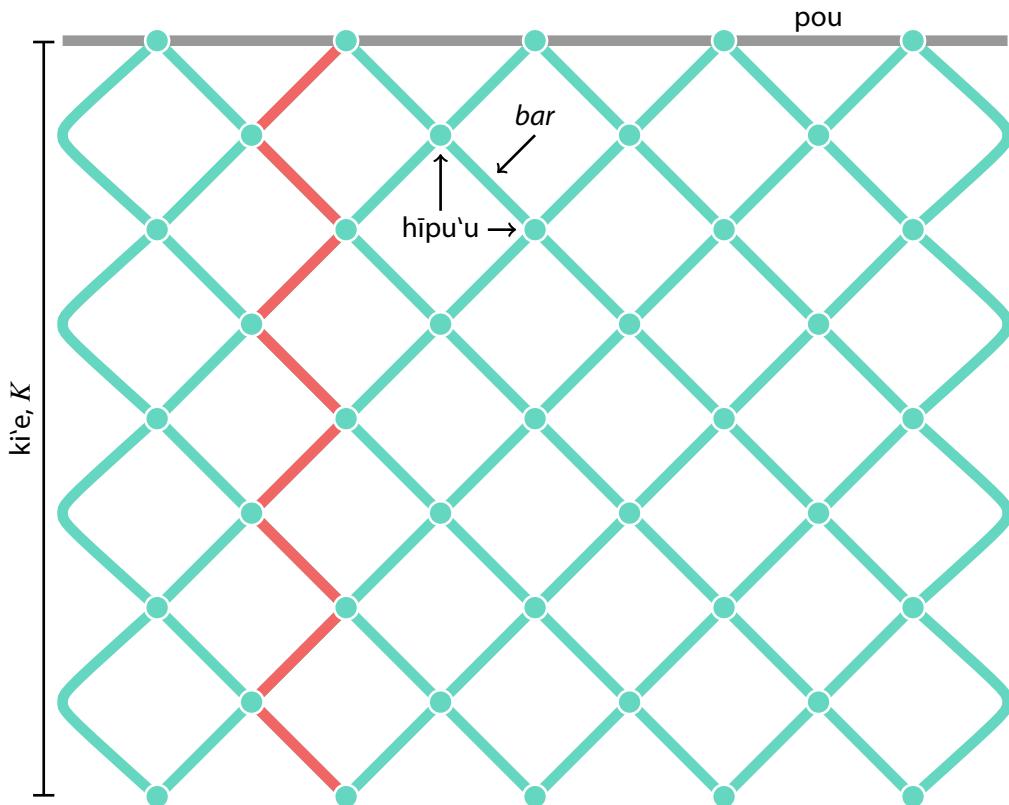
Nā Pono Hana:

1. Kaula
2. 'Ūpā
3. Lula
4. Pou 'ea a i 'ole he lā'au lō'ihi

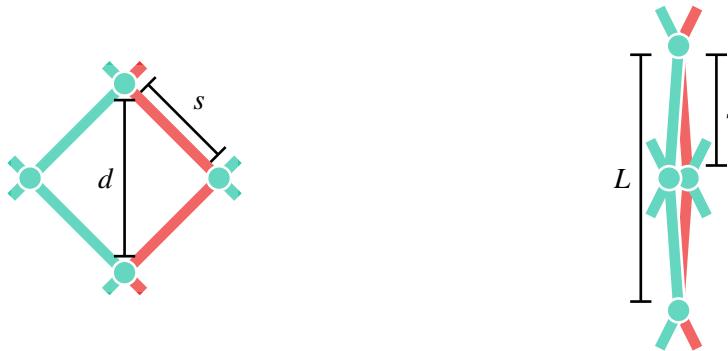
Hana:

Ke kā nei 'o Ku'ulei i 'upena. Maopopo iā ia kona makemake no ka lō'ihi o ka 'upena a me ka nui o kēlā me kēia maka*. 'A'ole 'o ia makemake e 'uha'uha i ke kaula a i 'ole e kaulike 'ole nā hīpu'u. Me kekahi hoaaloa a i 'ole ma ka hui a me ka 'ike no nā huinakolu a me nā helu pu'unaue, e kōkua iā Ku'ulei ma ka ho'olālā i ka lau 'upena.

Ma ke ki'i ma lalo, kaula'i 'ia ka 'upena mai ka pou. 'Oi aku ka ma'alahi o ka humu/nāki'i i ka 'upena a pa'a. Kā 'ia ka 'upena i ia mau kaula pa'a i ka pou. Hō'ike 'ia kekahi hapa o ho'okahi kaula ma ke ki'ikuhi a 'ula'ula. He mau **hīpu'u** me nā **bars**. Like nō ka lō'ihi o nā *bars*, s, a 'o *K* ke ki'e o ka 'upena.



I loko nō o ka maopopo i ka lō'ihi o nā bars , hiki ke pa'akikī ka huli a loa'a ke ki'e. Ma ka māmā a hakahaka 'ana o ka 'upena, laulā a hāmama nā maka a 'o ka lala d ke ki'e o kēlā me kēia maka. Ma ka piha a kaumaha 'ana o ka 'upena i ka i'a, mālo'elo'e nā kihi o kēlā me kēia maka a pani. Ma ke pani 'ana o nā maka, kapa 'ia ke ki'e o ka maka he "eye length", L .



1. Pololei me ka 'oia'i'o nā ha'ihielus o lalo. E kūkākūkā me ka hoaaloha a e wehewehe aku.

$$\text{Ka 'Upena Māmā: } d = \sqrt{2} \times s$$

$$\text{Ka 'Upena Kaumaha: } L = 2 \times s$$

Hiki iā 'oe ke kākau i ka wehewehe ma 'ane'i inā makemake. Ho'ākāka paha ke koena o kēia hanana ma hope.

Ma ka 'upena māmā, he huinakolu kūpono nā lō'ihi 'ekolu, 'o ia nā bar-length 'elua (s) a me ka lala, 'o d , 'o ia ho'i ka lala kūpono o ka huinakolu kūpono. Hō'ike mai ka Mana'oha'i 'o Paekakoleo i ka ha'ihielu mua.

