See back cover for an English translation of this cover.

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91267M

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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, Kaupae 2, 2024

91267M Te whakamahi tikanga tūponotanga i te whakaoti rapanga

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te whakamahi tikanga tūponotanga i te whakaoti rapanga.	Te whakamahi tikanga tūponotanga i te whakaoti rapanga, mā te whakaaro ā-pānga.	Te whakamahi tikanga tūponotanga i te whakaoti rapanga, mā te whakaaro waitara e whānui ana.

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.

Whakaaturia ngā whiriwhiringa KATOA.

Tirohia kia kitea ai kei a koe te Pepa Ture Tātai L2–MATHMF.

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 (▨). 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

Me whakaatu ō whiriwhiringa, tae atu ki ngā hoahoa, mō ngā wāhanga katoa o Te Tūmahi Tuatahi.

I tētahi rangahau o nā tata nei, i uia e Ihi Aotearoa te nui o ngā haora i te wiki ka hipa i whakapaua ai e te hunga whai wāhi ki ngā mahi korikori o te hākinakina, o te whakakaha tinana, o te kori tinana, o ngā mahi pārekareka rānei.

(a) I whakaatuhia i ngā hua, ko te 10.8 haora te toharite o te wā i te wiki ka pau i te taiohi (e 5–17 tau te pakeke) e korikori tinana ana, ā, e 3.2 haora te ine mahora.

Me kī, ka taea e te tuari māori te whakatauira tata te tuari o ngā haora i te wiki e korikori tinana ana, mō ngā taiohi katoa.

(i) Whiriwhiria te tūponotanga o tēnei tūāhua: kei waenga i te 6 me te 10.8 haora te roa o te korikori tinana a tētahi taiohi, i kōwhiri matapōkeretia ai, i te wiki ka hipa.

(ii) Whiriwhiria te tūponotanga o tēnei tūāhua: i roa ake i te 16 haora te roa o te korikori tinana a tētahi taiohi, i kōwhiri matapōkeretia ai, i te wiki ka hipa.

QUESTION ONE

Working, including diagrams, should be shown for all parts of Question One.

In a recent survey, Sport New Zealand asked how many hours in the last week that participants had spent being physically active for sport, PE, exercise, or fun.

(a)   The results showed that young people (aged 5–17) were involved in physical activity for a mean of 10.8 hours per week, with a standard deviation of 3.2 hours.

Assume that the distribution of weekly physical activity hours for all young people can be approximately modelled by a normal distribution.

(i)   Find the probability that a randomly chosen young person spent between 6 and 10.8 hours of physical activity in the last week.

(ii)   Find the probability that a randomly chosen young person spent over 16 hours on physical activity in the last week.

(iii) I kitea ko te 12% o ngā taiohi katoa kāore e eke te nui o te korikori tinana ki tērā e tūtohua ana kia hāngai ai ki ngā aratohu a Manatū Hauora.

E hia haora i te wiki, i tōna itinga katoa, me korikori te tinana e tutuki ai ngā aratohu?

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(b) I whakaatuhia hoki i ngā hua o te rangahau, ko te 8.1 haora noa iho te toharite o te wā i te wiki ka pau i ngā ākonga o te Tau 11 me te 12 (15–17 tau te pakeke) e korikori tinana ana.

E 5% o ngā ākonga 15–17 tau te pakeke i te rangahau kāore i eke ki te 30 meneti (0.5 haora) i te wiki te roa o te korikori tinana.

(i) Tātaihia te ine mahora o ngā haora i te wiki ka pau i ngā ākonga 15–17 tau te pakeke e korikori tinana ana.

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(iii) 12% of all young people were found to do less than the suggested amount of physical activity to meet the Ministry of Health guidelines.

What is the minimum number of weekly hours of physical exercise needed to meet the guidelines?

(b) The results of the survey also showed that for Year 11 and 12 students (age 15–17 years), the mean weekly hours spent on physical activity was only 8.1 hours.

