

# 3

91585M



915855



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Tohua tēnei pouaka  
mēnā kāore he tuhituhi i  
roto i tēnei pukapuka

## Te Pāngarau me te Tauanga (Tauanga), Kaupae 3, 2020

### 91585M Te whakahāngai ariā tūponotanga hei whakaoti rapanga

9.30 i te ata Rāapa 18 Whiringa-ā-rangi 2020  
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakahāngai ariā tūponotanga hei whakaoti rapanga.	Te whakahāngai ariā tūponotanga mā te whakaaro whaipānga hei whakaoti rapanga.	Te whakahāngai ariā 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–STATF.

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, ka mutu, 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

Whai muri i te korikori tinana, i inea te nui o te huka i roto i te toto me ngā taumata tauraki o ngā ākonga Tau 13 e 80 mai i tētahi kura. I whakarōpūtia ngā taumata huka toto ki te ‘kūhuka toto pāpaku’, ki te ‘kūhuka toto māori’, ā, ko ngā taumata tauraki ka whakarōpūtia ki te ‘tauraki’, ‘kore tauraki’ rānei.

O ngā ākonga 32 he kūhuka toto pāpaku, 20 o ēnei i te tauraki anō hoki.

53 ngā ākonga kāore i te tauraki.

- (a) I tīpako matapōkeretia tētahi o ngā ākonga.
- (i) Tātaitia te tūponotanga i te tauraki te ākonga.

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- (ii) Whakamāramahia mai mēnā ko ngā āhuatanga ‘kei te tauraki te ākonga’ me te ‘he kūhuka toto pāpaku tō te ākonga’ he tāuke tētahi ki tētahi.

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

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**QUESTION ONE**

After exercise, the blood sugar and dehydration levels of 80 Year 13 students from one school were measured. Blood sugar levels were classified as 'low blood sugar' or 'normal blood sugar' and dehydration levels were classified as 'dehydrated' or 'not dehydrated'.

Of the 32 students with low blood sugar levels, 20 were also dehydrated.

53 students were not dehydrated.

- (a) One of the students was randomly selected.
- (i) Calculate the probability that the student was dehydrated.

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- (ii) Explain whether the events 'student is dehydrated' and 'student has low blood sugar' are mutually exclusive.

Support your answer with statistical reasoning.

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- (iii) Homai kia RUA ngā pūtake me tūpato te whakamahi i ēnei raraunga hei whakatau tata i te tūponotanga e whakaatu ana tētahi ākonga Tau 13 i Aotearoa i tīpakohia matapōkeretia i ngā taumata kūhuka toto pāpaku whai muri i te korikori tinana.

Pūtake Tuatahi: \_\_\_\_\_

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Pūtake Tuarua: \_\_\_\_\_

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- (b) Ko te whakaaro ka whakahekea ana e te tauraki me ngā taumata kūhuka toto pāpaku ngā pūkenga hirikapo<sup>1</sup>.

I tētahi atu rangahau e pā ana ki tētahi rōpū ākonga Tau 13 mai i taua kura anō, i kitea i muri i te korikori tinana:

- mō te 15% o ngā ākonga i te tauraki, ā, he taumata kūhuka toto pāpaku ō rātou, i kitea te heke o ngā pūkenga hirikapo i roto i te 45% o rātou
- mō te 57% o ngā ākonga kāore i te tauraki, ā, i te tika ngā taumata kūhuka toto pāpaku, i kitea te heke o ngā pūkenga hirikapo i roto i te 5% o rātou
- mō ētahi atu o ngā ākonga, i kitea te heke o ngā pūkenga hirikapo i roto i te 32% o rātou.

- (i) Tātaitia te tūponotanga ka kitea i roto i tētahi ākonga i tīpakohia matapōkeretia i tēnei rōpū kua heke ngā pūkenga hirikapo i muri i te korikori tinana.

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<sup>1</sup> hinengaro

- (iii) Give TWO reasons why care should be taken when using this data to estimate the probability that any randomly chosen Year 13 student in New Zealand shows low blood sugar levels after exercise.

