Results of Primary 6 Mathematics in TSA 2015

The territory-wide percentage of P.6 students achieving Mathematics Basic Competency in TSA 2015 was 84.0% which was similar to that of the performance levels in 2011 and 2013.

Primary 6 Assessment Design

The assessment tasks for P.6 were based on the *Basic Competency at the end of KS2 for the Mathematics Curriculum (Trial Version)* and the *Mathematics Curriculum Guide (P1 – P6), 2000*. The tasks covered the five Dimensions of the Mathematics curriculum, i.e. Number, Measures, Shape & Space, Data Handling and Algebra.

The Assessment assumed students had already mastered the Basic Competencies covered in Key Stage 1 (Primary 1 to 3) and therefore focused primarily on the basic and important areas of the Key Stage 2 (Primary 4 to 6) curriculum, testing the concepts, knowledge, skills and applications relevant to these areas. Items were specifically set on the Basic Competencies covered in Key Stage 1 in order to test whether P.6 students still retained the essential knowledge and skills learnt in Primary 1 to 3.

The Assessment included a number of item types including multiple choice, fill in the blanks, solutions with working steps (or equations) required, as well as open-ended questions in which students were required to justify their answers, with item types varying according to the context. Some of the items consisted of sub-items. Besides finding the correct answers, students were also tested on their ability to present the solutions to problems, including writing out the necessary statements, mathematical expressions, equations and explanations.

The Assessment consisted of 104 test items (163 score points) covering the five Dimensions. These items were grouped into four sub-papers, each 50-minutes in duration and covering all five Dimensions. Some items appeared in more than one sub-paper to provide inter-paper links. Each student was required to attempt only one of the four sub-papers.

Table 8.4 Number of Items and Score Points for P.6

Subject	Number of Items (Score Points)				
	Paper 1	Paper 2	Paper 3	Paper 4	Total *
Mathematics Written Paper					
Number	24 (30)	22 (27)	19 (25)	20 (24)	54 (68)
Measures	3½ (9)	7½ (14)	9 (16)	8½ (14)	20 (37)
Shape and Space	6½ (13)	5½ (11)	4 (8)	5½ (11)	11 (24)
Data Handling	3 (6)	3 (7)	3 (9)	3 (7)	8 (19)
Algebra	3 (5)	3 (3)	5 (7)	5 (7)	11 (15)
Total	40 (63)	41 (62)	40 (65)	40 (63)	104 (163)

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

Performance of P.6 Students with Minimally Acceptable Levels of Basic Competence in TSA 2015

P.6 Number Dimension

P.6 students performed well in the Number Dimension. The majority of students grasped the basic concepts including the place values in whole numbers and decimals, common factors and multiples of two numbers, conversion between fractions, decimals and percentages, arithmetic operations and methods of estimation. However, some students confused the factors with the multiples of a number and were relatively weak in solving application problems involving fractions. Further comments on their performance are provided below with examples from different sub-papers quoted in brackets.

Understanding basic concepts

- Most P.6 students understood the concept of place values (e.g. Q1/M1).
- Most students were able to order numbers in descending order (e.g. Q1/M3).

Multiples and factors

- The majority of students understood the concept of factors (e.g. Q2/M1).
- Most students were able to use the listing method to find all the factors of a number (e.g. Q3/M1).
- The majority of students understood the concept of common factors (e.g. Q2/M3) and

could find the common multiples of two numbers (e.g. Q6/M1). However, a small number of students confused the multiples with the factors of a number (e.g. Q3/M3).

- The majority of students were able to find the least common multiple (L.C.M.) of two numbers (e.g. Q4/M1) but fewer students could find the highest common factor (H.C.F.) of two numbers (e.g. Q4/M2).

Fractions

- Most P.6 students fully understood fractions as parts of one whole (e.g. Q7/M1, Q5/M3).
- Most P.6 students could grasp the relationship between a fraction and the whole (e.g. Q5/M1, Q4/M3, Q15/M4).
- Most students performed satisfactorily when converting mixed numbers into improper fractions and vice versa (e.g. Q8/M1).
- Most students understood the concept of equivalent fractions (e.g. Q6/M3).
- The majority of students were capable of comparing fractions (e.g. Q9/M1, Q8/M3).