5% of students aged 15–17 in the survey spent less than 30 minutes (0.5 hours) on physical activity each week.

(i) Calculate the standard deviation for the number of weekly hours spent on physical activity by students aged 15–17.

(ii) Homai ngā take e RUA, e tohu ana tō whakautu i (b)(i) EHARA pea te tuari māori i te tauira tika mō te nui o ngā haora ka pau i te korikori tinana, mō ngā ākonga 15–17 tau te pakeke.

(c) Ko te rite tonu o te whai wāhi atu ki te korikori tinana tētahi o ngā huarahi pai katoa e heke ai te tūraru ka pāngia te tangata e te korongenge ka kaumātua ana. I tūhuratia hoki i te rangahau te nui o te korikori a te hunga kaumātua i Aotearoa e 75 tau te pakeke, e pakeke ake ana hoki i tērā.

E 45% o ngā kaiwhakautu e 75 tau te pakeke, e pakeke ake ana hoki i tērā, kāore i eke ki te 30 meneti (0.5 haora) i te wiki te roa o te korikori tinana, ā, e 4.3 haora i te wiki te toharite.

(i) He aha tā tēnei e tohu nei mō te tuari o ngā haora korikori tinana, mō te hunga e 75 tau te pakeke, e pakeke ake ana hoki i tērā?

(ii) Give TWO reasons why your answer in (b)(i) suggests that a normal distribution may NOT be an appropriate model for the number of hours spent on physical activity for students aged 15–17 years.

(c) Participating in regular physical exercise is one of the best ways to reduce the risk of dementia later in life. The survey also investigated the activity levels of elderly people in New Zealand aged 75 years and over.

45% of survey respondents aged 75 years and over spent less than 30 minutes (0.5 hours) in weekly physical activity, with a mean of 4.3 hours per week.

(i) What does this suggest about the distribution of physical activity hours for people aged 75 and over?

I te tangohanga o ērā pakeke e 75 tau te pakeke, e pakeke ake ana hoki i tērā, **kāore** i paku korikori tinana, i piki te toharite o te wā e korikori tinana ana ki te 7.2 haora i te wiki, ā, ka pēnei te āhua o ngā raraunga:

Te mātāpuna raraunga: https://sportnz.org.nz/resources/active-nz-survey-2018/

(ii) E ai ki te tūtohi ME te whakaaturanga raraunga o runga nei, ko tōna hia haora te **tau waenga** ka pau i te pakeke e 75 tau te pakeke, e pakeke ake ana hoki i tērā, e korikori tinana ana, ki tō whakapae?

(iii) He pēhea ēnei hua ina whakatauritea ki tētahi tuari māori, ko te 7.2 haora te toharite, ā, ko te 2.4 haora te ine mahora?

Whakatauritea, kia poto, te pū, te hora, me te āhua o te tuari, mā te whakamahi i ngā tātainga me ngā huahua e hāngai ana, hei tautoko i tō whakautu.

When those adults 75 years and over who spent **no** time in physical activity were excluded, the mean increased to 7.2 hours of physical activity per week and the data looks like this:

Data source: https://sportnz.org.nz/resources/active-nz-survey-2018/

(ii) Based on the table AND the data display above, approximately what would you expect the **median** number of hours adults aged 75 years and over spend on physical activity to be?

(iii) How do these results compare to a normal distribution with a mean of 7.2 hours and a standard deviation of 2.4 hours?

Briefly compare the centre, spread, and shape of the distribution, using any relevant calculations and sketches to support your answer.

TE TŪMAHI TUARUA

Ko te ako i tētahi reo tuarua tētahi huarahi pai hei whakapakari i te mahara, ā, kua kitea hoki tōna painga hei ārai korongenge ka kaumātua ana.