Ma ka 'upena kaumaha, ho'omālo'elo'e 'ia nā kihi o nā maka a pa'a. A laila mai ka loa'a o ka lālani he 'elua 'ao'ao o ka lō'ihi s , 'o ia ho'i ka ha'ihielu 'elua.

2. No laila, 'o ke ki'e o kēlā me kēia maka, 'o d ka li'ililoa, a 'o L ka nui loa. 'O ke ki'e o ka 'upena holo'oko'a, 'o $d \times n$ ka li'ililoa, a 'o $L \times n$ ka nui loa, ina loa'a he n maka mai ka pou a iho pololei i lalo.

E kūkākūkā me kekahī hoapapa no ka wehewehe i ka pololei o kēia mau kaulike 'ole.

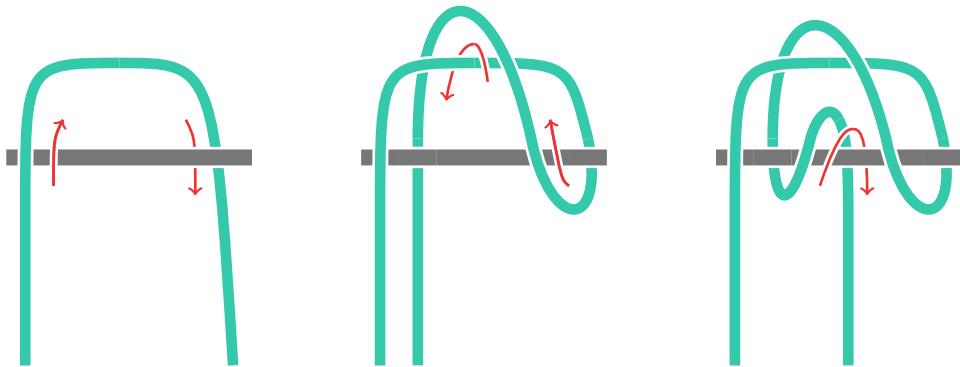
$$K \geq \sqrt{2} \times s \times n$$

$$K \leq 2 \times s \times n$$

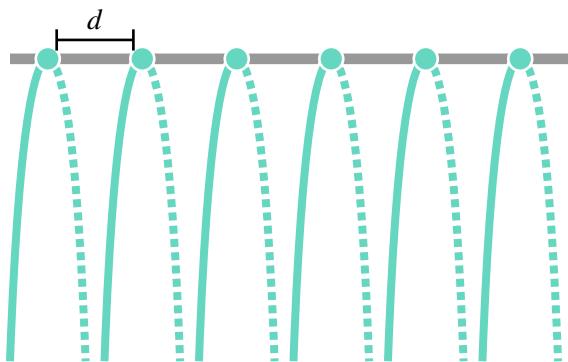
3. Makemake 'o Ku'ulei i 'upena he 5 kapua'i ke ki'e. Makemake pū 'o ia he 3 'iniha nā 'ao'ao o nā maka. He aha kekahī heluna maika'i o nā maka n mai luna a lalo? (He laulā nā hā'ina).

Ma ka 'iniha, $K = 60$ a $s = 3$. No laila, ke huli la loa'a, he $10 \leq K \leq 14.142$. He koho maika'i kekahī helu piha mai ka 10 a i ka 14 no n .

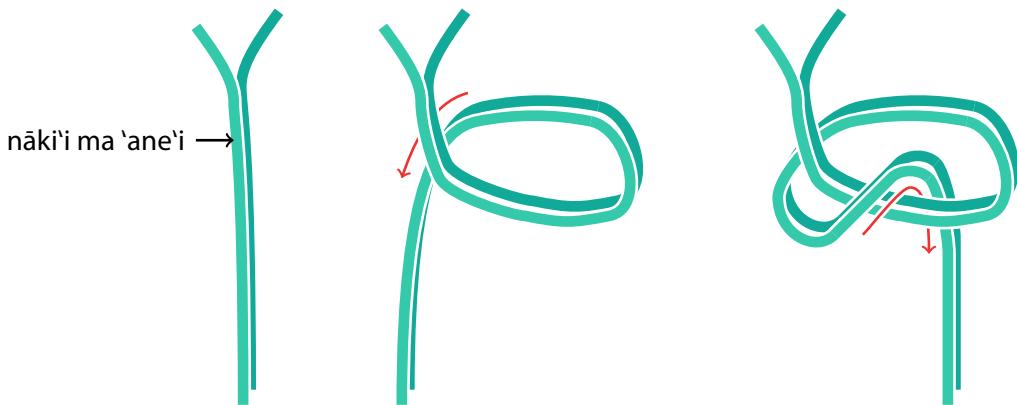
4. Ua loa'a nō iā Ku'ulei ke kōkua ma ka haku 'ana i lau no kāna 'upena, no laila, e kā kākou i kā kākou 'upena pono'i. E ki'i aku i ka pou a i 'ole ka lā'au lō'ihi a e 'oki i kekahī mau 'āpana kaula no ka nāki'i 'ana. Nāu nō ka huli a loa'a ka lō'ihi o kēlā me kēia 'āpana. Aia a koho 'ia 'o H a me s, a laila hiki ke huli a loa'a nā mea 'ē a'e. Hō'ike ke ki'ikuhi o lalo i ka nāki'i 'ana i ke kaula i ka pou.



E nāki'i i kēia hīpu'u ma waenakonu o ke kaula a e ho'oka'awale ma ka lō'ihi d ma ka pou. 'O d ka lō'ihi o ka lala o nā maka e makemake ai.