Reason One: \_\_\_\_\_

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Reason Two: \_\_\_\_\_

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- (b) Both dehydration and low blood sugar levels are thought to decrease cognitive (thinking) ability.

In a separate study involving a different group of Year 13 students from the same school, after exercise it was observed that:

- for the 15% of students who were dehydrated and who had low blood sugar levels, 45% showed decreased cognitive ability
- for the 57% of students who were not dehydrated and had normal blood sugar levels, 5% showed decreased cognitive ability
- for all other students, 32% showed decreased cognitive ability.

- (i) Calculate the probability that a randomly selected student in this group showed decreased cognitive ability after exercise.

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- (ii) Tātaitia te ōwehenga o ngā ākonga i roto i tēnei rangahau me te heke o ngā pūkenga hirikapo kāore i te tauraki, ā, kei te tika ngā taumata kūhuka toto.

Whakamāramatia tēnei ōwehenga.

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- (ii) Calculate the proportion of students in this study with decreased cognitive ability that are not dehydrated and have normal blood sugar levels.

Interpret this proportion.

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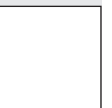
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## TŪMAHI TUARUA

I roto i te rēhita i ngā tūroro hou ki tētahi whare hauora, ka tātaritia rātou ki ngā aromatawai hauora. Ko tētahi o aua aromatawai he ine i te rahinga ngakototo hei tautohu i ngā tūroro he mate manawa. Ko ngā taumata ngakototo he nui ake i te 200 mg/dL e tohu ana pea kei te mate manawa pea te tūroro.

Ko te whakaatu a ngā rangahau hauora:

- tata ki te 5% o te taupori o Aotearoa e mōhiotia ana he mate manawa
- 73% o te hunga mate manawa he nui ake i te 200 mg/dL ngā taumata ngakototo, me te
- 76% o ngā tāngata kāore i te mate manawa he 200 mg/dL, iti iho rānei ngā taumata ngakototo.

- (a) (i) O ngā tāngata 100 i tātaritia ki tēnei aromatawai, tokohia te whakatau tata o ēnei tāngata ka nui ake i te 200 mg/dL tō rātou taumata ngakototo?

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- (ii) Ka kīia atu tētahi tūroro e nui ake tōna taumata ngakototo i te 200 mg/dL.

Homai he kōrero mēnā me māharahara tēnei tangata kei te pāngia ia e te mate manawa. Whakamahia te whakaaro whaitake o te tauanga hei tautoko i tō tuhinga.

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**QUESTION TWO**

As part of enrolling at a medical clinic, new patients undergo health-screening tests. One of these screening tests measures the amount of blood cholesterol in order to identify those patients who may have heart disease. Cholesterol levels greater than 200 mg/dL suggest that the patient may have heart disease.

Medical studies report that:

- approximately 5% of the New Zealand population are known to have heart disease
  - 73% of people with heart disease have cholesterol levels greater than 200 mg/dL, and
  - 76% of people without heart disease have cholesterol levels of 200 mg/dL or less.
- (a) (i) Out of 100 individuals who are screened with this test, approximately how many would be expected to have a cholesterol level greater than 200 mg/dL?

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- (ii) A patient is told that the result of their screening test is positive (cholesterol level is greater than 200 mg/dL).

Comment on whether this patient should be concerned that they do actually have heart disease.

Support your answer with statistical reasoning.

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- (iii) Me kī ko te uara whakarite mō te kī he mate manawa te tangata ka whakarerekētia mai i te 200 mg/dL ki te 250 mg/dL.

Whakaahuatia mai ka pēhea te piki o tēnei uara whakarite e whakarerekē ai i te ōwehenga o ngā tūroro i tika te tautohu kei te mate manawa (ko te hunga he nui ake te taumata ngakototo i te taumata whakarite, e tino pāngia ana e te mate manawa).

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- (b) Kei te hiahia te whare haumanu ki te mōhio i te tūponotanga ka whakatauhia he tūroro kei te mate manawa, te matehuka me te ikura roro.

