8. MATHEMATICS

Results of Primary 3 Mathematics in TSA 2008

The Territory-wide percentage of P.3 students achieving Mathematics Basic Competency in TSA 2008 was 86.9%. The proportion achieving basic competency in 2008 was the same percentage as in 2006 and 2007.

Primary 3 Assessment Design

The assessment tasks for P.3 were based on the *Basic Competency at the end of KS1 for the Mathematics Curriculum (Trial Version, November 2005)* and the *Mathematics Curriculum Guide (P1 – P6), 2000.* The tasks covered the four Dimensions of the Mathematics Primary 1 to 3 curriculum, i.e. Number, Measures, Shape & Space and Data Handling, testing the concepts, knowledge, skills and applications relevant to these areas.

The Assessment included a number of formats according to the context of the question, including fill in the blanks, answers only and answers involving working steps as well as multiple choice. Some of the test items consisted of sub-items. Besides finding the correct answers, students were also tested on the ability to present their solutions to problems, including writing out necessary statements, mathematical expressions and explanations.

The Assessment consisted of 112 test items (199 score points) covering the four Dimensions. These items were grouped into four sub-papers, each 40 minutes in duration and covered all four Dimensions. Some items appeared in more than one sub-paper to act as inter-paper links. Each student was required to attempt only one of the four sub-papers.

Since some of the Basic Competencies in the Number, Measures, and Shape & Space Dimensions are the same for both Key stages 1 and 2, 6 test items (9 score points), testing of these common Basic Competencies were purposely set to be the same in both the P.3 and P.6 Assessments. Such a measure provided a common basis to compare the performances of P.3 and P.6 students on the same Basic Competencies which they had previously learnt during Key Stage 1.

The composition of the four sub-papers is illustrated as follows:

Table 8.1 Composition of the Sub-papers

Sub-paper	No. of Items (Score Points)				
	Number Dimension	Measures Dimension	Shape & Space Dimension	Data Handling Dimension	Total
M1	15 (23)	$10^{1}/_{2}$ (15)	$8^{1}/_{2}$ (19)	2 (6)	36 (63)
M2	16 (24)	11 (19)	7 (16)	2 (5)	36 (64)
M3	16 (23)	11 (19)	7 (14)	2 (5)	36 (61)
M4	14 (20)	11 (20)	9 (20)	2 (5)	36 (65)
Total *	45 (66)	$33^{1}/_{2}$ (55)	$26^{1}/_{2}$ (59)	7 (19)	112 (199)

* Items that appear in two different sub-papers are counted once only.

Performance of P.3 Students with Minimally Acceptable Levels of Basic Competence in TSA 2008

P.3 Number Dimension

Students performed quite well in this Dimension. They could understand the basics of whole numbers and simple fractions, though some had difficulty demonstrating a deeper understanding of these concepts. Students were capable of performing addition, subtraction and multiplication of whole numbers as well as mixed operations, but were relatively weak in doing division. In solving application problems, students had adequate skills to present their solutions to problems with working steps. Further comments on students' performance are provided below with examples from different sub-papers quoted in brackets.

Understanding basic concepts

- Students were capable of recognizing the place values of whole numbers (e.g. Q1(b)(1)/M1; Q1(a)/M3), but a few students confused the value of the digit with the place value (e.g. Q1(b)(2)/M1; Q1(b)/M3). Students had difficulty in recognizing the place value of whole numbers when a calculation was involved (e.g. Q1/M4). The majority of students were capable of reading the number shown on the abacus as well as writing the number in words (e.g. Q1(a)/M1), and ordering whole numbers up to five digits (e.g. Q2/M1). Some students, however, could not use an abacus to display whole numbers satisfying specific criteria (e.g. Q2/M3), although many of them were

able to select digits to form whole numbers satisfying specific criteria (e.g. Q2/M4).

- In general, students showed a good understanding of the basic concept of fractions (e.g. Q9/M1; Q12(a)/M3) and could recognize the relationship between fractions and the whole (e.g. Q9/M4). Furthermore, many students understood when a fraction is used to represent part of a whole, the whole must be divided into a number of equal parts (e.g. Q8/M4). The majority of students were able to compare fractions with the same denominator as well as the same numerator (e.g. Q10/M1; Q11/M3).