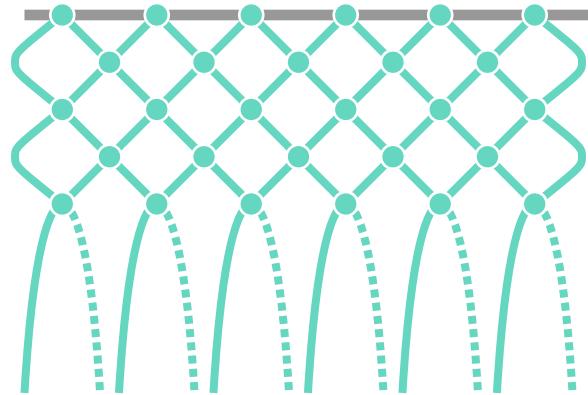
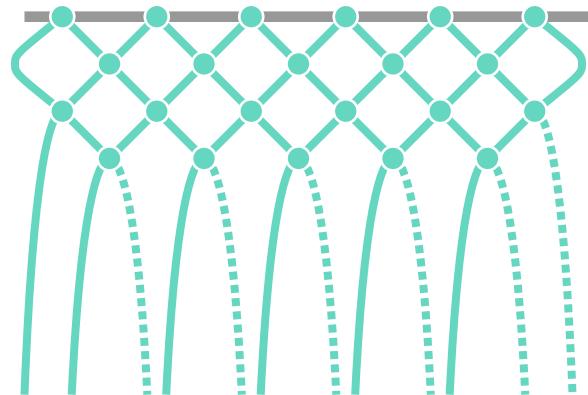
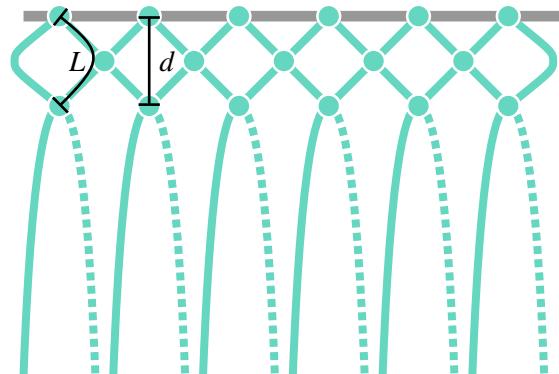
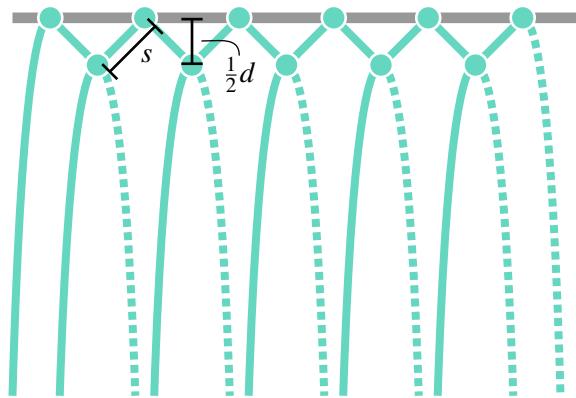


E ho'opili i nā kaula 'elua a nāki'i kekahī me kekahī no ke kā 'upena. Penei e nāki'i ai.



E ho'omau i ka nāki'i 'ana i nā kaula he ho'okahi lālani o ka manawa. E ana me ka maiau, i ma'ema'e ka hopena. Hiki ka ana 'ia nā maka a i 'ole nā kaula; nāu ke koho.

Ke pa'a kēia hana, e wehe i nā hīpu'u mai ka pou.



Nā Hanana o ka Mokuna 6



Hanana 6.1: Ka Wa'a i Pa'i 3D 'Ia

Nā Pono Hana:

1. Mīkini Pa'i 3D

Hana:

E aho ka ho'ā'o i kēia hanana ma ka hopena o ka makahiki kula. E ho'ohana 'ia ana nō nā mea a pau i a'o 'ia ma kēia makahiki. E hana i kēia me nā hui hoapapa. E wala'au kekahī me kekahī no nā nīnau a me nā hā'ina. Hiki ke huikau nā nīnau, e aho na'e ke alu like kekahī me kekahī a kō piha 'ole nā nīnau ma mua o ka hana ho'okahi me ke kūkākūkā 'ole.

No nā kula hoa kapanā o Ne'epapa Ka Hana, e kāhea mai no ke kōkua me ka pa'i 3D.

'Ōlelo Mua me nā Mana'o o nā Mokuna:

Ma kēia hana, e hakulau kākou i wa'a i kūpono ka nui no 'eono hoe wa'a. A laila, e pa'i 3D a e kūkulu i ke kūkohu wa'a.

E ho'ohana i ke anakahi mekalika no kēia hana. 'Oi aku ka maiau o nā helu me nā anakahi ma kēia 'ōnaehana mekalika ma mua o ke anakahi 'Amelika. 'O kēia ke kumu o ka ho'ohana "ana i kēia anakahi mekalika e ko ka honua a me nā akeakamai.

Ana	Anakahi Mekalika	Anakahi 'Amelika
Lō'ihi	Mika (m)	Kapua'i (ft)
Māmā Holo	Mika o ke kekona (m/s)	Kapua'i o ke kekona (ft/s)
Ho'ohikiwawe	Mika o ke kekona pāho'onui lua (m/s ²)	Kapua'i o ke kekona pāho'onui lua (ft/s ²)
Nuipa'a	Kilokalame (kg)	Paona (lb) – kekahī manawa
Kaumaha	Newton (N)	Paona (lb) – kekahī manawa

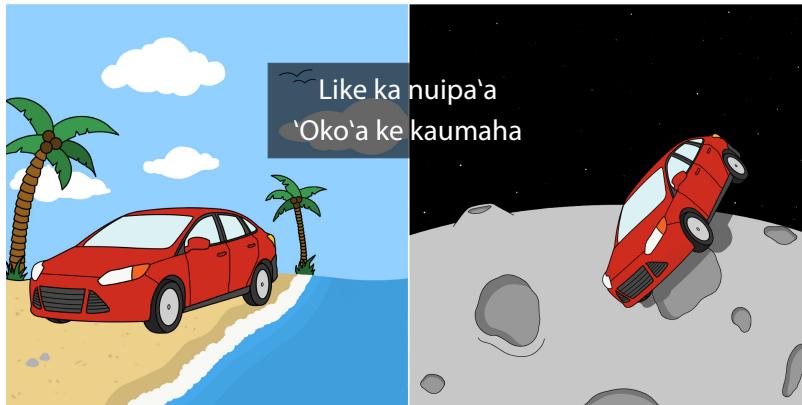
Māhele 1: Ke Kaumaha o ka Wa'a

Eia kekahī pakuhi papa o nā hoe wa'a 'eono me ko lākou kaumaha.

