2012 Grade 6 Mathematics

This is an unofficial translation of 2012 Japanese Achievement Test. Original may be found at

Grade 6 Mathematics Set A

[1]   Calculate the following.

(1)   132 + 459
(2)   148 ÷ 37
(3)   4.6 − 0.21
(4)   90 × 0.7
(5)   6 × 2 + 8 × 3
(6) $\dfrac{3}{7} - \dfrac{2}{5}$
(7) $\dfrac{4}{5} \div 8$

[2]   Fill in the [   ] with appropriate numbers.

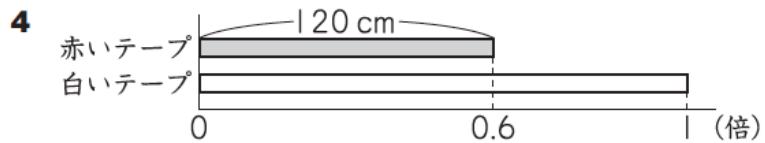(1)   47000 is a number that is a collection of [   ] 1000's.
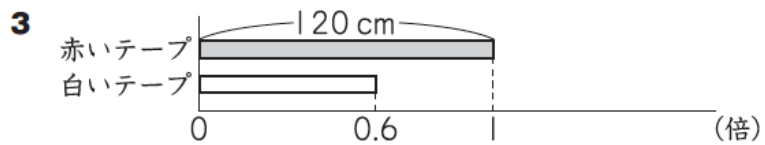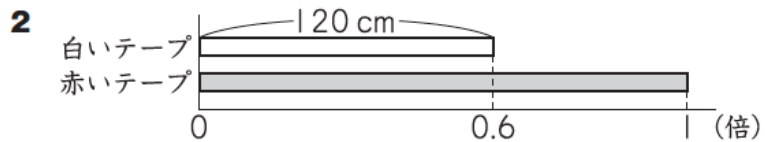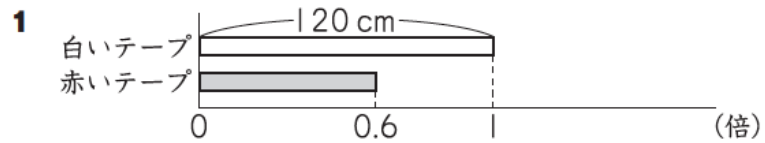
(2)   If we write the number that is $\dfrac{1}{100}$ of 596 as a decimal number, it is [   ].

[3]   We know the following about the length of the red and white tapes.

The length of the red tape is 120 cm.
The red tape is 0.6 times as long as the white tape.

(1)   Which of the following diagrams represent the relationship between the red and the white tapes correctly? Select from **1** through **4** below and write that number.

1
白いテープ
赤いテープ
―120 cm―
0   0.6   I   (倍)

2
白いテープ
赤いテープ
―120 cm―
0   0.6   I (倍)

3
赤いテープ
白いテープ
―120 cm―
0   0.6   I   (倍)

4
赤いテープ
白いテープ
―120 cm―
0   0.6   I (倍)

白いテープ：White tape
赤いテープ：Red tape
（倍） ：(times as much)

(2)   Write the calculation to determine the length of the white tape.
You do not have to write the answer for the calculation.

[4]   The table below summarizes the number of tomatoes that were harvested in a garden on Monday through Friday.
   In these 5 days, how many tomatoes were harvested in a day on average? Write your answer.

Number of tomatoes harvested

Day	Mon.	Tue.	Wed.	Thur.	Fri.
Number of Tomatoes	6	3	2	0	9

[5]   Answer the following questions.

