91586M

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SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Te Pāngarau me te Tauanga (Tauanga), Kaupae 3, 2019

91586M Te whakahāngai i ngā tuari tūponotanga hei whakaoti rapanga

9.30 i te ata Rāpare 28 Whiringa-ā-rangi 2019
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakahāngai i ngā tuari tūponotanga hei whakaoti rapanga.	Te whakahāngai i ngā tuari tūponotanga mā te whakaaro whaipānga hei whakaoti rapanga.	Te whakahāngai i ngā tuari tūponotanga mā te whakaaro waitara hōhonu hei whakaoti rapanga.

Tirohia mēnā e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOA kei roto i tēnei pukapuka.

Tuhia ō mahinga KATOA.

Tirohia mēnā kei a koe te Pukapuka Tikanga Tātai me ngā Tūtohi L3–STATMF.

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–23 kei roto i tēnei pukapuka, ā, kāore tētahi o aua whārangi i te takoto kau.

ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI

MĀ TE KAIMĀKA ANAKE

(a) I tērā tau, 45% i pai te tinaku o ngā kākano hūkini i whakatōngia ki tētahi māra pātāone, ā, ka tipu hei tipu hūkini (zucchini).

I tēnei tau, i tēnei māra, kua whakaritea kia 6 i te iti rawa ngā tipu hūkini ka whakatipuhia. He wāhi kei reira mō ngā tipu hūkini 10 te mōrahi. 10 ngā kākano hūkini ka whakatōngia mai i tētahi pākete kākano hou.

(i) Mā te whakamahi i tētahi tauira tuari tūponotanga tōtika, tātaihia te whakatau tata mō te tūponotanga e 6 ngā tipu hūkini i te iti rawa ka tipu mai i ngā kākano ka whakatipuria i tēnei tau.

(ii) Hei whakamahi i te tuari i whakamahia i te wāhanga (a)(i), me whakaputa kia kotahi te whakapae pūtake i te iti rawa.

Tautohua kia KOTAHI te whakapae pūtake kei te **hē** pea, ā, matapakihia te take i pēnei ai.

Matapakitia te pānga pea o te tuku i tēnei whakapae ki tō tātaitanga i te wāhanga (a)(i).

QUESTION ONE

ASSESSOR'S USE ONLY

(a) Last year, 45% of the zucchini seeds planted in a suburban garden successfully germinated and grew into zucchini plants.

This year, in this garden, it is planned to grow at least 6 zucchini plants. There is space for a maximum of 10 zucchini plants. 10 zucchini seeds are planted from a new packet of seeds.

(i) Using an appropriate probability distribution model, calculate an estimate for the probability that at least 6 zucchini plants will grow from this year's seed planting.

(ii) To apply the distribution used in part (a)(i), at least one assumption needs to be made.

Identify ONE such assumption that may be **invalid** and discuss why this is the case.

Discuss the impact that making this assumption may have on your calculation in part (a)(i).

(b) Katohia ai ngā hūkini ina roa atu i te 190 mm te roa, ā, i mua i te ekenga ki te 270 mm te roa. Ko te roa e kitea nuitia ana o ngā hūkini e katohia ana he 220 mm.

MĀ TE KAIMĀKA ANAKE

(i) Mā te whakamahi i tētahi tuari tūponotanga tōtika, tātaihia tētahi whakatau tata mō te tūponotanga he poto iho i te 220 mm te roa o tētahi hūkini i katohia.

(ii) He roa ake, he poto iho rānei te roa tau waenga o ngā hūkini i katohia i te 220 mm?
Whakamahia te whakaaro whaitake o te tauanga hei tautoko i tō tuhinga.

ASSESSOR'S USE ONLY

(b) The zucchinis are picked (harvested) when they are more than 190 mm long, and before they grow to reach 270 mm long. The most common length of picked zucchinis is 220 mm long.

(i) Using an appropriate probability distribution, calculate an estimate for the probability that a picked zucchini is less than 220 mm long.

(ii) Is the median length of picked zucchinis more, or less, than 220 mm?

Support your answer with statistical reasoning.