Inoa	Nuipa'a
Keola	90 kg
Jim	92 kg
Lehua	76 kg
Jaime	67 kg
John	80 kg
Kapono	78 kg

Ma ke anakahi 'Amelika, ua like nō ke kaumaha me ka nuipa'a. 'O ka 'oia'i'o na'e, he 'oko'a. He ana ka nuipa'a i ka "nui" o kekahī mea a he ana ke kaumaha i ke "kaumaha" o kekahī mea. I la'a me kēia, he mau mekala, he laholio, a he kakalina ko ke ka'a no laila, nui kona nuipa'a. Pa'akikī

ka ho'olewa 'ana i ke ka'a no laila, nui pū kona kaumaha. E no'ono'o no kēlā ka'a ho'okahi ma ka mahina. Ua like nō nā makelia o ke ka'a, he māmā loa na'e i kēia manawa no ka mea 'u'uku ka 'umekaumaha. No laila, ma ka mahina, ua like ka nuipa'a a kokoke na'e i 'ole ke kaumaha. No ka hapanui o nā kinona, loli ke kaumaha a pa'a na'e kona nuipa'a.



'O ka manaehu, 'o ia ka nuipa'a × ka ho'ohikiwawe, a 'o ka Newton ke ana o ka nuipa'a. $1 \text{ kg} \times \text{m/s}^2 = 1 \text{ Newton}$. Inā mai ka 'umekaumaha mai ka ho'ohikiwawe, kapa 'ia ka manehu 'o "kaumaha".

No ka loa'a o ke kaumaha o ka wa'a, 'o ka hikiwawe i ka 'umekaumaha he $g \text{ m/s}^2$. 'A'ole pono e 'ike i ka waiwai helu no g ma kēia hana no laila, 'a'ole e ho'olaha 'ia ana, hiki na'e ke 'imi ma ka punaewelege inā makemake. Eia 'o **kaumaha** = **nuipa'a × g**.

Inā hakahaka ka wa'a, e ho'omaopopo 'ia, he 'ole kona nuipa'a. Inā he 'ole ka nuipa'a o ka wa'a hakahaka, 'ehia ka nui **kaumaha** o ka wa'a me nā hoewa'a 'eono ma luna?

Kōkua: Aia nō 'o g ma ka hā'ina.

$$\begin{aligned}\text{Huinanui Nuipa'a} &= 90 \text{ kg} + 92 \text{ kg} + 76 \text{ kg} + 67 \text{ kg} + 80 \text{ kg} + 78 \text{ kg} \\ &= 483 \text{ kg} \\ \text{Huinanui Kaumaha} &= 483 \text{ kg} \times g \frac{\text{m}}{\text{s}^2} \\ &= (483 \times g) \text{ N}\end{aligned}$$

Mana'o: Ma hope ma kēia hana, kāpae 'ia 'o g a 'o ia ke kumu 'o ka pono 'ole o kona waiwai. Eia nō na'e, hiki ke huikau nā haumāna ma ka ho'omau 'ana. No kēlā mau haumāna, e hā'awi aku i ka waiwai helu ' $g \approx 9.8 \text{ m/s}^2$ '. Inā ke ho'ohana 'ia nei kēia waiwai no g , a laila he 4733.4 N ke kaumaha. E ho'ohana iā 9.8 m/s^2 ma kahi o g no ka ho'onōhie i kēia hana me ka ho'olauna pū i ka 'alimakika.

Māhele 2: Ka Nui Wa'a ma ka Li'iili'i i Hiki

E huli kākou a loa'a ka palena iki o ka nui o ka wa'a e kau ai nā hoe wa'a 'eono.

- a. E mahu'i mai, 'a'ohe kanaka e noho ma nā wēlau o ka wa'a a he 0.75 mika ka lō'ahi o nā wēlau 'elua pākahi. Noho kēlā me kēia hoe wa'a ma ka wa'a ma kekahī lālani pololei, a pono kēlā me kēia hoe wa'a he 0.5 mika no ka noho 'olu'olu. Inā 'o p ka nui hoe wa'a ma ka wa'a, e kākau i ha'ihe lu no L , 'o ia ho'i ka palena iki o ka nui o ka wa'a.



$$L = 0.5p + 1.5$$

- b. Makemake kākou e hakulau i wa'a no 'eono hoe wa'a, 'ehia ka palena iki o ka lō'ahi o ka wa'a? (E ho'ohana i ka ha'ihe lu mai ka māhele a.)

$$\begin{aligned} L &= 0.5p + 1.5 \\ &= 0.5(6) + 1.5 \\ &= 3 + 1.5 \\ &= 4.5 \end{aligned}$$

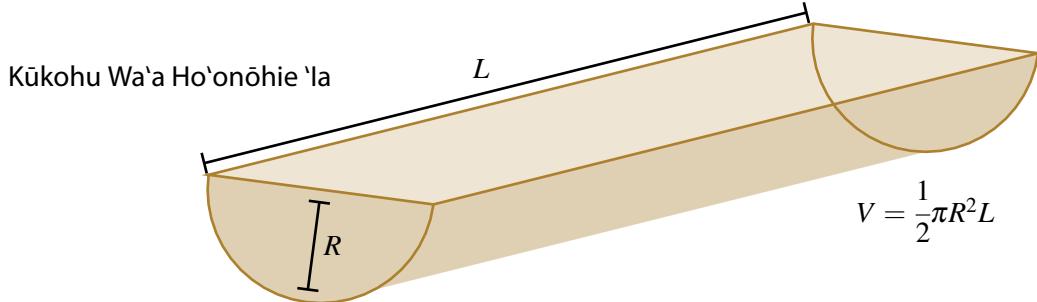
Pono he 4.5m ka palena iki o ka nui o kahi wa'a no nā hoe wa'a 'eono.