(1)   About how many cm^2 is the area of the postcard shown below. Select from **1** through **4** below, and write that number.
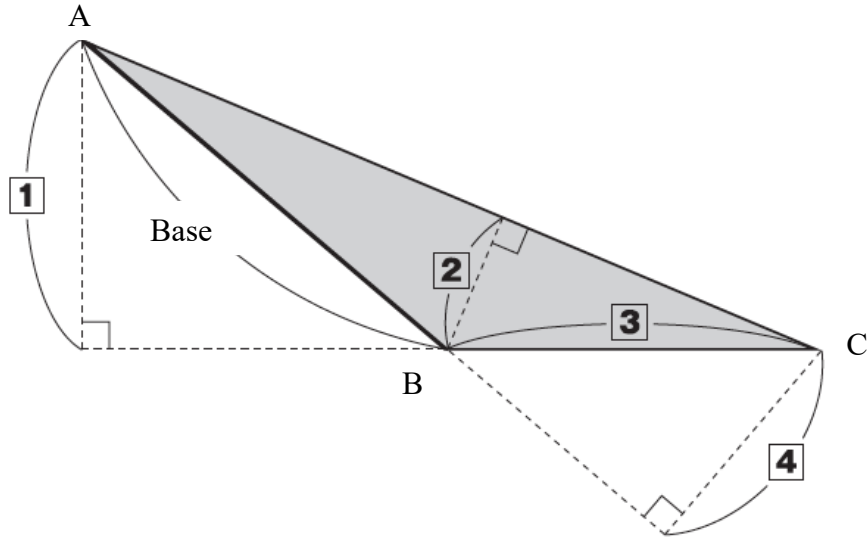
1   About 50 cm^2
2   About 150 cm^2
3   About 450 cm^2
4   About 1350 cm^2

郵便 は が き
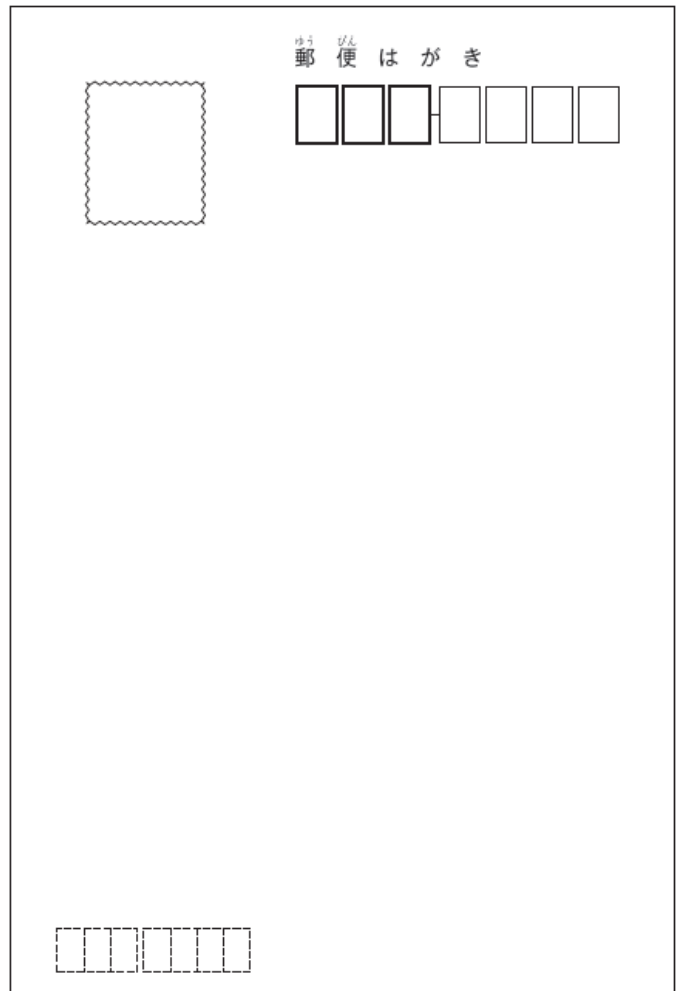
(2)   We are going to think about ways to determine the area of triangle ABC
shown below.
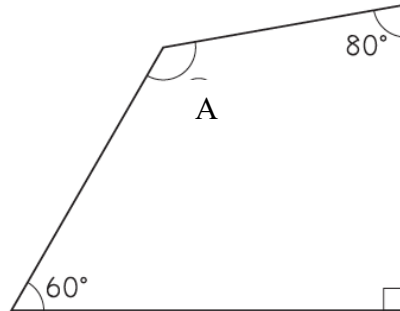   If we consider side AB as the base, where will be the height?
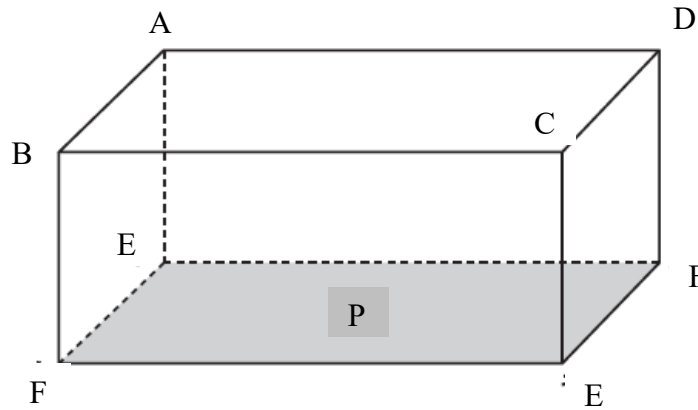   Select from [1] through [4] below, and write that number.

