2009 Grade 6 Mathematics

This is an unofficial translation of 2009 Japanese Achievement Test. Original may be found at

2009 Problem Set A

[1] Calculate the following.
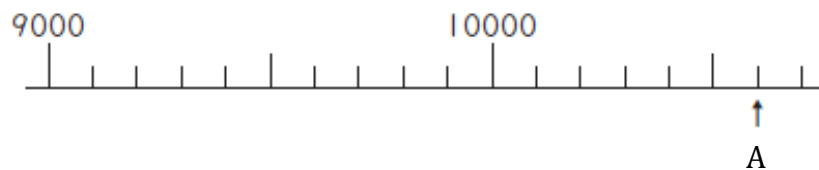
(1) 153 + 49

(2) 725 × 8

(3) 204 ÷ 4

(4) 48.1 ÷ 1.3

(5) $\frac{7}{6} - \frac{2}{6}$

(6) 80 − 30 ÷ 5

[2] Answer the following questions.

(1) Write the number that is represented by the tick mark labeled A.

(2) Write the number that is made up of 45 100's.

(3) Select the number that is obtained by rounding 74291 to the nearest thousands from **1** through **4** below and write the number.

    1   70000
    2   74000
    3   74300
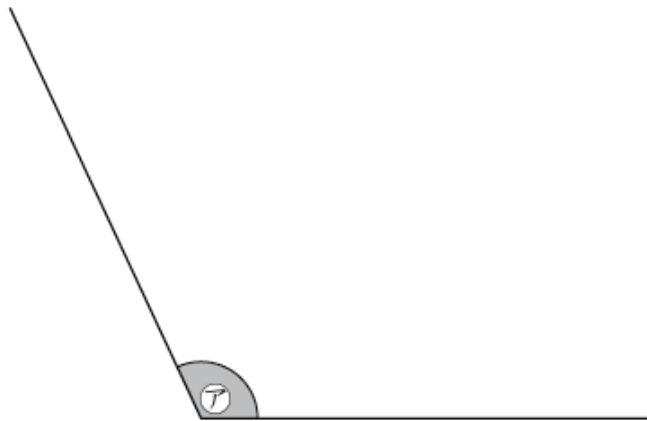   4   75000

(4) From the numbers below, select all even numbers and list them.

        0,   1,   35,   78,   100

[3]   If you consider a 1000-yen bill as a rectangle, about how long are the long sides? Select from **1** through **4** below and write the number.
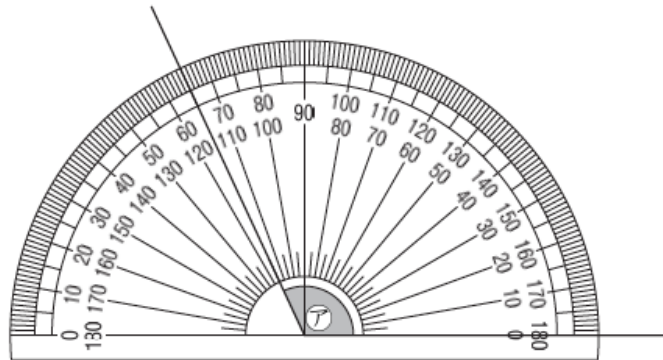
1   3 cm
2   15 cm
3   30 cm
4   50 cm

[4]   We are trying to measure Angle A using a protractor.

>>> Insert the figure: the shaded angle is angle A <<<

How many degrees is the measure of Angle A? Write your answer.

>>> Insert the figure: the shaded angle is angle A <<<

[5]   Answer the following questions.

(1)   As shown in the figure below, we are going to split a quadrilateral into 2 triangles and determine the sum of the four angles in the quadrilateral.

Using the fact that the sum of angles in a triangle is 180°, write the expression that will calculate the sum of angles in a quadrilateral.
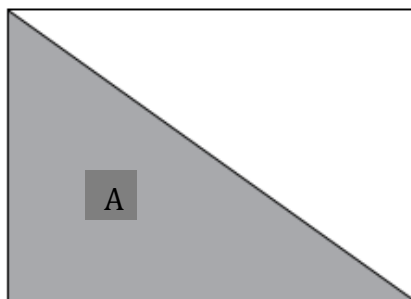
You do not have to write the result of the calculation.
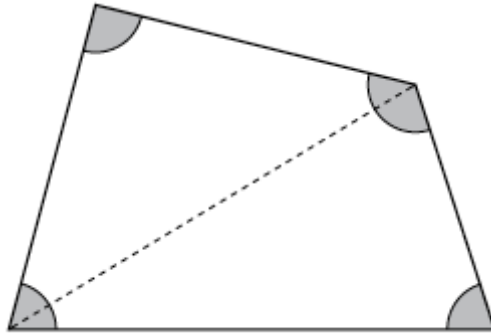
(2)   There is a rectangle like the one shown below.

