SUPERVISOR'S USE ONLY

*See back cover for an English translation of this cover*

**3**

**91585**

915855

Tuhia he (☒) ki te pouaka mēnā kāore koe i tuhi kōrero ki tēnei puka

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NZQA

**Mana Tohu Mātauranga o Aotearoa**
New Zealand Qualifications Authority

# Te Pāngarau me te Tauanga (Te Tauanga), Kaupae 3, 2023

## 91585 Te whakahāngai ariā tūponotanga i te whakaoti rapanga

Ngā whiwhinga: E whā

| Paetae | Kaiaka | Kairangi |
|---|---|---|
| Te whakahāngai ariā tūpono i te whakaoti rapanga. | Te whakahāngai ariā tūpono, mā roto i te whakaaro pānga, i te whakaoti rapanga. | Te whakahāngai ariā tūpono, mā roto i te whakaaro waitara e whānui ana, i te whakaoti rapanga. |

Tirohia kia kitea ai 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.**

Tirohia kia kitea ai kei a koe te Puka mō ngā Ture Tātai me ngā Tūtohi L3–STATMF.

Whakaaturia ngā whiriwhiringa KATOA.

Ki te hiahia wāhi atu anō koe mō ō tuhinga, whakamahia ngā whārangi kei muri o tēnei pukapuka.

Tirohia kia kitea ai e tika ana te raupapa o ngā whārangi 2–23, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki tētahi wāhi e kitea ai te kauruku whakahāngai (AE TUHI KI TE WAHI KAUPAE TUHI ATU). Ka poroa taua wāhanga ka mākahia ana te pukapuka.

**HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.**

## TE TŪMAHI TUATAHI

(a) E rua ngā kura, ko tētahi i Te Ika a Māui me tētahi i Te Waipounamu, i rangahau, ka whakakotahi ai i ngā raraunga i tētahi rōpū ākonga 157 nō te tau 9, nō te tau 11, me te tau 13 e pā ana ki tō rātou pai, ki te korenga rānei i pai, ki te kawhe.

E whakaaturia ana i te tūtohi o raro nei ngā hua o ngā rangahau i whakakotahitia

| | **Tau 9** | **Tau 11** | **Tau 13** |
|---|---|---|---|
| **E pai ana ki te kawhe** | 13 | 11 | 22 |
| **Kāore e pai ana ki te kawhe** | 43 | 38 | 30 |

(i) Mā te whakamahi i ngā hua o te rangahau, tātaia te tūponotanga nō te tau 9, nō te tau 11 rānei tētahi ākonga i kōwhiria matapōkeretia ai, mēnā i kī ia kāore ia i pai ki te kawhe.

(ii) I kōwhiria matapōkeretia ngā ākonga e whā nō te tau 11 i ngā hua o te rangahau.

Tātaia te tūponotanga o te kīnga a tētahi, a ētahi rānei o taua tokowhā e pai ana ki a ia/rāua/rātou te kawhe.

(iii) Tuhia tētahi o āu whakapae i puta rā nōu ka tātai i tō tuhinga ki te wāhanga (ii), ka matapakina ai mēnā rānei kāore e kore ka tika taua whakapae.

## QUESTION ONE

(a) Two schools, one in the North Island and one in the South Island, surveyed and combined the data from a group of 157 Year 9, Year 11, and Year 13 students about whether they liked coffee or not.

The table below shows the results of the combined surveys

| | **Year 9** | **Year 11** | **Year 13** |
|---|---|---|---|
| **Like coffee** | 13 | 11 | 22 |
| **Do not like coffee** | 43 | 38 | 30 |

(i) Using the results of the survey, calculate the probability of a randomly selected student being in Year 9 or Year 11 if they stated that they do not like coffee.

(ii) Four Year 11 students are randomly chosen from the survey results.

Calculate the probability that at least one of these four students stated that they like coffee.

(iii) State an assumption you made when you calculated your answer to part (ii) and discuss whether (or not) this assumption is likely to be valid.

(iv) Tērā te whakapono, ka pakeke haere ana ngā ākonga, ka nui ake te paingia o te kawhe.

E tika ana rānei tēnei whakapono mō tēnei rōpū ākonga?

