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91586M



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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

SUPERVISOR'S USE ONLY

Te Pāngarau me te Tauanga (Tauanga), Kaupae 3, 2016

91586M Te whakahāngai i ngā tuari tūponotanga hei whakaoti rapanga

2.00 i te ahiahi Rāpare 24 Whiringa-ā-rangi 2016

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 tuinga, 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 2–15 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

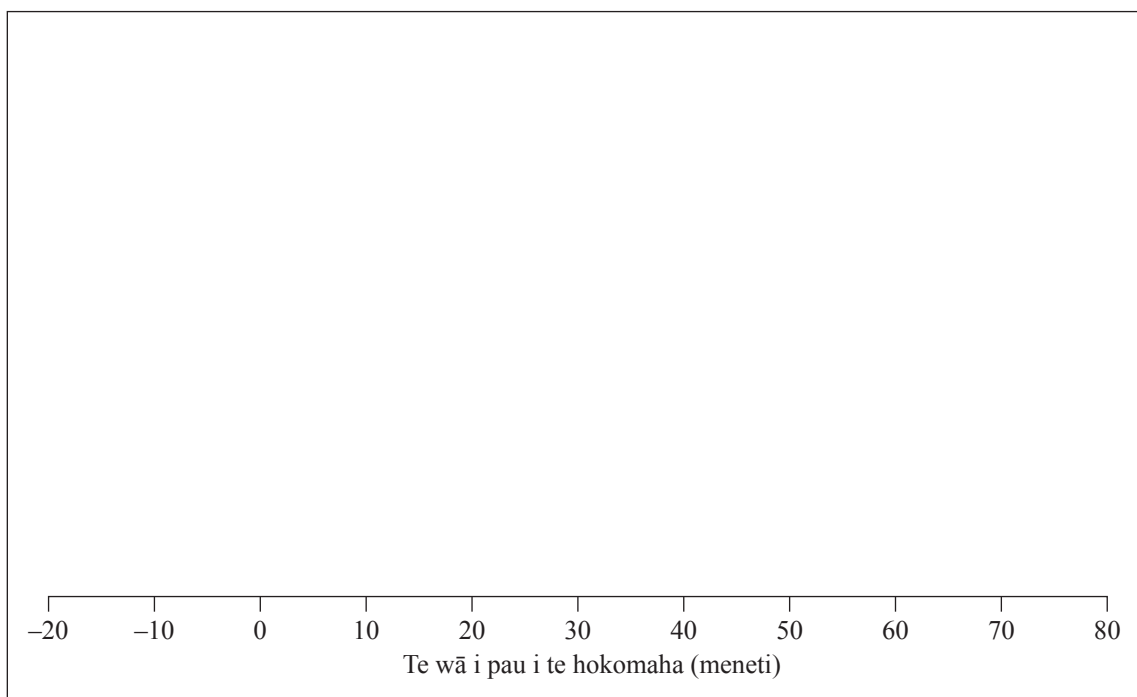
TŪMAHI TUATAHI

- (a) Ka tāea te whakatauirā te roa o te wā e kimi tūnga waka ana tētahi kaihoko i te hokomaha mā tētahi taurangi matapōkere e whai uara ana i waenga i te 0 me te 8 meneti. Ko te tino wā ka kitea he tūnga waka e tētahi kaihoko he 2 meneti.

Mā te whakamahi i tētahi taurā tōtika, tātaihia te tūponotanga ka iti ake i te rua meneti, neke atu RĀNEI i te ono meneti e kimihia ana e te kaihoko he tūnga waka.

- (b) Kua whakatauirahia e tētahi hokomaha te roa o te wā e pau ana i ngā kaihoko i te hokomaha mā te whakamahi i tētahi tuaritanga māori me te toharite o te 32.5 meneti me te ine mahora o te 10.8 meneti.

- (i) Tātuhia tēnei taurā tuari tūponotanga ki te tuaka i raro.