Decimals

- The majority of P.6 students were able to record numbers with decimals (e.g. Q13/M3).
- The majority of students comprehended the place value of decimals (e.g. Q11/M1, Q9/M3) but some of them easily confused the tenths and hundredths places or misspelled the 'tenths' place as 'tenth' place (e.g. Q6/M4).
- The majority of students were capable of converting decimals into fractions and vice versa (e.g. Q10/M1) but some students did not give the answer correct to two decimal places (e.g. Q7/M3).

Percentages

- Generally P.6 students understood the basic concept of percentages (e.g. Q21/M4).
- The majority of students were capable of converting percentages into fractions and vice versa (e.g. Q23/M1, Q18/M3).
- The majority of students were capable of converting percentages into decimals and vice versa (e.g. Q21/M1).

Performing basic calculations

- Generally, students had no difficulty in carrying out the four operations on whole numbers including small brackets (e.g. Q13/M1, Q7/M4, Q9/M4). Some students could not manipulate mixed operations involving multiplication and division (e.g. Q12/M1). In Q11/M2, some students wrongly chose the option B as they apparently neglected the computation rule of 'doing multiplication/division before addition/subtraction'.
- The majority of students were capable of carrying out the four arithmetic operations involving fractions (e.g. Q14/M1, Q15/M1, Q11/M3, Q12/M3, Q10/M4).
- The majority of students could perform arithmetic operations involving decimals (e.g. Q17/M1, Q14/M3, Q12/M4, Q13/M4) except that they were relatively weak in the multiplication of decimals (e.g. Q16/M1).

Solving application problems

- Generally, P.6 students could solve application problems involving whole numbers and fractions (e.g. Q18/M1, Q17/M2). However, some students were unable to handle subtraction of fractions (see an example of students' work on Q18/M1 below).

Q18/M1
$5-1\frac{1}{4}-\frac{3}{5}$ $=(5-1)+(\frac{5}{20}-\frac{12}{20})$ $=(4-1)+(\frac{25}{20}-\frac{12}{20})$ $=3+\frac{13}{20}$ $=3\frac{13}{20}$ 還餘果汁 $3\frac{13}{20}$ 升。

- In Q20/M1, some students were able to find the correct answer but missed the brackets in the mathematical expression or gave wrong units.

Q20/M1	
1.25 + 2.6 ÷ 7 = 3.85 ÷ 7 = 0.55 Each bottle contains 0.55 L of juice.	每瓶有: (1.25 + 2.6) ÷ 7 = 3.85 ÷ 7 = 0.55 (毫升)

- The majority of students were capable of solving application problems involving decimals (e.g. Q20/M1, Q24/M1, Q16/M4).
- Students performed well in solving application problems involving money calculations (e.g. Q17/M3).
- The majority of students could solve application problems on percentages (e.g. Q19/M1, Q22/M2).
- The majority of students could choose an appropriate method in estimating the average value or a certain amount of money (e.g. Q25/M1, Q20/M2).

P.6 Measures Dimension

The performance of students in the Measures Dimension was satisfactory. P.6 students mastered the basic concepts learnt in Key Stage 1. The majority of students could answer questions about the problems of daily life. However, some students were not able to find the area and perimeter of 2-D shapes. They did not understand the relationship between the capacity and the volume nor were they able to find the relationship between the circumference and the diameter of a circle. Further comments on their performance are provided below with examples from different sub-papers quoted in brackets.

Measurement of time, length, distance, weight and capacity

- The majority of students could write the correct date corresponding to a given context (e.g. Q24(a)/M2) and knew the number of days in a common year (e.g. Q24(b)/M2).
- Most students were capable of reading a clock (e.g. Q22(a)/M1), applying the '24-hour time' (e.g. Q22(b)/M1) and measuring the duration of time in 'minutes' (e.g. Q22(c)/M1).

- Most students were capable of recording the length of objects with an appropriate single unit (e.g. Q23(a)/M2, Q22(a)/M3).
- Most students were able to compare the weight of objects using improvised units (e.g. Q21/M3).
- The majority of students could record the weight of objects with suitable units (e.g. Q23(b)/M2, Q22(b)/M3).
- The majority of students could choose suitable tools to measure capacity (e.g. Q26/M2), though some of them neglected the scales of a beaker or a syringe.
- The majority of students could record the capacity of containers with suitable units (e.g. Q23(c)/M2, Q22(c)/M3).
- The majority of students could measure and compare the capacity of containers using 'litre' (L) or 'millilitre' (mL) (e.g. Q26/M1).