Whai muri i te tātari i ngā pūkete mō ngā tūroro 5000, i kitea:

- 71 ō rātou i whakatauhia kei te mate manawa, matehuka me te ikura roro
- 1359 kāore i whakatauhia ki tētahi o ēnei mate
- 1907 i whakatauhia kei te mate manawa
- 1814 i whakatauhia kei te matehuka
- 627 i whakatauhia he ikura roro
- 388 o rātou i whakatauhia kei te mate manawa i whakatauhia he matehuka anō rātou
- 170 o rātou i whakatauhia kei te mate manawa i whakatauhia kei te pāngia anō rātou e te ikura roro.

- (i) Tātaihia te ōwehenga o ngā tūroro i whakatauhia ki te mate manawa, engari kua te matehuka, te ikura roro rānei.

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- (iii) Suppose the threshold value for suggesting a person has heart disease is changed from 200 mg/dL to 250 mg/dL.

Describe how this increase in threshold value could change the proportion of patients correctly identified as having heart disease (those with a cholesterol level greater than the threshold, that actually have heart disease).

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- (b) The medical clinic is interested in understanding the probability of patients being diagnosed with heart disease, diabetes, and stroke.

After analysing the records of 5000 patients, they found that:

- 71 were diagnosed with heart disease, diabetes, and stroke
- 1359 were not diagnosed with any of these conditions
- 1907 were diagnosed with heart disease
- 1814 were diagnosed with diabetes
- 627 were diagnosed with stroke
- 388 of those diagnosed with heart disease were also diagnosed with diabetes
- 170 of those diagnosed with heart disease were also diagnosed with stroke.

- (i) Calculate the proportion of patients that were diagnosed with heart disease, but not diabetes or stroke.

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- (ii) Ko te whakapae, mō ngā tūroro he mate manawa, ka huarua te tūponotanga ka whakatauhia rātou ki te matehuka tēnā i te ikura roro.

Kei te tautoko ngā raraunga i tēnei whakapae?

Tautokona tō tuhinga ki ngā tauākī tauanga e tōtika ana.

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- (ii) It is claimed that, for patients with heart disease, they are twice as likely to be diagnosed with diabetes than stroke.

Does the data support this claim?

Support your answer with appropriate statistical statements.

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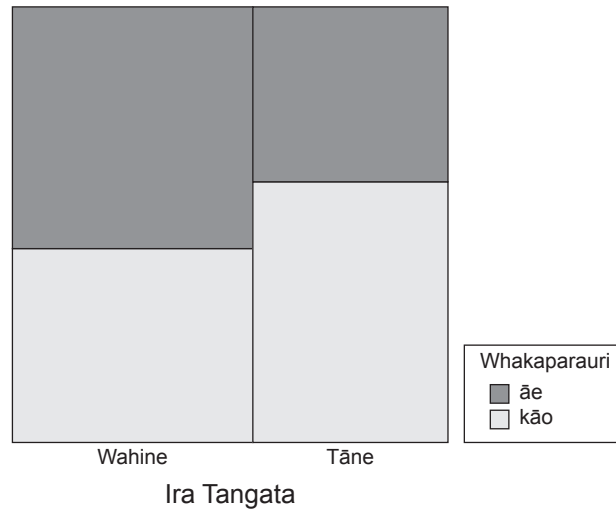
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## TŪMAHI TUATORU

E ai ki ngā rangahau he raruraru te whakaparauri horihori ki te hauora. E whakaatu ana te Eikosogram i raro i tētahi whakaaturanga o ngā ōwehenga o tētahi rōpū ākonga tāne me te wāhine i whai wāhi ki te whakaparauri horihori i te tau kua hipa. Ko ngā wāhanga tapawhā-hāngai o te Eikosogram he whai horahanga e ōrite ana ki ngā tūponotanga ki te whai wāhi mai ki te whakaparauri (kua rānei) mō ngā tāne me ngā wāhine i roto i tētahi rōpū rangahau.



250 ngā ākonga i roto i tēnei rangahau, he 55.2% o ēnei he wāhine. Kei raro tonu i te haurua (48.4%) o ngā ākonga 250 ko ngā ākonga i whai wāhi mai ki te whakaparauri horihori i te tau kua hipa (tae atu ki te  $\frac{2}{5}$  o ngā tāne).

