2013 Grade 6 Mathematics

This is an unofficial translation of 2013 Japanese Achievement Test. Original may be found at

Grade 6: Mathematics Set A

[1]   Calculate the following.

(1)   243 – 65

(2)   0.75 + 0.9

(3)   9.3 × 0.8

(4)   6 ÷ 5 (Divide completely. Write your answer as a decimal number.)

(5)   16 – (6 + 3)

(6) $2\frac{5}{7} + 1\frac{1}{7}$

(7) $\frac{2}{9} \times 4$

[2]   Which of the numbers below will be 20000 when rounded to the nearest ten thousand? Select all such numbers from 1 through 5 below.

1   14500

2   15000

3   19500

4   24999

5   25000

[3]   When a certain number was divided by 3, the quotient was 9 and the remainder was 2.
From the expressions 1 through 4 below, select the expression that is used to determine the number.

1   9 ÷ 3 + 2

2   9 ÷ 3 − 2

3   3 × 9 + 2

4   3 × 9 − 2

[4]   There are 2 picnic sheets, A and B.

A

6 m²

B

5 m²

The table below shows the number of people sitting on each picnic sheet and the area of the sheets.

Number of people and the area of picnic sheets

	People	Area (m^2)
A	12	6
B	8	5

To determine which sheet is more crowded, the following calculations were completed.

    A $12 \div 6 = 2$
    B $8 \div 5 = 1.6$

What can we say from the above calculations? Select the best answer from 1 through 4 below.

1. Since the number of people for 1 m² are 2 people and 1.6 people respectively, Sheet A is more crowded.

2. Since the number of people for 1 m² are 2 people and 1.6 people respectively, Sheet B is more crowded.

3. Since the area of sheet for each person is 2 m² and 1.6 m² respectively, Sheet A is more crowded.

4. Since the area of sheet for each person is 2 m² and 1.6 m² respectively, Sheet B is more crowded.

[5]   Answer the following questions.

(1)   To measure the length around a trunk of a tree, what should we use? Select the best answer from 1 through 4 below.

        1.   Ruler

        2.   Compass

        3.   Set square

        4.   Measuring tape

(2)   What is the length of a side of a square whose area is 1 a (1 are)? Select the correct answer from 1 through 4 below.

        1. 10 cm

        2. 1 m

        3. 10 m

        4. 100 m

(3)   What is the area of the trapezoid below? Write both the calculation
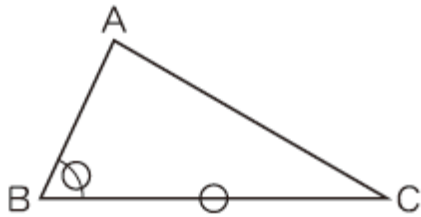   (equation) and the answer (the area).
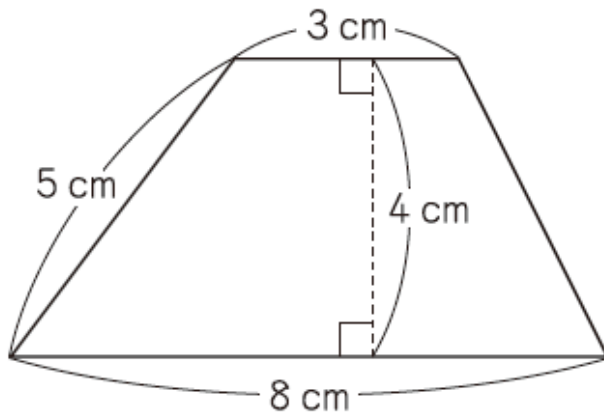
[6]   We are going to think about which lengths and angle measurements we need to measure to draw a triangle that is congruent to triangle ABC.
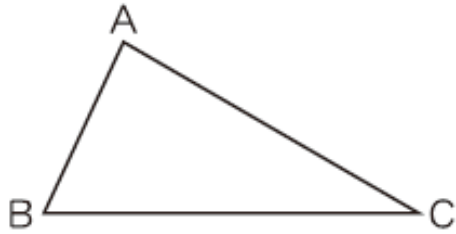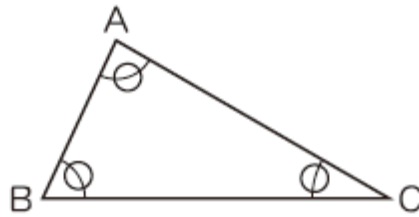