(iii) He pai ake te kai i ngā hūkini paku (poto iho i te 215 mm te roa).

MĀ TE KAIMĀKA ANAKE

Tātaihia tētahi whakatau tata mō te tūponotanga e rima i te nui rawa o ngā hūkini tekau ka katohia he hūkini paku.

Hei wāhanga o tō tuhinga, me āta tautohu i tō kōwhiringa o te (ngā) tuari me te (ngā) tawhā hāngai, me te tuhi i te (ngā) whakapae pūtake i tukuna e koe.

ASSESSOR'S USE ONLY

(iii) Small zucchinis (less than 215 mm long) are preferred for eating.

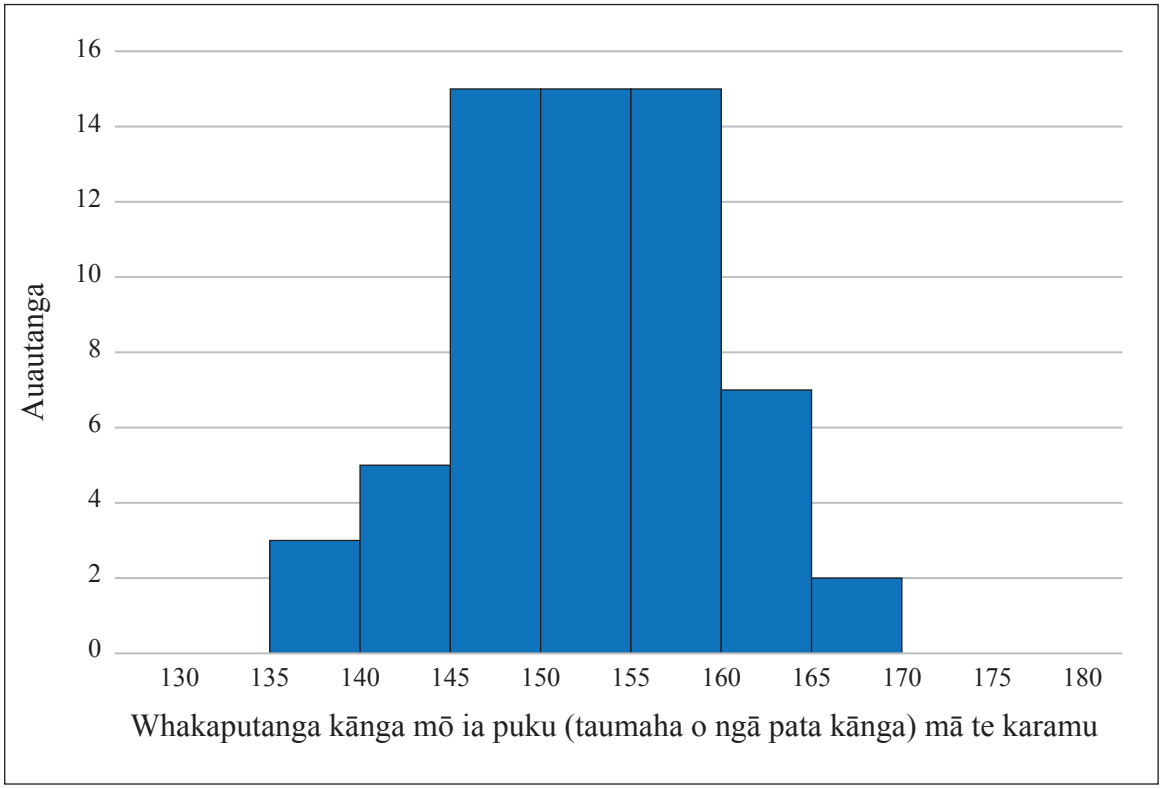
Calculate an estimate for the probability that at most five of the next ten zucchinis picked are small zucchinis.

As part of your answer, clearly identify your choice of distribution(s) and associated parameter(s), and state any assumption(s) you have made.

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) I kohia ngā raraunga o tērā tau mai i ngā kānga Super-Sweet o tētahi māra huawhenua pātāone. 62 te tapeke o ngā puku kānga i hua. E whakaaturia ana te tuari o te whakaputanga kānga (te taumaha o ngā pata kānga) mō ia puku mō tēnei māra ki te kauwhata i raro.