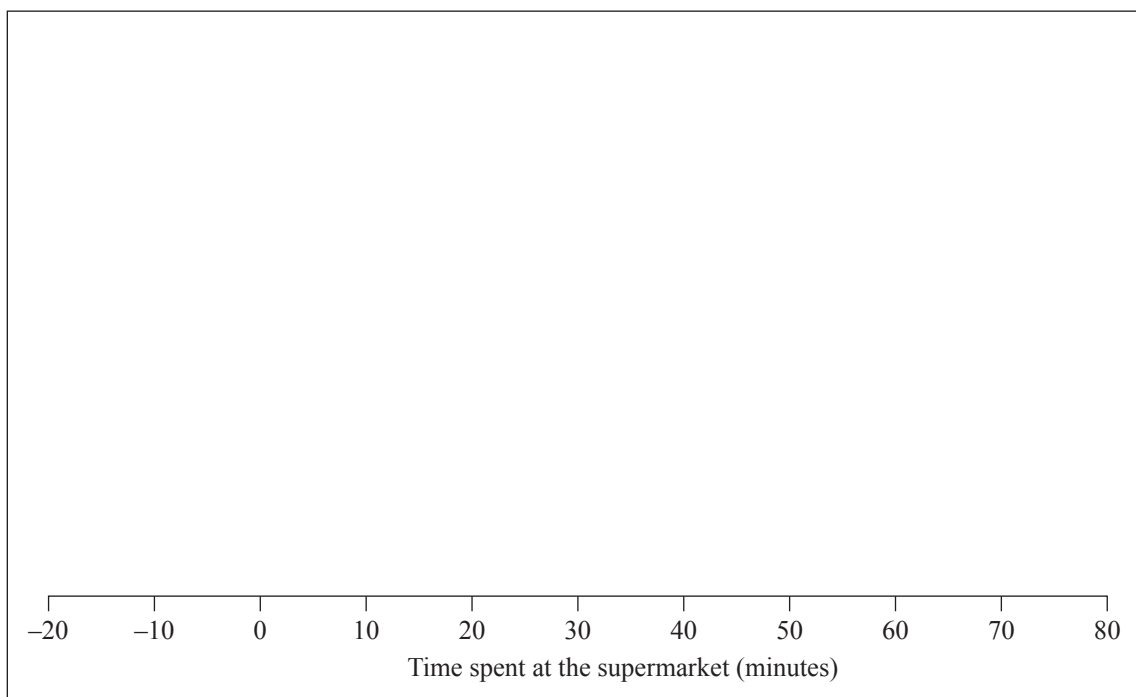
QUESTION ONE

- (a) The time it takes a shopper to find a carpark at the supermarket can be modelled by a random variable that takes on values between 0 minutes and 8 minutes. The most likely time it takes a shopper to find a carpark is 2 minutes.

Using an appropriate model, calculate the probability that it will take less than two minutes OR more than six minutes for a shopper to find a carpark.

- (b) A supermarket has modelled the time shoppers spend at the supermarket using a normal distribution with a mean of 32.5 minutes and a standard deviation of 10.8 minutes.

- (i) Sketch this probability distribution model on the axis below.



- (ii) Mā te whakamahi i tēnei tauira, tātaihia te tūponotanga ka neke atu i te 40 meneti te roa o te wā i te hokomaha o ngā kaihoko rerekē e rua i tīpako matapōkeretia.

Hōmai (t)ērā whakapaenga ka hiahiatia.

- (iii) Mā te whai i tētahi mātāi mātakinga o ngā kaihoko, kua huria e te hokomaha tana tauira mō te wā e pau ana i ngā kaihoko ki te hokomaha. Mō tēnei tauira hou, kei te mau i te hokomaha te toharite ki tērā o te tauira tawhito, ēngari kua whakatikahia te ine mahora. Mā te whakamahi i tēnei tauira hou, ko te ōrau o ngā kaihoko ka roa atu i te 40 meneti i te hokomaha ka whakatau tatahia kia 31.1%.