Performing basic calculations on whole numbers

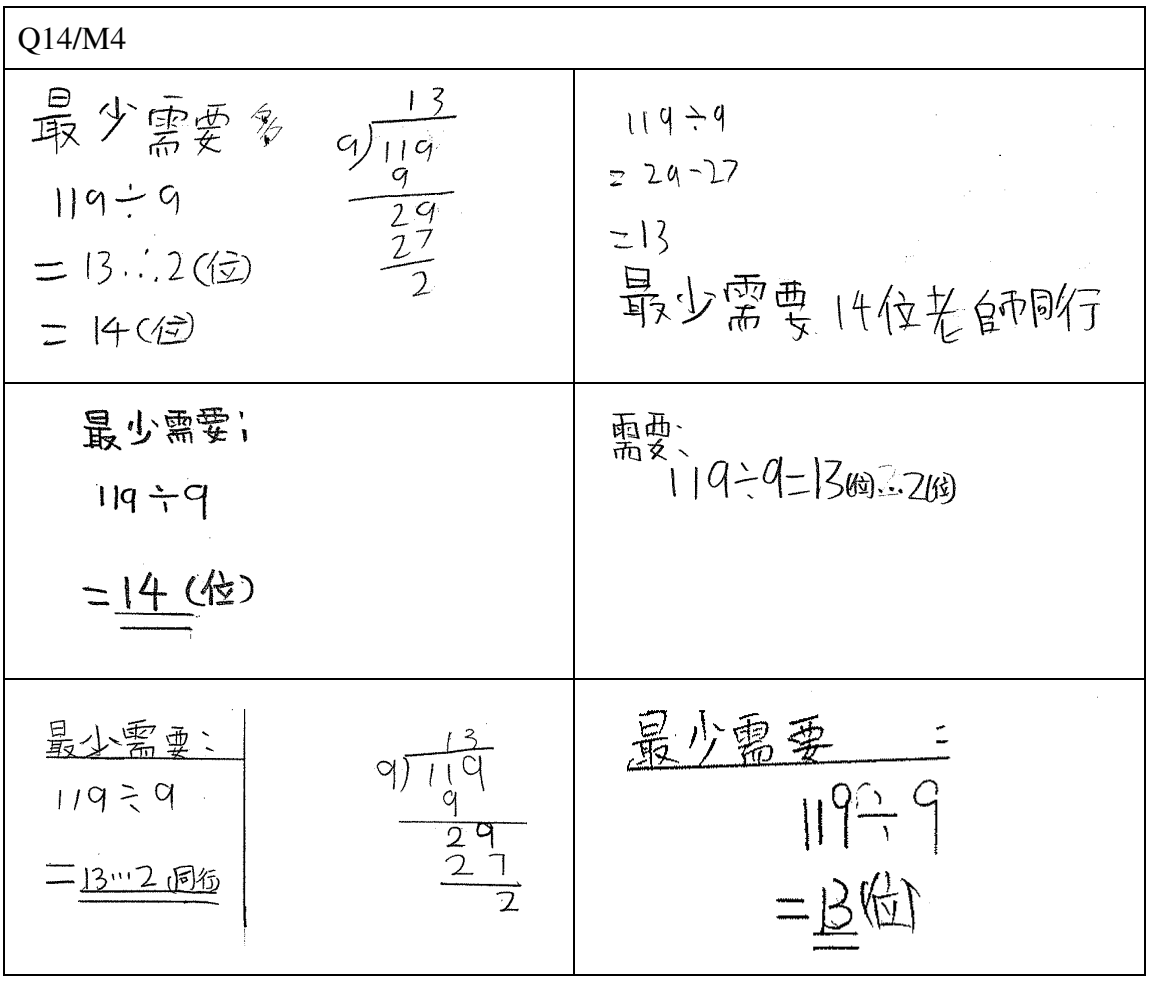
- Addition – The majority of students performed well in the addition of whole numbers up to 3 digits, inclusive of carrying (e.g. Q3/M4), repeated addition (e.g. Q3/M3) and the commutative property of addition (e.g. Q3/M1).
- Subtraction – Students performed well in the subtraction of whole numbers up to 3 digits involving the process of one decomposition (e.g. Q4/M3; Q4/M4) and repeated subtraction (e.g. Q4/M1).
- Multiplication – Students did well in the multiplication of whole numbers up to 1 digit by 3 digits involving carrying (e.g. Q5/M1; Q5/M3; Q6/M3) and repeated multiplication (e.g. Q5/M4).
- Division – Students showed a satisfactory performance in division. They could perform division directly and when a placeholder had to be inserted in the quotient (e.g. Q7/M1; Q7/M3; Q6/M4). Many students were capable of working out the division in a specific format (e.g. Q6/M1).
- Mixed operations – A majority of students could perform mixed operations of addition and subtraction, including items involving small brackets (e.g. Q8/M1; Q8/M3). Many of them performed well with the mixed operations of multiplication and addition/subtraction (e.g. Q9/M3; Q7/M4) though occasional careless mistakes in computation were evident.

Solving application problems

- Students were capable of understanding and solving simple problems involving addition and subtraction (e.g. Q13(a)/M1; Q16(a)/M2; Q11/M4; Q12(a)/M4; Q13/M4) and also straightforward problems involving multiplication and mixed operations (e.g. Q15/M1; Q16/M1; Q14/M2; Q15/M2; Q13/M4). For some of the application problems, many students were either careless or did not understand the question (e.g.