I kitea ngā hua e whai ake nei i tētahi mātaitanga nui o ngā kaiwhakamahi o tētahi taupānga ako reo e paingia ana:

• Ko tōna 22% o ngā kaiwhakamahi o te taupānga kāore anō kia 18 tau te pakeke, ko tōna 35% kei waenga i te 18 me te 30 tau, ko te toenga e pakeke ake ana i te 30 tau.

• O te hunga kāore anō kia 18 te pakeke, ko te ¾ i te ako i tētahi reo mā te whakamahi i te taupānga mō ngā take mātauranga (te kura, te mahi rānei), ko te 15% mō te tāpoi, ā, ko te toenga i te ako mō take whaiaro kē, pēnei i te whānau.

• Mō ngā kaiwhakamahi taupānga kei waenga i te 18–30 tau te pakeke, ko te ¼ i whakamahi i te taupānga mō ngā take mātauranga, ko te 60% i whakamahi i te taupānga e takatū ai mō te tāpoi, ā, ko te toenga i whakamahi i te taupānga mō take whaiaro kē.

(a) Whakaotihia te hoahoa-peka, ā, whakamahia hei whakautu i ngā pātai kei raro nei.
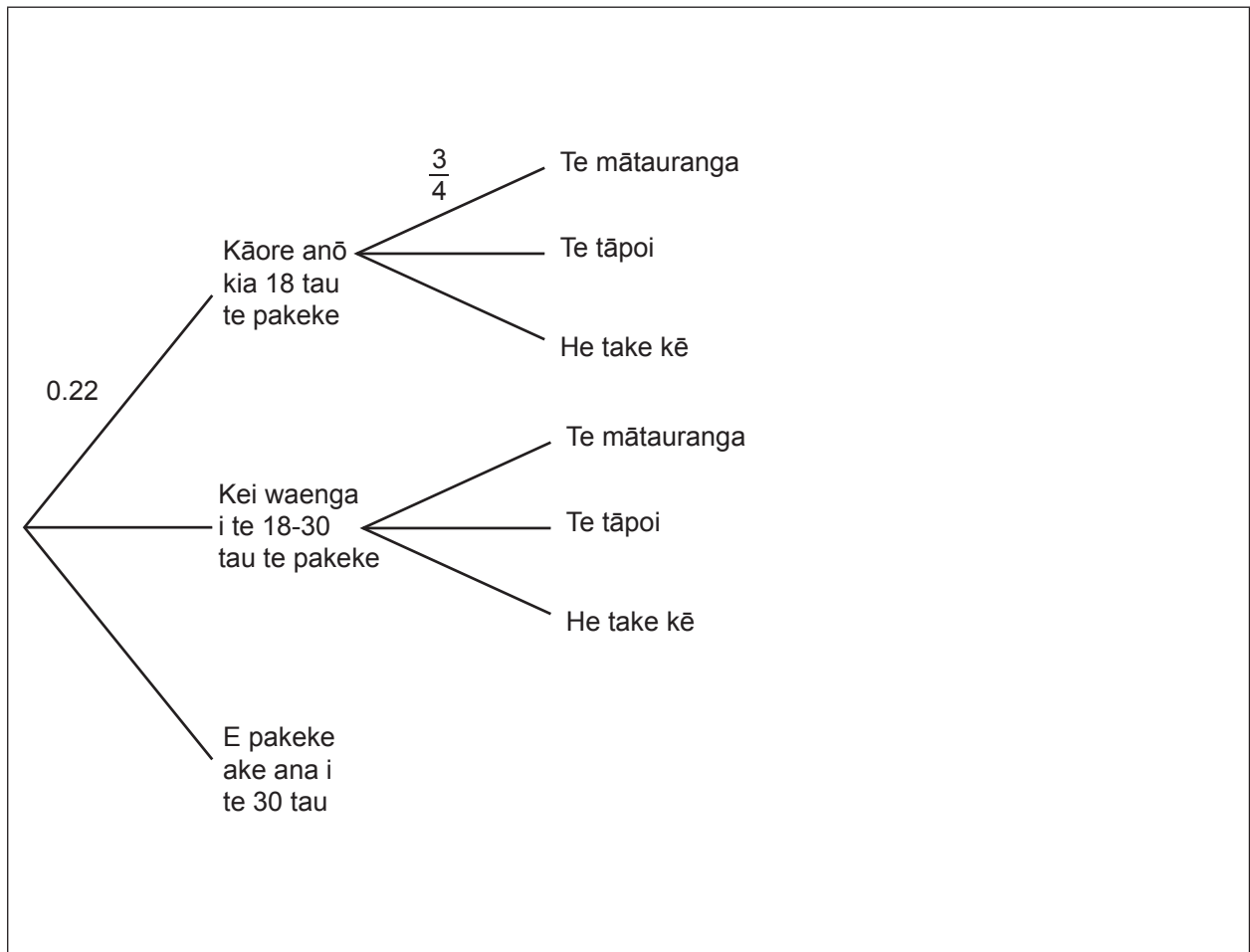
(i) He aha te tūponotanga kāore anō kia 18 tau te pakeke o tētahi kaiwhakamahi i te taupānga, i kōwhiri matapōkeretia ai, ā, ka whakamahia hei ako i tētahi reo e takatū ai mō te tāpoi?