(i) Mō ēnei raraunga, ko te whakaputanga toharite mō ia puku he 152.3 karamu o ngā pata kānga me te tuari ine mahora o te 7.0 karamu. Ko te whakapae neke atu i te 10% o ngā puku kānga mai i te whakaputanga o tēnei māra he neke atu i te 160 karamu ngā pata kānga.

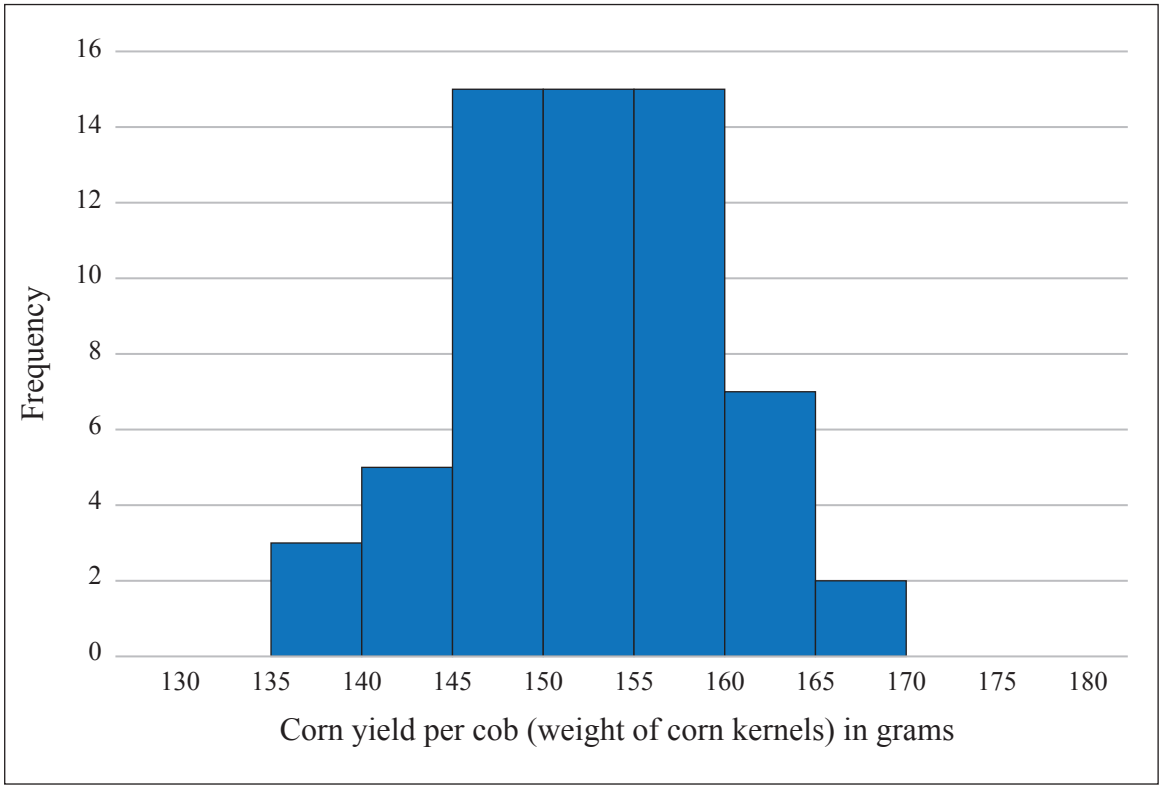
Kei te tika tēnei whakapae?

Whakamahia he tātaitanga hei tautoko i tō tuhinga.

QUESTION TWO

ASSESSOR'S USE ONLY

(a) Data from last year's Super-Sweet corn crop from one suburban vegetable garden was collected. A total of 62 cobs of corn were produced. The distribution of the corn yield (weight of corn kernels) per cob for this garden is displayed on the graph below.



(i) For this data, the mean yield per cob is 152.3 grams of corn kernels and the standard deviation is 7.0 grams. It is claimed that over 10% of the corn cobs from this garden yield more than 160 grams of kernels.