Finding perimeters

- The majority of students could compare the perimeters of 2-D shapes (e.g. Q24/M4).
- Most students could calculate the perimeter of a square (e.g. Q23(a)/M3) but just slightly more than half of them were able to find the relationship between the circumference and the diameter of a circle (e.g. Q23(b)/M3).
- The majority of students could apply the circumference formula in solving problems (e.g. Q25(b)/M2, Q31/M3).

Finding areas

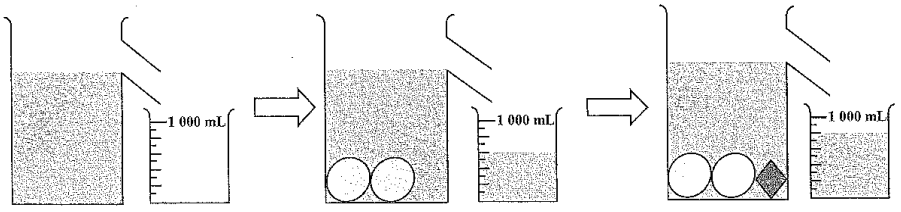
- Some students could not estimate the area of an irregular 2-D shape using an effective strategy (e.g. Q28/M2).
- Generally students were able to find the areas of a square and a rectangle (e.g. Q27(a)&(c)/M1) as well as the area of a parallelogram (e.g. Q26/M4).

Finding volumes

- The majority of students could find the volume of 3-D solids with correct units (e.g. Q24/M3).
- The majority of students could calculate the volume of a cube (e.g. Q29(2)/M2).

- Some students did not understand the relationship between the capacity and the volume (e.g. Q27/M2).
- Many students were capable of finding the volume of irregular solids by displacement of water but a few of them were not able to deduce the answer from the previous result (see the example of a student's work on Q26/M3 below).

Q26/M3



(a) 一個 ○ 的體積是 300 cm^3。

(b) 一個 ◆ 的體積是 500 cm^3。

Speed

- Some students could not record the speed of vehicles in 'kilometres per hour' (km/h) (e.g. Q30/M1).
- The majority of students could calculate speed with the correct unit (see the example of a student's work on Q25/M2 below).

Q25/M2

她的平均速率是： 84÷10.5 =840÷105 =8 (m/s)	84÷10.5 =8 她的平均速率是8米每秒。

- The majority of students were able to use the speed formula to calculate time but quite a number of them could not express the answer in 'minutes' (e.g. Q27/M3).

P.6 Shape & Space Dimension

Students performed well in the Shape & Space Dimension. They could identify the characteristics of 2-D and 3-D shapes. They were capable of recognizing straight lines, curves and the eight compass points. There was room for improvement in the recognition of directions relative to a reference point. Further comments on their performance are provided below with examples from different sub-papers quoted in brackets.

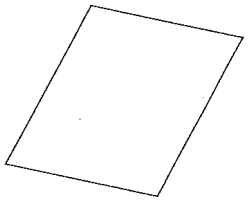
Lines and curves

- Most students were able to recognize straight lines and curves (e.g. Q33/M1).

3-D and 2-D Shapes

- The majority of students could distinguish between pyramids and prisms as well as give the correct number of vertices, edges and faces (e.g. Q31/M2, Q28/M1, Q29(1)/M2).
- The majority of students were able to recognize the characteristics of isosceles triangles and right-angled triangles (e.g. Q29/M1, Q27(b)/M1). However, some students easily confused isosceles triangles with equilateral triangles (e.g. Q31(a)/M1).
- The majority of students could recognize circles, rhombuses, parallelograms, rectangles and their characteristics (e.g. Q31/M1, Q32/M1, Q32/M2, Q28/M3). A few students easily confused parallelograms with rectangles (see the example of a student's work on Q32/M2 below).

Q32/M2



上面的平面圖形是一個

* 平行四邊形 / 長方形 / 菱形 。(*圈出答案)

它有 2 組對邊平行。

- In classifying 2-D figures, some students were prone to confuse trapeziums with parallelograms (e.g. Q30/M3).

The eight compass points

- The majority of students could recognize the eight compass points (e.g. Q35/M1, Q35(a)&(c)/M2). A few students however, wrote the wrong Chinese character for the South direction.

Q35(c)/M1: An example of wrong Chinese character for 'south'（南）
(c) 壽司店在中菜館的 東南 方。

- When the north direction was not pointing upward on the map, some students were not able to locate the position of the reference point (e.g. Q35(b)/M2).