Figures 1 through 4 below show what measurements were taken (indicated by ◯). Select the one that shows the measurements we need to draw a triangle that is congruent to triangle ABC.
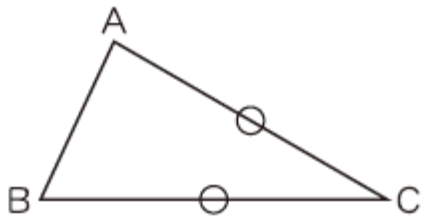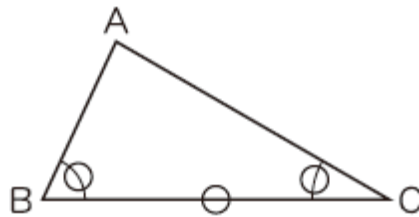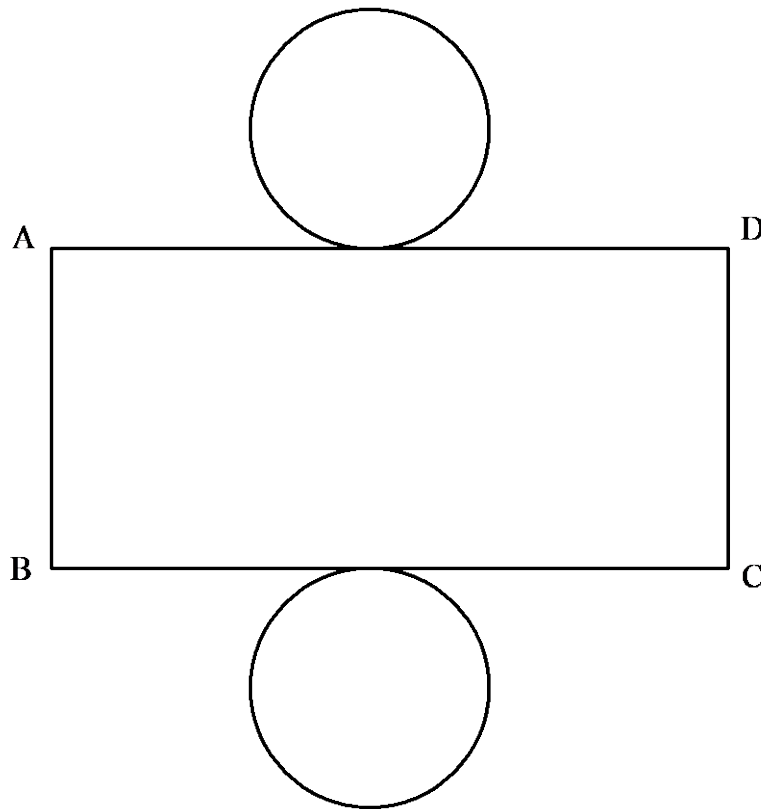
1

2

3

4

[7] There is a cylinder like the one shown on the right. A net of this cylinder was drawn so that its lateral side will be a rectangle.
Answer the following questions. Use 3.14 as the value of π.
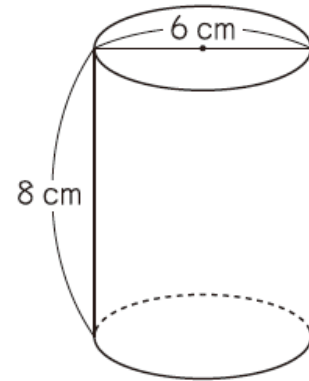
(1) What is the length of side AB?
(2) What is the length AD? Write both the calculation (equation) and the answer (the length).

[8] Answer the following questions.

(1) The length that is 50 % of 200 cm is [   ] cm.

Select the appropriate number for the [   ] above from 1 through 4 below.

1   100
2   150

3   250
                4   400

(2)   The weight that is 120% of 500 g is [   ].

        Select the appropriate phrase for [   ] above from 1 through 3 below.

        1   lighter than 500 g
        2   heavier than 500 g
        3   equal to 500 g

[9]   The bar graph below shows the number of library books students in a certain class checked out.