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QUESTION TWO

Learning a second language is considered a good way to improve memory, and has also been found to help prevent dementia later in life.

A large study of the users of a popular language learning app found the following:

*   Approximately 22% of users of the app were under 18 years of age, 35% were aged 18 to 30, and the rest were over 30.

*   Of those who were under 18 years old, ¾ were learning a language using the app for academic reasons (school or work), while 15% were for travel, and the remainder were for other personal reasons, such as family.

*   For the 18–30 year old app users, ¼ used it for academic purposes, while 60% used it to prepare for travel, and the rest used it for other personal reasons.

(a) Complete the probability tree and use it to answer the questions below.
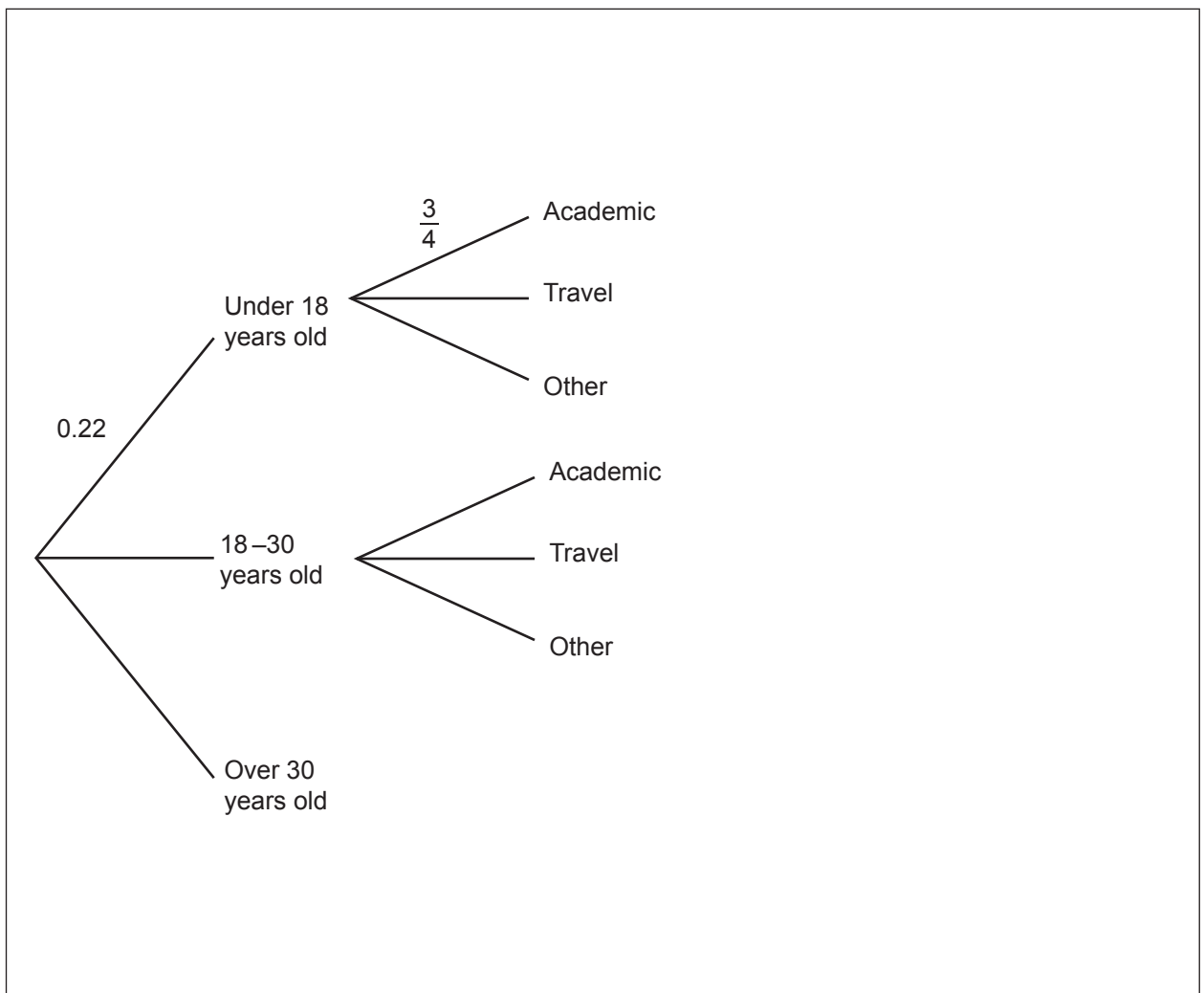
(i) What is the probability that an app user chosen at random, is under 18 years old and uses it to learn a language to prepare for travel?