P.6 Data Handling Dimension

Students performed well in the Data Handling Dimension. The majority of students were capable of reading and drawing pictograms and bar charts. They could correctly extract data given in statistical graphs. They could calculate the average of a group of data and solve problems of averages. Further comments on their performance are provided below with examples from different sub-papers quoted in brackets.

Reading and interpreting pictograms and bar charts

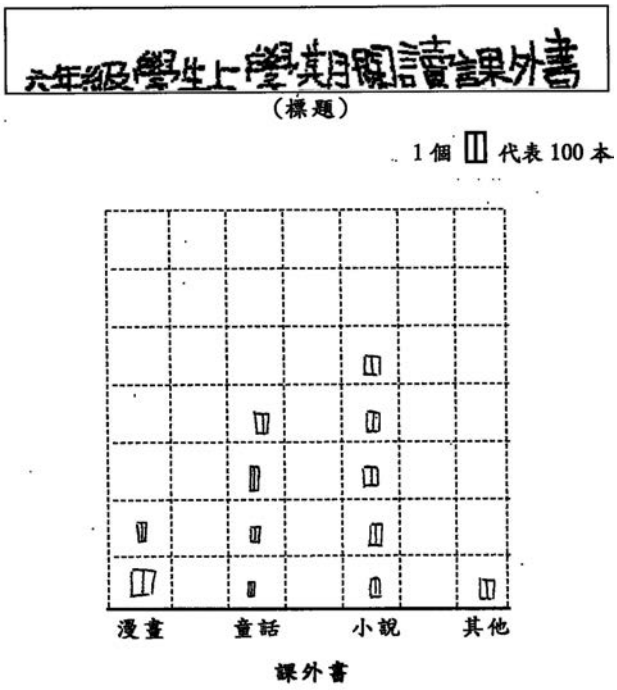
- Most students were good at reading data directly from pictograms and interpreting the information, including a one-to-hundred representation or greater frequency counts (e.g. Q38/M4 and Q39/M2).

- The majority of students were capable of reading data directly from bar charts with a one-to-ten representation or greater frequency counts (e.g. Q39/M1, Q40(a)&(c)/M3). Only a few of them were not able to make references with given data (e.g. Q40(b)/M3).

Constructing pictograms and bar charts

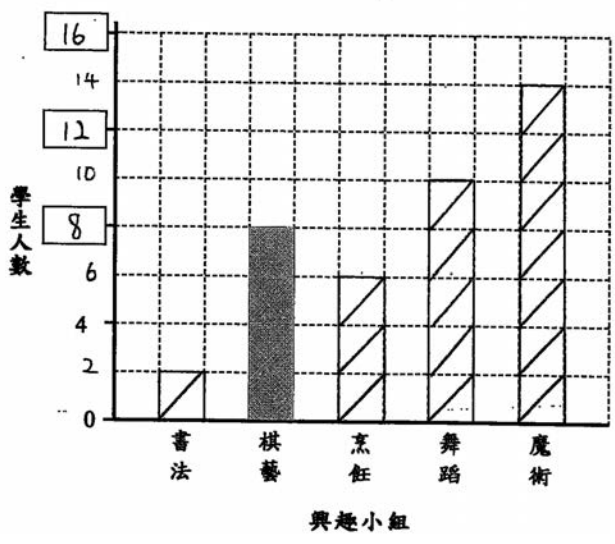
- The majority of students could construct correct pictograms. However, some students missed the keyword 'number' in the title or unnecessarily added a frequency axis (see the example of a student's work on Q38/M1).

Q38/M1



- The majority of students could construct bar charts with correct scales along the vertical axis (see an example of a student's work on Q40/M2 below).

Q40/M2



Concept of averages and its applications

- The majority of P.6 students were able to calculate the average of a group of data (e.g. Q40/M1).

- The majority of students could find the average in application problems (e.g. Q40/M4).

P.6 Algebra Dimension

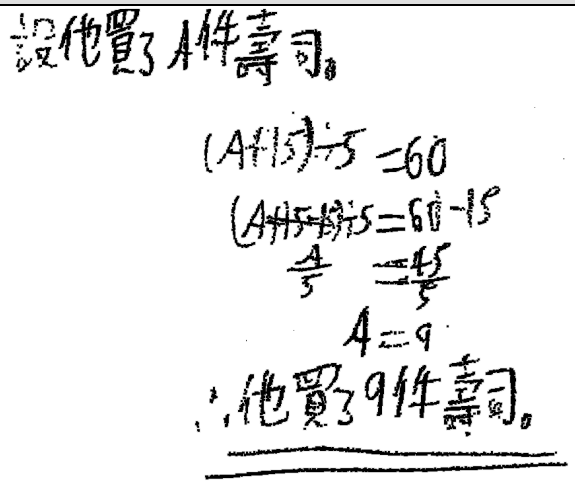
The performance of P.6 students was stable in the Algebra Dimension. They were able to use symbols to represent numbers, solve equations up to two steps and use equations to solve simple application problems. More detailed comments on their performance are provided below with examples from different sub-papers quoted in brackets.