                Number of books checked
Books
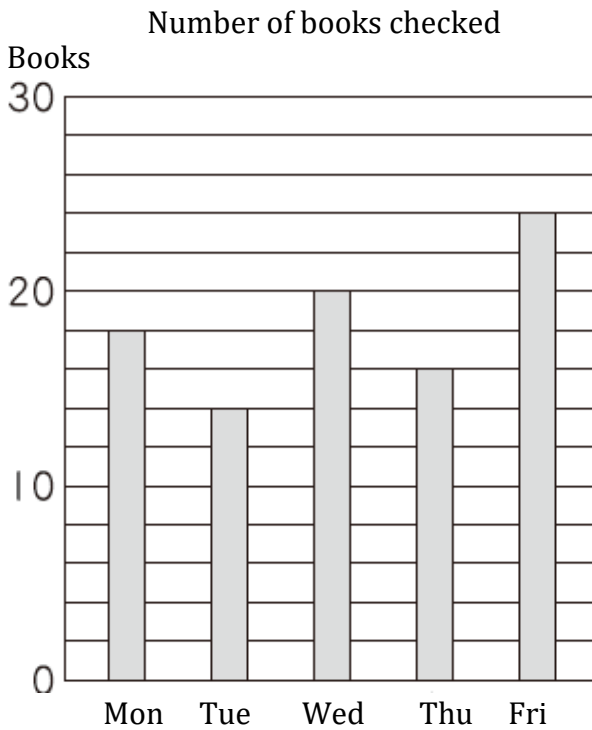
        Of which day of the week was the most books checked out? How many books were checked out on that day?

2013 Grade 6: Mathematics Set B

[1]   Yurie and her friends are planning to go to an amusement park.
   (1)   Yurie and Hisako are each planning to get 8 ride tickets.
         The number of tickets needed for the rides at the amusement park is
         summarized in the following table.

Rides		Number of Tickets
Roller Coaster		5
Ferris Wheel		4
Boat		3
Go Kart		2
Tea Cup		1
Carousel		1

They decided to ride the following rides.

Yurie

Ferris Wheel	
Carousel	

Hisako

Roller Coaster	
Tea Cup	

Since they still have more ride tickets, they thought about other rides, following the rules below.
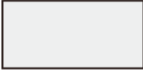
- Use only the remaining tickets.
- Select from the rides that they have not selected yet.
- They must ride the ride together.

Which ride can they ride? Write your answer.

(2)   After Toshio planned his rides, he realized that he would need 15 tickets.
The prices of ride tickets and the all-you-can-ride pass are as follows.

Ticket Prices

Tickets		All-You-Can-Ride Pass
Single ticket 100 yen	Book of 11 tickets 1000 yen	1500 yen

Which of the following ways to buy tickets will result in the lowest cost for the 15 ride tickets he needs. Select from 1 through 3 below. In addition, write the reason why that method will result in the lowest cost using words and numbers.

1   Buy 15 single tickets.
2   Buy a book of 11 tickets and 4 additional single tickets.
3   Buy an All-You-Can-Ride pass.

[2]   Yukiko will be conducting 3 experiments with a pendulum.

In the experiments, the amplitude will be kept constant while the lengths of the pendulum string or the amounts of the weight will be varied. She will then measure how long it will take for a pendulum to complete one swing to return to the starting position.

Length of pendulum

Amplitude (angle)