Is this claim correct?

Use a calculation to support your answer.

MĀ TE KAIMĀKA ANAKE

(ii) Parahautia te whakamahi i tētahi tuari māori hei whakatauira i te tuari o te whakaputanga mō ia puku mō ngā kānga Super-Sweet katoa.

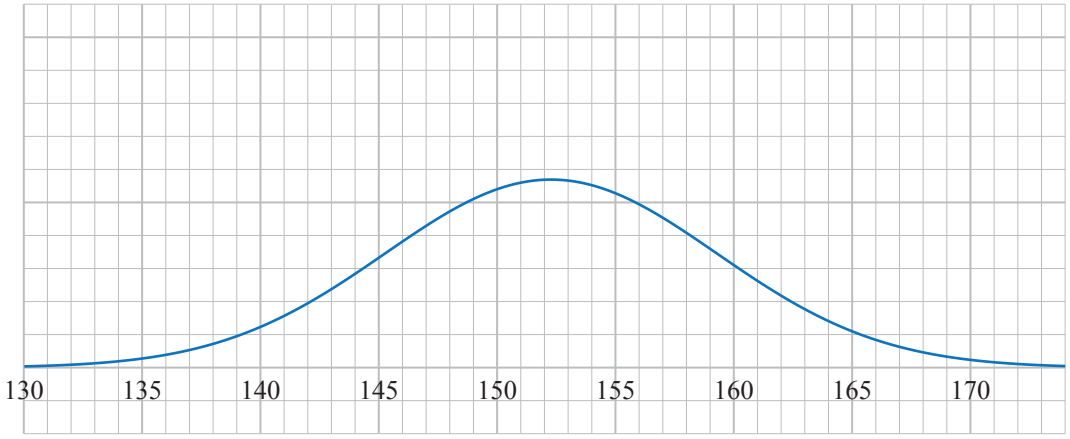
Whakamahia te whakaaro whaitake o te tauanga hei tautoko i tō tuhinga.

I roto i tō tuhinga, whakaahuahia kia RUA i te iti rawa ngā āhuatanga o te tuari o te whakaputanga kānga mō ia puku, me tētahi tātaitanga KOTAHI i te iti rawa.

(iii) Ko te tauira tuari māori mō te whakaputanga kānga Super-Sweet mō ia puku e whakaaturia ana ki te kauwhata i raro.

Ka hangaia tētahi momo kānga hou (Ambrosia-Sweet). E whakaatu ana ngā raraunga mai i ngā whakamātau māra ko te whakaputanga mō ia puku kānga Ambrosia-Sweet, ki ngā karamu pata kānga mō ia puku, ka taea te whakatauira mā tētahi tuari māori. Ko te tauira tuari māori mō te whakaputanga kānga Ambrosia-Sweet mō ia puku he 149 karamu te tau toharite me te tuari māori o te 4 karamu.

Tuhia te tauira tuari māori mō te whakaputanga kānga Ambrosia-Sweet mō ia puku ki te hoahoa i raro.



Whakaputanga kānga mō ia puku (karamu)

Ki te hiahia koe ki te tuhi anō i te kōpiko, whakamahia te hoahoa i te whārangi 19.

ASSESSOR'S USE ONLY

(ii) Justify the use of a normal distribution to model the distribution of yield per cob for all Super-Sweet corn.