Matapakitia ka pēhea te whakataurite o te ine mahora o te tauira hou mō te wā e pau ana i ngā kaihoko ki te hokomaha tēnā ki te ine mahora o te tauira tawhito mō te wā e pau ana i ngā kaihoko ki te hokomaha.

Ka hiahia pea koe ki te kōrero mō ō whakautu i ngā wāhanga (i) me (ii) hei tautoko i tō whakamāramatanga.

- (iv) Matapakitia kia KOTAHI te ngoikoretanga pea ka tāea mēnā ka whakamahia te tuari māori hei whakatauiria i te wā i pau ki tēnei hokomaha.

- (ii) Using this model, calculate the probability that two different randomly selected shoppers both spend more than 40 minutes at the supermarket.

Give any assumption(s) that need to be made.

- (iii) Following an observational study of shoppers, the supermarket has changed its model for the time shoppers spend at the supermarket. For this new model, the supermarket has kept the mean the same as the old model, but has adjusted the standard deviation. Using this new model, the percentage of shoppers who take longer than 40 minutes at the supermarket is estimated to be 31.1%.

Discuss how the standard deviation of the new model for the time shoppers spend at the supermarket compares with the standard deviation of the old model for the time shoppers spend at the supermarket.

You may wish to refer to your answers in parts (i) and (ii) to support your explanation.

- (iv) Discuss ONE potential limitation with using a normal distribution to model the time spent at this supermarket.

TŪMAHI TUARUA

- (a) E waru ngā kaimahi “hauminga” o tētahi hokomaha hei āwhina i ngā wā e tino poke¹ ana. E ai ki ngā rokiroki mōhiohio a te hokomaha, ko te tūponotanga kāore tētahi o ēnei kaimahi i te wātea ina tonoa ana he 0.14 te whakatau tata.

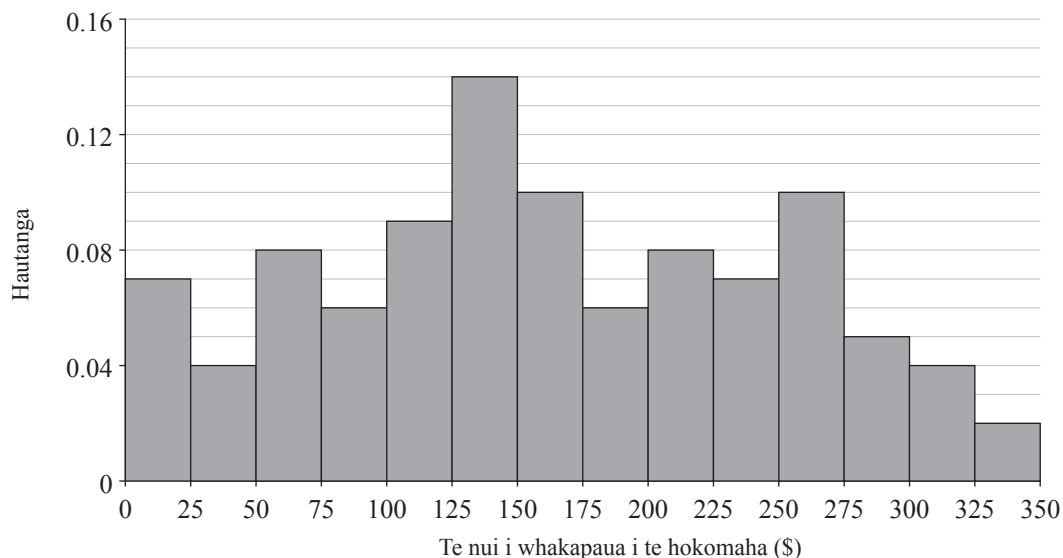
Ka tonono atu te hokomaha i ngā kaimahi e waru katoa i tētahi rā e tino pokea ana e te mahi.

- (i) Mā te whakamahi i tētahi tauira tōtika, tātaihia te tūponotanga ka iti ake i te toru ēnei kaimahi kāore e wātea mai ina tonoa mai.

- (ii) Parahautia tō whakautu mā te whakamahi i te tuari tūponotanga mō tō whakautu (i).