Weight

Amplitude (distance)
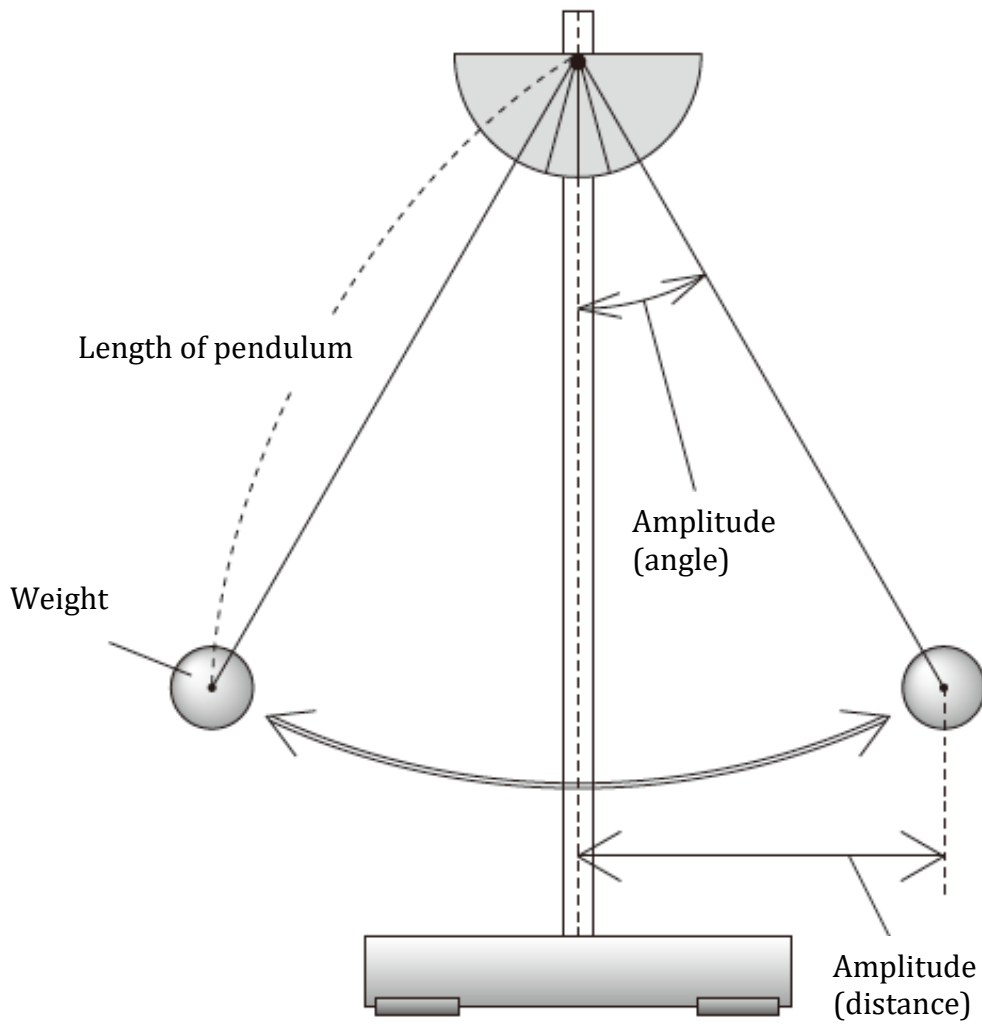
(1)　In Experiment 1, the length of pendulum was set at 50 *cm* and the weight was 40 *b*. Then, the time it took for the pendulum to make 10 full cycles was measured 6 times, and the results are summarized in the table below.

Results of Experiment 1

Trial number	1	2	3	4	5	6
Time for 10 cycles (sec.)	14	15	14	13	15	16

Based on the table above, Yukiko calculated the average time it takes for a pendulum to swing 1 full cycle using the following two equations.

Yukiko's calculations

What does **14.5** (*sec.*) in calculation ① tell us? Write your answer.

①　$(14 + 15 + 14 + 13 + 15 + 16) \div 6 = \mathbf{14.5}\ (sec.)$
②　$14.5 \div 10 = 1.45\ (sec.)$　⋯⋯　average time for 1 cycle

(2)　In Experiment 2, only the weight was changed to 80 *g*, and the time for the pendulum to make 10 cycles was measured 6 times. The results are summarized in the table below.
From the table, it became clear that the time for the second trial was not taken correctly.

Results of Experiment 2

Trial number	1	2	3	4	5	6
Time for 10 cycles (sec.)	14	7	15	14	14	15

Yukiko is going to determine the average time it takes for the pendulum to make 1 cycle using the results of 5 trials except the time for the second trial. Which of the following calculations 1 through 4 can be used to determine the average. Select the one and write the number.
1.　$(14 + 15 + 14 + 14 + 15) \div 5 \div 10$
2.　$(14 + 7 + 15 + 14 + 14 + 15) \div 5 \div 10$
3.　$(14 + 15 + 14 + 14 + 15) \div 6 \div 10$
4.　$(14 + 7 + 15 + 14 + 14 + 15) \div 6 \div 10$

(3)　　In Experiment 3, the weight was re-set at 40 *g*.　Then, the length of the pendulum was changed and the time for 10 cycles was measured. The results summarized in the table below.