A

1

Base

2

3   C

B

4

[6]   Answer the following questions.

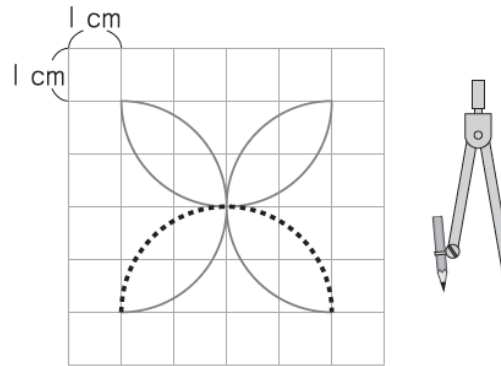(1)   How many degrees is the measure of angle A shown below. Write your answer.

(2)   In the rectangular prism shown below, there are some edges that are perpendicular to face P. Select one edge that is perpendicular to face A and write its name.

[7]   We are drawing a design on a centimeter grid paper using a compass.

In order to draw (dashed arc) shown above, where do we need to place the needle of the compass?

Select the location where you have to place the needle of the compass (•) from **1** through **4** in the figure below, and write that number.

Also, in order to draw the dashed curve, how many cm should the compass opening be? Write your answer.
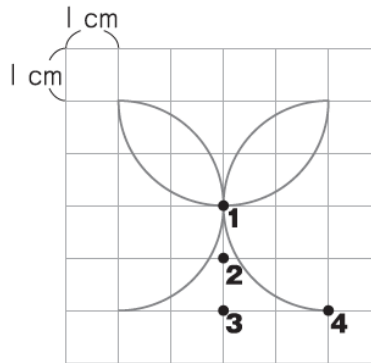
[8] The circle graph below shows the percentage of students in a class who own a dog as a pet.

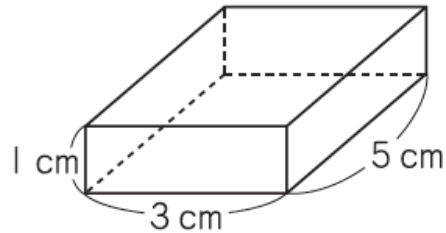Percentage of students who own a dog as a pet
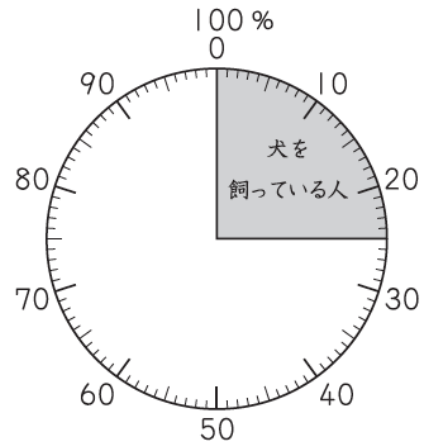
犬を飼っている人 : Students who own a dog as a pet

There are 8 students who own a dog as a pet.
These 8 students represent 25 % of this class.
How many students are in this class? Write both the equation to calculate the number of students in the class and the answer.

