Name: ……..

Year Level: …… Date: …….

STATISTICS FORM B

Assessment Booklet

Reframing Mathematical Futures II

An Australian Mathematics & Science Partnership Project (2015-2018)

STATISTICS FORM B

1. Skin

[SSKIN]

The following information is from a study to see if a non-active life style has some relationship with skin allergies.

	Skin allergy	No skin allergy	Total
Non-active life style	13	3	16
Active lifestyle	2	12	14
Total	15	15	30

Using this information, do you think that people's skin allergies depend on a non-active life style? Explain your answer.

2. Dice roll

[SD12A]

a Imagine you threw a dice 60 times.

In the table below, fill in how many times you think each number came up.

Number on dice	How many times it might come up
1	
2	
3	
4	
5	
6	
Total	**60**

b [SD12B]

Explain why you think these numbers are reasonable.

3. Movieworld

A class wanted to raise money for their school trip to Movieworld. They could raise money by selling raffle tickets for a Nintendo Game system.

Before they decided to have a raffle they wanted to estimate how many students in the whole school would buy a ticket. They decided to do a survey to find out first.

The school has 600 students in grades 1 – 6 with 100 students in each grade.

a [SMV10]

How many students would you survey?

How would you choose them? Explain your answers.

b [SMV12]

Jake asked 10 students at an after-school meeting of the computer games club.

What do you think of Jake's survey? Explain your answer.

4. Coin Toss

[SCON1A]

a Imagine you are playing a game where you throw a coin 4 times. How many tails do you think might come up?

[SCON1B]

b Explain why?

5. Marbles

[SBOX9]

Box A and Box B are filled with red and blue marbles as follows. Each box is shaken. You want to get a blue marble, but you are only allowed to pick out one marble without looking.

Should you choose Box A, Box B or doesn't it matter?

Please explain your answer using as much mathematics as you can

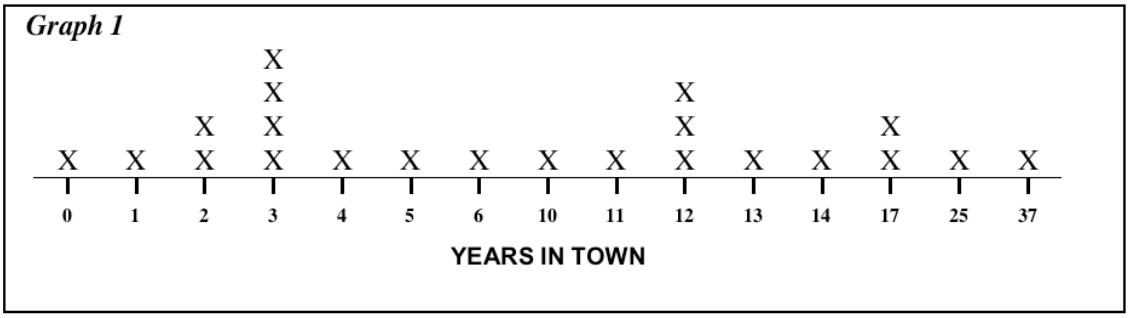
6. Tattslotto

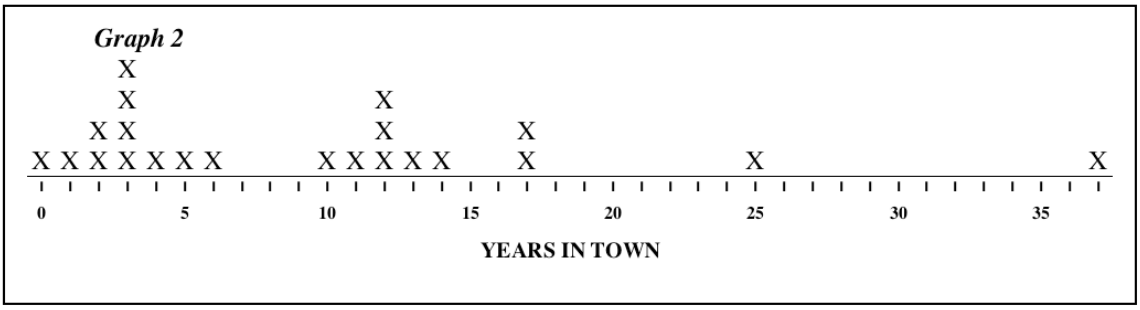
[STATS]

One day Claire won Tattslotto with the numbers 1, 7, 13, 21, 22, 36. So she said she would always play the same group of numbers, because they were lucky. What do you think about this?

