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| **MATHEMATICS DEPARTMENT** | |  |
| **Course:** **A2MAA** | |
| **Topic Title**: **Investigation 1 – Making it Fair** | |
| Student Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Date: \_\_\_\_\_\_\_\_\_\_2016 | | |
| Special Instructions: Scientific Calculators only, No Notes allowed | Time Allowed: 60 mins | | |
|  | Marks: / 50 | | |

**In-class investigation**

In this investigation the effects of various measures on students’ marks are examined.

**Introduction**

Two classes of 25 Year 8 students have sat the same test in Science. Class 8.1 did the test in period 1 and had 50 minutes, the recommended time. Class 8.2 started the test in period 2 and after 40 minutes the school had to be evacuated and they missed out on the last 10 minutes. The maximum number of marks any student could have achieved in the test was 50. The teachers wanted to adjust the marks so that it was fair to both classes. They marked the test, placed some statistics in the table below and then discussed various options for adjusting the marks.

**Question 1 [2,2,1,1 : 6 marks]**

(a) Complete the table.

**Science marks for Classes 8.1 and 8.2 (out of 50)**

|  |  |  |
| --- | --- | --- |
| **Statistic** | **Class 8.1** | **Class 8.2** |
| Minimum | 20 | 15 |
| Maximum | 48 | 41 |
| Median | 34 | 25 |
| Mean | 33.76 | 25.16 |
| First quartile | 29 | 20 |
| Third quartile | 38 | 27 |
| Range |  |  |
| Inter-quartile range |  |  |

(b) On the basis of these statistics only, which class has produced a higher standard? Justify your answer.

(c) Suggest a reason why the marks might need to be adjusted so that it is fairer for Class 8.2.

(d) Suggest a reason why the marks should **not** be adjusted.

**Question 2 [1,2,1 : 4 marks]**

(a) The first option considered was to take 10 marks off each person in Class 8.1.

Give one reason why this process would be unfair.

The teachers decided they would only adjust the marks for Class 8.2. A sample of five students was chosen and the effects of the changes on their marks were examined for each adjustment suggested. The five students chosen and their marks in the test were;

**Tom 41 Don 15 Sam 25 Ria 20 Fay 27**

(b) Suggest two reasons why this is a good sample.

(c) The second option chosen was to say that the test for Class 8.2 was only out of 40 (instead of 50) so the marks were altered and Ria’s 20 out of 50 became 20 out of 40. Would Ria be pleased with this outcome? Explain.

**Question 3 [1,1,3,2 : 7 marks]**

The third option for adjusting the marks of students in Class 8.2 was to add 10 marks to each student’s mark.

(a) Why was the addition of 10 marks thought to be a fair adjustment?

(b) What marks do the sample students now get?

Tom

Don

Sam

Ria

Fay

(c) For the adjusted marks in Class 8.2, state the

(i) range

(ii) interquartile range

(iii) mean

(d) Give two reasons why it is not appropriate to add 10 marks to each student’s score.

**Question 4 [3,2,2 : 7 marks]**

It is suggested that *as the students missed a fifth of the time for the test, then add a fifth of their marks onto the total of their original score.*

(a) Show the effect of this adjustment on the sample students by completing the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Student | Tom | Don | Sam | Ria | Fay |
| Original mark | 41 | 15 | 25 | 20 | 27 |
| One fifth of original mark |  |  |  |  |  |
| Adjusted mark |  |  |  |  |  |
| Round to the nearest whole number |  |  |  |  |  |

(b) For the adjusted marks of the students in Class 8.2, what is the new

(i) range

(ii) interquartile range

(c) Give two reasons why this method of adding a fifth of the students’ marks to their original marks is better than adding 10 marks.

**Question 5 [3,1,1,1,1,2,2 : 11 marks]**

The fifth adjustment investigated was to *multiply the marks for students in Class 8.2 by 1.25.*

(a) Show the effect of this process on the sample students by completing the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Student | Tom | Don | Sam | Ria | Fay |
| Original mark | 41 | 15 | 25 | 20 | 27 |
| Multiply by 1.25 to get new score |  |  |  |  |  |
| Gain in marks |  |  |  |  |  |
| Round new score to nearest whole number |  |  |  |  |  |

(b) What is the range for the new scores of the students in Class 8.2?

(c) Does multiplying by 1.25 give the same results as adding on one-fifth of the original marks? Justify your answer.

(d) List the students in ascending order of their original marks

(e) List the students in ascending order of their gain in marks

(f) Compare the lists produced in parts (d) and (e). Explain the comparison.

(g) Which is a fairer adjustment of the marks?

Determining a fifth and adding it on **OR** Multiplying by 1.25

Justify your decision

**Question 6 (1, 1, 3, 3, 11 marks)**

The last process considered to adjust the marks was to *make both class averages the same (i.e., 33.76)* as the means for both classes were equal in the previous test.

(a) Determine the total of the marks for students in Class 8.2 if the mean of their marks is to be 33.76. (1)

(b) Determine the total of the marks for students in Class 8.2 before any adjustments. (1)

(c) To increase the mean for Class 8.2 to 33.76, 8.6 marks can to be added to each student’s mark. Describe two ways by which this value (8.6) could have been determined from the data available in this investigation? (3)

(d) Complete the following table using this method of adding 8.6 to adjust the score.

(3)

|  |  |  |
| --- | --- | --- |
| Student | Tom | Don |
| Original mark |  |  |
| Marks added |  |  |
| Percentage increase |  |  |

(e) For the adjusted class data calculate the

(i) median

(ii) inter-quartile range (2)

(f) Is this process fair to the students in Class 8.2? (1)

Explain.

**Question 7 (4 marks)**

(a) For all options chosen complete the table provided expressing numbers to the nearest tenth where numbers are not whole numbers. (2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Process  Student | Original marks | Add 10 to original marks | Add a fifth of the original marks | Multiply original marks by 1.25 | Add 8.6 to original marks |
| Tom | 41 |  |  |  |  |
| Don | 15 |  |  |  |  |
| Sam | 25 |  |  |  |  |
| Ria | 20 |  |  |  |  |
| Fay | 27 |  |  |  |  |

(b) Determine the best and worst options as far as these students are concerned. (2)

**End of questions**