Q14/M1; Q16(b)/M2; Q17/M2; Q12(b)/M4). Their performance also declined for problems involving division. For example, in Q13/M2, about half of the students either worked out the sum of the average of each admission fee for both John and his mother or just added up the admission fees shown in the table. Almost half of them ignored the remainder in the division and only gave the quotient as the answer (e.g. Q13(b)/M1), and in Q14/M4, they had difficulty in explaining the answer clearly (see exemplars of students' work below).

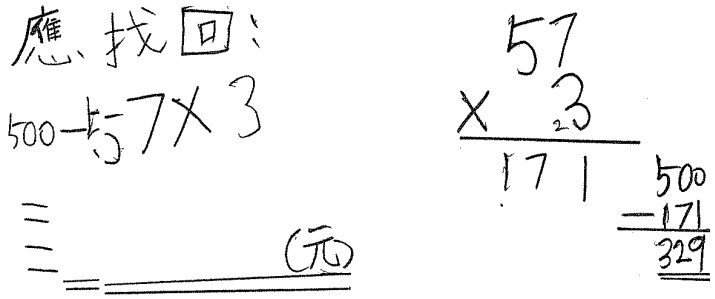
Q14/M4

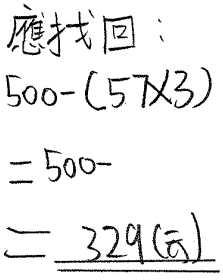


- When students were required to show their working steps, many of them could properly present their solutions, especially for simple problems. However, some could not write an appropriate description to illustrate or explain their solutions clearly (see exemplars of students' work below).

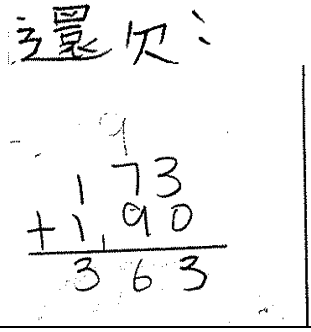
(a) No/incomplete working steps:

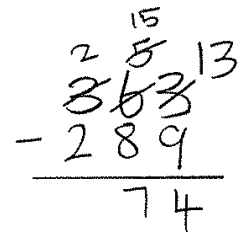
Q15/M2



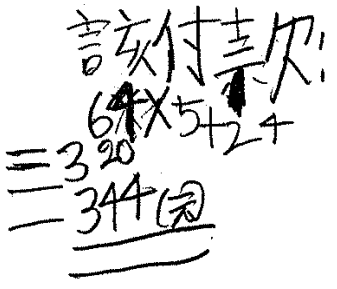


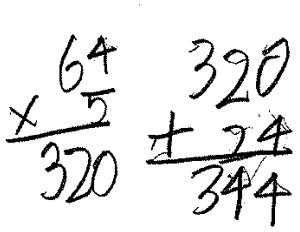
Q13/M4





Q15/M1





(b) Inappropriate/incorrect working steps:

Q15/M3
應找回： (500 - 5×3 = 1329 (元)

(c) No descriptive statements/explanations/conclusions:

Q14/M4
119÷9 =13…2(人)

- In most cases, students used two common ways of presenting solutions to application problems: (a) to write a descriptive statement or give an explanation right at the beginning of the solution or (b) to write a conclusion or concluding statement at the end of the solution. Both methods are considered appropriate and suitable for a clear and accurate presentation (see exemplars of students' work below).

(a) Showing a descriptive statement/an explanation at the beginning:

Q13/M4
還欠： (173+190)-289 =363-289 = 74 (張)

(b) Showing a conclusion/concluding statement at the end:

Q13/M4
173+190-289 = 363-289 =74 more bookmarks Ans: She need 74 more bookmarks.

- Some students were able to give correct answers but showed incorrect mathematical expressions. Many students understood the technique of subtraction or division in solving a problem, but they mixed up the minuend/subtrahend or dividend/divisor in mathematical expressions. (see exemplars of students' work below).

Q15/M2
應找回： (57×37)-500 =500-171 =329蚊

Q13/M4
還欠： 289-(173+190) =363-289 =74(張)

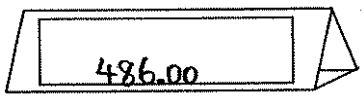
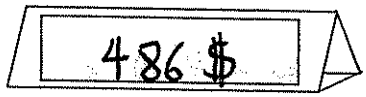
- Students were capable in solving application problems in the calculation of money (e.g. Q12/M1). Only some students were able to perform division of money involving conversion of money. For example, in Q15/M4, many of them gave the answer 21 dollars and 10 cents as they were not aware that when dividing $43 by 2, the remainder was in dollars not cents.