We will cut this rectangle along a diagonal as shown below.

A

Select the name of the figure as region A that we make from **1** through **5** below and write the number.

1   Rhombus
2   Rectangle
3   Equilateral triangle
**4**   Right triangle
5   Isosceles triangle

(3)   There is Parallelogram ABCD as shown below.

A   D

8 cm

B   C

10 cm
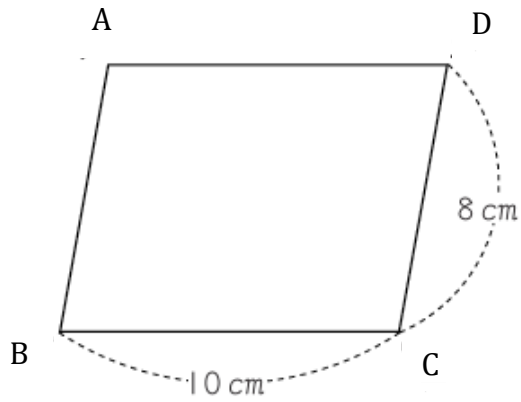
How many cm is the length of side AD? Write your answer.

[6]   We are going to determine how many cm² is the area of the triangle shown below. Write the expression to calculate the area of this triangle.

Gridlines are 1 cm apart. You do not have to write the result of your calculation.
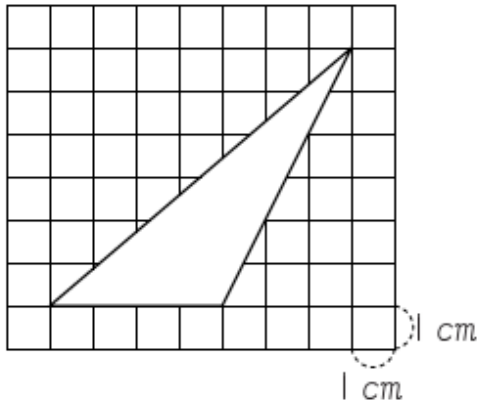
[7]   Elementary school students gathered at a certain location.
Of the 200 elementary school students gathered there, 80 of them were girls.
What % of the total number of elementary school students gathered were girls? Select from **1** through **4** below and write the number.

1   0.4%
2   2.5%
3   40 %
4   80 %

[8]   We asked 13 people whether or not they have a dog or a cat at their houses and recorded the results as shown below.

Survey of Pets at Home

Roll #	Dog	Cat
1	○	×
2	×	×
3	○	×
4	○	○
5	○	×
6	×	×
7	○	×
8	×	×
9	○	○
10	×	○
11	○	×
12	×	×
13	○	×

○ .... Yes
× ..... No

We are going to summarize the results into the table below.
Write the appropriate number that will go into Cell A.

Survey of Pets at Home

		Cat		Total
		○	×	
Dog	○		A	
	×			
Total				

○ .... Yes
× ..... No

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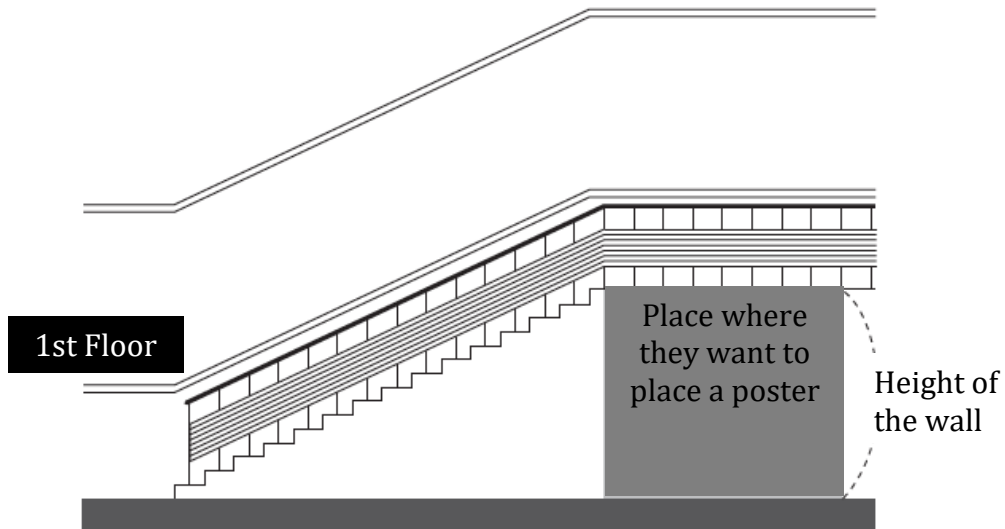
2009 Problem Set B

[1]   At Yuji's school, they are getting ready for a children's festival.