Whakamahia ngā whakaaro ā-tauanga i tō whakautu.

(v) Whakamāramahia mai te huarahi e taea ai te whakaatu atu, e motuhake ana te paingia, te kore rānei e paingia o te kawhe, e ia ākonga nō te tau 9, nō te tau 11, me te tau 13 i ngā rangahau i whakakotahitia, i te tūnga o te kura i Te Ika a Māui rānei, i Te Waipounamu rānei.

(iv) It is believed that coffee is more popular as students age.

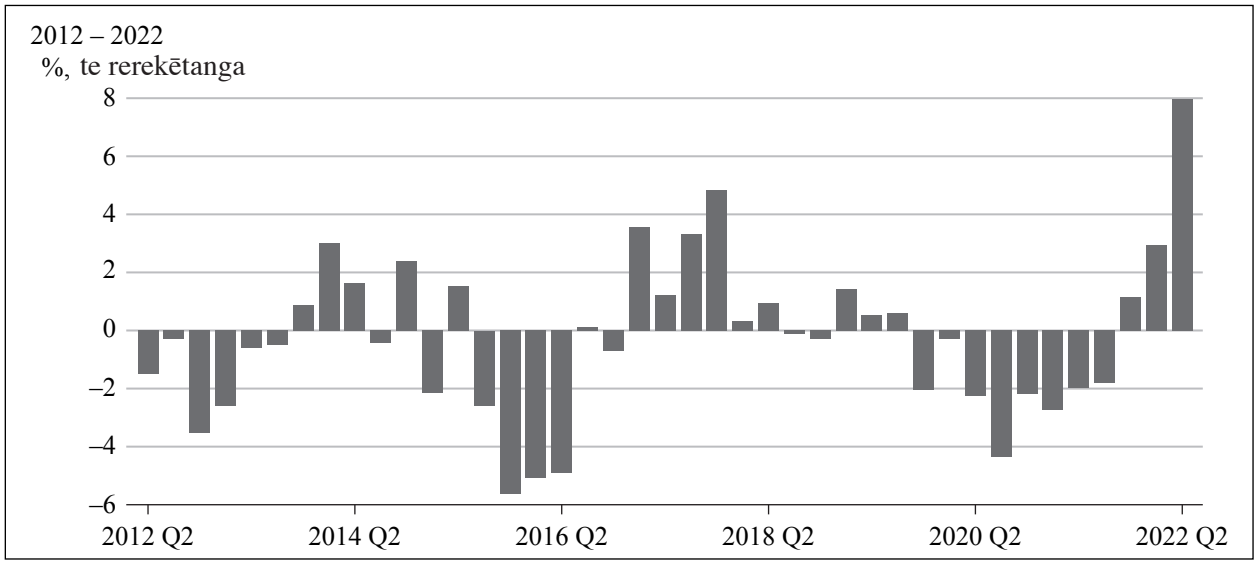
Is this belief correct for this group of students?

Use statistical reasoning in your answer.

(v) Explain how it could be shown that liking or not liking coffee for each of Year 9, Year 11, and Year 13 students from the combined surveys are independent of whether the school is located in the North Island or South Island.

(b) Ka inea e Tatauranga Aotearoa te utu o tētahi kapu kawhe i Aotearoa i ia hauwhā (ngā marama e 3). E whakaaturia ana i te ataata o raro nei te nui o te rerekētanga o te utu o te kawhe i taua hauwhā hei ōrau nō te tau o mua, i ngā tau 10 o mua, mai i te hauwhā tuarua o te tau 2012 ki te hauwhā tuarua o te tau 2022. Kia mōhio rā koe – ka **41 ngā hauwhā** i tēnei kauwhata.