P.3 Measures Dimension

The performance of students was satisfactory in this Dimension. Most students could identify and use Hong Kong money, read price tags, compare directly the length, mass and capacity of objects; and record the length of objects. Students showed a slight improvement in using appropriate units of measurements for recording the length and mass of objects but were relatively weak at choosing the appropriate tool for measuring length and mass. Students in general were capable of telling the dates and days of the week, identifying dates correctly with a given duration of an activity, telling time from a clock face and a digital clock and showing the correct time with hour hand and minute hand on a clock face. However, they were particularly weak in recording the duration of activities. Further comments on students' performance are provided below with examples from different sub-papers quoted in brackets.

Knowledge of Hong Kong money

- Students in general could identity and use Hong Kong money (e.g. Q10/M3). Most students could read price tags (e.g. Q20(a)/M3) but were less competent at filling in the prices on price tags. For example, half of the students did not include the dollar sign in Q11(a)/M1 (see exemplars of students' work below).

Q11(a)/M1	
	

- Many students were capable of exchanging money directly (e.g. Q10/M4), but had difficulties when they were required to do simple calculations before exchanging money (e.g. Q20(b)/M3).

Knowledge of time

- Students generally were capable of telling the dates and days of a week from a calendar (e.g. Q21/M2), except in Q22(b)/M3, some students did not understand or did not read the question carefully and gave the incorrect school open day.

- Many students could tell the time from a clock face/digital clock including the 24-hour system (e.g. Q20(a)/M1; Q22(b)/M2; Q23(a)/M3; Q24/M3), but had

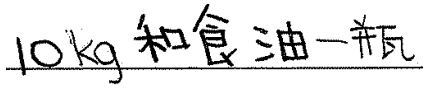
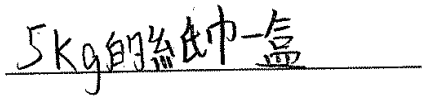
difficulties when recording the duration of time for activities which involved some calculations (e.g. Q19/M1; Q20(a)/M1; Q22/M1; Q22(a)/M2; Q23(b)/M3). The majority of students were capable of drawing the hour hand and minute hand on a clock face to show the time (e.g. Q20/M2).

Measurement of length/distance, mass and capacity

- Students in general could compare directly the length/distance and mass of different objects (e.g. Q18(b)/M1; Q23/M1). They were also capable of comparing directly or using improvised units to compare the capacity of different containers (e.g. Q25/M2; Q27/M3), though many of them had difficulty in making indirect comparisons (e.g. Q24/M2).

- Many students were capable of using a ruler to measure and record the length of an object with an appropriate unit (e.g. Q18/M2; Q21/M3; Q16/M4) and most of them were able to use 'kilometre' to compare the distance between objects (e.g. Q17/M1). They were capable of choosing the appropriate measuring tools for measuring capacity of objects (e.g. Q27/M2), but had difficulties measuring weight and length/distance (e.g. Q21&25/M1). For measuring the lengths of objects and the distance between objects with finger width, arm length, foot span etc., as 'ever-ready rulers' (e.g. Q18/M4) students performed well though they found it difficult to measure and calculate the difference in capacity with different measurement units (e.g. Q26/M1; Q26/M2).

- The majority of students were able to record the weight of an object using 'gram' or 'kilogram' (e.g. Q23(a)/M2) and performed well in calculating the difference in weight of objects placed on a weighing scale using the same measuring units (e.g. Q23(b)/M2). But students' performance was weak when they had to write the unit as well as reading the weighing scale (e.g. Q25/M3), they either forgot to write the unit or gave wrong answers such as 21, 21 kg or 22 etc. In Q24/M1, some students had difficulty in expressing their answers (see exemplars of students' work below).

Q24/M1	
	

食油一瓶餘50g	食油一瓶和五百克。

- Many students could choose suitable measurement units for recording length (e.g. Q19/M2) and weight (e.g. Q26/M3). When length and mass were combined into a single test item, a small number of students could not distinguish amongst the different measurement units (e.g.Q17/M4). Moreover, few students were unable to write the measurement units in words or symbols correctly (see exemplars of students' work below).

Q19/M2
(b) 使用電腦時，眼睛應最少與熒光屏保持約 40厘米 的距離。
(c) 窗戶玻璃的厚度約 4 毫米。
(d) 青馬大橋全長約 2 公里。

Q17/M4
(b) 一本字典的厚度約 55 毫米。

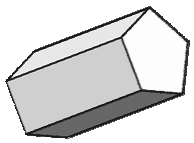
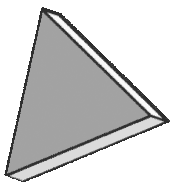
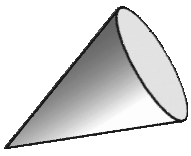
P.3 Shape & Space Dimension

The performance of students was fair in this Dimension. They were capable of comparing objects according to their height and identifying 2-D and 3-D shapes when these shapes were drawn in a commonly placed orientation, though some of them still had difficulty in writing the answer in Chinese or English correctly. They could recognize straight lines, curves, angles and the four directions, but they had difficulty in identifying perpendicular lines and parallel lines. Further comments on students'

performance are provided below with examples from different sub-papers quoted in brackets.