(1)   At Yuji's school, there is a stairway as shown in the figure below. In the ▭ area, they are planning to place a poster for the children's festival.

Because we want to know the height of the wall shown in the figure above, we are going to use the steps to figure it out.

In order to figure out the height of the wall, which of the following **A** through **D** are needed? Select all that are needed from **A** through **D** and write the letters. Also, write the expression to calculate the height of the wall.

You do not need to write the answer for the calculation.
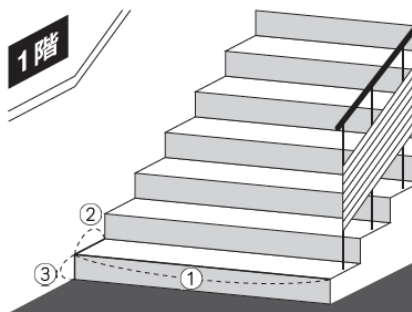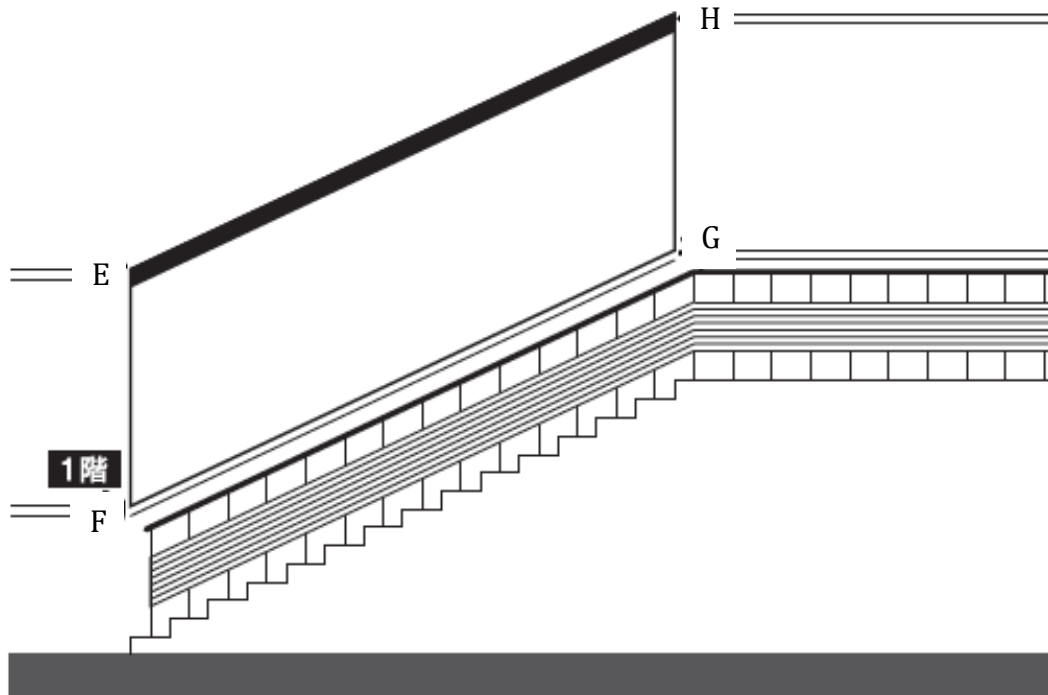

A   Length of (1) ----- 200 cm
B   Length of (2) ----- 30 cm
C   Length of (3) ----- 14 cm
D   The number of steps ----- 15 steps

>>> Insert the figure <<<
On the left side: "1st Floor"

(2)   They are planning to place decorations from Point E to Point H on the figure below.

We want to know the length between Point E and Point H, but because of its height, we cannot measure it directly.

We can see that quadrilateral EFGH is a parallelogram.

So, Yuji thought that to know the length between Point E and Point H, we need to measure the length between Point F and Point G.

What is the reason that makes Yuji's idea correct? Select one from **1** through **5** below and write the number.

1   In a parallelogram, the lengths of the diagonals are equal.
2   In a parallelogram, the lengths of four sides are equal.
3   In a parallelogram, the lengths of opposite sides are equal.
4   In a parallelogram, the measures of opposite angles are equal.
5   In a parallelogram, the opposite sides are parallel.