Results of Experiment 3

Length of pendulum (*cm)*	25	50	75	100
Time for 10 cycles (sec.)	10	14	17	20

From these results, we can make the following conclusion.

Since <u>the time it takes for the pendulum to make 10 cycles did not double when the length of the pendulum is doubled</u>, the length of the pendulum and the time for it to make 10 cycles are not in a proportional relationship.

Using the words and the numbers in the table above, write the fact that "<u>the time it takes for the pendulum to make 10 cycles did not double when the length of the pendulum is doubled.</u>"

[3]　　　We thought about ways to divide the rectangle into 4 pieces so that the areas of the parts will be equal.

①　　　A vertical line was drawn so that the rectangle was divided into 2 rectangles of equal area.
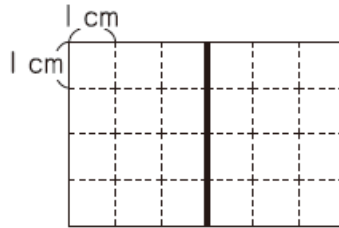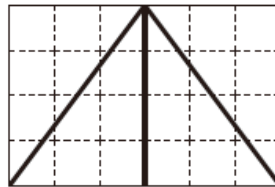

②　　　While thinking about dividing the 2 rectangles obtained in step ①, the following methods 1 through 3 were found.

1

2

3
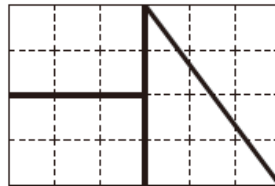

　　Harumi, Kenta, and Akiko explained how each method will divide the original rectangle into 4 parts of equal areas as shown below.

Harumi

I split the rectangle into 4 congruent right triangles whose base is 3 *cm* and the height is 4 *cm*.

I split the rectangle into 4 congruent rectangles whose length is 2 *cm* and the width is 3 *cm*.

Kenta

I split the rectangle into 2 congruent rectangles whose length is 2 *cm* and the width of 3 *cm* and 2 congruent right triangles whose base is 3 *cm* and the height is 4 *cm*. Since each shows half of half, the rectangles is divided into 4 equal parts.
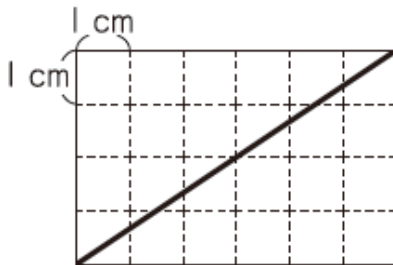
Akiko

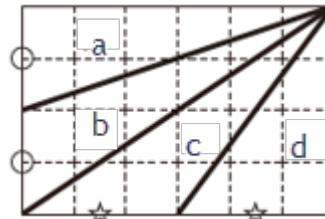(1)   Which of method 1, 2, or 3 is each student explaining? Write the appropriate number.

(2)   Takashi thought of the following way to divide the rectangle.

Takashi's method

① Divide the rectangle into 2 right triangles by drawing a diagonal.	② From one vertex, draw segments to the mid-points of the length and the width of the rectangle to splict the rectangle into 4 triangles.

I wonder if the areas of triangles a, b, c, and d are a half of a half of the original rectangle.
Takashi

If we consider the sides marked with ☆ as the base, triangles c and d both have the base of 3 *cm* and the height of 4 *cm*. Therefore, the areas of triangles c and d are equal.

After looking at Takashi's method, Naomi said the following.

Naomi   After listening to Naomi's explanation, Takashi realized that the areas of triangles a and b are also equal.

        Explain why the areas of triangles a and b are equal using words and numbers.

(3)   Takashi's method satisfied each of the following statements 1 through 3. As a result, we can tell that the four triangles divide the area of the original rectangle into 4 equal parts.
1.   The areas of the two triangles created in step ① are equal.
2.   The areas of triangles a and b created in step ② are equal.
3.   The areas of triangles c and d created in step ② are equal.