3-D shapes

- Students' overall performance was satisfactory in naming 3-D shapes including spheres, prisms, pyramids, cylinders and cones (e.g. Q27/M1; Q28/M2; Q28/M3). About half of them had difficulty in naming the prisms in Q27(c)/M1 and in Q28(2)/M3, giving triangle and hexagon as the answers respectively. Some students attempted to name the 3-D shapes by specifying the shapes of their bases, though it was not required in the framework of Basic Competencies in Key Stage 1. Students' performance dropped significantly in grouping 3-D shapes (e.g. Q29/M2), particularly when they had to identify 3-D shapes with real life objects (e.g. Q29/M3) or made spelling mistakes or gave incorrect Chinese characters for identifying 3-D shapes (see exemplars of students' work below).

<table>
<tr><td colspan="2">Q27/M1</td></tr>
<tr><td>(a)
 
柱體</td><td>(b)
 
球體</td></tr>
<tr><td>(c)
 
三角柱體
prism triangle</td><td>(d)
 
圓錐體
長方體
鉛體</td></tr>
</table>

- Students did well in comparing objects according to their heights (e.g. Q18(a)/M1).

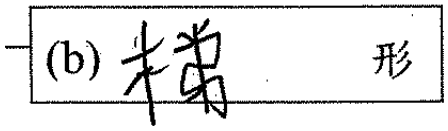
2-D shapes

- Students in general could identify, group or name 2-D shapes including circles, triangles, squares, rectangles, and parallelograms (e.g. Q29/M1; Q30/M2; Q30/M3;

Q28/M4), but not rhombuses, trapeziums, pentagons and hexagons (e.g. Q33/M2; Q28(d)/M4; Q29(c)/M4). It was noted that a few students incorrectly named a trapezium/parallelogram as a '4-sided shape' or a pentagon as a '5-sided shape' (「梯形/平行四邊形」 as 「四邊形/四角形」 or 「五邊形」 as 「五角形」). The majority of students could identify different types of triangles (e.g. Q30(a)/M1; Q32/M3; Q30/M4), but they were less capable in identifying isosceles triangles (e.g. Q30(b)/M1). Similar to 3-D shapes, some students made spelling mistakes or gave incorrect Chinese characters when they were asked to name 2-D shapes (see exemplars of students' work below).

Q29/M1

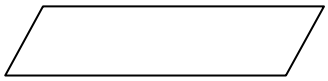
(b)

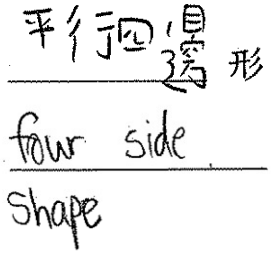


(d)

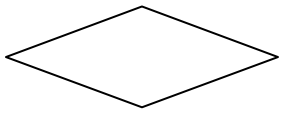
Q28/M4

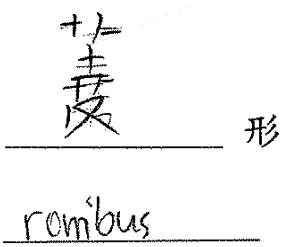
(c)



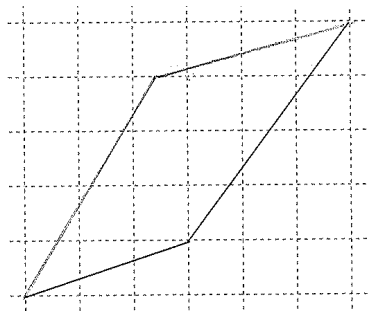
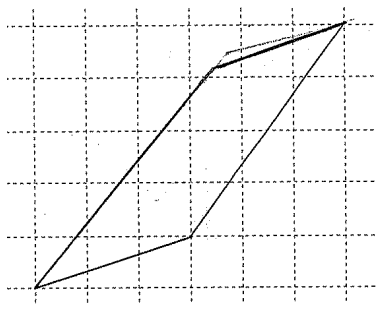


(d)





- Furthermore, many students could draw a right-angled triangle on a pin-board paper (e.g. Q31/M2) but quite a number of students were unable to draw a parallelogram properly on a square grid paper (e.g. Q28/M1) (see exemplars of students' work below).