Using symbols to represent numbers

- The majority of students could use algebraic expressions to represent contexts (e.g. Q34/M1) but some students misunderstood the question or forgot the use of brackets (e.g. Q33/M3)

Solving simple equations

- Most students understood the concept of equations (e.g. Q34/M3 and Q34/M4).
- The performance of students was good in solving equations of up to two steps (e.g. Q36/M1, Q37/M2, Q36/M3, Q35/M4). However, their performance declined slightly when fractions were involved in the equation (e.g. Q38/M2).
- The majority of students could solve application problems by setting up an equation with a defined symbol (e.g. Q37/M1 and Q37/M3). However, some students could not write correct equations nor present logical working steps (see a student's answer for Q37/M1 below).

Q37/M1


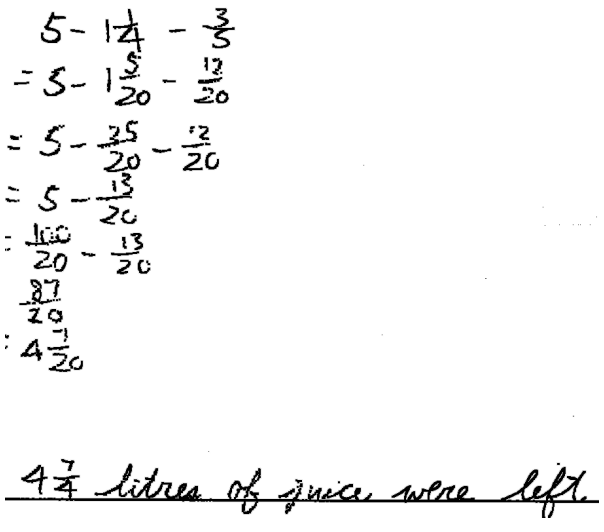
General Comments on P.6 Student Performances

The overall performance of P.6 students was good. The majority of students did well in the Data Handling and Shape & Space Dimensions. They performed satisfactorily in the Number, Measures and Algebra Dimensions.

In general, P.6 students mastered the basic concepts and computational skills stipulated in the document *Basic Competency at the end of KS2 for the Mathematics Curriculum (Trial Version)*. Nevertheless, some students need to reinforce basic concepts such as factors and multiples as well as the perimeter and area of 2-D figures. They need to improve calculations involving fractions and the techniques in using symbols to represent numbers and solving equations. They also need to deepen their understanding of the relationship between the capacity and the volume, and also the relationship between the circumference and the diameter of a circle.

P.6 students were weak in solving application problems involving fractions. Some students did not show the working and conclusion logically (see an example of a student's work on Q18/M1 below).

Q18/M1

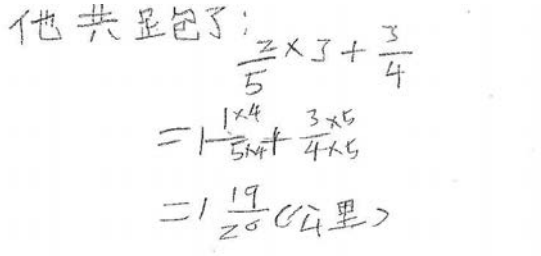


In Q18/M2, many students mistook the number of laps as distance.