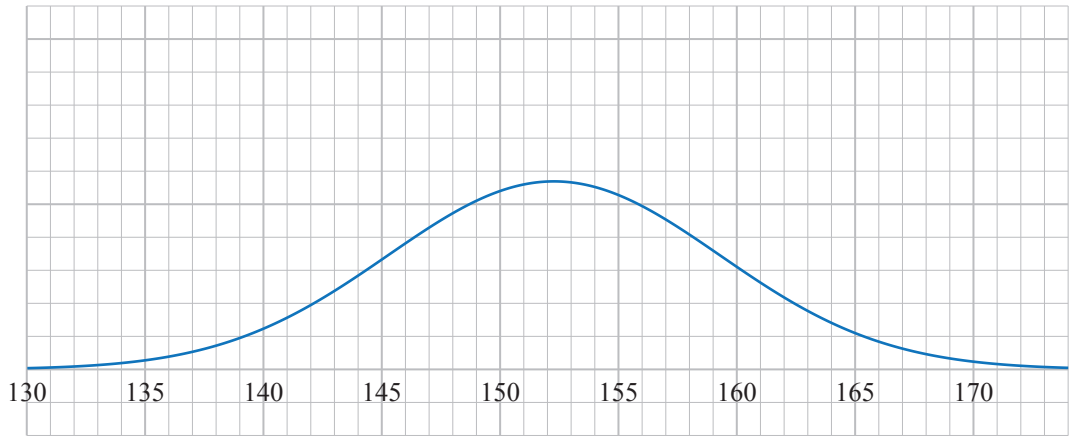
Support your answer with statistical reasoning.

As part of your answer, describe at least TWO features of the distribution of corn yield per cob, and include at least ONE calculation.

(iii) A normal distribution model for Super-Sweet corn yield per cob is shown in the graph below.

A new variety of corn (Ambrosia-Sweet) is developed. Data from field trials shows that the yield per Ambrosia-Sweet corn cob, in grams of corn kernels per cob, can be well modelled by a normal distribution. The normal distribution model for Ambrosia-Sweet corn yield per cob has mean 149 grams and standard deviation 4 grams.

Sketch the normal distribution model for Ambrosia-Sweet corn yield per cob on the diagram below.



If you need to redraw your curve, use the diagram on page 21.

(iv) Whakatauritea ngā tauira tuari māori mō te whakaputanga kānga Super-Sweet mō ia puku me te whakaputanga kānga Ambrosia-Sweet mō ia puku.

MĀ TE KAIMĀKA ANAKE

(b) Tata ki te 25% o ngā rīwai ‘Bush Road’ he māmā ake i te 186 karamu.

Ka whakamahia tētahi tuari māori me te tau toharite o te 235 karamu hei whakatauira i te taumaha o ngā rīwai ‘Bush Road'.

Mā te whakamahi i tēnei tauira tuari māori, ki ō whakaaro ko te ōrau o ngā rīwai 'Bush Road' e taumaha ake ana i te 300 karamu kei te takiwā o te 25%?

Whakamahia te whakaaro whaitake o te tauanga hei tautoko i tō tuhinga.

ASSESSOR'S USE ONLY

(iv) Compare the normal distribution models for Super-Sweet corn yield per cob and Ambrosia-Sweet corn yield per cob.

(b) Around 25% of 'Bush Road' potatoes are lighter than 186 grams.

A normal distribution with mean 235 grams is used to model the weight of 'Bush Road' potatoes.

Using this normal distribution model, would you expect the percentage of 'Bush Road' potatoes that weigh greater than 300 grams to be around 25%?

Support your answer with statistical reasoning.

TŪMAHI TUATORU

MĀ TE KAIMĀKA ANAKE

(a) E mōhiotia ana te tau toharite o ngā tipu tarutaru i ia mita pūrua i tētahi māra pātāone he 6.

(i) Mā te whakamahi i tētahi tauira tuari tūponotanga tōtika, tātaihia te whakatau tata mō te tūponotanga neke atu i te 8 ngā tipu tarutaru ka kitea i tētahi mita pūrua kotahi o te māra.

(ii) Mā te whakamahi i tētahi tauira tuari tūponotanga tōtika, tātaihia te whakatau tata mō te tūponotanga e 4 ngā tipu tarutaru i te iti rawa ka kitea i ia mita pūrua motuhake e 5 o te māra.

QUESTION THREE

ASSESSOR'S USE ONLY

(a) The mean number of weed plants per square metre in one suburban garden is known to be 6.

(i) Using an appropriate probability distribution model, calculate an estimate for the probability that more than 8 weed plants will be found in one square metre of garden.

(ii) Using an appropriate probability distribution model, calculate an estimate for the probability that at least 4 weed plants will be found in each of 5 different square metres of garden.

(iii) Whakaaroarohia tētahi whakapae pūtake i oti i a koe i tō tātaitai i tō tuhinga ki te wāhanga (a)(ii).