- (b) Kei te whakahaere whakatairanga tētahi hokomaha e whiwhi ai ngā kaihoko i tētahi taonga hei whakakao mō ia \$50 ka whakapaua i te hokomaha mai i te hokotanga kotahi.

Mā te whakamahi i tētahi rahinga nui o ngā raraunga hokohoko tāhiko, kua whakaputaina e te hokomaha te kauwhata e whai ake.



¹ takatū

QUESTION TWO

- (a) A supermarket has eight employees who are “on call” to help out during busy periods. Based on the supermarket’s records, the probability of one of these employees being unavailable when called is estimated to be 0.14.

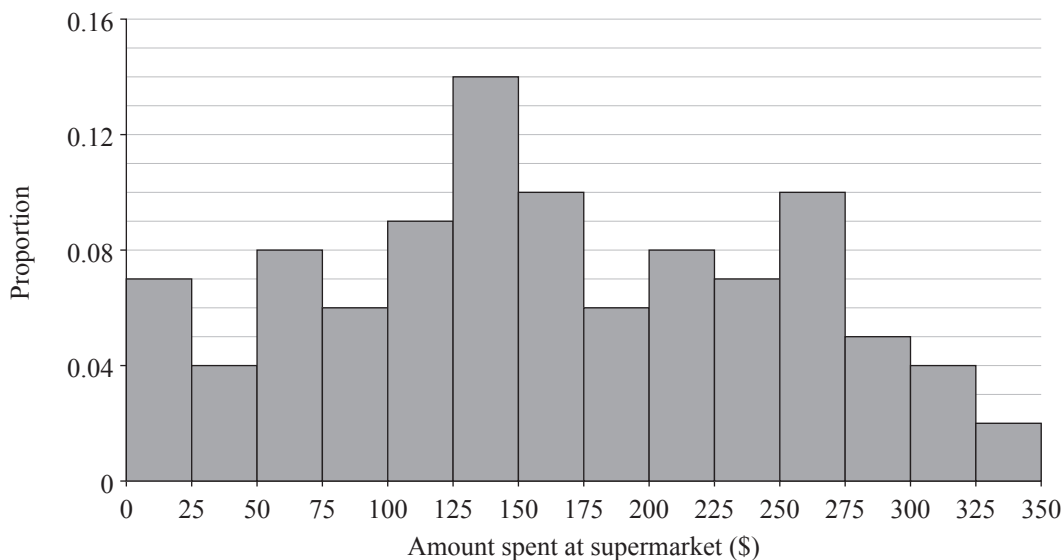
The supermarket needs to call all eight employees during one particularly busy period.

- (i) Using an appropriate model, calculate the probability that fewer than three of these employees will be unavailable when called.

- (ii) Justify the use of the probability distribution for your answer in (i).

- (b) A supermarket is running a promotion where shoppers get one collectable item for every \$50 they spend at the supermarket in one purchase.

Using a very large amount of electronic sales data, the supermarket has produced the following graph:



- (i) Whakamahia ēnei raraunga hei whakaoti i te papatau i raro, e whakaatu ana i te taurira tuari tūponotanga mō te taurangi matapōkere N , ko te maha o ngā taonga hei whakakao ka riro mai i te hokotanga kotahi.

n	0	1	2	3	4	5	6
$P(N = n)$		0.14		0.16	0.15	0.15	0.06

- (ii) Mā te whakamahi i te taurira i waihangatia i (b)(i), tātaihia te tau toharite o ngā taonga hei whakakao i riro mai i ngā kaihoko i ia hokotanga.

Hōmai (t)ērā whakapaenga ka hiahiatia.

- (iii) Kei te whakaararo te hokomaha ki te huri i te whakatairanga kia riro mai ai i ngā kaihoko he taonga hei whakakao kotahi mō ia \$25 ka whakapaua i te hokomaha i te hokotanga kotahi.

Me te kore mahi i ētahi tātai anō, matapakitia mēnā ka huaruatia te tau toharite o ngā taonga hei whakakao e riro ana i ngā kaihoko i ia hokotanga.