**Te rerekētanga o te utu o te kawhe i tētahi tau ki tētahi i Aotearoa**




Te mātāpuna: https://figure.nz/chart/0ByKhsHZZX7N8W2x-dkvqiLEp0dslISfY

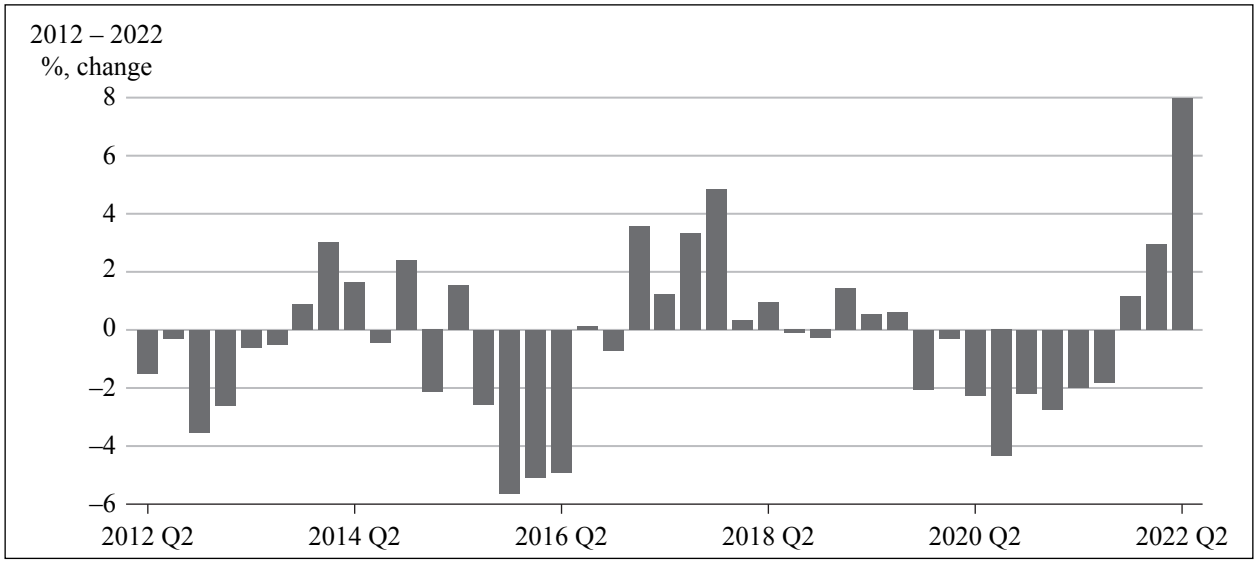
(i) Kua tonoa tētahi kaitiro tauanga kia arotake i tētahi tauira e whakapae ana i te tūponotanga ka paku iti iho i te 20% te pikinga o te utu o tētahi kapu kawhe hei ngā hauwhā e rua e whai ake ana.

Whakaaturia mai te āhua pea o te whakawhanaketia o tēnei tauira.

(ii) Tuhia tētahi whakapae i puta rā i te wā e whakawhanaketia ana tēnei tauira, ā, matapakina mēnā rānei kāore e kore ka tika tēnei whakapae.

(b) The price of a cup of coffee in New Zealand is measured every quarter (3 month period) by Stats New Zealand | Tautauranga Aotearoa. The visualisation below shows how much the price of coffee has changed in that quarter as a percentage from the previous year, over 10 years from the 2nd quarter of 2012 to the 2nd quarter of 2022. Note – this means there are **41 quarters** included in the graph.

**Year-on-year price change in price of coffee in New Zealand**




Source: https://figure.nz/chart/0ByKhsHZZX7N8W2x-dkvqiLEp0dslISfY

(i) A statistician has been asked to review a model that claims the probability of the next two successive quarters showing a price increase for a cup of coffee is just under 20%.

Show how this model could have been developed.

(ii) State an assumption that was made when developing this model, and discuss whether (or not) this assumption is likely to be valid.

## TE TŪMAHI TUARUA

(a) I uia ngā tāngata e 510, puta noa i Aotearoa, i pai rā ki te kawhe, e pā ana ki te kawhe ka tino paingia e rātou. I te rangahau, i āhei tā rātou kōwhiri i ngā momo kawhe ATU KI TE RUA e tino paingia ana: he mokatino, he mōwai, he kaputino rānei.

I kitea rā i ngā hua:

- e 423 i tino pai ki tētahi, ki ētahi rānei o ngā momo kawhe i te rangahau
- e 81 i tino pai ki te kaputino anake
- e 38 i tino pai ki te mōwai anake
- e 29 i tohu i tō rātou tino pai ki te mōwai me te mokatino
- 103 i tino pai ki te mokatino anake
- kāore tētahi tangata i te rangahau i tohu i tana tino pai ki te kaputino me te mokatino.