(3)   As shown in the figure below, there is a rectangular paper with 6
        circles in which the letters of 子どもまつり (children's festival) are
        written.
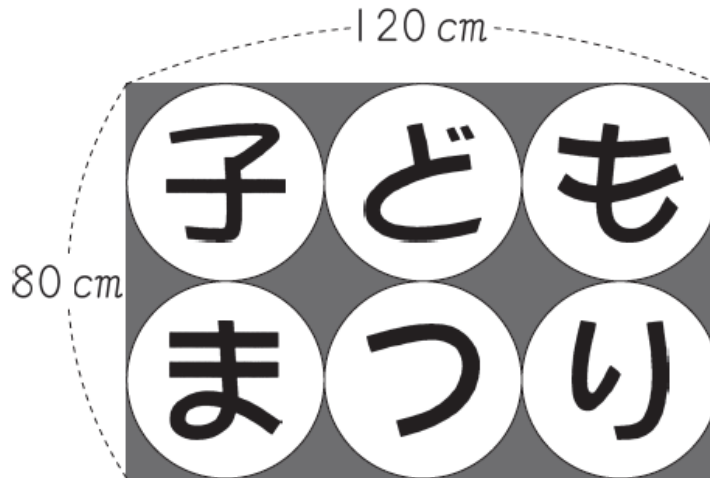
        The vertical sides of the paper are 80 cm long, and the horizontal
        sides are 120 cm long. As shown in the figure, 6 circles of the same
        size are fitted inside the paper exactly.

        Because we want to make the same sign, we are going to figure out
        how many cm is the radius of the circle.

        Yuji used the length of the vertical sides and determined the radius of
        the circle as follows.

Yuji's method

Equations	Answer
80 ÷ 2 = 40 40 ÷ 2 = 20	20 cm
Explanation The vertical sides of the paper are 80 cm long. Since there are 2 circles one above the other, I calculated the diameter by 80÷ 2 = 40. Since the radius is a half of the diameter, I calculated the radius by 40 ÷ 2 = 20. Therefore, the radius is 20 cm.	

If we determine the radius using Yuji's method but with the length of the horizontal sides, what will be the expressions and the explanation?

In the Solution Method below, write appropriate numbers in the [   ] in the 2 equations. In (   ), write words and expressions/equations. Write your answers on the answer sheet.

Solution Strategy

Equations	Answer
120 ÷ [ ] = [ ] [ ] ÷ [ ] = [ ]	20 cm
Explanation The horizontal sides of the paper are 120 cm long. (Write all you answers on the answer sheet.) Therefore, the radius is 20 cm.	

[2] Using a pan balance and weights, we are investigating the weights of various objects.

(1) Takashi is measuring the weight of an eraser.

As shown in the figure below, one eraser on the pan on the left side and one each of 5 g, 1 g, and 0.5g weight on the pan on the right side balanced.

How many g was the weight of the eraser on the pan on the left side? Write your answer.

Weights on the pan on the right side

5 g   1 g   0.5 g
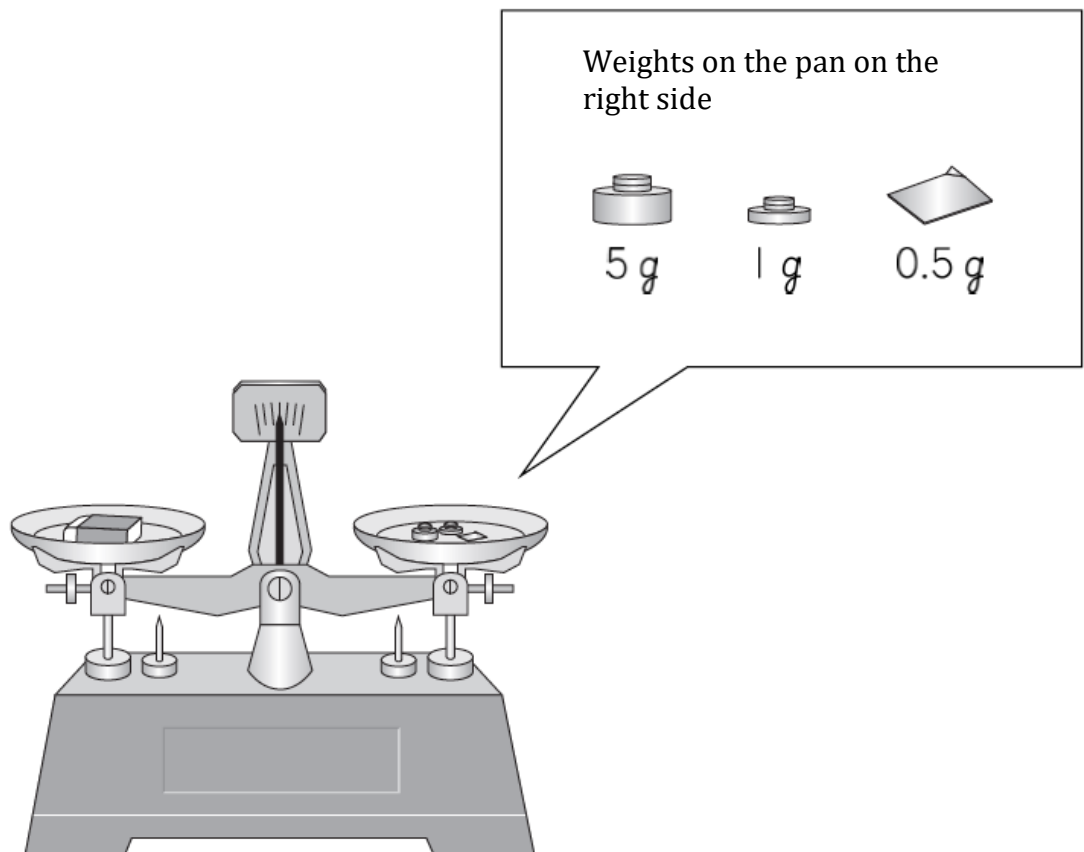
(2) Takashi measured the weights of red, blue, yellow, green and black balls and recorded the results on a sheet of paper as shown on the right.