- (i) Use this data to complete the table below, which shows a probability distribution model for the random variable N , the number of collectable items gained in one purchase.

n	0	1	2	3	4	5	6
$P(N = n)$		0.14		0.16	0.15	0.15	0.06

- (ii) Using the model formed in (b)(i), calculate the mean number of collectable items gained by shoppers per purchase.

Give any assumption(s) that need to be made.

- (iii) The supermarket is considering changing the promotion so that shoppers get one collectable item for every \$25 they spend at the supermarket in one purchase.

Without performing additional calculations, discuss whether this will result in a doubling of the mean number of collectable items gained by shoppers per purchase.

TŪMAHI TUATORU

- (a) E tuwhera ana tētahi hokomaha paku i te pokapū o te tāone i ngā haora 24 i ia rā..
- (i) Mai i te 10 i te pō ki te 6 i te ata i ia rā, ko te tau toharite o ngā kaihoko e tae mai ana ki te hokomaha i ia 5 meneti he 1.3.

Mā te whakamahi i tētahi tauira tuari tūponotanga e hāngai ana, tātaihia te tūponotanga ka nui atu i te rua ngā kaihoko ka tae mai ki te hokomaha i roto i tētahi wā 5 meneti i waenga i te 10 i te pō me 6 i te ata.

- (ii) Mai i te 6 i te ata ki te 10 i te pō i ia rā, mā te whakamahi i ngā pikitia mai i ngā kāmera whakamaru, i kitea e te hokomaha i te 94% o ngā wā 5 meneti, kotahi te kaihoko i te iti rawa e taetae ana ki te hokomaha.

Matapakitia he pēhea te whakataurite o te tau toharite o ngā kaihoko e tae mai ana ki te hokomaha i ia wā 5 meneti mai i te 6 i te ata ki te 10 i te pō ki te tau toharite o ngā kaihoko e tae mai ana ki te hokomaha i ia wā 5 meneti mai i te 10 i te pō ki te 6 i te ata.

- (iii) Matapakitia tētahi atu take KOTAHI (i tua atu i te wā o te rā) hei whakaaroaro mā te hokomaha ina whakatauiria i te maha o ngā kaihoko e tae atu ana ki te hokomaha i ia 5 meneti.

QUESTION THREE

- (a) A small supermarket located in the city centre is open 24 hours per day.
- (i) Between 10 pm and 6 am each day, the mean number of shoppers who arrive at the supermarket per 5 minutes is 1.3.

Using a suitable probability distribution model, calculate the probability that more than two shoppers arrive at the supermarket during a 5-minute period between 10 pm and 6 am.

- (ii) Between 6 am and 10 pm each day, using footage from its security cameras, the supermarket found that in 94% of 5-minute periods, there was at least one shopper arriving at the supermarket.

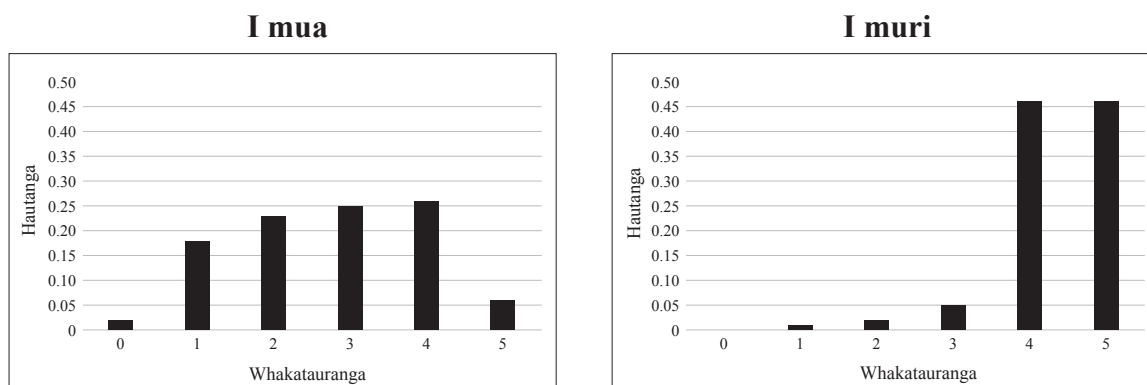
Discuss how the mean number of shoppers who arrive at the supermarket per 5 minutes between 6 am and 10 pm compares to the mean number of shoppers who arrive at the supermarket per 5 minutes between 10 pm and 6 am.