(ii) O roto i te 40 kaiwhakamahi, i kōwhiri matapōkeretia ai, tokohia kei waenga i te 18–30 tau te pakeke, ā, e whakamahi ana i te taupānga mō ngā take mātauranga rānei, mō ngā take tāpoi rānei, ki tō whakapae?

(iii) I whakaatuhia hoki i ngā hua o te rangahau:

O ngā kaiwhakamahi taupānga e pakeke ake ana i te 30 tau, e toru whakareanga te tokomaha ake o ngā tāngata i whakamahi i te taupānga mō te tāpoi, tēnā i take 'kē'.

Ko te 55% o ngā kaiwhakamahi i te taupānga o ngā pakeketanga katoa kei te ako i ngā reo mō te tāpoi.

He aha te tūponotanga, mēnā e pakeke ake ana i te 30 tau te pakeke o te kaiwhakamahi taupānga, kei te whakamahi ia i te taupānga mō ngā take mātauranga (te kura, te mahi rānei)?

(iv) Ko te whakatau tata, ka tutuki te hōtaka i tōna 10% o ngā kaiwhakamahi kei waenga i te 18–30 tau te pakeke mēnā ko ngā take mātauranga te take matua e ākona nei tētahi reo, ka tutuki te hōtaka i te 6% o ngā kaiwhakamahi kei waenga i te 18–30 tau te pakeke mēnā ko te tāpoi te take matua e ākona nei tētahi reo, ā, ka tutuki te hōtaka i te 2.5% noa iho mēnā e whakamahia ana te taupānga hei ako i tētahi reo mō take kē.

He aha te tūponotanga, ki te kōwhiri matapōkeretia tētahi kaiwhakamahi kei waenga i te 18–30 tau te pakeke, ka tutuki i a ia te hōtaka?

(ii)   Out of a randomly selected group of 40 users, how many would you expect to be aged 18–30 years using the app for either academic or travel purposes?