Q28/M1	
	

Lines, angles and the four directions

- Students were capable of identifying straight lines and curves (e.g. Q31/M3; Q31(b)/M4), though less so when identifying and drawing parallel lines and perpendicular lines according to specific formats (e.g. Q31/M1; Q32/M2).
- Students performed fairly well in recognizing right angles (e.g. Q32/M1; Q31(a)/M4) and did well in comparing the sizes of angles (e.g. Q33/M1). However, a small number of students only choose one option for Q33/M3 rather than two options as required.
- Students were unable to recognize the four directions when the direction of the compass was not pointing North (e.g. Q34/M1; Q34/M2; Q34/M3). Few students were unable to write the four directions in words correctly (see exemplars of students' work below).

Q34/M2
偉業先向 西 方行駛，然後轉往 南 方，最後轉向 東 方走便可到達。
偉業先向 西 方行駛，然後轉往 南 方，最後轉向 東 方走便可到達。
偉業先向 西 方行駛，然後轉往 南 方，最後轉向 東 方走便可到達。

P.3 Data Handling Dimension

Students performed well in this Dimension as usual. They could readily read and interpret data or information from given pictograms and made use of them to answer straightforward questions. They were also capable of constructing pictograms from given data. Further comments on students' performance are provided below with examples from different sub-papers quoted in brackets.

Reading and interpreting pictograms

- Students could read and interpret simple pictograms, and were capable of making use of the data or information in the pictograms, sometimes after carrying out simple calculations, to straightforward questions (e.g. Q35/M1; Q35/M2; Q36/M3; Q36/M4). However, for an open-ended test item that required the interpretation of reasoning (e.g. Q35(c)/M1), a considerable number of students did not perform as well (see exemplars of students' work below).

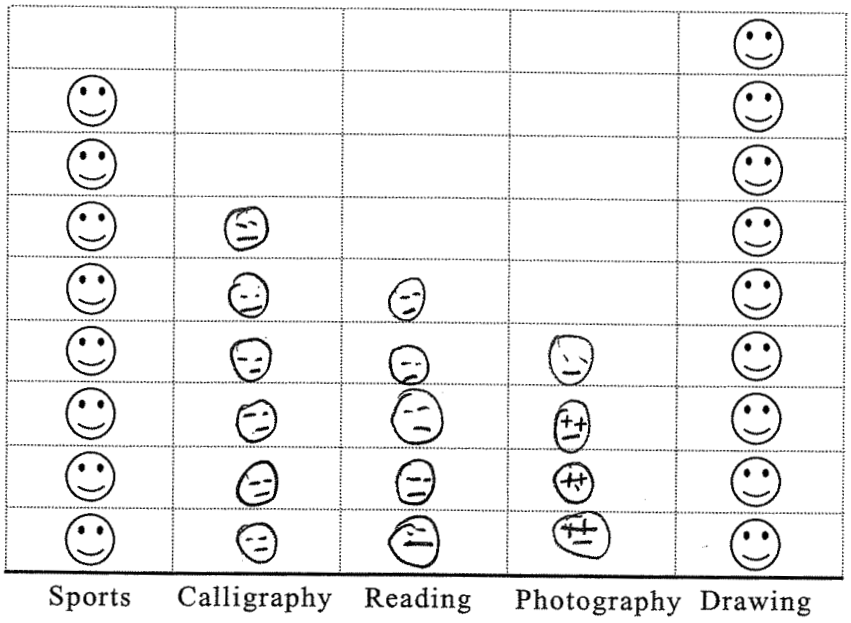
Q35(c)/M1	
因為 星期一太少了。	因為 少人。
因為 得一人買。	因為 數量很小。

Constructing pictograms

- Students were capable of constructing pictograms from given data, writing down the proper title for a pictogram (e.g. Q36/M1; Q36/M2) and naming the categories of data on the vertical axis of the pictogram (e.g. Q35/M3). Some students did not draw the pictures correctly or neatly to represent their respective frequencies across the row, and did not complete the pictogram in Q35/M3 (see exemplars of students' work below).

Q36/M1


3D班同學的課餘活動
（標題）
每個 代表 1 人
運動
書法
閱讀
攝影
繪畫


Sports
Calligraphy
Reading
Photography
Drawing

General Comments on P.3 Student Performances

The overall performance of P.3 students was good. Students demonstrated mastery of basic concepts and computational skills of foundational mathematics in Key Stage 1.

Students' performance in the Number Dimension and Data Handling Dimension was better than their performance in the Measures dimensions and Shape & Space dimensions. They were capable of solving simple application problems and in presenting proper working steps in their solutions, except when there is a remainder involved in the solutions. Most students could read and interpret simple pictograms and performed well in constructing pictograms. Some students, however, could not deduce the solution to an open-ended question using the given data and could not complete the pictograms as required.

For Measures Dimension and Shape & Space Dimension, students generally performed well in areas such as Hong Kong money, Lines, Angles and Four Directions, but were relatively weak in the following areas: identifying the sets of parallel lines and perpendicular lines, reading the scale of measuring instruments accurately, using suitable measuring tools for recording measurements, and identifying, grouping and naming 3-D or 2-D shapes.