Matapakitia mēnā kei te tika pea (kāore rānei) tēnei whakapae pūtake.

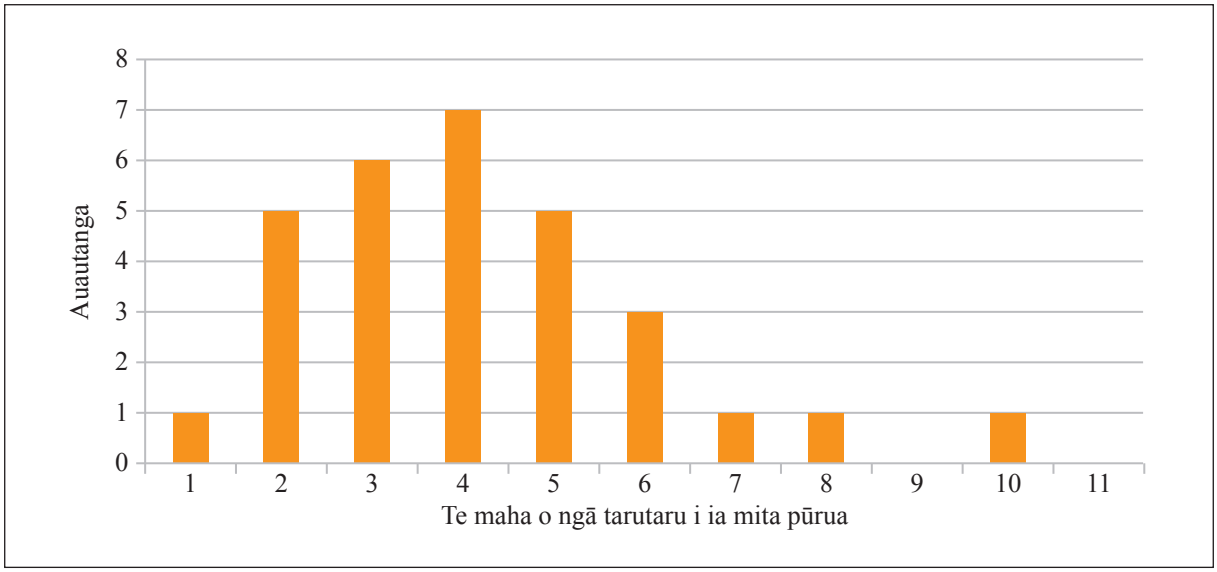
MĀ TE KAIMĀKA ANAKE

(iii) Consider an assumption you made when you calculated your answer to part (a)(ii). Discuss whether (or not) this assumption is likely to be valid.

ASSESSOR'S USE ONLY

(b) Ka whakamahia tētahi matū patu tarutaru pararopi hei whakaiti i te maha o ngā tarutaru kei te māra. E whakaatu ana te kauwhata i raro i te maha o ngā tarutaru i mātakina i ngā wāhi motuhake 30 o tētahi mita pūrua kotahi o te māra whai muri i te whakamahinga o te matū patu tarutaru.

Te maha o ngā tarutaru i mātakina



(i) Tātaihia te tau toharite o te maha o ngā tarutaru i ia mita pūrua i muri i te whakamahi i te matū patu tarutaru.

(ii) Mā te whakamahi i tō tuhinga ki te wāhanga (i) me tētahi tuari tūponotanga tōtika hei whakatauira i tēnei āhuatanga, me kōrero mō te tūponotanga 10 ngā tarutaru ka kitea i tētahi ngakinga māra he 3 mita pūrua te horahanga.

I tō tuhinga, me parahau tō kōwhiringa o te tuari me te tautohu i te (ngā) tāwhā o tēnei tuari.