[9]   There is a rectangular prism as shown below.

        We investigated how the volume of this rectangular prism would change when the height was changed to 1 cm, 2 cm, 3 cm, ... while keeping the length, 5cm, and the width, 3cm, the same. The results are summarized in the table below.

Height and Volume of Rectangular Prism

Height (cm)	1	2	3	4	5	
Volume (cm^3)	15	30	45	60	75	

        When the height becomes 2 times, 3 times, ... as much, how does the volume change. Select from **1** through **4** below and write that answer.

1   The volume will become 2 times, 3 times, ... as much.
2   The volume will become 15 times, 30 times, ... as much.
3   The volume will become 15 times as much.
4   The volume will not change.

Grade 6 Mathematics Set B

[1]   Takashi went shopping.

(1)   The cost of an item was 320 yen.
        Because Takashi did not have 3 100-yen coins, he decided to pay with a 500-yen coin and get change.
        Then, the store clerk asked, "do you have 20 more yen?" So, Takashi gave her 20 yen in addition to the 500-yen coin.

I wonder why I should give 20 more yens?

(500) (10) (10)

Takashi

Clerk

Here are your change.

I can get a fewer number of coins for my change if I think carefully about how I pay.

Takashi

        The change Takashi received were 2 coins of the same type.
        Which of the following 6 types of coin did Takashi receive? Write your answer.

Types of coins

| ①	五円	10	50	100	500
1 yen	5 yen	10 yen	50 yen	100 yen	500 yen

Next day, Takashi went shopping with his older sister.

(2)   The cost of the item was 630 yen.
        Takashi decided to give 30 yen in addition to a 1000 yen bill in order to reduce the number of coins he would get for his change.
        Then, his sister told him, "If you give 100 yen more, the number of coins will be even fewer."

Takashi's method   Sister's method

| 1000 | | 1000 |
| (10) (10) (10) | | (100) (10) (10) (10) |
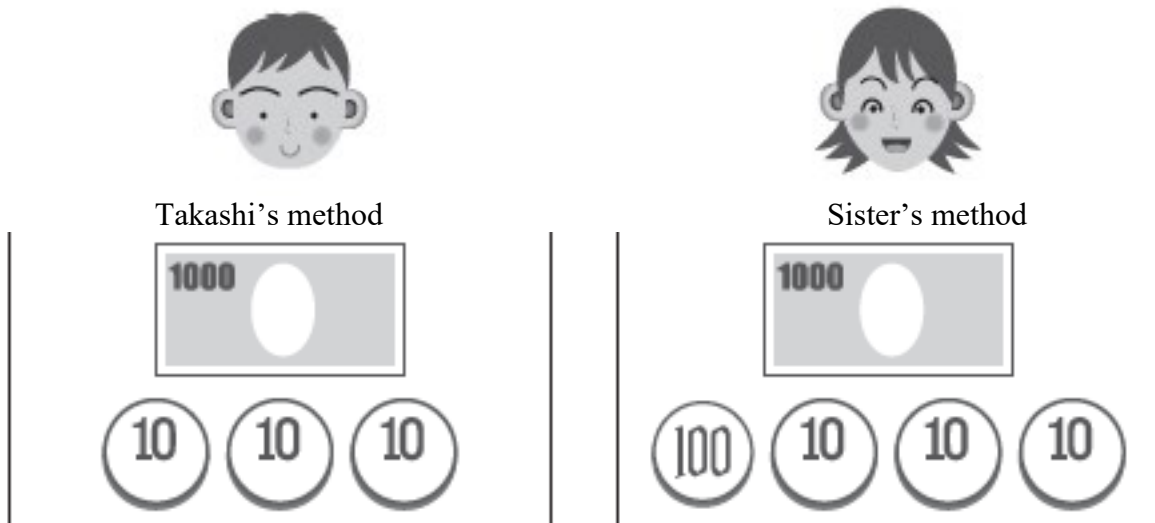
        The number of coins Takashi will receive for change will be fewer if Takashi uses his sister's method.
        Explain using words and numbers why the number of coins in change will be fewer with Takashi's sister's method by comparing the number of coins for each method.