(iii)   The survey results also showed:

Of the app users over 30 years old, three times as many people used it for travel than for 'other' reasons.

Overall, 55% of app users of all ages are learning languages for travel.

What is the probability that, given an app user is aged over 30, they are using the app for academic (school or work) purposes?

(iv)   It is estimated that about 10% of 18–30 year old users finish the course if their main purpose in learning a language is for academic purposes, while 6% of 18–30 year old users finish the course if their main purpose in learning a language is for travel, and only 2.5% finish the course if they are using the app to learn a language for other reasons.

What is the probability that, if a user aged 18–30 years is chosen at random, they finish the course?

(b) E ai ki ngā kaiwhakatairanga o te taupānga ako reo, "e 4.2 whakareanga te nui ake o te tūponotanga ka tutuki te hōtaka i ngā ākonga ka hoko i te putanga utu, tēnā i ērā kāore e utu."

E mōhiotia ana, ka tiki ake tōna 5% o ngā kaiwhakamahi i te putanga utu.

Ko te whakatau tata, ko te tūponotanga he kaiwhakamahi utu kore tētahi kaiwhakamahi i kōwhiria matapōkeretia ai, ā, ka tutuki i a ia te hōtaka, ko te 3.8%.

Mēnā e houtupu ana te whakapae, he aha te tapeke o te tūponotanga ka tutuki te hōtaka?

(b) According to the promoters of the language learning app, "learners who buy the premium version are 4.2 times as likely to finish the course as standard users."

It is known that about 5% of users install the premium version.

It is estimated that the probability of a user chosen at random being a standard user who finishes the course is 3.8%.

If the claim is valid, what is the probability of finishing the course overall?

TE TŪMAHI TUATORU

Kua kitea e te huhua kairangahau, ka āwhina te whakatangi i tētahi taonga puoro, te ako rānei i tētahi reo tuarua i te tangata kia kakama tonu te hinengaro, kia āraitia hoki te korongenge, te waimaero hirikapo rānei, ka kaumātua ana.

I tētahi mātaitanga whāroa i whakaputaina i te tau 2015, i uia te hunga whai wāhi e 964 e taipakeke ana, e hauora ana (kei waenga i te 60 me te 75 tau te pakeke), mēnā i ako rātou i tētahi reo manene, i mātai puoro rānei i mua i te 18 tau te pakeke. Kātahi rātou ka aroturukitia kia kitea mēnā i puta haere ngā tohu tuatahi o te waimaero hirikapo (MCI) i ngā tau e 6 e whai ake ana.

Anei ētahi o ngā hua:

Te tūtohi 1: I ākona tētahi reo manene

		I puta haere te MCI	Kāore i puta haere te MCI	Te tapeke
I ākona tētahi reo (te roa o te ako)	Karekau	130	134	264
	1–4 tau	224	352	576
	Neke atu i te 4 tau	42	82	124
	Te tapeke	396	568	964

Te tūtohi 2: I ākona tētahi taonga puoro

		I puta haere te MCI	Kāore i puta haere te MCI	Te tapeke
I ākona te puoro (te roa o te ako)	Karekau	α		346
	1–4 tau			360
	Neke atu i te 4 tau	85	173	258
	Te tapeke	396	568	964

Te mātāpuna: https://psycnet.apa.org/record/2014-32649-001

(a) Whakamahia te/ngā tūtohi o runga hei whakautu i ngā pātai e whai ake nei.

(i) He aha te ōrau o te hunga whai wāhi i puta haere ai te MCI i a rātou?

(ii) He aha te tūponotanga i puta haere te MCI i tētahi o te hunga whai wāhi, mēnā i ako ia i tētahi reo mō tētahi wā (te 1–4 tau rānei, i neke atu rānei i te 4 tau)?

QUESTION THREE

Many researchers have found that playing a musical instrument or learning a second language can help to keep people mentally active, and prevent dementia or cognitive impairment later in life.

