2015 Grade 6 Mathematics

This is an unofficial translation of 2015 Japanese Achievement Test. Original may be found at
https://www.nier.go.jp/15chousa/pdf/15mondai_shou_sansuu_a.pdf
and
https://www.nier.go.jp/15chousa/pdf/15mondai_shou_sansuu_b.pdf

2015 Problem Set A

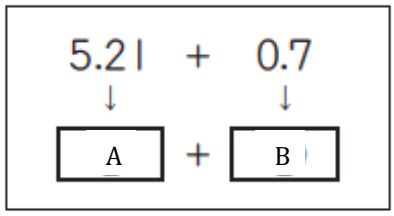
[1] Answer the following questions.

(1) Select the good approximate answer for 8.9 − 0.78 from **1** through **4** below and write the number.

1 0.1
2 1
3 0.8
4 8

(2) We are going to express 5.21 + 0.7 as an expression based on 0.01 as the unit.

How many units of 0.01 together will make 5.21 and 0.7 respectively? Write the appropriate numbers in (A) and (B) below.



(3) We found 6.52 as the answer for 6.3 + 0.22.
We are going to check if this answer is correct as follows.
Write the appropriate numbers in (C), (D) and (E) below.

Calculate [C] − [D] and check if we get [E] .

[2] Calculate the following.

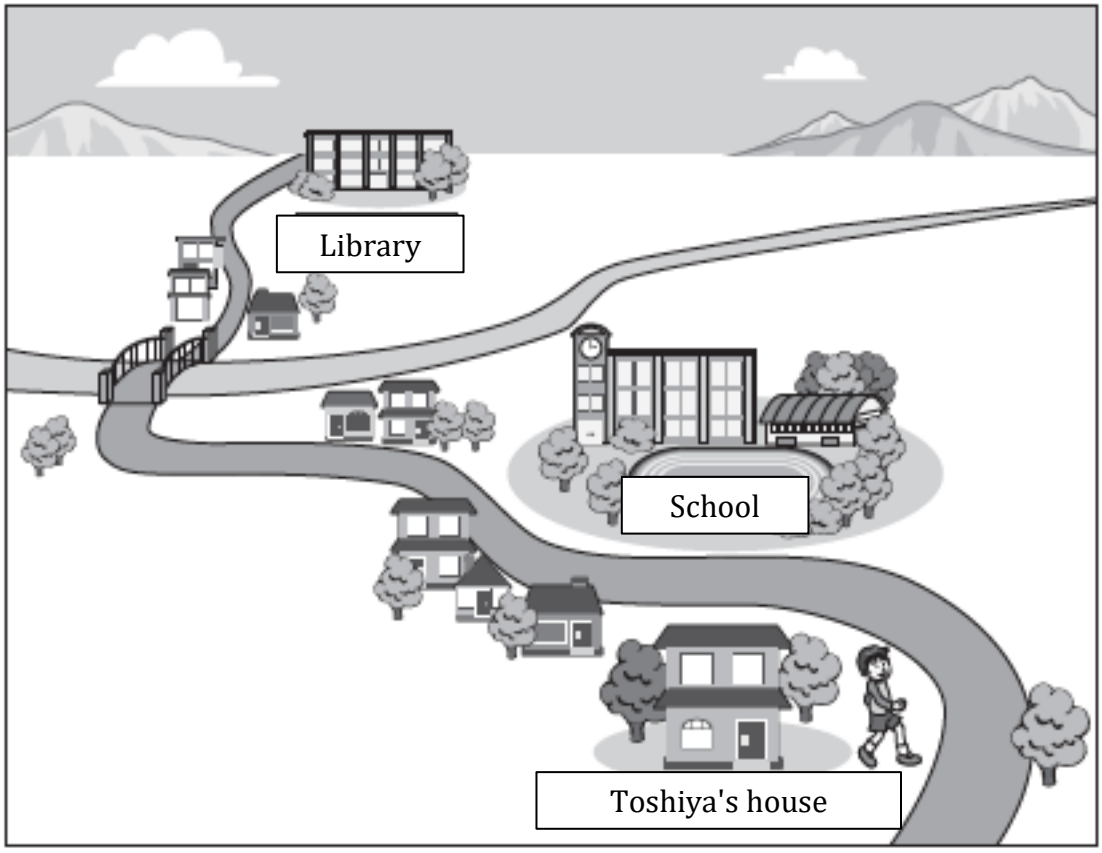
(1) 28 + 72

(2) 6.79 − 0.8

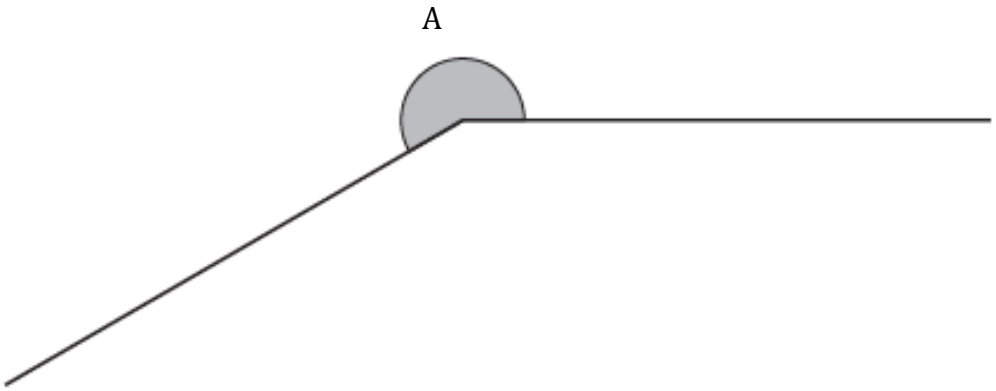
(3) $\frac{5}{9} - \frac{1}{4}$

(4) $\frac{5}{6} \div 7$

[3] Toshiya is going to the library from his house, passing in front of the school. It takes 5 minutes to go from his house to the school, and it takes 20 minutes to go from the school to the library.
In order to arrive at the library by 3:10 pm, by what is the latest time he can leave his house? Write that time.