Hiroshi split trapezoid ① into 4 triangles as shown in ② using Takashi's method.
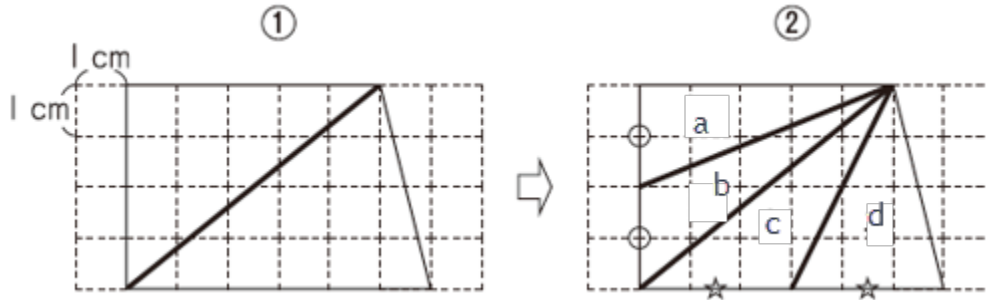
Hiroshi found that the areas of the four triangles are not equal.
That is because one of the statements 1 through 3 above is not satisfied. Select the one statement that is not satisfied in the way Hiroshi split the trapezoid.

[4]   Japanese women's national soccer team, *Nadeshiko Japan*, won the 2011 Women's Soccer World Cup.

(1)   Hiroki thought the attendances at the *Nadeshiko League* (Japanese women's soccer league) has increased after the World Cup.

So, he researched the attendances of games held at a certain soccer stadium in 2013 and summarized his findings in the table below.

Number of games and attendances at a certain soccer stadium

	Number of games (games)	Attendance (people)	Attendance per game (people)
Before World Cup	2	about 2200	about 1100
After World Cup	3	about 33000	

About how many times as many people attended a game after the World Cup compared to the attendance per game before the World Cup? Explain how you can find the answer using equations and words. Write your answer, too.

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(2)   Hiroki became interested in soccer, so he went to see a game.
          He is looking for his seat, Row 2 Seat 4.
          The seat marked by ● was Row 5 Seat 10. Where is the seat, Row 2,
Seat 4. Write a ○ in the seating chart on the answer sheet.
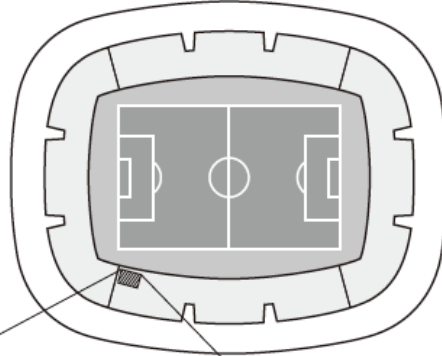
(3)   Hiroki then participated in a town soccer league.
          There are four teams in the town, East, West, South, and North.
Hiroki's team is the North team. Each team played other teams twice for the total of 6 games.
          The league standing is determined in the following manner.
          Way to determine the league standing

- Teams are ranked according the number of points they earned.
- A team will receive 3 points for a win and 1 point for a draw.

     Formula for calculating the total points
     $$3 \times number\ of\ wins + 1 \times number\ of\ draws$$

- If two teams have the same number of points, the team with more wins will be ranked higher.

          The results of the games played are as follows.
                    Game Results

Team	Wins	Draws	Losses	Points
East	2	4	0	10
West	1	2	3	5
South	2	2	2	8
North	3	0	3	

          What is the North team's final ranking? Using the formula for calculating the total points, write the equation to calculate the North team's points, and write their final ranking.

[5]   Kazuya and his friends are visiting a library.

(1)   A librarian showed them graphs showing the numbers of books checked out and the number of library visitors in years from 2003 to 2011. The bar graph shows the number of books checked out and the broken line graph shows the number of library visitors.