But, he forgot which weight is for which ball. Therefore, in order to figure out the weight of the black ball, he conducted 3 experiments in the following order.

9 g
13 g
15 g
17 g
24 g

[Experiment 1]
First, the black ball was place on the left side, and a 20 g weight was placed on the right side. The result was as shown in Figure 1.
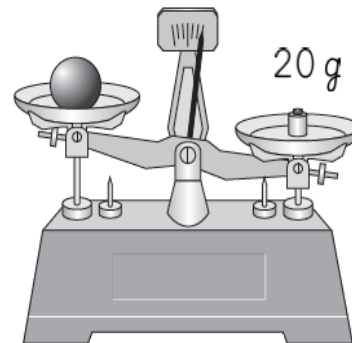
20 g

Figure 1

[Experiment 2]
Next, a 10 g was placed on the right side in place of the 20 g weight. The result was as shown in Figure 2.
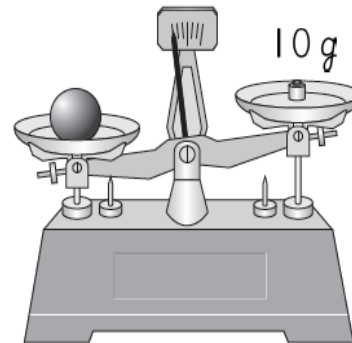
10 g

Figure 2

[Experiment 3]
Finally, a 5 g weight was added on the right side. The result was as shown in Figure 3.
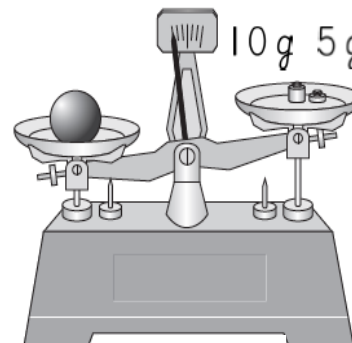
10 g 5 g

Figure 3

Takashi summarized the results of Experiment 1 and Experiments 1 and 2 in the table below.

|	What we learned from the experiments about the weight of the black ball	The possible weight for the black ball
Experiment 1	Lighter than 20 g.	9 g, 13 g, 15 g, 17 g
Experiments 1 and 2	Heavier than 10 g but lighter than 20 g.	13 g, 15 g, 17 g
Experiments 1, 2 and 3	A	B

We are going to complete the table.
Write the appropriate words and weights based on Experiments 1, 2 and 3 in the spaces A and B.

[3]   Yoko and her friends are going to the Harbor Museum.

(1)   Yoko and her friends are going to the Harbor Museum by bus.
        The table below shows a part of the timetable for the buses going to
   the Harbor Museum at a bus stop.

Hour	To the Harbor Museum Time Table			
6	10	40		
7	10	40		
8	10	30	50	
9	10	25	45	55
10	10	25	45	55
11	10	30	50	

The first bus in the
morning is at 6:10 am.
The next bus after that
is at 6:40 am.
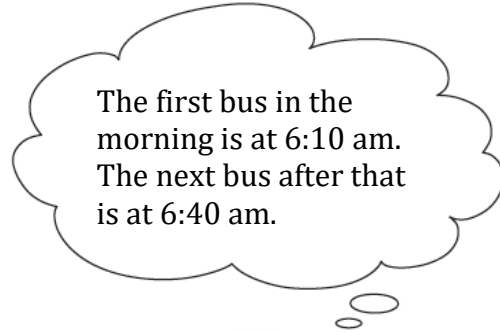
Yoko

The group will be gathering at the bus stop at 9:40 am.
It takes 20 minutes to the Harbor Museum.
In order to arrive at the Harbor Museum by 10:20 am, which busses
should they take? Write the times for **all busses** they can take.

