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.

Ride	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 going on another ride, following the rules below.

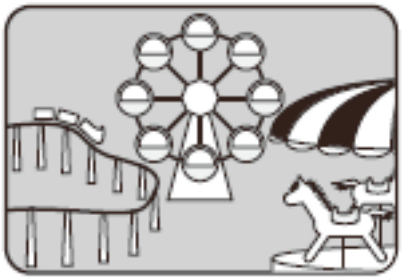
- Use only the remaining tickets.
- Select from the rides that they have not selected yet.
- They must ride the ride together.

Which ride can they ride?

(2) After Toshio planned his rides, he realized that he would need 15 tickets.

The prices of ride tickets and of the all-day pass are as follows.

Ticket Prices

Tickets		All-Day Pass
Single ticket	Book of 11 tickets	
100 yen	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.

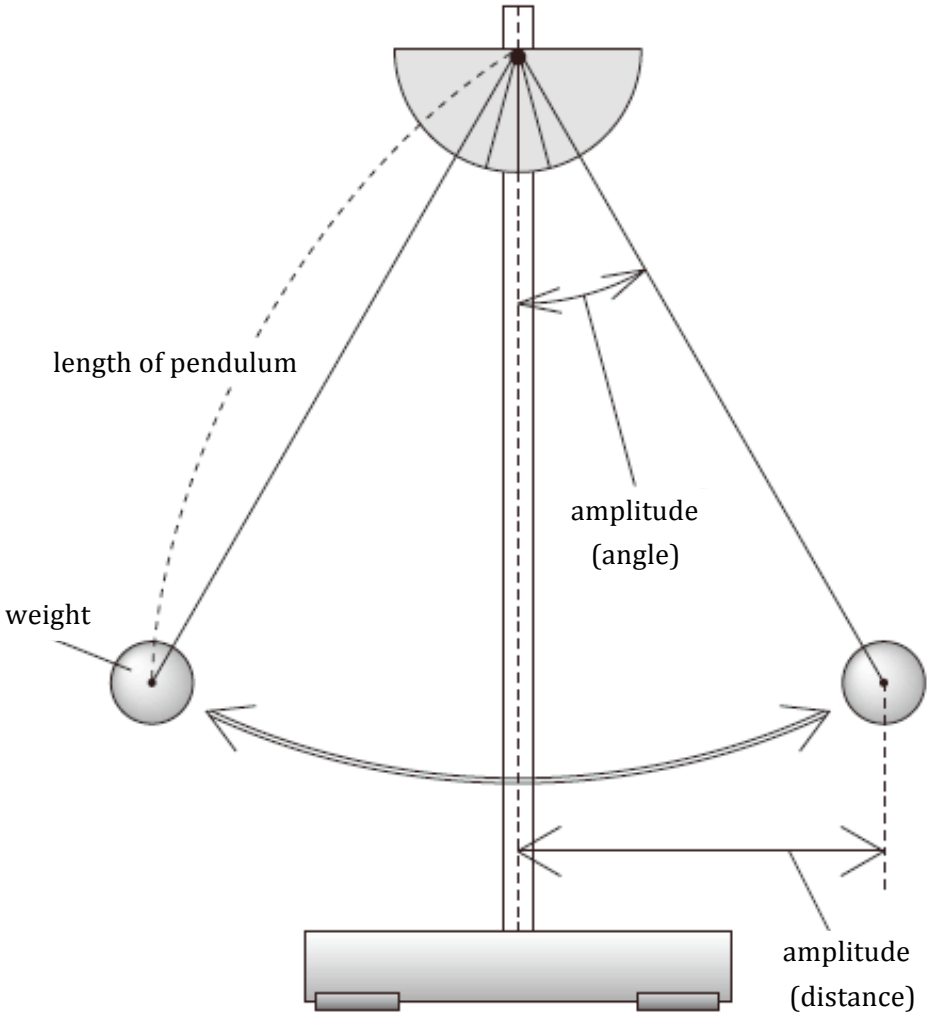
1 Buy 15 single tickets.