- c. E 'imi kākou i ka hohonu a me ka laulā ma hope. No kēia manawa, he x mika ka hohonu. 'A'ole kākou makemake e laulā loa a hāiki loa ka wa'a no laila, ma waena o x me $2x$ mika ka laulā. E ho'ohana i ka hā'ina mai ka māhele 2b no ka ho'opihapiha i kēia pakuhī.

Nui	Ana (mika)
Lō'ahi	4.5 a 'oi
Laulā	Ma waena o x a me $2x$
Hohonu	x

Māhele 3: Ke Kūkohu 'Ana i ka Wa'a

He aha ka pihanahaka o ka wa'a? 'Oiai 'a'oke o kākou ha'ihielu no ka pihanahaka o ka wa'a e ho'ohana kākou i kekahī ha'ihielu e hō'ike i ka pihanahaka o kekahī kinona 'ane like, 'o ia ho'i ka hapalua o ka paukū 'oloka'a. Inā 'o L ka lō'ihi a 'o R ke kahahānai o ka paukū 'oloka'a, 'o $\pi R^2 L$ kona pihakanaka. No laila, 'o $V = \frac{1}{2} \pi R^2 L$ ka pihanahaka o ka hapalua o ka paukū 'oloka'a.



- a. He aha ka ha'ihielu pihanahaka ke kuapo 'ia 'o R me ka hohonu, a kuapo 'ia L me ka lō'ihi kūpono?

Kōkua:

Maopopo paha iā x ?

Pono e ho'ohana i ka palena iki o ka lō'ihi?

Hiki ke kuapo 'ia 'o R me x a me L me 4.5 a 'oi a'e. No laila, $V = \frac{1}{2} \pi x^2 (4.5)$ a i 'ole $V = 2.25 \pi x^2$.
 Hiki ke loa'a nā hā'ina he nui ma ka ho'onui 'ana i ka waiwai no L . I la'a me kēia, maika'i 'o $V = \frac{1}{2} \pi x^2 (5)$, 'a'ole na'e maika'i 'o $V = \frac{1}{2} \pi x^2 (4)$.

- b. 'O ka pololei, 'a'ole ke kinona o ka wa'a he paukū 'oloka'a, ua kokoke na'e. He aha nā kinona 'ē a'e nona ka ha'ihielu pihanahaka? Maika'i a maika'i 'ole paha kēia mau kinona ma mua o ka paukū 'oloka'a?

'A'ole kūpono nā pa'a'iliono a me nā poepoe ma ke 'ano he kinona no ke kūkohu wa'a.
 Kūpono paha ka 'ōpaka huinakolu ma ke 'ano he kūkohu.

- c. Inā 'oi aku ka maika'i o kekahī kinona ma mua o ka paukū 'oloka'a, nāu nō e ho'ohana.

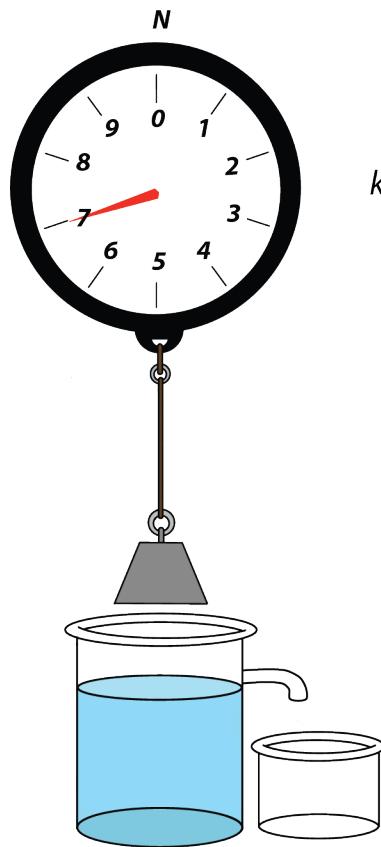
Māhele 4: Manehu 'Ālana a me Ke Kulehana a 'Akimika (Archimedes' Principle)

Pono e hō'opia no ka lana o ka wa'a. No kēia, pono e a'o no ka 'ālana a me ke kulehana a 'Akimika.

- a. E 'imi ma ka pūnaeweple no ke kulehana a 'Akimika. He aha kāu i a'o mai ai? He aha nā mea i huikau iā 'oe no ke kulehana a 'Akimika? E ho'oka'a'ike a e kūkākūkā me ka papa.

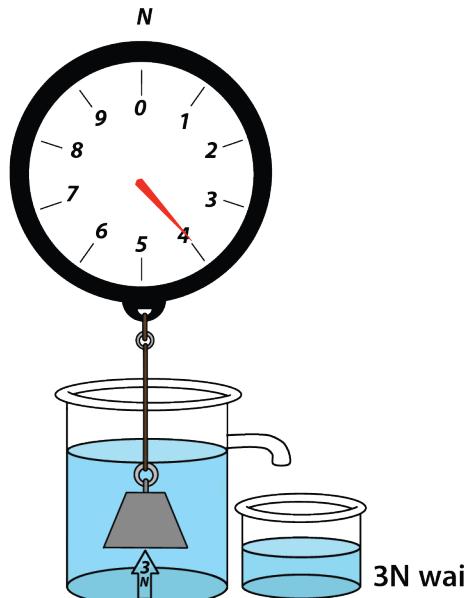
E 'oko'a ana nā hā'ina ma waena o nā haumāna. Wehewehe 'ia ke kulehana a 'Akimika ma lalo.

E nānā i ka la'ana mua i ke ki'i. Loa'a kekahi mea 7N o ke kaumaha, ke lewa nei. Ke ho'olu'u 'ia kēlā mea i ka wai, pohupani 'ia ka wai a hanini mai loko mai. He 3N ke kaumaha o ka wai i pohupani 'ia a he 4N ke kaumaha o ka mea. **He manehu pahu iho ke kaumaha a he manehu ho'olana a'e ka 'ālana**, a wehewehe mai ke kulehana a 'Akimika, like ka manehu 'ālana i ke kaumaha o ka wai i pohupani 'ia.