In general, P.3 students had little difficulty solving familiar problems but sometimes did not complete the task as required, perhaps misreading instructions or drawing conclusions based on their usual practices. Also, their performance tended to decline slightly for test items that were less familiar or required higher order thinking.

Performance of the Best P.3 Students in TSA 2008

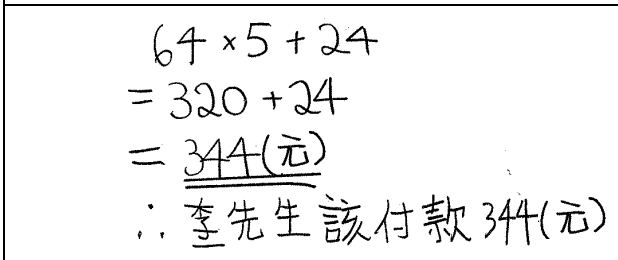
Students sitting for each sub-paper were ranked according to their scores and the performances of approximately the top 10% were singled out for further analysis. The performances of these students are described below.

Among these students, few of them achieved a full score or lost at most three score points in the assessment. They demonstrated an almost complete mastery of the concepts and skills being assessed by the sub-papers they attempted.

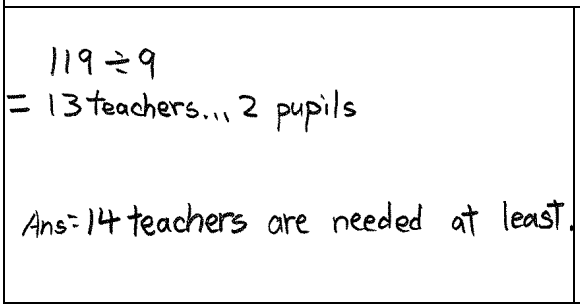
The best performing students continued to excel in all dimensions and most of these students demonstrated a good understanding of the concepts of fractions such as comparing fractions with the same denominator or numerator. They were also adept at arithmetic computations including those involving mixed operations and the use of

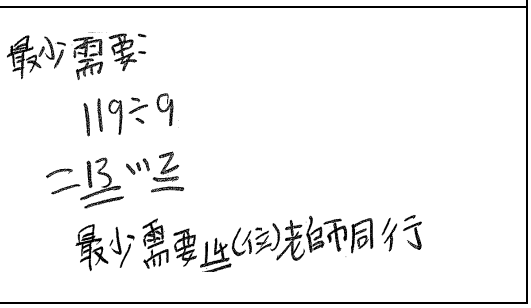
brackets, and solving more demanding application problems with whole numbers. When required to show their working steps, most students could present their solutions properly with clear explanations or concluding statements even for the more difficult division problem where there was a remainder (see exemplars of students' work below).

Q15/M1



Q14/M4





The best performing students could handle problems relating to Hong Kong money and performed well in the division of money involving conversion of money, and measurement of time. They could compare directly the length/distance, mass and capacity of objects, use suitable units for recording measurement in daily-life experiences and read accurately the scale of a measuring instrument.

Best performing students were also capable of identifying straight lines, curves, parallel lines and perpendicular lines as well as recognizing the four directions. They had a very good knowledge of angles and how to compare their sizes, as well as identifying and naming accurately 2-D shapes. They were also capable of identifying 3-D shapes including those of real life objects. Some of them could even use more specific mathematical terms other than simply prism or pyramid when naming different types of prisms and pyramids, for example, triangular prism (三角柱體) in Q27(c)/M1 and hexagonal prism (六角柱體) in Q28/M3, though these mathematical terms were not included in the framework of Basic Competency of Key Stage 1 (see exemplars of students' work below).