2 Buy a book of 11 tickets and 4 additional single tickets.

3 Buy an All-Day 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.



(1) In Experiment 1, the length of the pendulum was set at 50 *cm* and the weight was 40 *g*. 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

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

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

(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, without 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 are 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

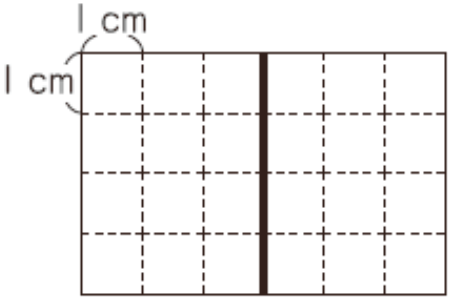
From these results, we can make the following conclusion.

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

Using words and using the numbers in the table above, justify the statement "the time it takes for the pendulum to make 10 cycles did not double when the length of the pendulum is doubled."

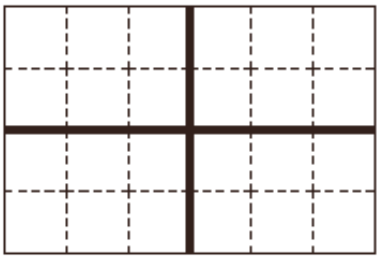
[3] We thought about ways to divide a rectangle into 4 pieces so that the areas of the parts will be equal.

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



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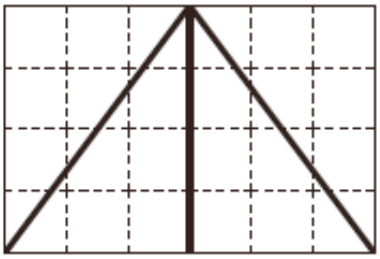

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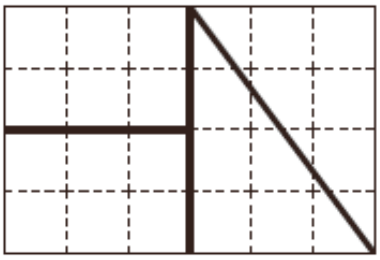


Harumi, Kenta, and Akiko explained how each method will divide the original rectangle into 4 parts of equal areas as shown below.

Harumi

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

Kenta

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

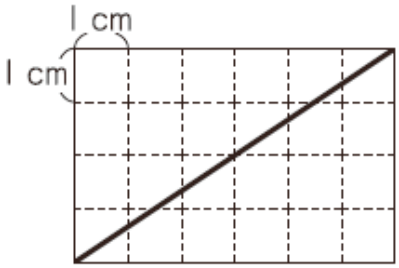
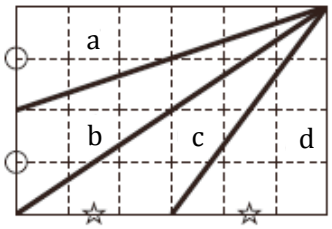
Akiko

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.

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

(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 split the rectangle into 4 triangles.
	

Takashi

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

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

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.

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.