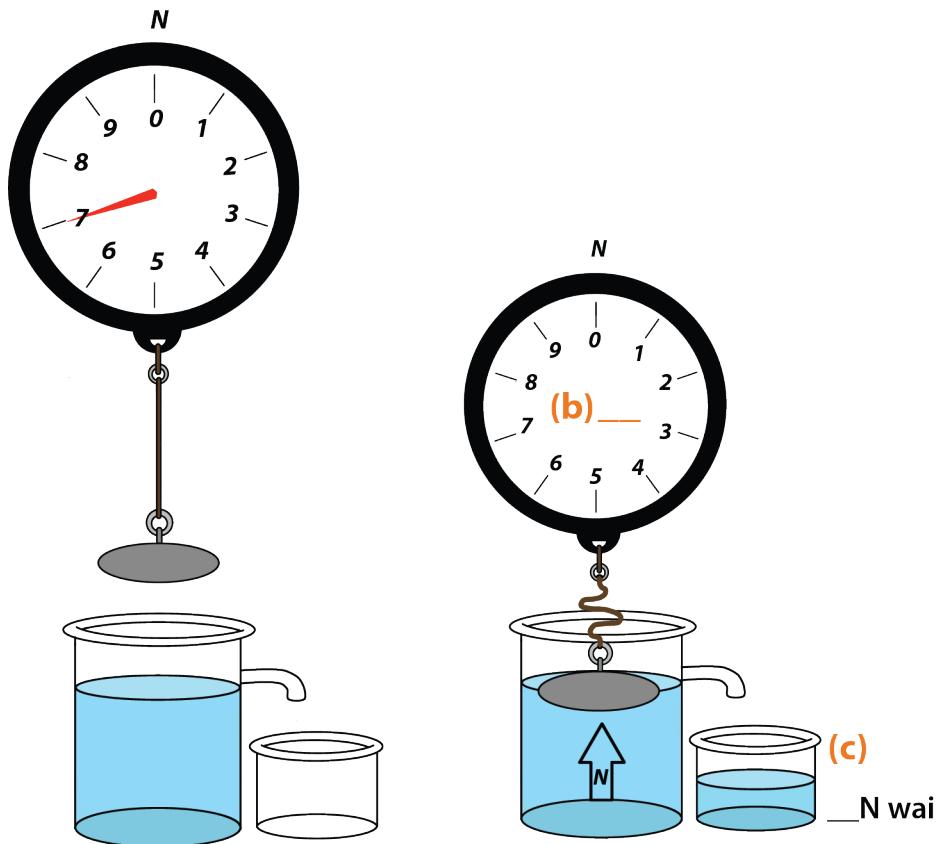
**Ke Kulehana a 'Akimika
(Archimedes Principle)**

*Like ka manehu 'ālana i ke
kaumaha o ka wai i pohupani 'ia*



b. E nānā i ka la'ana 'elua. I kēia manawa, lana ka mea ke ho'olu'u 'ia i ka wai. He aha ke kaumaha o ka mea ke ho'olu'u 'ia i ka wai?

'Oiai, lana nō ia, he 0 Newton ke kaumaha o ka mea.



c. I loko nō o ka lana o ka mea, pohupani 'ia ka wai. He aha ke kaumaha o ka wai i pohupani 'ia?

He 7 N ke kaumaha o ka mea ma mua. I 0 N ke kaumaha i kēia manawa, ua pohupani 'ia 7 N wai me he manehu 'ālana ($7 \text{ N} - 7 \text{ N} = 0 \text{ N}$).

- d. E kohu nā hā'ina no nā māhele 3b a me 3c i nā la'ana. E kūkākūkā me ka papa, i 'a'apo pono.
e. 'A'ole i lu'u piha ka mea. No laila, hiki ke 'oi aku ka wai i pohupani 'ia inā ho'olu'u hou 'ia iho. Inā hiki iā 'oe ka ho'opau i kēia māmala'ōlelo, mākaukau no ka ho'omau.

_____ ke kaumaha o ka wai i pohupani 'ia e ka mea i hiki ke **lana** ma mua o ke kaumaha o ka mea.

- Emi mai
- Like a 'oi aku nō paha

Māhele 5: Kūkohu Hope Loa

- a. 'Ehia Newtons wai i pohupani 'ia e ka wa'a no ka lana 'ana? E nānā i nā hā'ina mai ka māhele 1 inā kānalua.

Pono e pohupani ka wa'a ($483 \times g$) N (a i 'ole ma kahi o 4733.4 N, inā ho'ohana 'ia 'o $g \approx 9.8 \text{m/s}^2$).

- b. He Nuipa'a \div Pihanahaka ka Pa'apū. No laila, inā loa'a ka pihanahaka wai a ho'onui 'ia me ka pa'apū wai, loa'a mai ka nuipa'a wai. Inā ho'onui hou i kēlā ma ka ho'ohikiwawe ma muli o ka 'umekaumaha, loa'a mai ke kaumaha o ka wai. E 'imi i ke kaumaha o ka wai i pohupani 'ia e ka wa'a.

Kōkua:

1. Loa'a ka ha'ilula no ka pihanahaka mai ka māhele 3.
2. He 1000 kg/m^3 ka pa'apū wai.
3. He $g \text{ m/s}^2$ ka ho'ohikiwawe i ka 'umekaumaha.
4. Pono ke kumuloli 'o x ma ka hā'ina.

E loli ana nā hā'ina. Inā ho'ohana 'ia ka paukū 'oloka'a i ho'ohapa 'ia no ka lō'ihi li'il'i'i, he $2.25\pi x^2$ ka pihanahaka. 'O $(2.25\pi x^2) \times 1000$ ka nuipa'a a 'o $(2.25\pi x^2) \times 1000 \times g = 2250\pi gx^2$ ke kaumaha. Inā ho'ohana 'ia ke kokekau kekimala $g \approx 9.8 \text{m/s}^2$, a laila he $22050\pi x^2$ Newtons ke kaumaha.

Hiki i nā haumāna ke ho'ohana i nā kinona 'oko'a mai ka paukū 'oloka'a.

- c. 'Ehia ka hohonu, 'o ia 'o x , i mea e lana ai ka wa'a, ke kau nā hoe wa'ma luna?