(i) Tātaia te hautau o ngā tāngata i tohu rā i tō rātou tino pai ki te kaputino.

(ii) Ka puta te whakapae, e 50% te nui ake o te tūponotanga i kōwhiria e te hunga i tino pai ki te kaputino te kaputino anake, tēnā i te kōwhiri a te hunga i tino pai ki te mokatino i te mokatino anake.

E tautoko ana rānei ngā hua o te rangahau i tēnei whakapae?

Taunakitia tō whakautu ki ngā whakaaro ā-tauanga e tika ana.

## QUESTION TWO

(a) 510 people who liked coffee from around New Zealand were asked about their preferred coffee. The survey allowed them to select UP TO TWO preferred coffee types: mocha, flat white, or cappuccino.

The results found that:

- 423 preferred at least one of the coffee types offered in the survey
- 81 preferred only cappuccino
- 38 preferred only flat white
- 29 indicated they preferred flat white and mocha
- 103 preferred mocha only
- none of the people surveyed indicated they preferred cappuccino and mocha.

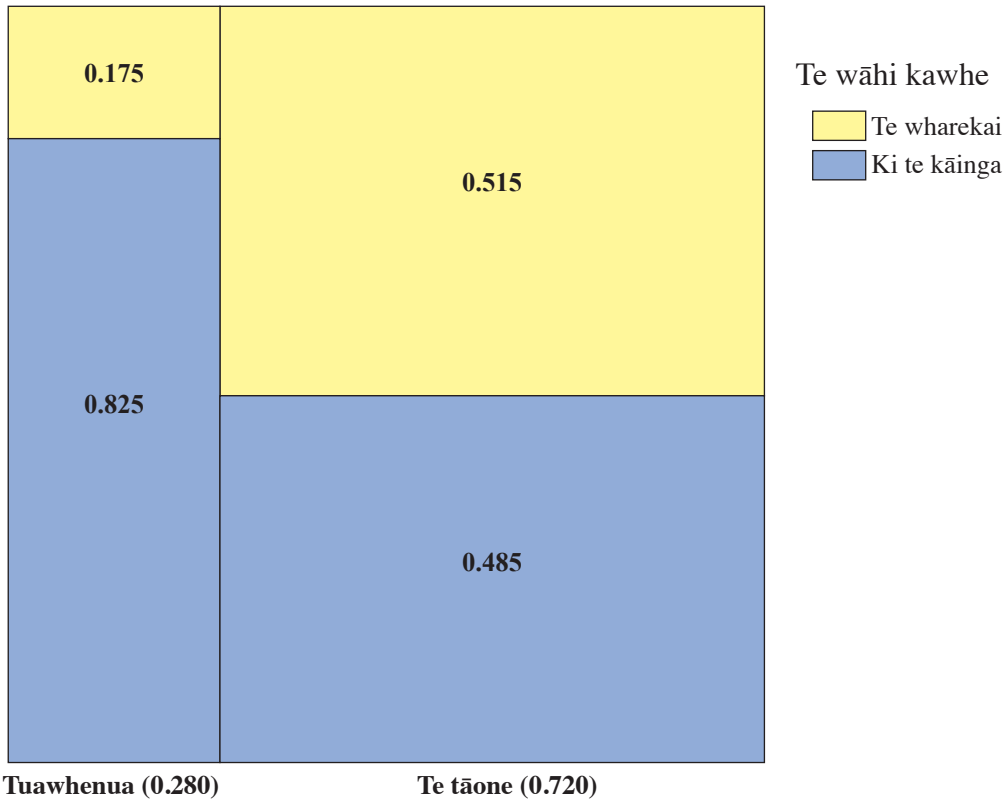
(i) Calculate the proportion of people who indicated they preferred cappuccino.

(ii) A claim is made that it is 50% more likely that those people who preferred cappuccino selected only cappuccino compared to those people who preferred mocha selecting only mocha.

Do the survey results support this claim?

Support your answer with appropriate statistical reasoning.