MĀ TE KAIMĀKA ANAKE

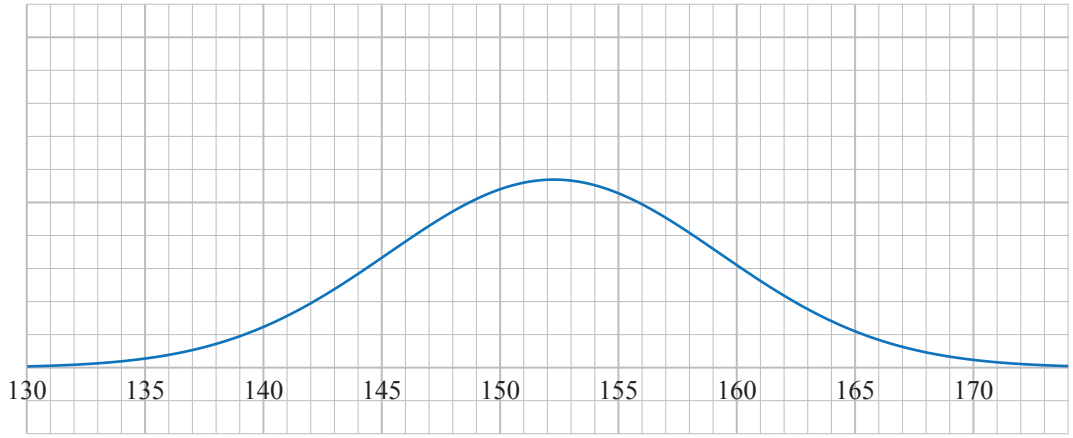
(iii) E mōhiotia ana ko te tau toharite o ngā tipu tarutaru mō ia mita pūrua he 6. E kī ana te kaiwhakanao matū patu tarutaru, atu ki te 40% te nui o ngā whakahekenga nā tana matū patu tarutaru.

E ai ki ngā raraunga kua tukuna mai, ka taea e koe te whakatau ko te pāpātanga whakaheke tarutaru mō te matū patu tarutaru hou he 40% i te iti rawa?

Whakamahia te whakaaro whaitake o te tauanga hei tautoko i tō whakautu.

HOAHOA WĀTEA

Ki te hiahia koe ki te tuhi anō i te kōpiko mō te Tūmahi Tuarua (a)(iii), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.

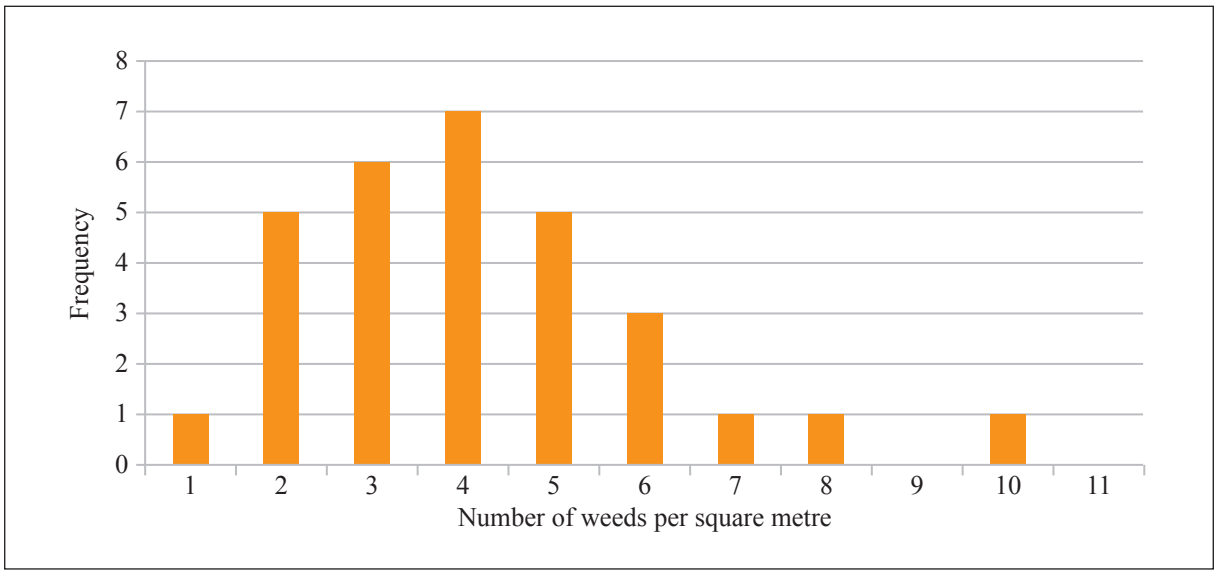


Whakaputanga kānga mō ia puku (karamu)

ASSESSOR'S USE ONLY

(b) A new organic weedkiller is used in an attempt to reduce the number of weeds in the garden. The plot below displays the number of weeds observed in 30 separate areas of one square metre of garden after the weedkiller has been used.