Q18/M2

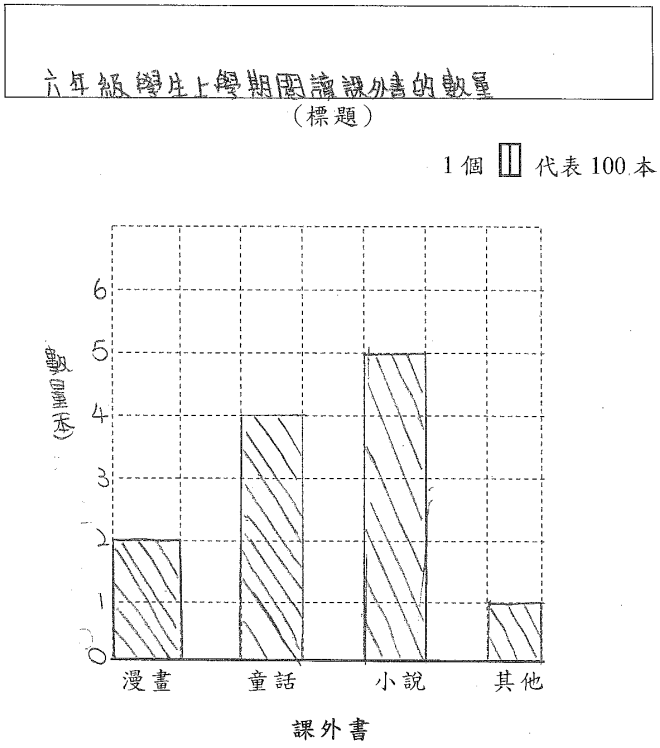
運動場一圈長 $\frac{2}{5}$ 公里。小建跑了 3 圈後，休息一會，再跑 $\frac{3}{4}$ 圈。他共跑了多少公里？

（列式計算）



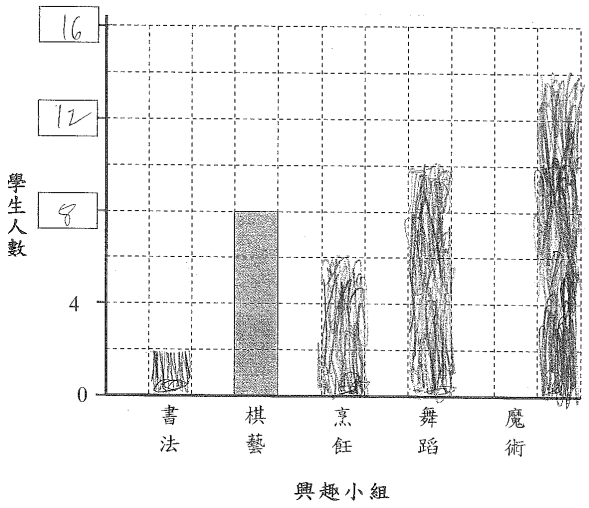
Some students confused pictograms with bar charts and added a ‘frequency axis’ to the pictogram (see an example of a student’s work on Q38/M1 below).

Q38/M1



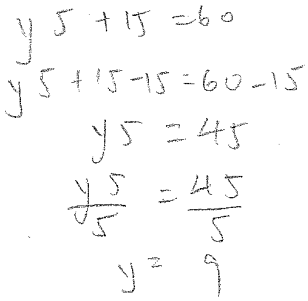
The majority of students could construct bar charts but a few of them drew bars on the wrong positions or with inconsistent separations (see an example of a student's work on Q40/M2 below).

Q40/M2



Some students knew that the multiplication sign could be omitted but misplaced the coefficient after the symbol as shown in the following example:

Q37/M1

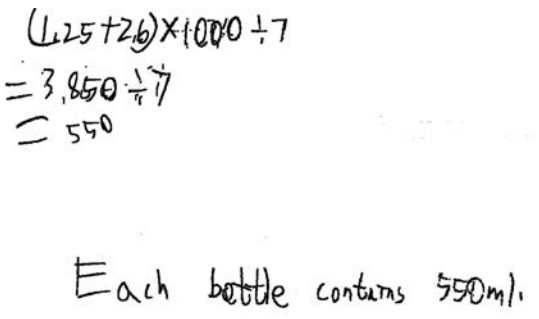
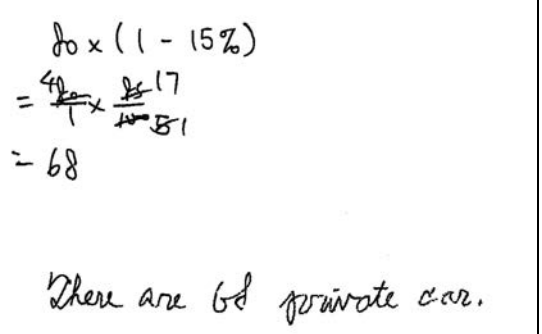


Best Performance of P.6 Students in TSA 2015

Students were ranked according to their scores and the performance of the top 10% was singled out for further analysis. Among the top performing P.6 students, about one third of them achieved a perfect score or lost at most two score points in the whole assessment. That is, they demonstrated an almost complete mastery of the concepts and skills being assessed by the sub-papers they attempted.