(2)   At the Harbor Museum, Yoko and her friends are looking at the graph
       shown below.
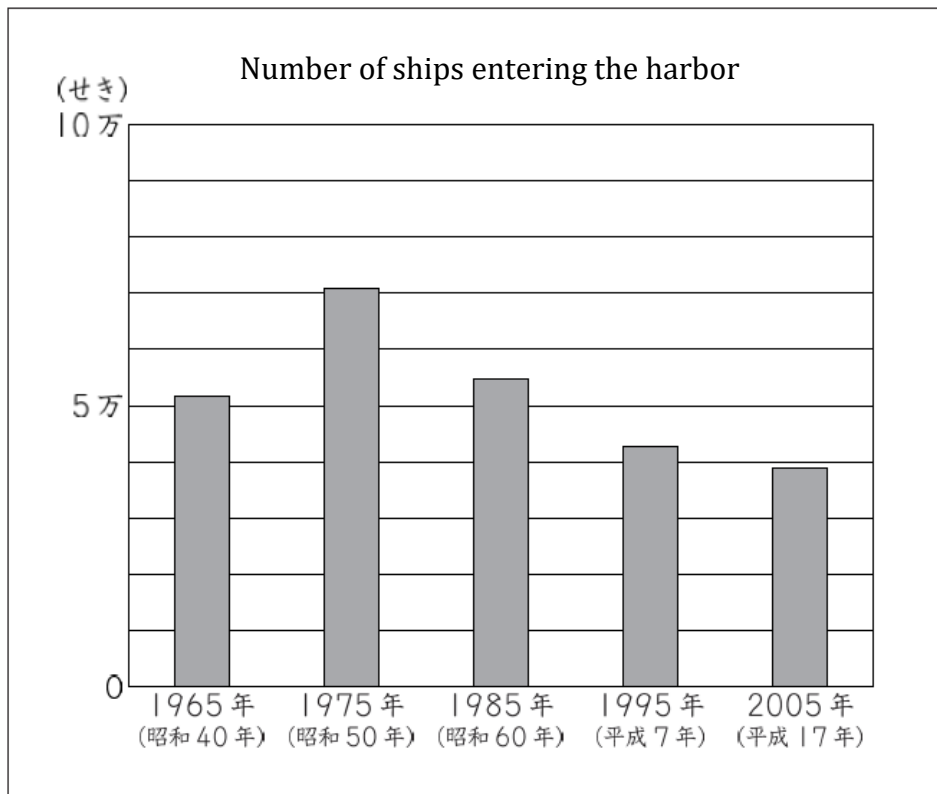
Number of ships entering the harbor

(せき)
10万

5万

0

1965年   1975年   1985年   1995年   2005年
(昭和40年) (昭和50年) (昭和60年) (平成7年)   (平成17年)

Based on the above graph, how many fewer ships entered the harbor
in 2005 compared to the year with the largest number of ships
entering the harbor? Write your answer rounded to the nearest ten
thousand.

(3)   Yoko and her friends are at the souvenir shop.

The regular prices of handkerchiefs, pens, notebooks and erasers sold at the museum are as follows.

Handkerchief	Pen	Notebook	Eraser
350-yen	280-yen	250-yen	200-yen

Yoko is thinking about buying 2 of the items from handkerchief, pen, notebook and eraser. She can spend at most 500-yen.

Yoko noticed the following.

Yoko

If I buy a handkerchief, I cannot buy another item.

Write the reason why she cannot buy another item if she buys a handkerchief using words and expressions.

[4] There are rectangular cards whose vertical sides are 2 cm long and horizontal sides are 1 cm long. We will use these cards to cover rectangular boards of various sizes completely without any gap or overlap. The cards cannot stick out of the board.