Kōkua: E ho'ohana i nā hā'ina 'elua ma mua o kēia.

E ho'opa'a i ke kaumaha o ka wai pohupani i like a 'oi a'e nō paha i ke kaumaha o ka wa'a. A laila e 'imi i ka hā'ina no x .

$$\begin{aligned}
 \text{Ke kaumaha o ka wai pohupani} &\geq \text{Ke kaumaha o ka wa'a} \\
 2250\pi gx^2 &\geq (483 \times g) \\
 (2250\pi g)x^2 &\geq 483g \\
 \div(2250\pi g) &\quad \div(2250\pi g) \\
 x^2 &\geq \frac{483g}{2250\pi g} \\
 x^2 &\geq \frac{483}{2250\pi} \\
 x^2 &\geq 0.215
 \end{aligned}$$

Loa'a mai ka ha'ihelu 'o $x \geq 0.463$ a me ka ha'ihelu hiki 'ole 'o $x \leq -0.463$. No laila, he 0.463 mika 'o x ma ka li'il'i'i loa.

Hiki ke 'ae i nā haumāna e ho'ohana iā www.desmos.com no ke kōkua.

d. Ua 'ike paha 'oe i ka li'ihi'i o ka hohonu? 'A'ole paha palekana ka wa'a li'ihi'i. E koho i x i 'oi aku ka nui e 'olu'olu ai nā mākua e kau ma luna. Loa'a 'o x, e ho'ohana i ka pakuhi mai ka māhele 2 no ke koho i nā ana.

Eia nā hā'ina hāpana ma lalo. Eia na'e, hiki ke 'oko'a nā hā'ina a wehewehe 'ia ka nui 'oko'a ma ka pakuhi ma ka māhele 2.

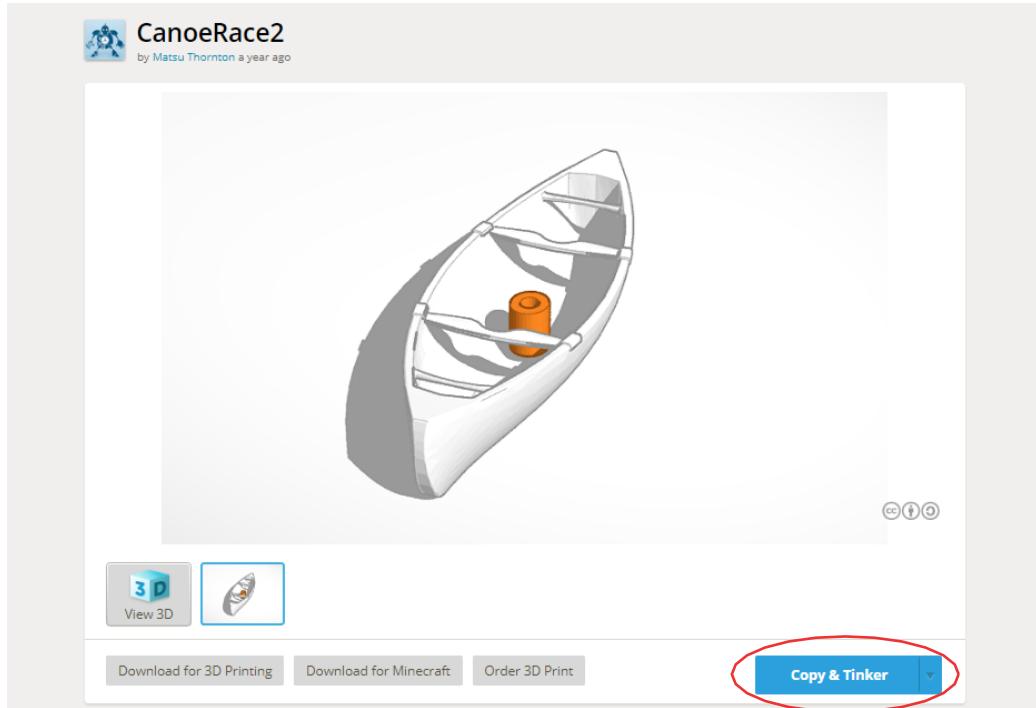
Nui	Ana (mika)
Lō'ihi 'l'o	5
Laulā 'l'o	0.75
Hohonu 'l'o	0.5

e. I kēia manawa, e ho'oli'ihi'i i ka wa'a no ka mīkini pa'i 3D. E ho'onui i nā nui ma ka 1/50. E ho'ololi pū a i ka milimika.

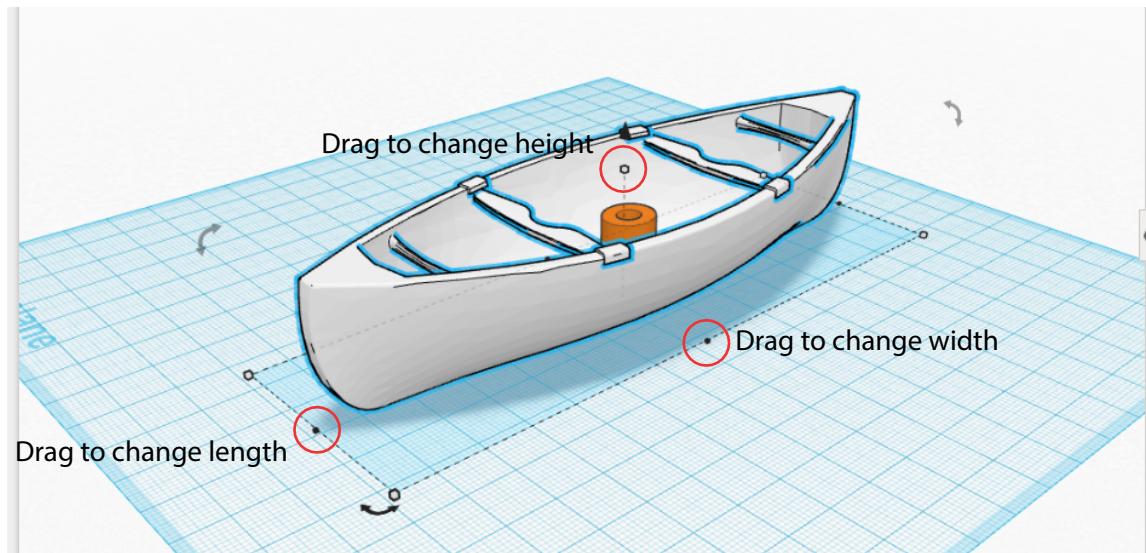
Nui	Ana Kūkohu 3D (milimika)
Lō'ihi Kūkohu	100
Laulā Kūkohu	15
Hohonu Kūkohu	10