(b) E whakaaturia ana i te tapawhā tūponotanga *(eikosogram)* o raro nei mēnā rānei ka noho ngā tāngata e 510 i te rangahau i tuawhenua, ka noho rānei ki te tāone, ā, mēnā rānei ka hiahia rātou ki te whakarite i ā rātou kawhe i te kāinga, ka haere rānei ki tētahi wharekai. Ka whakaahuatia i te tapawhā tūponotanga te wehenga o ngā tūponotanga mō ngā taurangi e rua ki ngā rohenga tapawhā roa, e rite ana ngā horahanga ki te uara tūponotanga.

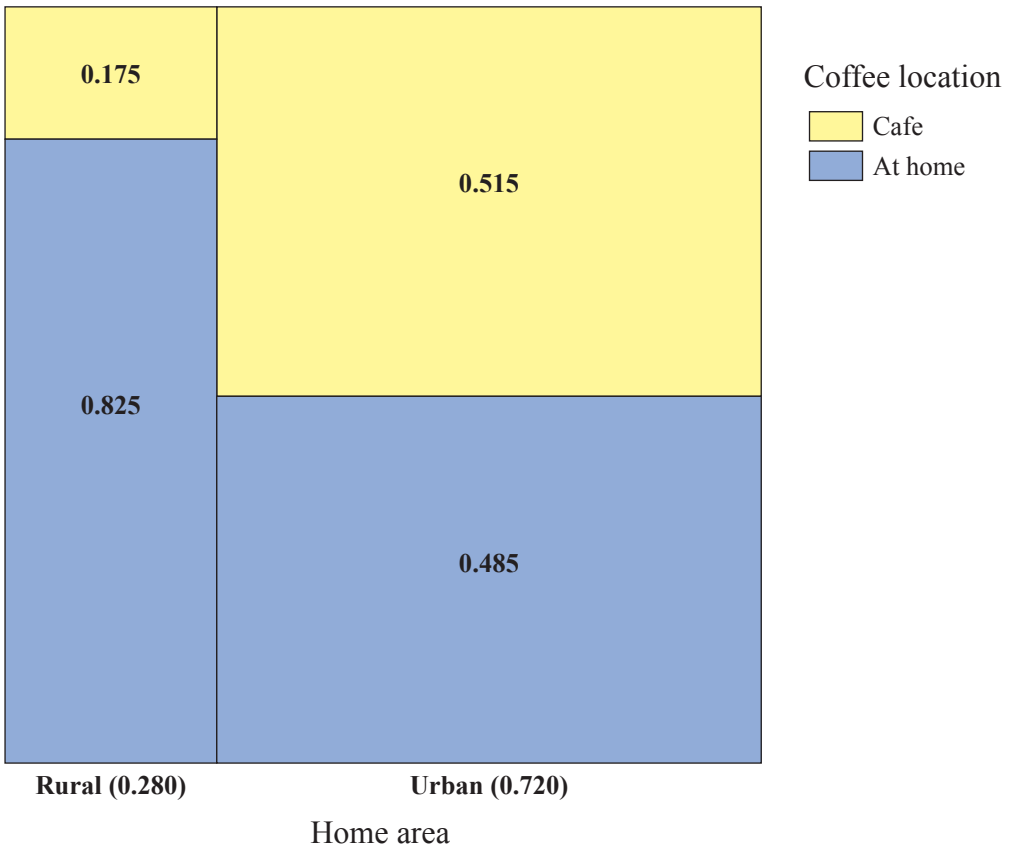



(i) Tuhia te tūponotanga o te hiahia o tētahi tangata e noho ana ki te tāone, ki te inu kawhe ki tētahi wharekai.

(ii) He aha ngā taunakitanga kei ngā hua o te rangahau e whakaaturia ana i te tapawhā tūponotanga *(eikosogram)*, e tohu ana i te rerekētanga o te hiahia ki te inu kawhe i te kāinga, i tētahi wharekai rānei, i waenganui i te hunga e noho tāone ana me ērā e noho ana ki tuawhenua?

Taunakitia tō whakautu ki ngā whakaaro ā-tauanga, kōrerohia hoki te taurangirangi tīpakonga.