Card

1 cm

2 cm
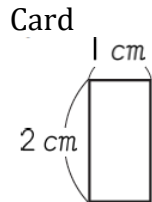
For example, we can cover completely a rectangular board whose vertical sides are 2 cm long and horizontal sides 4 cm as shown in Figure A or Figure B.
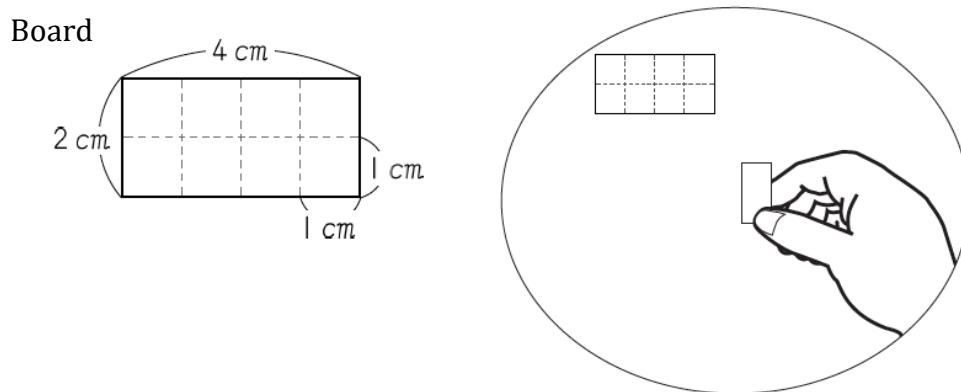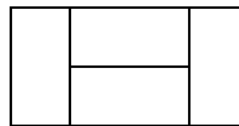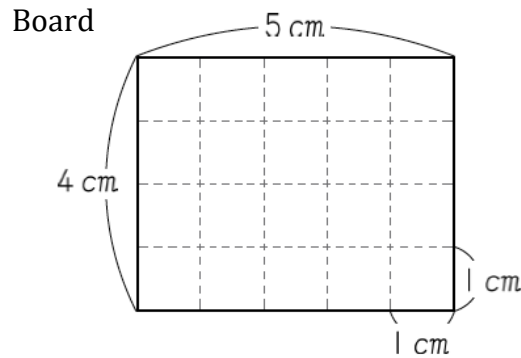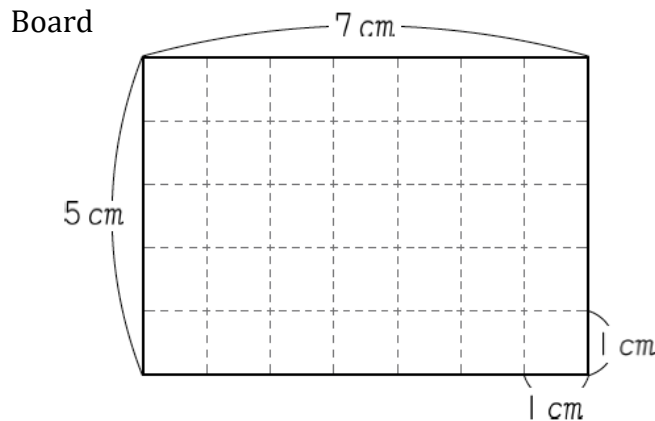
Board

4 cm

2 cm

1 cm

1 cm

Figure A

Figure B

(1)   We are going to cover completely a board whose vertical sides are 4 cm long and horizontal sides 5 cm as shown below.

Board   — 5 cm —

4 cm

| cm

| cm

How can we cover the rectangular board above completely without any gap? In the diagrams on **the answer sheet**, show **2 different ways** by drawing along the   ▬▬▬▬▬▬   . Also, in order to cover this board completely, how many cards are needed? Write your answer.

(2)   Next, we are going to investigate whether or not a board whose vertical sides are 5 cm long and horizontal sides 7 cm as shown below can be covered completely without any gap.

Board   — 7 cm —

5 cm

| cm

| cm

Akiko said the following about whether or not the rectangular card above can be covered completely without any gap.

| cm

2 cm
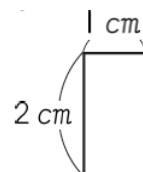
Without actually placing cards or investigating by drawing figures, I can tell that this board cannot be covered without any gap.

Akiko

We cannot cover this rectangular board completely without any gap. How can we reason so that we know that this board cannot be covered completely without actually placing the cards or drawing figures? Write the reasoning using words and expressions.

(3) We can summarize whether or not the rectangular boards we have looked at can be covered completely in the table below.

Rectangular Board	Whether or not it can be covered
Vertical 2 cm Horizontal 4 cm	⟨Can be covered⟩ Cannot be covered
Vertical 4 cm Horizontal 5 cm	⟨Can be covered⟩ Cannot be covered
Vertical 5 cm Horizontal 7 cm	Can be covered ⟨Cannot be covered⟩

After looking at the table above, Makoto said the following.

I found other rectangular boards that cannot be covered completely.

Makoto

Of the rectangles that **cannot be covered completely**, find one whose vertical sides are longer than 5 cm and the horizontal sides are longer than 7 cm. Write the lengths of the sides.
The lengths of the sides should be whole numbers.