- (a) (i) Whakaaturia ngā mōhiohio kua tukuna mai mō te rangahau mā tētahi tūtohi tataua ara-rua.

- (ii) Whakamāramahia mai he aha ngā mōhiotanga ka taea mai i ēnei raraunga mō te hononga ka taea i waenga i te ira tangata me te whakaparauri mō te hunga ka whakauru ki tēnei rangahau.

Tautokona tō tuhinga mā ngā tātaitanga.

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- (iii) Ko te whakapae he 1.5 whakareanga ake te tūponotanga ka whakauru ngā wāhine ki te whakaparauri horihori, tēnā i ngā tāne.

Kei te tautoko ēnei raraunga i tēnei whakapae?

Tautokona tō tuhinga ki ngā tauākī tauanga e tōtika ana, ka taea te whakauru mai ngā whakaaro whaitake mai i te Eikosogram.

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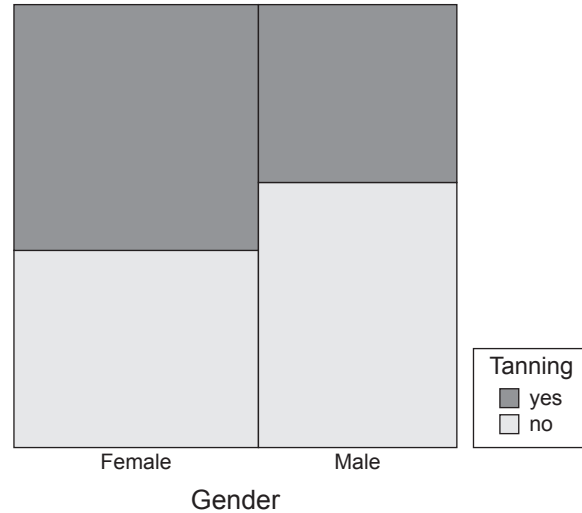
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**QUESTION THREE**

Research suggests that artificial tanning is detrimental to health. The Eikosogram below shows a representation of the proportions of a group of male and female students who have participated in artificial tanning during the previous year. The rectangular regions of the Eikosogram have areas in proportion to the probabilities of participating in tanning (or not) for males and females in a study group.



There were 250 students in this study, of whom 55.2% were female. Just less than half (48.4%) of the 250 students had participated in artificial tanning during the previous year (including  $\frac{2}{5}$  of the males).

- (a) (i) Represent the information provided about the study using a two-way table of counts.





- (b) Ko ngā tatau o ēnei ākonga 250 he whai whakarākei taringa ka whakarāpopotohia ki te tūtohi tatau ara-rua i raro. Ka tīpakohia matapōkeretia tētahi ākonga mai i tēnei rōpū.

	He whakarākei taringa	Kāore he whakarākei taringa
Tāne	58	54
Wahine	91	47

- (i) Whakamāramahia mai mēnā ko ngā pāpono ‘he wahine te ākonga’, ā, ‘he whai whakarākei taringa te ākonga’ he pāpono wehe kē.

Tautokona tō tuhinga ki ngā tauākī tauanga me ngā whakaaro whitake e tōtika ana.

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**Ka haere tonu te Tūmahi  
Tuatoru i te whārangi 20.**

- (b) The counts of these 250 students who have ear piercing(s) is summarised in the two-way table below. A student is randomly chosen from this group.

	Ear piercing(s)	No ear piercing(s)
Male	58	54
Female	91	47

- (i) Explain whether the events ‘student is female’ and ‘student has ear piercing(s)’ are independent.

Support your answer with statistical statements and reasoning.

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**Question Three continues  
on page 21.**









*English translation of the wording on the front cover*

## **Level 3 Mathematics and Statistics (Statistics) 2020**

### **91585 Apply probability concepts in solving problems**

9.30 a.m. Wednesday 18 November 2020  
Credits: Four

91585M

<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
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.**

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.**