[2]   At Yuriko's school, there are two types of vaulting horse, small and medium.
         The top layer of the small vaulting horse is 30 cm high, and each of the second
through the eighth layer is 10 cm in its height.
         For the medium vaulting horse, the top layer is 35 cm high and each of the second
through the fourth layer is 15 cm in its height. For the 5th through the 8th layers, their
height is 10 cm.

Small Vaulting Horse (8 layers)   Medium Vaulting Horse (8 layers)
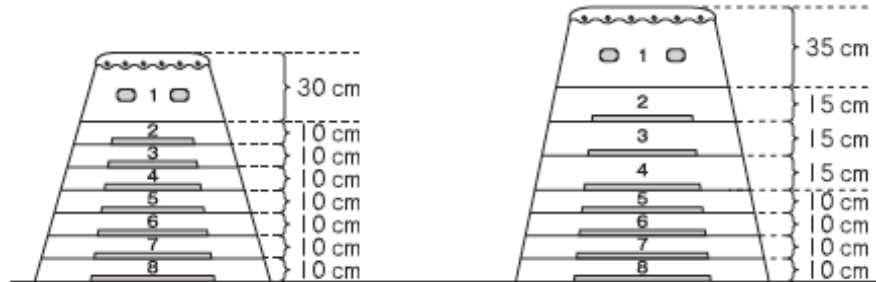

(1)   Which of the following calculations will determine the total height of the medium
vaulting horse when all 8 layers are used? Select from (1) through (4) below and write
the number.

(1) $35 + 15 \times 8$
(2) $35 + 15 \times 7$
(3) $35 + 15 \times 4 + 10 \times 3$
(4) $35 + 15 \times 3 + 10 \times 4$

(2)   Yukari's teacher asked her and her friends to prepare both the small and the medium vaulting horses but make them the same height.
         First, they set up the small vaulting horse that they use to practice often with 5 layers. The height was 70 cm.

Small Vaulting Horse (5 layers)
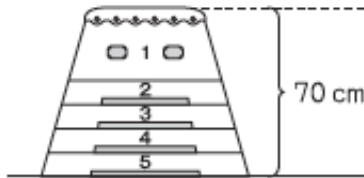
   Next, they want to set up the medium vaulting horse so that its height will be 70 cm as well.
         Is it possible to set up the medium vaulting horse with the height of 70 cm?
         Select the correct answer from (1) and (2) below and write the number. Also, explain why you chose that answer using words and numbers.

(1)   It is possible to set up the medium vaulting horse with the height of 70 cm.
(2)   It is not possible to set up the medium vaulting horse with the height of 70 cm.

(3)   Yukari and her friends decided to investigate when the two types of vaulting horse will have the same height.
        They found that the heights are the same when there are 3 layers for the small vaulting horse and 2 layers for the medium vaulting horse. The heights were also the same when there are 6 layers in the small vaulting horse and 4 layers in the medium vaulting horse.

Small Vaulting Horse   Medium Vaulting Horse
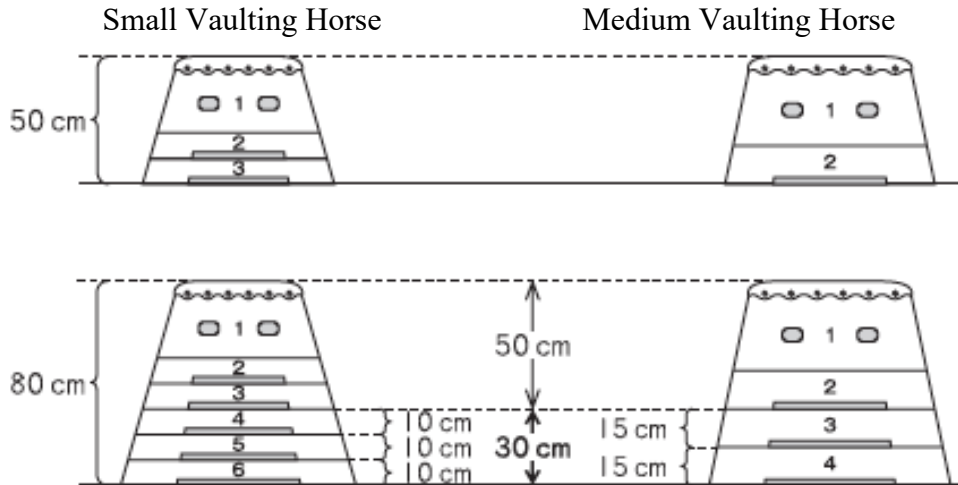
        The heights when the two types of vaulting horse are the same are 50 cm and 80 cm. Thus, we know that if we increase the height of each vaulting horse by 30 cm from 50 cm, the height will be the same.
        Why does the height of the two types of vaulting horse stay the same when the height is increased by 30 cm? Select the reason from (1) through (4) below and write the number.