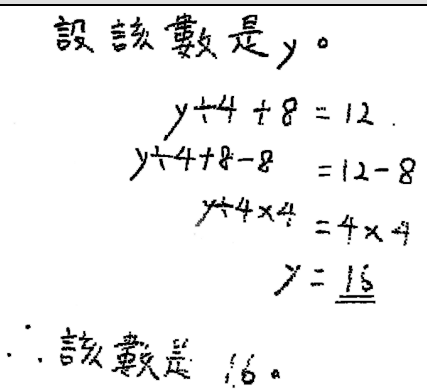
The top performing students have mastered the basic concepts and calculations taught in Key Stages 1 and 2, including the common factors and common multiples of two numbers, finding the least common multiple and the highest common factor of two numbers, etc.

The top performing students were capable of solving problems involving decimals and percentages including the use of brackets in expressions (see the students' answers shown below).

Q20/M1	Q22/M2
	

They were able to find the perimeter and area of 2-D shapes, the volume of solids and the capacity of containers. They could also recognize the characteristics of various 2-D shapes and 3-D shapes as well as the eight compass points.

They understood the concept of equations and could solve simple equations. They could define the unknown with symbols and solve application problems by equations (see a student's answer for Q37/M3 below).

Q37/M3


Overview of Student Performances in Mathematics at Primary 6 TSA 2011-2015

The percentages of students achieving Basic Competency in 2011, 2013 and 2015 are provided below.

Table 8.5 Percentages of P.6 Students Achieving Mathematics Basic Competency in 2011-2015^

Year	% of Students Achieving Mathematics Basic Competency
2011	84.1
2013	84.2
2015	84.0

^ The 2012 and 2014 P.6 TSA were suspended. As participation in the 2012 and 2014 P.6 TSA was on a voluntary basis, not all P.6 students were involved and hence no territory-wide data is provided in this report.

A comparison of the strengths and weaknesses of P.6 students in TSA 2011, 2013 and 2015 provides useful information for teachers to help students improve the effectiveness of their learning. The percentage of students achieving mathematics basic competency in 2015 is similar to that of 2011 and 2013. The following tables provide a comparison of the student performances for these years in each of the five dimensions.

Table 8.6 Overview of Student Performances in Mathematics at Primary 6 TSA 2011-2015

Year / Number	2011	2013	2015	Remarks
Strengths	• Students could master basic concepts including the place value of digits in whole numbers and decimals. • Students could find the factors and multiples. • Students could handle the conversion between fractions, decimals and percentages. • Students could perform arithmetic operations on whole numbers, fractions and decimals. • Students could present their solutions and working steps clearly in solving application problems.	• Students were capable of performing arithmetic operations on whole numbers, fractions, decimals and percentages. • Students could understand the concept of a fraction as parts of one whole and compare fractions. • Students were capable of choosing the appropriate mathematical expression in estimation.	• Students grasped the basic concepts including the place values in whole numbers and decimals, common factors and common multiples of two numbers. • Students understood the highest common factor and the least common multiple. • Students were capable of carrying out the arithmetic operations on whole numbers, fractions and decimals including small brackets. • The majority of students could choose suitable methods of estimation. • Students could solve application problems by clear presentation of steps and explanations.	• Teachers can use some examples to show the difference between factors and multiples of a number. • Students need to improve the basic skills in the operation of fractions. • Teachers can explain different strategies in estimating values under different circumstances.
Weaknesses	• Some students were not able to find the common factors and common multiples of two numbers. • Students had room for improvement in the estimation methods. • Some students had difficulty in answering application problems involving fractions and percentages.	• Students needed improvement in finding the common multiples and L.C.M. of two numbers. • Some students forgot the rule of "performing multiplication/division before addition/subtraction" when carrying out mixed operations. • Some students had difficulty in solving application problems involving fractions or unfamiliar contexts.	• Some students confused factors with multiples. • Students needed to improve in calculations of fractions. • Some students could not manipulate mixed operations involving multiplication and division. • Students were weak in solving application problems, especially in contexts involving fractions.	