(b) The eikosogram below illustrates from the 510 people in the survey whether they live in a rural or urban area, and whether they prefer to make their coffee at home or go to a cafe. An eikosogram visually separates the probabilities for two variables into rectangular regions whose areas are in proportion to the probability value.



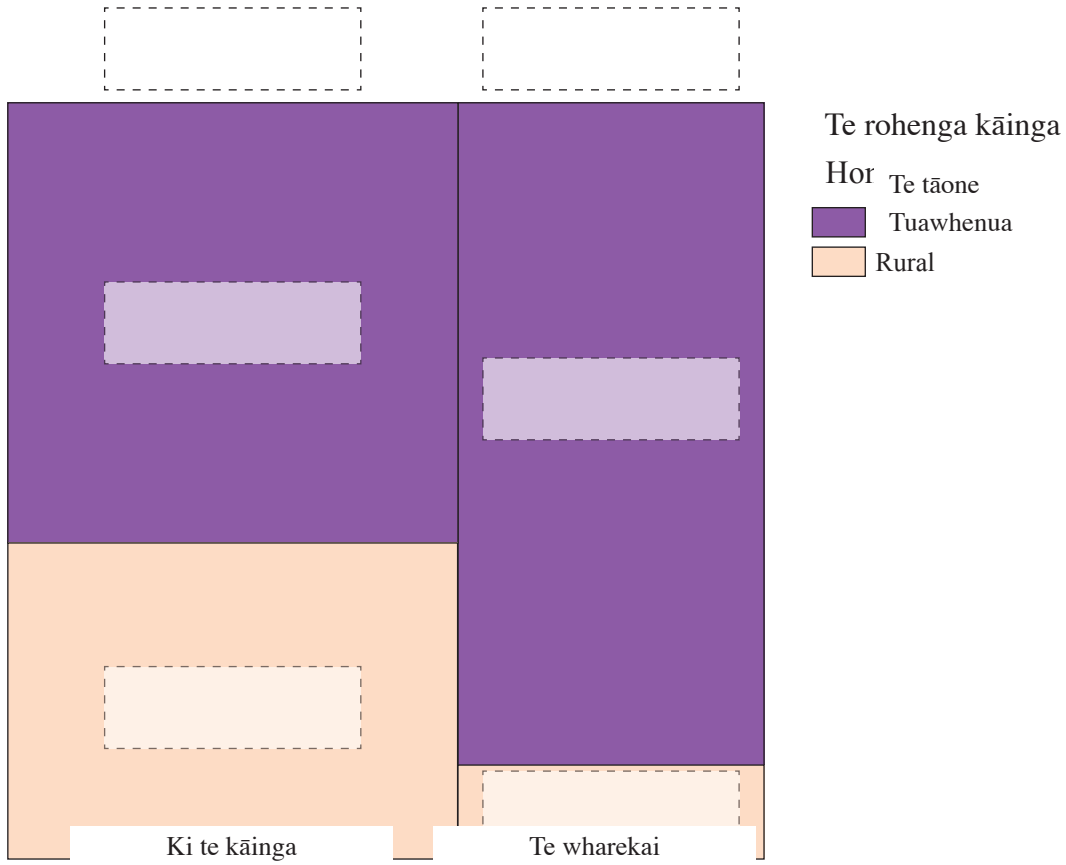

(i) Write down the probability that a person who lives in an urban area would prefer to have their coffee at a cafe.

(ii) What evidence exists from the results of the survey displayed in the eikosogram that there is a difference in preference for having coffee at home or in a cafe between people who live in rural or urban areas?

Support your answer with statistical reasoning, with reference to sampling variation.

(iii) E whakaahuatia ana i te tapawhā tūponotanga *(eikosogram)* o raro nei ngā hua o taua rangahau tonu, engari kua whakawhitihia ngā horopaki (**te rohenga kāinga** me te **wāhi kawhe**).