(1)   It is because "30" of 30 cm is the greatest common factor of 10 and 15.
(2)   It is because "30" of 30 cm is the greatest common factor of 15 and 30.
(3)   It is because "30" of 30 cm is the least common multiple of 10 and 15.
(4)   It is because "30" of 30 cm is the least common multiple of 15 and 30.

[3]   Atsuko is investigating the area of a quadrilateral drawn inside a rectangle.

(1)   She is going to determine the area of the rhombus drawn inside the rectangle whose length is 6 cm and width is 10 cm, as shown in Figure A.
      If the diagonals of the rhombus are drawn, the rectangle will be divided into 8 right triangles.
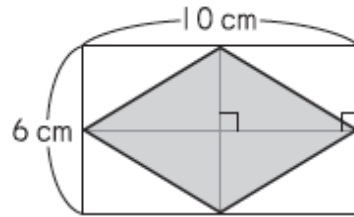

Figure A

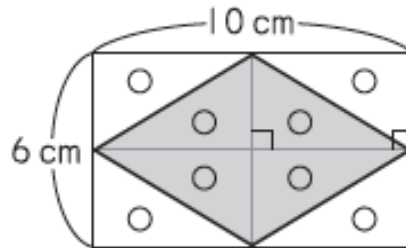If right triangles of the equal area are marked with ○, the result will be as shown below in Figure B.

Figure B

If we determine the area of the rhombus based on Figure B, it will be as follows.

How to find the area

The area of the rhombus is the total of 4 of the triangles marked with ○.
The un-shaded part of the figure is also the total of 4 of the triangles marked with ○.
Since the area of the rectangle is the sum of the area of the rhombus and the area of un-shaded part, it is the total of 8 triangles marked with ○.
Therefore, the area of the rhombus is a half of the area of the rectangle.
The calculation to determine the area of this rhombus will be [(1)   ], and the answer will be [(2)] cm².

In "How to find the area" above, write the appropriate calculation for [(1)] and the answer in [(2)].

(2)   Next, Atsuko is going to investigate if the area of quadrilaterals drawn inside a rectangle will always have the area that is a half of the area of the rectangle.

As shown in Figures 1 through 3, right triangles are drawn inside the quadrilateral constructed within a rectangle. The right triangles will equal area are marked with symbols like ○ and △.
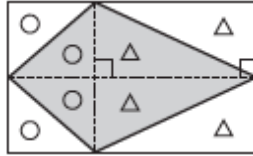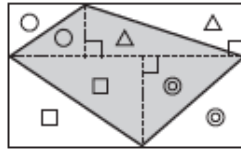
Figure 1

Figure 2

Figure 3
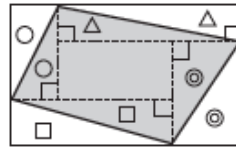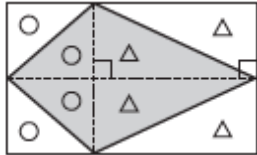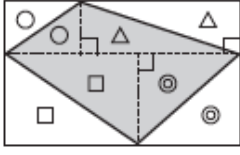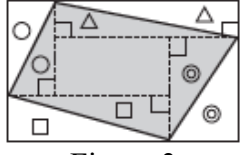
Atsuko

Inside the quadrilateral in Figure 3, there is a part with no symbol (▭).