Q27/M1	
(a) 五角柱 體	(c) 三角柱 體

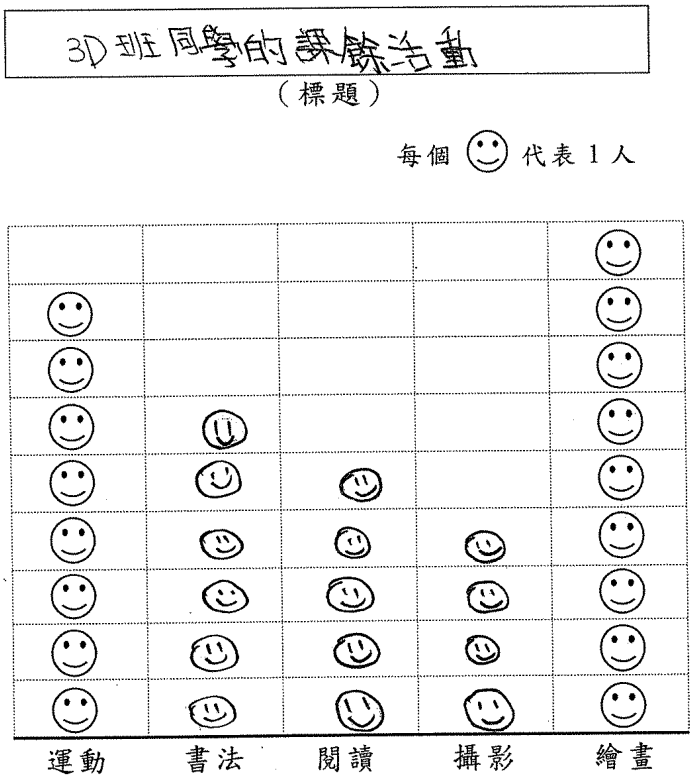
Q28/M3

上圖的立體圖形是由一個 圓柱 體和兩個 六角柱 體所組成。

The above 3-D shape is made up of **one** cylinder and **two** hexagonal prism.

Furthermore, they were capable of reading and interpreting data or information given in pictograms as well as using data to construct proper pictograms (see exemplars of students' work below).

Q36/M1



In spite of their overall good performances, some of these students had some common weaknesses as described below:

- Many students could not choose the appropriate measuring tools for measuring the distance between objects (e.g. Q21/M1).
- Many students were unable to make indirect comparison of mass of different objects (e.g. Q24/M2).
- Some students could not measure and calculate the difference in capacity with different measurement units (e.g. Q26/M2).
- About half of the students had difficulty in identifying all sets of parallel lines in the given 2-D shapes (e.g. Q31(a)/M1).
- Some students were not familiar with open-ended questions and unable to explain their answers clearly and correctly (e.g. Q35(c)/M1).

Comparison of Student Performances Mathematics at Primary 3 TSA 2006, 2007 and 2008

The percentages of students achieving Basic Competency in these three years are provide below.

Table 8.2 Percentages of P.3 Students Achieving Mathematics Basic Competency in 2006, 2007 and 2008

Year	% of Students Achieving Mathematics Basic Competency
2006	86.9
2007	86.9
2008	86.9

A comparison of the strengths and weakness of P.3 students in TSA 2006, 2007 and 2008 provides useful information on how teachers can help students improve their learning. The following provides a comparison of the students' performances in each of the four Dimensions for the last three years.

Number Dimension

- The overall performance of students in the Number Dimension was the same as in 2006 and 2007.
- Students performed at about the same level as those in the previous years for problems relating to whole number concepts and calculating arithmetic operations involving whole numbers.

- Students demonstrated a steady performance in solving simple and straightforward application problems and presenting their working steps logically. However, they had difficulty expressing the quotient and remainder for division, and were unable to conclude the answer from the remainder.
- Students continued to have difficulty in solving problems involving the division of money.
- Students showed a satisfactory performance in understanding the basic concept of fractions and comparing fractions.

Measures Dimension

- The overall performance of students in the Measures Dimension was about the same as in 2006 and 2007.
- Students showed fair performance in exchanging and using money.
- Students showed a slight improvement in telling the dates from a calendar and telling the dates of an activity according to the duration of the activity when compared to the previous year.
- Students' performance in measuring and comparing length/distance and choosing suitable measuring units for recording length and weight of objects remained the same as in previous years. However, they were weak in choosing appropriate measuring tools for measuring length/distance and weight, comparing the weight of objects using improvised units, and recording the weight of objects with appropriate measurement units.
- Similar to last year, a few students still had difficulty in writing measurement units in Chinese correctly.
- Students demonstrated a similar performance compared to the previous years in telling the time from a clock face/digital clock and recording the duration of activities.

Shapes & Space Dimension

- The overall performance of students in the Shapes & Space Dimension was about the same as in 2006 and 2007.
- Students performed at about the same level as the previous years in identifying, naming and grouping 3-D or 2-D shapes, though most of them had difficulty in

identifying trapeziums which were not presented in a commonly placed orientation and naming rhombuses. In additions, students had difficulty in drawing parallelograms as instructed.

- Students did better this year in identifying, naming and drawing different types of triangles.
- Students performed at the same level as the previous years in identifying straight lines, curves, parallel lines and perpendicular lines.
- Students performed slightly better this year in recognizing right angles and showed a steady performance in comparing the sizes of angles.
- Students had difficulty in recognizing the four directions when the direction of the compass was not pointing North.

Data Handling Dimension

- The overall performance of students in 2008 in the Data Handling Dimension was slightly lower than that of 2006 and 2007.
- Students performed similarly to previous years in reading and interpreting simple pictograms, drawing pictograms, and giving a title to a pictogram. As it was the first year that an open-ended question was introduced in Key Stage 1, students were not capable of answering. Some of them failed to complete the rest of the pictogram if part of the pictogram was provided.