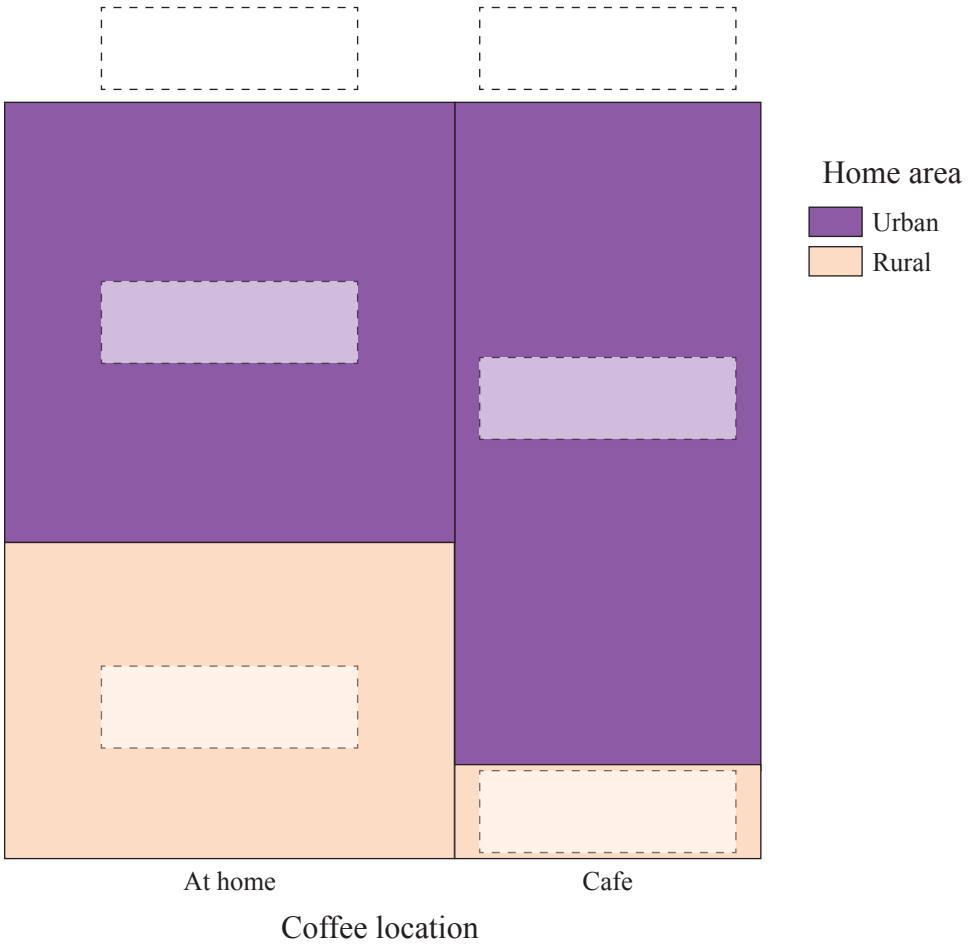
Whakaotingia ngā uara ki ngā pouaka e ono e kapi ai ngā taipitopito e ngaro ana mō tēnei tapawhā tūponotanga *(eikosogram)*.




Te wāhi kawhe
Coffee location

(iii) The eikosogram below represents the results from the same survey but with the factors swapped around (**home area** and **coffee location**).

Complete the values in the six boxes to complete the missing information for this Eikosogram.



## TE TŪMAHI TUATORU

(a) He rite tonu te hui a ētahi hoa e toru ki te inu kawhe. Kua arotake rātou i ngā painga (te tino hūnene, te kore rānei i hūnene) me ngā waitohu (ngā waitohu Fair Trade, ngā waitohu rānei ehara i te Fair Trade) o ngā kawhe kua inumia e rātou.

Tekau mā rima katoa ngā momo waitohu kawhe rerekē kua inumia e rātou, ā, o ēnei, 12 nō ngā waitohu Fair Trade. E waru o ngā waitohu e tino hūnene ana, ā, e rima o ērā nō ngā waitohu Fair Trade.

Whakamāramahia mai mēnā rānei e motuhake ana ngā pāpono "ehara te kawhe i te waitohu Fair Trade", me te "kāore te kawhe i te tino hūnene".

Tuhia kia kotahi te tātainga ā-nama, kia neke atu rānei.

## QUESTION THREE

(a) Three friends meet regularly for coffee. They have been analysing the strengths (extra strong or not extra strong) and brands (Fair Trade brands or not Fair Trade brands) of coffee that they have tried.