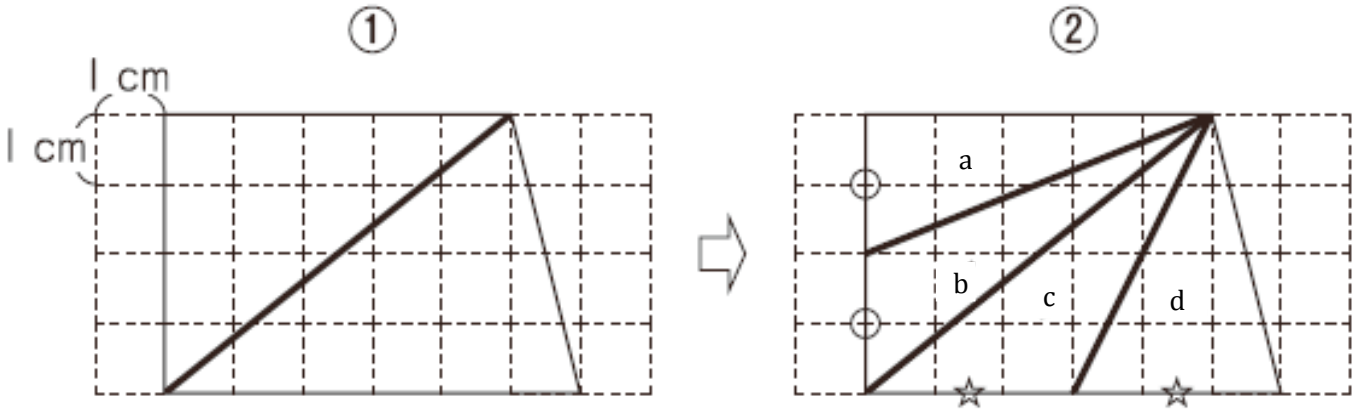
(3) Takashi's method satisfied each of the following statements 1 through 3. As a result, we can tell that the four triangles divide the area of the original rectangle into 4 equal parts.

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] The 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) had increased after the World Cup.

Place folder for a photo from 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

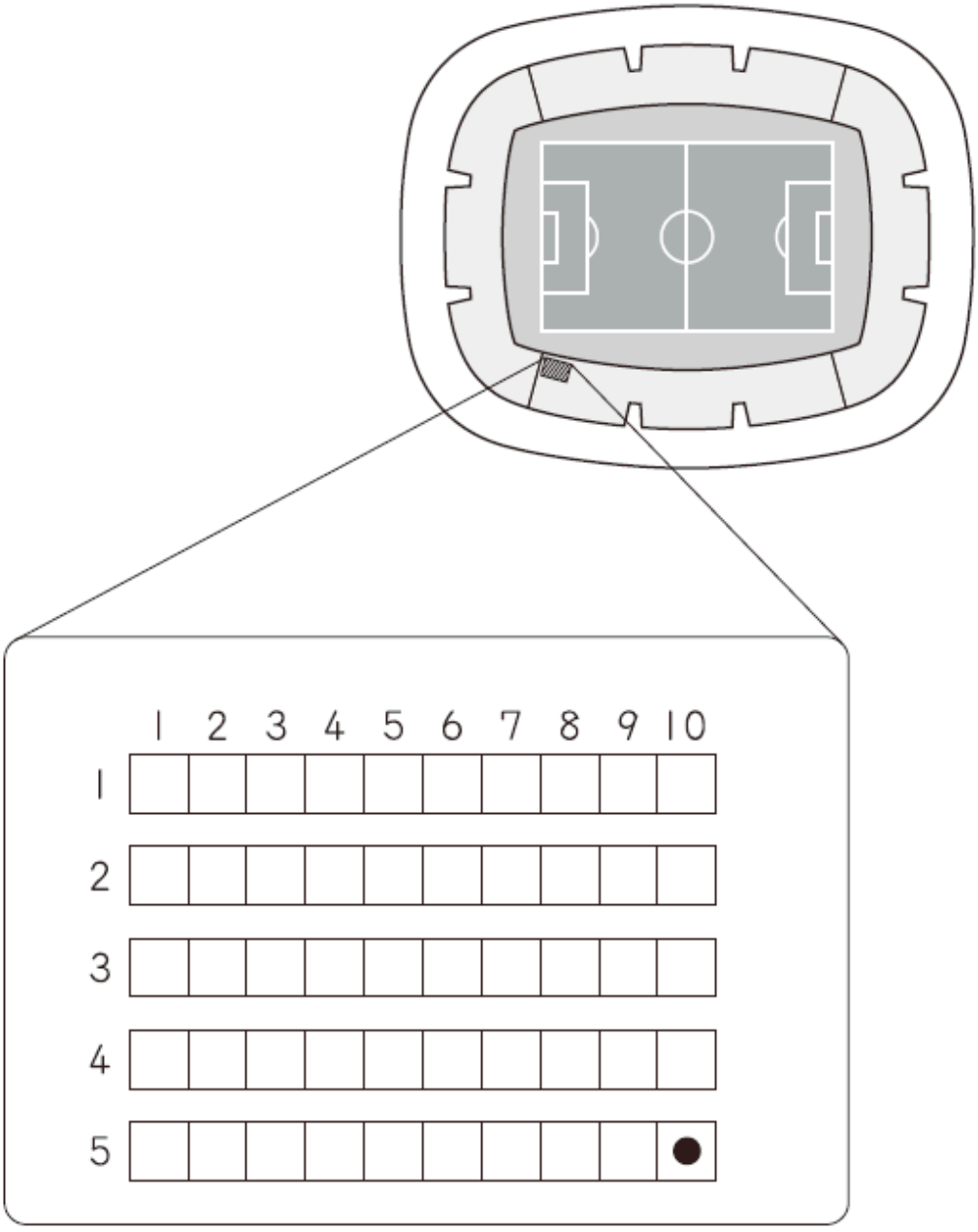
	Number of games	Attendance (people)	Attendance per game (people)
Before World Cup	2	about 2200	about 1100
After World Cup	3	about 33000	