7. Families

A class of students recorded the number of years their families had lived in their town. Here are two graphs that students drew to tell the story.





a [STWN1]

What can you tell by looking at Graph 1?

b [STWN2]

What differences do you notice between Graph 1 and Graph 2?

c [STWN3]

Which graph is better at presenting the information and "telling the story"? Explain your answer.

8. Scales

[SAMEA]

Nine students in a science class weighed a small object separately on the same scales. The weights (in grams) recorded by each student are shown below.

6.3 6.0 6.0 15.3 6.1 6.3 6.2 6.15 6.3

The students had to decide on the best way to summarise these values.

Ron said, "I'd add them all up and divide by 9 to get the mean. That's 7.18." Is Ron's way a good way to summarise the information? Explain your answer.

STATISTICS FORM B RUBRIC

1. SSKIN

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Comment based on opinion or context, little/no reference to numbers or informaiton in the table; or uses inappropriate numbers
2	Suggests and association but unquantified (e.g., *people with a non-active life style have more skin allergies*)
3	Suggests and association but uses information from two cells only (e.g., 13 *people with a non-active life style have skin allergies compared to only 2 who have an active life style*)
4	Uses the information from all four central cells (maybe totals as well) to justify association; for example comparison of diagonal cells (13,12) with opposite diagonal (2,3), use of ratio, percent or proportion

2. SD12A

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Table entries add to 60 but include an outlier larger than 21 (e.g., *5, 40, 3, 4, 2, 5; 25, 10, 10, 6, 4,*)
2	Entries add to 60 and reflect strict probability outcomes (i.e., all rows 10) or indicate variability but spread is too narrow (less than 4), too wide (greater than 12) or unlikely (e.g., *5, 15, 10, 15, 10, 5; 11, 11, 11, 11, 11, 5*)
3	Entries add to 60 and indicate appropriate variability, that is a spread between 4 and 12 inclusively (e.g., *9, 8, 11, 12, 10, 10*)

SD12B

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Reasoning relies on personal beliefs , no mention of chance (e.g., *It's the way I roll the dice; Because they look like they're reasonable*)
2	Reasoning refers to chance or uncertainty in a general way (e.g., *Anything can happen; 50-50 chance, luck of the draw)*
3	Reasoning based on strict probability, numbers have an equal chance (e.g., *There is a 1 in 6 chance of getting each number; Because 60 divided by 6 equals 10*), may refer to dice being regular (e.g., *The die is even on all sides; All the numbers have one each)*
4	Reasoning acknowledges variability in a reasonable way (e.g., *Because they're all pretty equal; I just put in numbers that are close to 10 as its most likely that each number on the dice will be rolled around an equal time*)

3. SMV10

SCORE	DESCRIPTION
0	No response or irrelevant response
1	No sample size or unreasonable number, may/may not include method (e.g. *Pull their names out of a hat; 500 randomly; all of them*) OR Non-representative methods (e.g., *I would survey 10 from each class. I would choose them by the richest in the class*) OR Sample only, no method (e.g. *I would survey 30 people*)
2	Reasonable number (at least 10%) and representative methods (no random device) (e.g., *I would survey 60 students, 10 from each grade and pick 5 boys and 5 girls; 300, I would choose an equal amount of students from each grade)*
3	Reasonable number, random and representative methods OR reasonable number and random methods *(e.g., Probably 10 from each class. I would choose them by picking out of a hat; 300 students, 50 from each class chosen randomly; Put all 600 student names into a hat and draw out 65 names)*

SMV12

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Inappropriate appraisals focusing on creating bias (e.g., *Good, he picked people who would be interested*), sample size (e.g., *Good, he didn't ask so many people*), or methodology and implications (e.g., *Good, it was quick and easy and not taking too long*)
2	Appropriate criticisms, focusing on sample size (e.g., *Bad, wasn't enough people*) or non-representativeness (e.g., *Bad, because most of them would say the same thing*) OR Statistical uncertainty focusing on appropriate criticisms (e.g., *Not sure, because not many different people would go there*) OR Appropriate, non-central criticisms focusing on fairness, methodology and implications (e.g., *Bad, because not everyone has got a chance*)
3	Appropriate and fully integrated criticism focusing on sample size and non-representativeness (e.g., *Bad, because he got an opinion from a small group of people with the same interests; Bad, not enough people and they're game fanatics*)

4. SCON1A

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Less likely (e.g., any other number, *you don't know, could be any of them)*
2	Most likely (2 tails or 50%)