If you examine Figures 1 through 3, you will notice that the area of the rectangle is the sum of the area of the quadrilateral inside the rectangle and the area of white (un-shaded) parts.

We are going to investigate the relationship between the area of the rectangle and the area of the quadrilateral by comparing the area of the quadrilateral and the area of the white (un-shaded) parts.

The table below summarizes this comparison.

	Figure 1	Figure 2	Figure 3
Area of quadrilateral	The sum of 2 parts with and 2 parts with ◯ and 2 parts with △.	A	Thus sum of the areas of the parts marked with ◯, △, □, ⊙ and the area of ⬚.
Area of white parts	The sum of 2 parts with and 2 parts with ◯ and 2 parts with △.	B	Thus sum of the areas of the parts marked with ◯, △, □, and ⊙.
Relationship between the areas of the rectangle and the quadrilateral	The area of the quadrilateral is a half of the area of the rectangle.	C	The area of the quadrilateral is not a half of the area of the rectangle.

> Sometimes the area of the quadrilateral is a half of the area of the rectangle and sometimes it is not a half.

Atsuko

Fill in the spaces A, B, and C, using words and symbols.

[4]   Hiroshi's class will be making rice and potato salad for a home economics lesson.

(1)   The class is planning how to prepare rice.
        Rice will be cooked after 40 minutes after it is put on a stove.
        In order to have rice ready by 11:30, what is the latest time it should be put on a stove? Write that time.

(2)   Hiroshi's group is wondering if it is possible to prepare the potato salad during the 40 minutes rice is cooking.

They asked the teacher about the preparation time for potato salad, and she gave them the following information.

Approximate time needed to prepare potato salad

Step 1 (weigh → wash → cut)	10 ~ 15 minutes
Step 2 (boil → season → plate)	20 ~ 25 minutes

For the number of people in your group, the approximate preparation time will be like this.

Teacher

After looking at this information, Hiroshi's group decided that they could prepare potato salad during the 40 minutes rice is cooking.

If you reason as shown below, we can see that it is possible to prepare potato salad in 40 minutes or less.

Even if it takes [(1)] minutes for Step 1 and [(2)] minutes for Step 2, we can prepare potato salad in 40 minutes or less.

Write the appropriate numbers in (1) and (2) above.

(3)　　　　　Now it is time for the cooking lesson. The ingredients and the amount necessary to prepare rice are as follows.

Ingredients and amount per person

Rice ⋯ 80 g
Water ⋯ 120 g
(The weight of water is 1.5 times of the weight of rice.)

Hiroshi is going to measure the amount of rice the group will need.
First, he placed the empty container on a scale, and the weight was as shown in Figure A. After he placed rice in the container, the weight was as shown in Figure B.
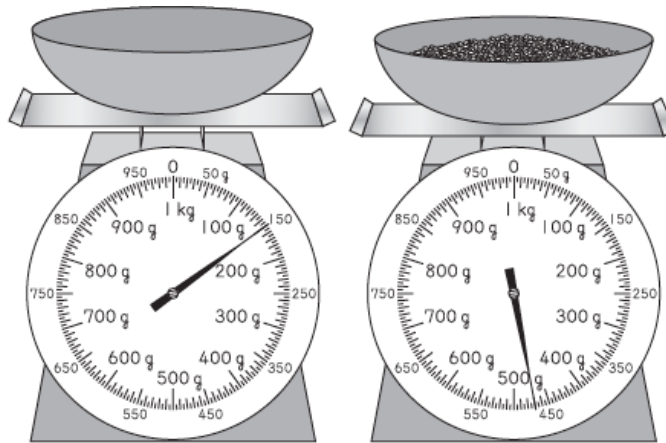
Figure A   Figure B

How many g of water will Hiroshi's group need? Write how we can figure out the amount of water needed using mathematical expressions and words. Also, write your answer.