Number of weeds observed



(i) Calculate the mean for the number of weeds per square metre after the weedkiller has been used.

(ii) Using your answer to part (i) and an appropriate probability distribution to model this situation, comment on the chance that 10 weeds will be found in a garden plot that has an area of 3 square metres.

In your answer, you should justify your choice of distribution and identify the parameter(s) of this distribution.

ASSESSOR'S USE ONLY

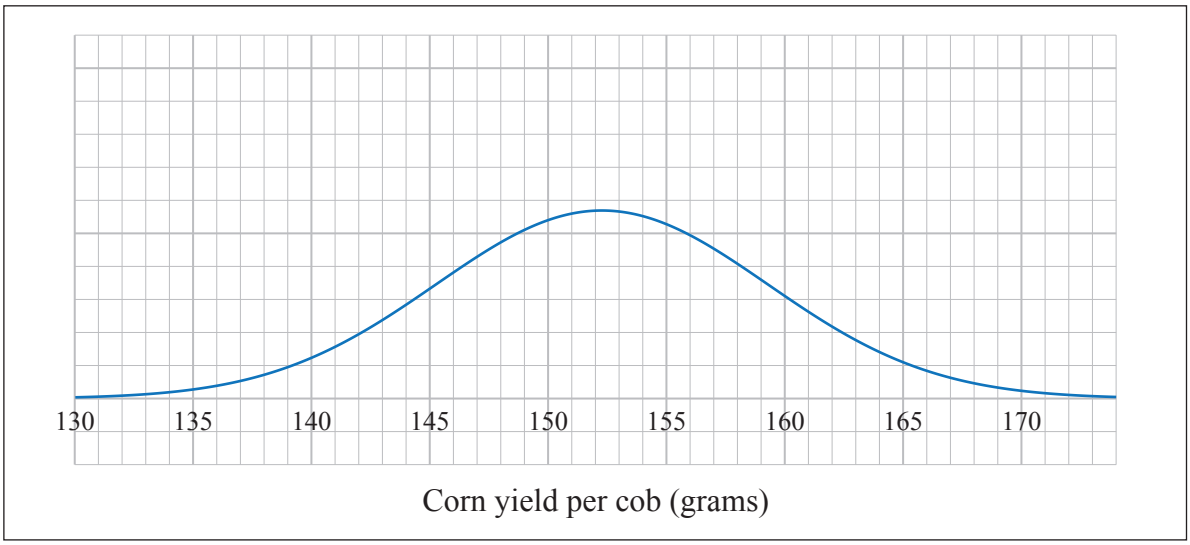
(iii) The mean number of weed plants per square metre is known to be 6. The weedkiller manufacturer states that this weedkiller has achieved reductions of up to 40%.

Based on the data provided, can you conclude that the weed reduction rate for the new weedkiller is at least 40%?

Support your answer with statistical reasoning.

SPARE DIAGRAM

If you need to redraw your curve for Question Two (a)(iii), use the diagram below. Make sure it is clear which diagram you want marked.



He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

MĀ TE KAIMĀKA ANAKE

Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

ASSESSOR'S USE ONLY

English translation of the wording on the front cover

Level 3 Mathematics and Statistics (Statistics), 2019

91586 Apply probability distributions in solving problems

9.30 a.m. Thursday 28 November 2019
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Apply probability distributions in solving problems.	Apply probability distributions, using relational thinking, in solving problems.	Apply probability distributions, using extended abstract thinking, in solving problems.

91586M

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Show ALL working.

Make sure that you have the Formulae and Tables Booklet L3–STATMF.

If you need more room for any answer, use the space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–23 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.