SCON1B

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Incorrect (anything other than 2), explanation based on a misinterpretation of the questions (e.g., assumes this means exactly 2 tails) OR correct (2) but explanation relies on numbers alone, little or no indication of relevance of proportion *(e.g. Because 8 possibilities and 4 successes)*
2	Correct (2), explanation involves some indication of proportion (e.g., *2 because there is a 50% chance, 50-50 of throwing a head or a tail, probability of a tail is 1 in 2*) OR some recognition of variation (e.g., *2 tails because a coin has only 2 sides so we can only assume that the results will be 50-50, You can't really tell how many tails might come up)*
3	Correct (2) but also recognises variation (e.g., *Most times a tail should normally appear at least once in those four throws but there are a whole lot of possibilities as shown above* - student has listed possibilities)

5. SBOX9

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Incorrect (A or B) or Correct (it doesn't matter) with little/no explanation or general statement involving chance (e.g., *could be anything, just luck, 50/50 pick*)
2	Correct or Incorrect, explanation relies on quantities alone suggesting additive thinking (e.g., *it idoesn't matter both have more red, A because it has only 2 more reds and B has 20 more reds* or *B because it has more blues*)
3	Correct (it doesn't matter) with an explanation that suggests multiplicative thinking (e.g., they both have a 40%)

6. STATS

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Affirms a belief in being lucky (e.g., *I think it would be lucky I will pick the same number's too; I don't think many numbers are lucky. But I think 4, 7 & 9 are, so I guess I'd agree in a way you can have lucky numbers*)
2	Rejects 'luck' (e.g., *There is no such thing as lucky numbers*) or states that numbers were unlikely to occur again, or less likely to occur than other numbers (e.g., *I think she shouldn't go for the group of numbers again because you can't get the same numbers after numbers, you always get different numbers all the time*)
3	Implicitly recognises that all combinations of numbers have the same chance of occurring on any draw *(e.g., It was just a stroke of luck because any number could of come up; There is no such thing as a lucky number, things like Tattslotto are picked at random*)
4	Explicit recognition that all numbers or combinations of numbers are equally likely, may/may not offer an opinion (e.g., *There is an equal chance for all combinations, but she's already won once, so why keep gambling, why not invest the money, you would get more out of it*)
5	Reasoning that recognizes equal chance and interprets Claire's comments relative to context (e.g. *It is a good idea to use the same numbers all the time but there is as much chance as getting any other six numbers*)

7. STWN1

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Tautological response (e.g., *The numbers along the bottom tell you how many years; How long people lived in that town*)
2	Response refers to one or more specific aspects (e.g., *3 and 12 have the most; 1 family had lived there 37 years*, *There are 22 kids*)
3	Summative or comparative response that reflects some appreciation of information overall (e.g., *They range from all years; Not many families have stayed there for the same time*)

STWN2

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Incorrect (e.g., *Less people live in the town in Graph 2 than Graph 1; There are more Xs in Graph 2*) or superficial comments related to the appearance of the graph (e.g., *Graph 2 is harder to read because numbers are together, Graph 1 is easier to read because numbers are spread out)*
2	Some indication that difference recognised in terms of spread and accuracy (e.g., *Graph 2 goes up in fives and Graph 1 doesn't*)
3	Acknowledges that graphs show the same data and describes the difference in terms of the scales used (e.g. *There is no difference from graph 1 to graph 2 except that graph 2 shows the spaces where graph 1 doesn't; graph 2 says all the years between 0 and 37 – while graph 1 only tells the relevant ones*)

STWN3

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Statistically inappropriate choice (Graph 1) with reasoning that ignores spread (e.g., *Graph 1 because it only has the time it needs*)
2	Statistically appropriate choice (Graph 2) with reasoning based on personal preferences (e.g., *Graph 2 because they have set it out better*) or indicates both the same (e.g., *Neither – they tell the same amount of information*)
3	Statistically appropriate choice (Graph 2) with reasoning that recognises the importance of seeing all the years (e.g., *Graph 2 because you can see the difference between the years more clearly and the graph is more spaced out; Graph 2 because it has all the years*)

8. SAMEA

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Either "Yes" with little/no explanation or a very general statement (e.g., *Yes, it's quick and easy)* or "No" with little/no explanation or another method nominated (e.g., *No, other methods are better)*
2	Claims of inaccuracy (negative) with no statistical response (e.g., *No, there's no 7.18)* or claims of accuracy (positive) with no statistical response (e.g. *Yes, it is accurate*)
3	Statistical response reflecting a positive or negative evaluation (e.g., *Yes, he is getting the average; Yes, it includes all information; No, because the answer is too large*)
4	Statistical and contextual response that recognises both positive and negative aspects of Ron's method (e.g., *Yes but there is an extreme measurement; It is not that good as it needs to get rid of the 15.3*)

STUDENT SCORE SHEET STATISTICS FORM B

Student Name:	Year Level:

		Score	Comments
1	SSKIN		
2	SD12A		
	SD12B		
3	SMV10		
	SMV12		
4	SCON1A		
	SCON1B		
5	SBOX9		
6	STATS		
7	STWN1		
	STWN2		
	STWN3		
8	SAMED		
Total Raw Score			

RAW SCORE TRANSLATOR FOR STATISTICS FORM B

The following table locates students on the **Learning Progression for Statistical Reasoning** based on their total score for Statistics Form B. Total scores are obtained by adding the rubric scores assigned to each item on the form. Where a total score is very close to the beginning or end of a score range, teachers are advised to use their knowledge of the student to make a decision about the most appropriate Zone.