<div align="center">Number of books checked out and library visitors</div>
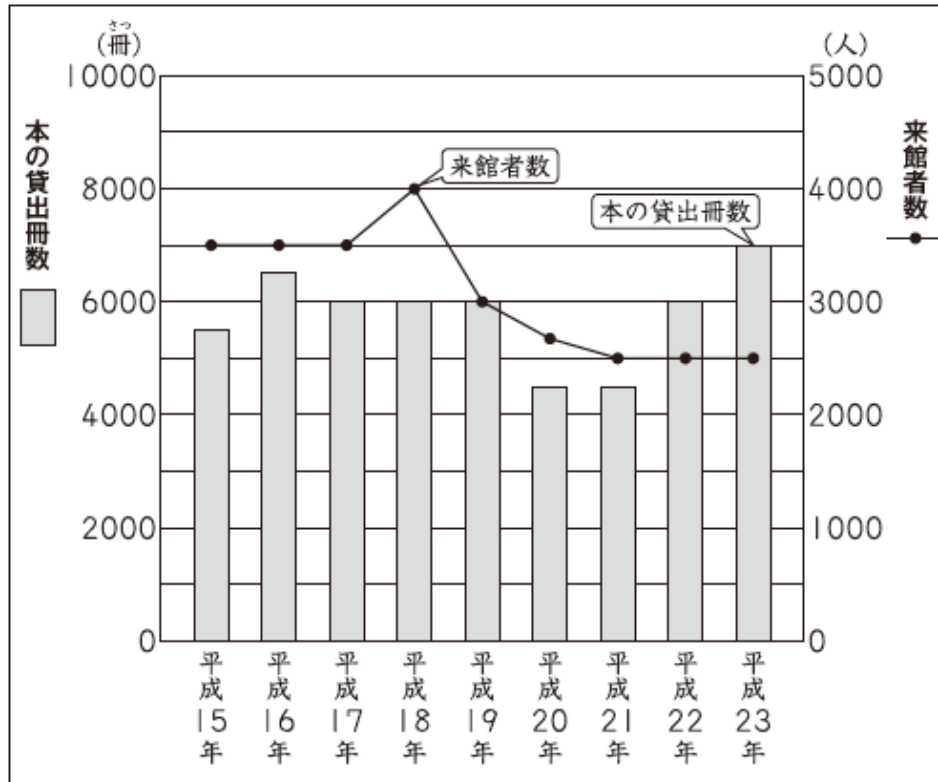
>>>>>>Left side of the graph (ほんの貸出冊数)：Number of books checked out

Right side of the graph(来館者数)：Number of library visitors

平成 15 年 2003 -------平成 23 年　2011

Kazuya noticed the following while looking at these graphs.

> Although the numbers of library visitors increase and decrease, there is **a period** in which the number of books checked out remain the same.

Kazuya

Between which years in the graph above was Kazuya referring to when he said "**a period**." Select from (1) and (4) below and write the number.

(1)   From 2003 through 2005

(2)   From 2005 through 2007

(3)   From 2007 through 2009

(4)   From 2009 through 2011

(2)   Then, the library told them that the percentages of people who use to check out books using the Internet have increased recently.

The library showed them the following percentage bar graphs. The graphs show the total number of books checked out and the percentage of books checked out using the Internet and the percentage of books checked out from the library circulation desks for the years from 2008 through 2011.
Total number of books checked out and percentage of books checked out by using the Internet

Kazuya and his friends are going to check if the number of books checked out by using the Internet is indeed increasing.
The number of books checked out using the Internet can be calculated using the following formula.

$$\begin{bmatrix} Total\ number\ of\ books \\ checked\ out \end{bmatrix} \times \begin{bmatrix} Percentage\ using \\ the\ Internet \end{bmatrix}$$

Using this formula, Kazuya and Tamaki compared 2008 and 2009.

Kazuya's Idea   Tamaki's Idea

When 30% and 40% are represented as decimal numbers, it will be 0.3 and 0.4, respectively.
Since 0.3 × 4500 = 1350, the number of books checked out by using the Internet is 1350 books.
Since 0.4 × 4500 = 1800, the number of books checked out at the library circulation desks is 1800 books.
   Therefore, there has been an increase from 2008 to 2009.

When 30% and 40% are represented as decimal numbers, it will be 0.3 and 0.4, respectively.
If we compare 0.3 × 4500 and 0.4 × 4500, the base quantity is the same and the percentage has increased. Therefore, there has been an increase from 2008 to 2009.

From 2010 to 2011, did the number of books checked out using the Internet increase? Select your answer from (1) through (3) below and write that number. Also, explain why you chose the answer by using words and equations based on one of the two students' ideas above.
(1)   The number increased from 2010 to 2011.
(2)   The number decreased from 2010 to 2011.
(3)   The number did not change between 2010 and 2011.