Fifteen different brands of coffee were tried and of these, 12 were from Fair Trade brands. Eight of the brands were extra strong strength, of which five were from Fair Trade brands.

Explain if the following events "the coffee is not a Fair Trade brand" and the "coffee is not extra strong" are mutually exclusive.

Give at least one numerical calculation.

(b) Ka hui ngā hoa i tētahi rā i ia wiki ki tētahi wharekai ki te inu kawhe; kotahi ki tēnā, ki tēnā. He pūnaha tā rātou hei whakatau i te tangata māna e utu ngā kawhe e toru, arā, ka piua e tēnā, e tēnā tētahi uka. Ko te hoa ka rerekē te hua o tana piu i ō ērā atu, ko ia te "rāwaho", ā, māna e utu ngā kawhe e toru.

(i) Tātaia te tūponotanga o te korenga o tētahi e noho hei "rāwaho", ā, ka mate ngā hoa e toru ki te piu anō i ā rātou uka.

(ii) Whakamāramatia te take, mā te whakamahi whakaaro ā-tauanga, kāore e kore ka rite tonu te nui o ngā wā ka utu tēnā me tēnā i te nama.

(b) The three friends meet for a coffee each in a cafe once a week. They have a system for deciding who will pay for all three coffees which involves each of them flipping a coin. The friend who flips a result different to the other two is considered the "odd one out" and ends up paying for all three coffees.

(i) Calculate the probability that no one is "the odd one out" and the three friends will end up having to flip their coins again.

(ii) Explain, using statistical reasoning, why each friend can expect to pay on the same number of times.

(iii) Kua neke atu i te 100 ngā hui a ngā hoa ki te inu kawhe i ngā tau e rua. E ohorere ana ngā hoa kāore i nui ake i te rima ngā piunga o ā rātou uka i tētahi hui kotahi, i te roanga o taua wā rā, hei whakatau i te tangata māna e utu.

Whakamāramatia, mā te whakamahi whakaaro ā-tauanga, mēnā rānei he pāpono whanokē tērā.

(iii) The friends have met for coffee 100 times over two years. The friends were surprised that during that whole period of time, they have never had to flip their coins more than five times at any meeting, in order to decide who paid.

Explain, using statistical reasoning, if this is an unusual occurrence.

(iv) Kua tuhia e Hoa A te tangata nāna i utu ngā kawhe i ngā tau e rua kua hori. E whakaaturia ana ngā hua o ngā hui inu kawhe 100 i te tūtohi o raro nei. Ka whakaaro a Hoa A kua nui rawa ngā wā i mate ai ia ki te utu i ngā kawhe.

**Te nui o ngā wā i mate ai ia hoa ki te utu i ngā kawhe**

| **Hoa A** | Hoa B | Hoa C |
|---|---|---|
| **49** | 23 | 28 |

Matapakina te āhua o te āwhinatia o Hoa A mā te whakahaere i tētahi whaihanga ki te whakatau mēnā i nui rawa te hautau o ana utu i ngā kawhe.

Ehara i te mea me hoahoa e koe te whaihanga.

(iv) Friend A has been recording who has been paying for the coffees over the last two years. The results of 100 coffee meet ups are shown in the table below. Friend A thinks that the number of times they have had to pay has been too high.

**Number of times each friend ended up paying for coffees**

| **Friend A** | Friend B | Friend C |
|---|---|---|
| **49** | 23 | 28 |

Discuss how carrying out a simulation would help Friend A decide if the proportion of times they have paid for coffee has been too high.

You do not need to design the simulation.

**He whārangi anō ki te hiahiatia.**
**Tuhia te tau tūmahi mēnā e hāngai ana.**

TE TAU TŪMAHI

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

QUESTION NUMBER

*English translation of the wording on the front cover*

# Level 3 Mathematics and Statistics (Statistics) 2023

## 91585M Apply probability concepts in solving problems

Credits: Four

91585M

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

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.**

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

Show ALL working.

If you need more room for any answer, use the extra space provided at the back of this booklet.

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

Do not write in any cross-hatched area (DO NOT WRITE IN THIS AREA DO NOT WRITE). This area will be cut off when the booklet is marked.

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