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.

(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.

Method for determining the league standing

- Teams are ranked according the number of points they earned.
- A team receives 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

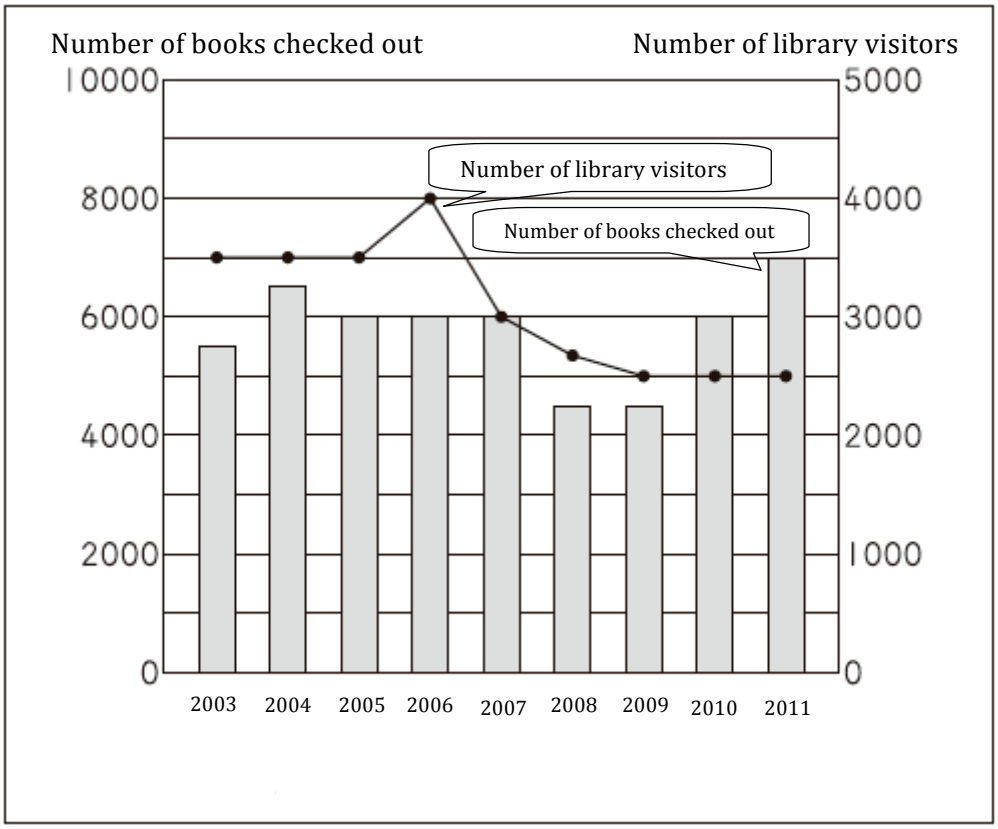
Team	Wins	Draws	Losses	Points
East	2	4	0	10
West	1	2	3	5
South	2	2	2	8
North	3	0	3	

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.