[5]   At Akane's school, they are recycling certain materials.
       Akane and her friends summarized the weights of materials that have been
       collected through recycling in April, May and June in the graph below.

                Weights of Materials Collected through Recycling by Month
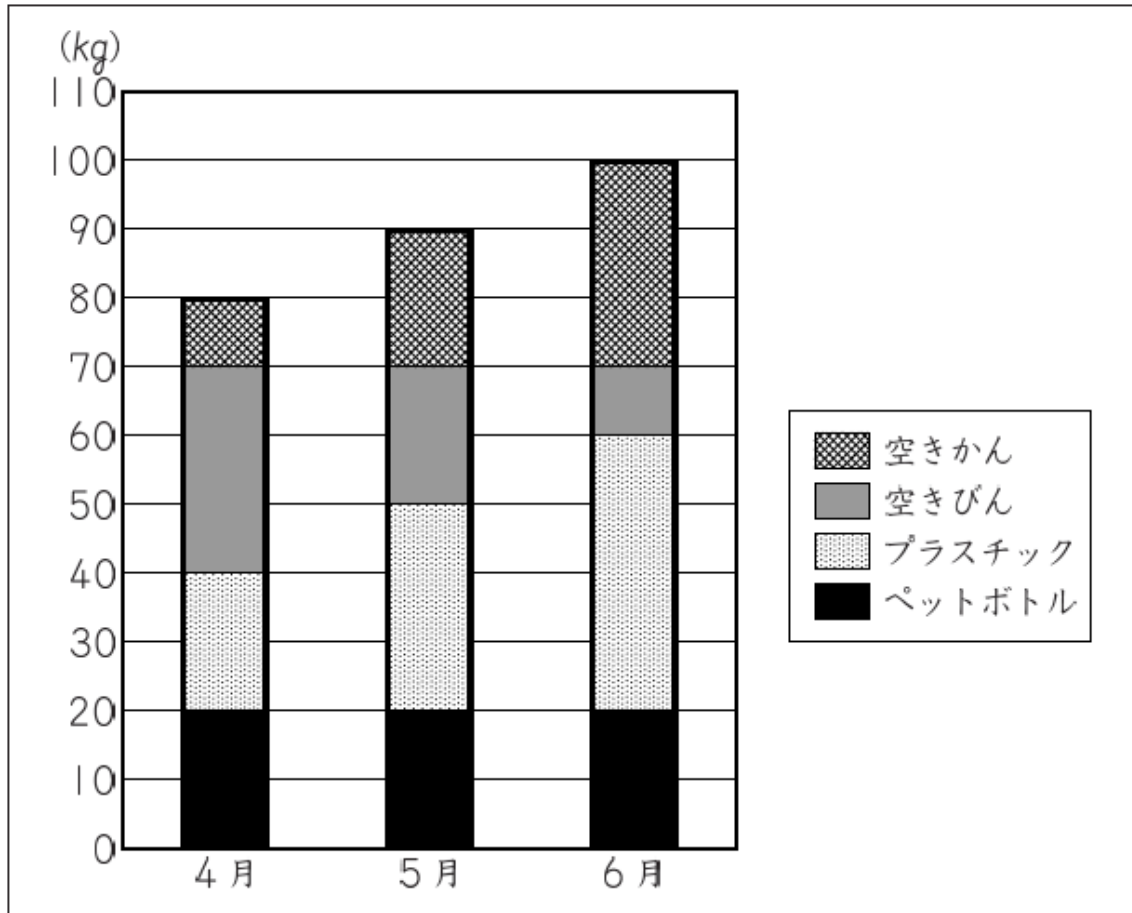
{graph} below the bars from left: April, May, June
{keys}
         empty cans
         empty glass bottles
         plastic
         plastic bottles

(1)   About how many kg of plastic bottles were collected in April? Write
       your answer.

(2)   By looking at the graph, what can you observe about the changes in the weight of empty glass bottles collected from April through June?

Select the correct one from **1** through **3** below and write the number.

1   The weights of empty glass bottles are decreasing.
2   The weights of empty glass bottles are not changing.
3   The weights of empty glass bottles are increasing.

(3)   If you compare the proportion of the weight of the plastic bottles based on the total weight in April with the proportion of the weight of the plastic bottles based on the total weight in June, what can you say?

Select the correct one from **1** through **3** below and write the number. Also, write the reason you chose that number using words and expressions.

1   The proportion of the weight of plastic bottles is greater in April.
2   The proportion of the weight of plastic bottles are the same in April and June.
3   The proportion of the weight of plastic bottles is greater in June.