Students need to have had an opportunity to attempt all tasks for this process to be meaningful.

Total Score	Zone	Zone Description
40-43	8	Recognises variability relative to context using proportional reasoning to support arguments. Can recognise, coordinate, and integrate all relevant information to make evidence-based decisions using proportional reasoning and relevant context. Applies ideas about central tendency to justify explanations and decisions and is able to make appropriate statistical critiques of sampling using size, method, range, representativeness in justification. Recognises equal chance and interprets chance situations mathematically rather than offering an opinion.
32-39	7	Recognises and describes the spread of data explicitly in a statistical sense using statistically important information and not just a visual image. Recognises variation appropriately including ideas of fairness, equality of outcomes, and distribution as appropriate. Uses all available data to justify decisions or evaluations statistically. Makes reasonable sampling decisions that recognise the importance of randomness and critiques inappropriate non-representative and/or non-random samples. Uses data to justify responses and recognises limitations but may still revert to offering an opinion based on individual beliefs. Recognises variability relative to context and the nature of a distribution to provide a realistic solution.
28-31	6	Interprets and describes the association between two variables and considers the implication in visual contexts. Beginning to work with the association between two variables in a non-graphical format. Constructs reasonable arguments based on an understanding of chance and probability and context. Provides a sensible critique of sampling in relation to method and sample size but is implicit rather than explicit about randomness. Uses measures of central tendency to justify a closed response.
21-27	5	Provides a statistical explanation, but this may be incomplete, and can recognise important information in making comparisons. Intuitively suggests association expressed in non-quantitative ways

		and recognises equal likelihood. Recognises appropriate sample size and provides appropriate critiques of sampling method but does not explicitly include randomness. Recognises simple proportion in chance contexts and orders language of chance qualitatively. Recognises relevant aspects of graphical representation and uses these to reason statistically but may not include all aspects. Recognises key aspects of central tendency but reverts to non-statistical justifications. Implicitly recognises that all combinations of numbers have the same chance of appearing when randomly sampled from a grid with no replacement.
15-20	4	Compares data in two graphs but focuses on single elements only. Can associate two variables with a single value and provides descriptive explanations. Recognises variability and expectation in more complex random situations but explanation refers to uncertainty in general terms and is not quantified or is based on strict probability (expectation). May not recognise the importance of equal likelihood. Recognises relative order in the language of uncertainty but does not appreciate some subtleties. Reasons quantitatively in familiar situations involving related comparisons and in the context of uncertainty. Relies on additive thinking in situations involving measures of central tendency, and is unlikely to question the quality of data. Critiques sampling approaches using single aspects only (i.e., size or method) in an evaluative situation. Falls back on personal beliefs in more complex situations when asked for an explanation.
7-14	3	Recognises expectation but interprets this in terms of strict probability or based on a visual representation. Recognises variation but in graphing situations may explain this based only on visual representation rather than quantitative reasoning. Applies ideas of variation drawing on expectation but only in familiar contexts such as coin flips. Recognises expectation in statistical situations (e.g. value of mean/median) but explanations are limited. Reasons quantitatively using direct comparison but relies on additive thinking (e.g., not recognising proportion. In more complex inference tasks or less familiar contexts, draws on opinion rather than data or retreats to “luck” as an explanation in more complex situations.
3-6	2	Uses reasoning that recognises variation in some way but may not appreciate expectation (chance). Uses the language of 50% or 50:50 but does not appreciate the meaning. Reads information from simple graphs using x and y axes, and can describe what the graph is about but may not recognise association between variables. Is familiar with simple chance experiments but is unable to reason quantitatively and is likely to rely on personal beliefs rather than the data when explaining an outcome (e.g., it’s the way you roll the die). Recognises one aspect of sampling, such as size or method, in a

		familiar context but does not coordinate these ideas to provide a random and representative sample.
1-2	1	Reads a single value from a simple graph on either the x or y axis but does not look at axes values simultaneously. Tends to focus on the highest values unless directed. Variation is considered visually but not otherwise recognised. Is familiar with standard simple probabilistic/chance situations (e.g., dice, coins) but uses these at a superficial level. Can give real world examples of variation (e.g., weather).