Māhele 6: Ka Pālākiō a me Ka Pa'i'Ana

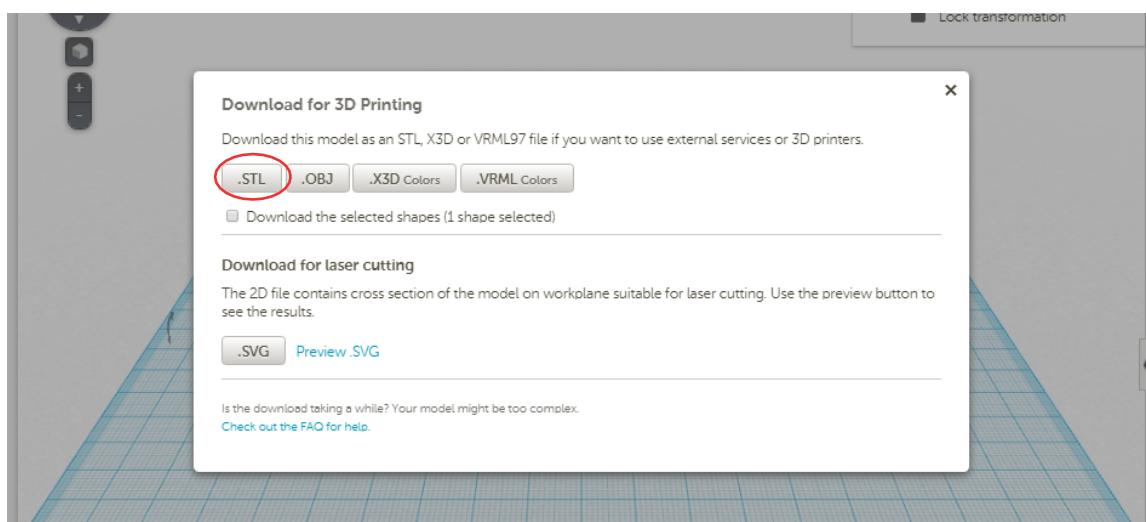
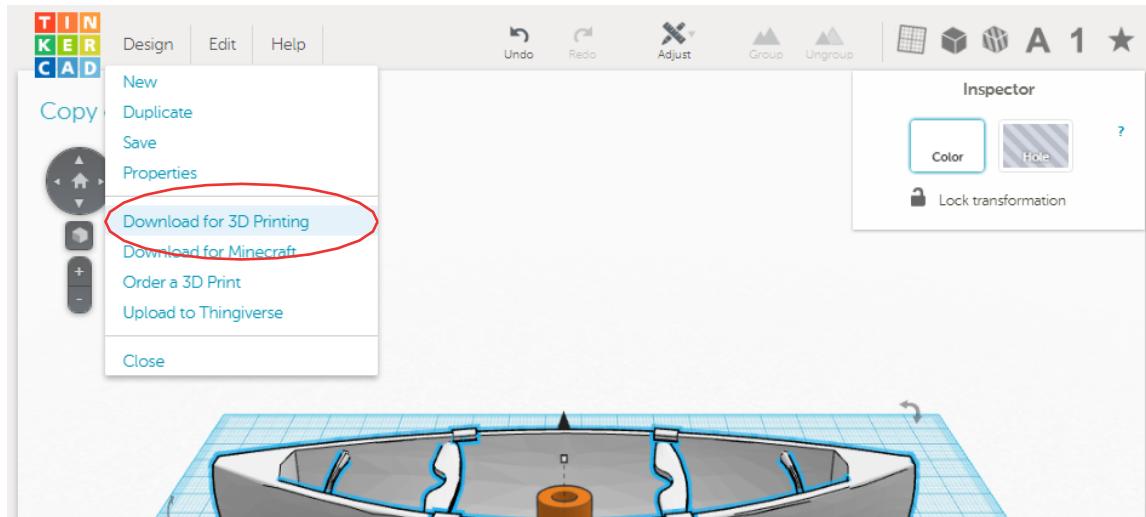
- a. E wehe i ke kūkohu ma <https://tinkercad.com/things/9LTGjEvNOLJ>. E 'e'e a i 'ole e ho'okāinoa no kekahi waihona manuahi a e kaomi iā "Copy & Tinker" e like me ke ki'i o lalo.



- b. E hana i ka wa'a ma ka nui pololei. No ka ho'oponopono i ka lō'ihi, ka lauā, a me ka hohonu, e ho'ohana i nā wahi pa'a ma ke ki'i o lalo.



c. Ke pa'a ke kinona wa'a, e koho iā "Download for 3D Printing" ma lalo o ka papa kuhikuhi "design". E koho iā .stl.



E ho'oili 'ia ana kēlā faila .stl ma kahi kūpono.

E kapa hou i ka faila me kēia:

[**<Inoa kula>_<Papa>_<Lō'ihi>_<Laulā>_<Hohonu>.stl**](#)

La'ana: [**WaipahuInt_MATH101_125_24_20.stl**](#)

d. E hana pū me ke kula no ka pa'i i kāu kōkohu 3D.

No nā hoa pakanā me Ne'epapa Ka Hana, hiki i nā haumāna ke ho'ouka i nā faila ma kēia dropbox no ka pa'i 3D.

<https://www.dropbox.com/request/swbYbb7P2i0yC6zBH3wz>

E ho'ouna 'ia ana nā kūkohu wa'a a me ka loulou e nānā ai i ka pa'i 3D 'ia 'o ka wa'a.

e. Ke ho'ouna 'ia kāu kūkohu wa'a, e ho'one a e pena.