Year / Measures	2011	2013	2015	Remarks
Strengths	• Students could apply the basic concepts of time, length, distance, weight and capacity in simple situations. • Students could choose suitable tools for recording length, weight and capacity. • Students could choose the appropriate units of measurement for recording length, weight and capacity. • Students could apply the formula to find circumference. • Students could solve simple application problems involving speed.	• Students could master the basic competencies learnt in Key Stage 1 (e.g. measuring length with a ruler, choosing the appropriate units of measurement for recording length, distance, weight and capacity, etc.). • Students could measure and compare the capacity of containers. • Students could calculate the volume of cubes and cuboids. • Students improved a little bit on solving application problems of speed.	• Students chose the appropriate units of measurement for recording length, distance, weight and capacity. • Students were able to compare the weight of objects with improvised units. • Students could measure and compare the capacity of containers. • Students could find the perimeter and area of 2-D shapes and the volume of solids. • Students could apply the speed formula.	• There is room for improvement in solving application problems involving speed. • Students found it difficult to understand the relationship between the circumference and the diameter of a circle.
Weaknesses	• Students were weak in recognising the relationship between the circumference and diameter of a circle. • Students had room for improvement in recognising the relationship between the volume and the capacity.	• There was room for improvement in finding the perimeter and area of 2-D shapes.	• There was room for improvement in finding the area of irregular 2-D shapes. • Students were relatively weak in understanding the relationship between the volume and the capacity.	

Year / Shape and Space	2011	2013	2015	Remarks
Strengths	• Students were capable of identifying 3-D shapes including pyramids/cones, prisms/cylinders and spheres. • Students were capable of identifying different 2-D shapes • Students were capable of identifying straight lines and curves as well as a set of parallel lines or perpendicular lines. • Students were able to recognize the eight compass points.	• Students were capable of identifying 3-D shapes including the numbers of vertices, edges and faces. • Students were capable of recognizing the characteristics of different 2-D shapes • Students performed well in identifying parallel lines and perpendicular lines. • Students were able to handle the eight compass points.	• Students were good at identifying 2-D shapes and 3-D shapes. • Students' performance was stable in recognizing the simple characteristics of triangles. • Students were capable of recognizing the eight compass points.	• Teachers can show students more 'non-standard' examples in the classrooms, e.g. circles and ellipses, 2-D shapes placed in different orientations and maps with the north direction not pointing upward.
Weaknesses	• A small number of students confused a circle with an ellipse. • Some students could not distinguish between parallel lines and perpendicular lines.	• Some students confused prisms with pyramids. • Some students mis-classified 2-D shapes with curved sides as polygons. • Some students could not find the correct direction relative to a reference point. • A small number of students neglected the implication when the 'north' direction was not pointing upward on the map.	• Some students had difficulty in judging the direction relative to a reference point. • There was room for improvement in the sense of direction when the 'north' direction on a map was not pointing upward.	

Year / Data Handling	2011	2013	2015	Remarks
Strengths	• Students were capable of reading and interpreting data presented in statistical graphs. • Students performed well in drawing pictograms or bar charts from tabulated data. • Students could find the average of a group of data and solve simple problems of averages.	• Students were capable of reading data presented in pictograms or bar charts. They could extract relevant information from given statistical graphs to make inferences. • Students were capable of drawing pictograms or bar charts. • Students were able to solve daily problems involving averages.	• Students were capable of reading and interpreting data presented in statistical graphs. • Students performed well in drawing pictograms and bar charts. • Students were capable of finding the average of a group of data and solving problems of averages.	• Teachers can show students different examples of pictograms and bar charts in the classroom.
Weaknesses	• A few students did not draw statistical graphs neatly and unnecessarily added a 'frequency axis' to a pictogram.	• Some students unnecessarily added a 'frequency axis' to the pictogram.	• A small number of students added inappropriate titles to statistical graphs. • Some students confused pictograms with bar charts or mistakenly added a 'frequency axis' to a pictogram.	

Year / Algebra	2011	2013	2015	Remarks
Strengths	• Students were capable of using symbols to represent numbers and understood the concept of equations. • Students were capable of solving equations of up to two steps. • Students' were able to solve application problems by using simple equations.	• Students were able to use symbols to represent numbers and understood the concept of equations. • Students were able to solve equations of up to two steps.	• Students were capable of using symbols to represent numbers and understood the concept of equations. • Students were capable of solving equations of up to two steps. • Students' performance improved in solving application problems by using simple equations.	• Students needed to pay more attention to definition of symbols and the steps and conclusion in solving application problems using equations.
Weaknesses	• Some students did not define the symbol they used.	• Students had room for improvement in solving application problems by equations.	• A few students placed the coefficient after the symbol, for instance, writing p×5 as p5.	