[5]   In Ayaka's class, many students enjoy riding unicycles.

(1)   Ayaka is adjusting the height of a unicycle.
    The most appropriate height of a unicycle is said to be the height of a belly button of a person from the ground. After adjusting the height of the saddle, the length of the section shown as (A) in the figure below became 20 cm.
    The radius of the tire on the unicycle is 25 cm.

Ayak

Saddle

20 cm ㋐

Height of the belly
button from the ground

25 cm
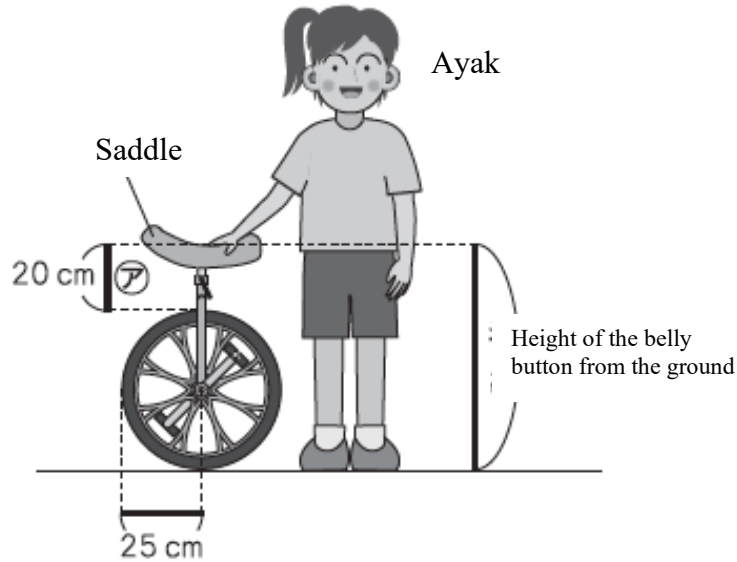
    How many cm is the height of Ayaka's belly button from the ground? Write your answer.

(2)　　　　　Ayaka wanted to know how far the unicycle moves forward when its tire makes one full rotation. So, she collected the data on the distance the unicycle traveled and the number of rotations its tire made.

Distance and the number of rotations

Number of rotations (turns)	1	2	3	4	
Distance traveled (cm)	157	314	471	628	

　　　　　After examining this table, Ayaka noticed that the distance traveled is proportional to the number of rotations made by the tire. She decided to use this fact to determine the length around the track in the school play ground.
　　　　　When she circled around the track once, the tire made exactly 120 rotations.
　　　　　Select the calculation needed to determine the length of the track from (1) through (4) below and write the number.

1　　　157 × 120
2　　　314 × 120
3　　　120 × 3.14
4　　　157 × 3.14
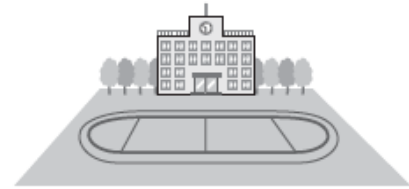
(3)   Ayaka wondered if more boys or girls are able to ride a unicycle in her class. So, she asked her classmates and summarized the results as shown in the table below.

People who can ride a unicycle

(people)

	Can ride a unicycle	Cannot ride a unicycle	Total
Boys	9	6	15
Girls	12	8	20

After examining the table, Ayaka said the following.

The number of people who can ride a unicycle is 9 for boys and 12 for girls. So, I wonder if we can say more girls can ride a unicycle than boys.

Ayaka

After hearing Ayaka's comment, Taro said the following.

But, the total numbers of boys and girls are different.
Why don't we compare using the ratios instead of comparing the actual numbers of people?

Taro

For boys and girls, we are going to compare the ratios based on the total numbers of students in each group. Which group has the greater ratio, boys or girls?
Select your answer from (1) through (3) below and write that numbers. Also, explain why you chose that answer using words and mathematical expressions.

(1)   The ratio of people who can ride a unicycle is greater for boys.
(2)   The ratio of people who can ride a unicycle is greater for girls.
(3)   The ratio of people who can ride a unicycle is the same for boys and girls.