- (iii) Discuss ONE other factor (in addition to the time of day) the supermarket should consider when modelling the number of shoppers who arrive at their supermarket per 5 minutes.

- (b) Kua hoahoatia anō e tētahi hokomaha nui tana wāhi tiriwā, tae atu ki te whakauru anō i ngā pae tiriwā mahi-whaiaro me te huri i te takoto o ngā pae tiriwā. I mua me muri o te hoahoatanga anō, e rua ngā rangahau kaihoko rerekē i whakahaerehia e te hokomaha.

I ia rangahau (i mua, i muri), i pātaihia ngā kaihoko ki te whakatau i tō rātou wheako mō te mahi tiriwā i te hokomaha ka tata ai ki te tauine o te 0 (tino koretake) ki te 5 (tino pai).

E whakaaturia i raro nei ngā otinga mō ia rangahau.



- (i) Tautuhia ko tēhea te huinga raraunga he iti iho te taurangitanga o ngā tatau whakatauranga.

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

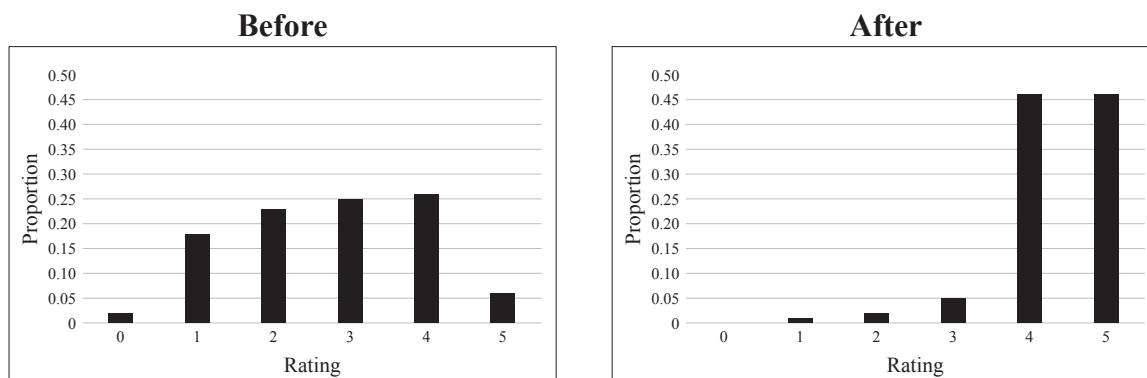
- (ii) Matapakitia mēnā he tika anō ki te whakamahi i te tuaritanga Poisson hei whakatauiria i ngā whakatauranga mō te rangahau 'i mua'.

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

- (b) A large supermarket has re-designed its checkout area, including installing more self-service checkouts and changing the layout of checkouts. Before and after the re-design, the supermarket conducted two different surveys of shoppers.

In each survey (before, after), shoppers were asked to rate their experience with checking out of the supermarket as a score on a scale of 0 (very unhappy) to 5 (very satisfied).

The results for each survey are shown below:



- (i) Identify which set of data has less variation in rating scores.

Support your answer with statistical reasoning.

- (ii) Discuss if it would be appropriate to use a Poisson distribution to model the ratings for the 'before' survey.

Support your answer with statistical reasoning.

English translation of the wording on the front cover

Level 3 Mathematics and Statistics (Statistics), 2016

91586 Apply probability distributions in solving problems

2.00 p.m. Thursday 24 November 2016
Credits: Four

91586M

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.

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 2–15 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.