In one longitudinal study published in 2015, 964 healthy older participants (aged between 60 to 75 years) were asked if they learned a foreign language or studied music before the age of 18. They were then monitored to see if they developed mild cognitive impairment (MCI) over the next 6 years.

These were some of the results:

Table 1: Learned foreign language

		Developed MCI	**No MCI**	**Total**
Learned language (years learned)	**None**	130	134	264
	1–4 years	224	352	576
	over 4 years	42	82	124
	Total	396	568	964

Table 2: Learned musical instrument

		Developed MCI	**No MCI**	**Total**
Learned music (years learned)	**None**	α		346
	1–4 years			360
	over 4 years	85	173	258
	Total	396	568	964

Source: https://psycnet.apa.org/record/2014-32649-001

(a) Use the table(s) above to answer the following questions.

(i) What percentage of participants developed MCI?

(ii) What is the probability that a participant developed MCI, if they learned a language for at least some time (either 1–4 or over 4 years)?

(b)   Ka titiro a Susie ki ngā tūtohi o ngā raraunga, ka mea atu "e rua whakareanga te nui ake o te tūponotanga ka puta haere te MCI i te tangata mēnā i roa ake i te 4 tau tana ako i te puoro, tēnā i tana ako i tētahi reo mō tētahi wā e roa ake ana i te 4 tau."

   (i)   Whakamāramahia te hē o ngā whakaaro o Susie, Ā,

   (ii)   whakatikaina tana kōrero ki ngā tātainga tika.

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(c)   Ko te pānga tūraru, e whakataurite ana i te tūraru o te puta haere o te MCI mō te hunga whai wāhi i roa ake i te 4 tau tā rātou ako i tētahi taonga puoro, ki te hunga kāore i whakatangi puoro, ko te 0.708.

   (i)   Whakamahia tēnei uara hei tātai i te tokomaha o te hunga whai wāhi i puta haere te MCI i a rātou, engari kāore i ako i te puoro (e tapā ana ki te α i Te tūtohi 2 i te whārangi 16).

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E rere tonu ana te Tūmahi Tuatoru i te whārangi e whai ake ana.

(b) Susie looks at the tables of data and says "it is twice as likely for people to develop MCI if they learn music for over 4 years than if they learn a language for over 4 years."

    (i)   Explain Susie's incorrect reasoning AND

    (ii)   with valid calculations, correct her statement.

(c) The relative risk comparing the risk of developing MCI for participants who learned a musical instrument for over 4 years to those who didn't play any music is 0.708.

    (i)   Use this value to calculate the number of participants who developed MCI but didn't learn any music (labelled α in the Table 2 on page 17).

(ii) I whakahuatia te mātaitanga i tētahi tuhinga e akiaki ana i te hunga taiohi ki te ako i te puoro me ngā reo, ā, i takoto te kōrero, "mā te ako i tētahi taonga puoro rānei, i tētahi reo manene rānei mō ngā tau e neke atu ana i te whā i te wā e taiohi ana, ka 30% te itinga iho o te tūpono ka puta haere te MCI ka kaumātua ana, tēnā i te kore i ako i tētahi."

Arotakehia tēnei whakapae mā te whakamahi tātainga i runga i ngā raraunga o mua ake, me te whakamāori i ngā pānga tūraru i te horopaki.

(ii)   A New Zealand article encouraging young people to learn music and languages, quoted the study, claiming that "either learning a musical instrument or a foreign language for over 4 years when young reduces the risk of developing MCI in later life by about 30%, compared to not learning either one."

Evaluate this claim using calculations based on the data above, interpreting the relative risks in context.

TE TAU TŪMAHI

<table>
<tr><td>

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

</td></tr>
</table>

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

English translation of the wording on the front cover

Level 2 Mathematics and Statistics 2024

91267M Apply probability methods in solving problems

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Apply probability methods in solving problems.	Apply probability methods, using relational thinking, in solving problems.	Apply probability methods, 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 Sheet L2–MATHMF.

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 (░). 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.