Number of books checked out and library visitors



Kazuya noticed the following while looking at these graphs.

Kazuya

> Although the number of library visitors increased and decreased, there was **a period** during which the number of books checked out remained the same.

Which years in the graph above was Kazuya referring to when he said "**a period**"? Choose from 1 to 4 below.

1 From 2003 through 2005

2 From 2005 through 2007

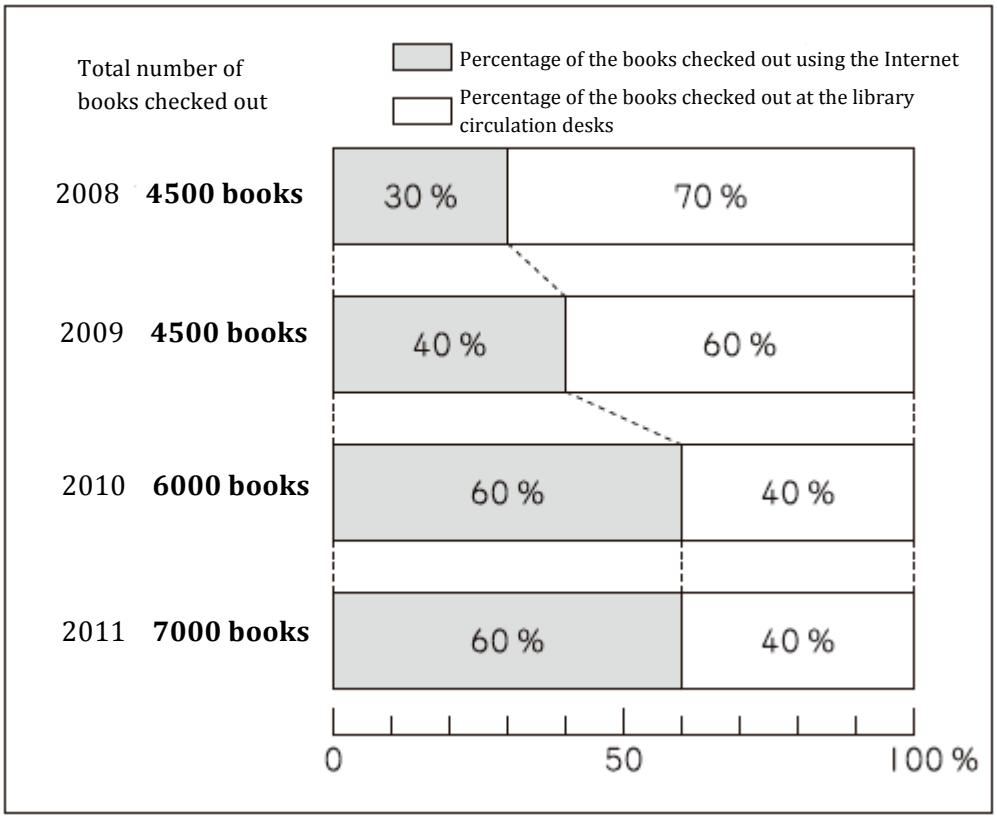
3 From 2007 through 2009

4 From 2009 through 2011

(2) Then, the library told them that the percentage of people who check out books using the Internet has increased recently.

The library showed them the following percentage bar graphs. The graphs show the total number of books checked out , 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 increasing.

The number of books checked out using the Internet can be calculated using the following formula.

$$\left[\begin{matrix}\text{Total number of books}\\ \text{checked out}\end{matrix}\right] \times \left[\begin{matrix}\text{Percentage using}\\ \text{the Internet}\end{matrix}\right] = \left[\begin{matrix}\text{Number of books checked out}\\ \text{using the Internet}\end{matrix}\right]$$

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

Kazuya'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.

Tamaki's Idea

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. 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.