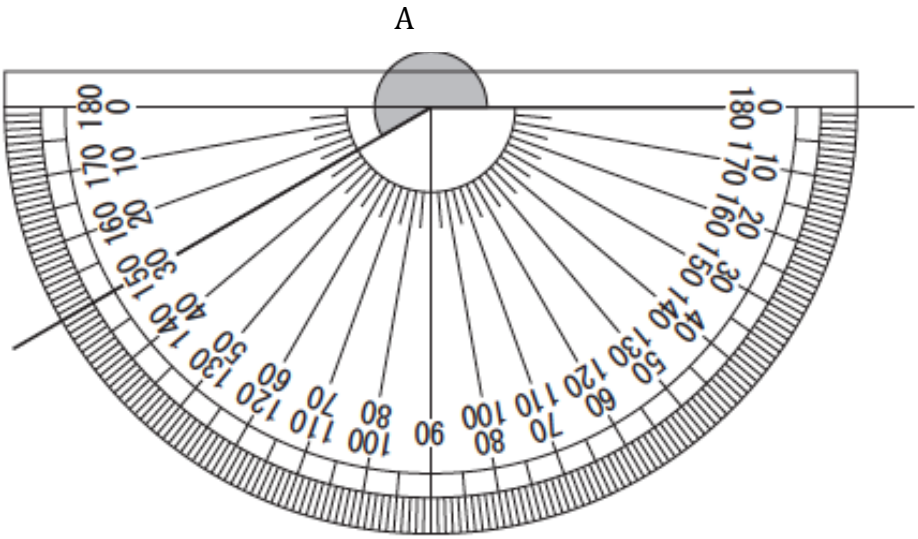
[4] We are going to measure angle A shown.



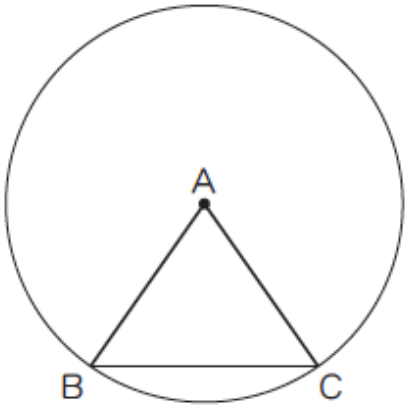
(1) Select one correct statement about the size of angle A from **1** through **4** below and write the number.

1 It is less than 90°.
2 It is greater than or equal to 90° but less than 180°.
3 It is greater than or equal to 180° but less than 270°.
4 It is greater than or equal to 270° but less than 360°.

(2) How many degrees is angle A? Write your answer.



[5] If we draw triangle ABC using a circle as shown below it will become an isosceles triangle.

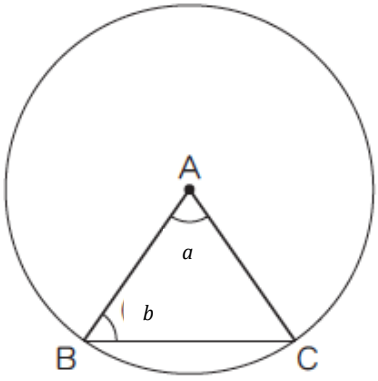


- Point A is the center of the circle.
- Pont B and Point C are on the circle.

(1) The reason triangle ABC is an isosceles triangle is due to what property of circles?
Select the most appropriate one from **1** through **4** below and write the number.

1 The radii of a circle are all equal in length.
2 The circumference of a circle is about 3.14 times of the diameter.
3 The diameter of a circle is twice as long as its radius.
4 The length of the diameter of a circle is the longest of all segments connecting 2 points on the circle.

(2) If the measure of angle *a* below is 70°, how many degrees is the measure of angle *b*. Write your answer.



[6] To draw a net of the rectangular prism in Figure 1 below, 5 of the 6 faces have been drawn as shown in Figure 2.

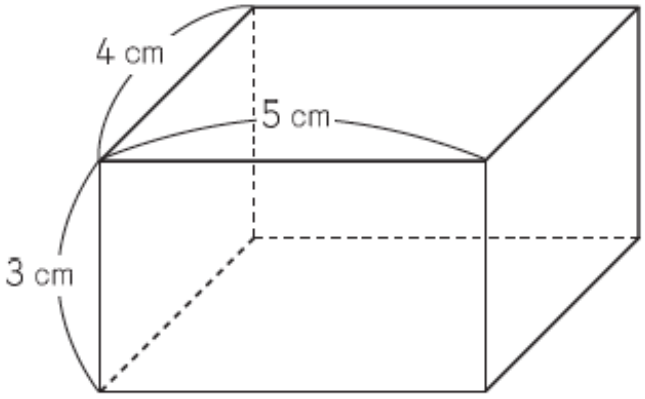


Figure 1

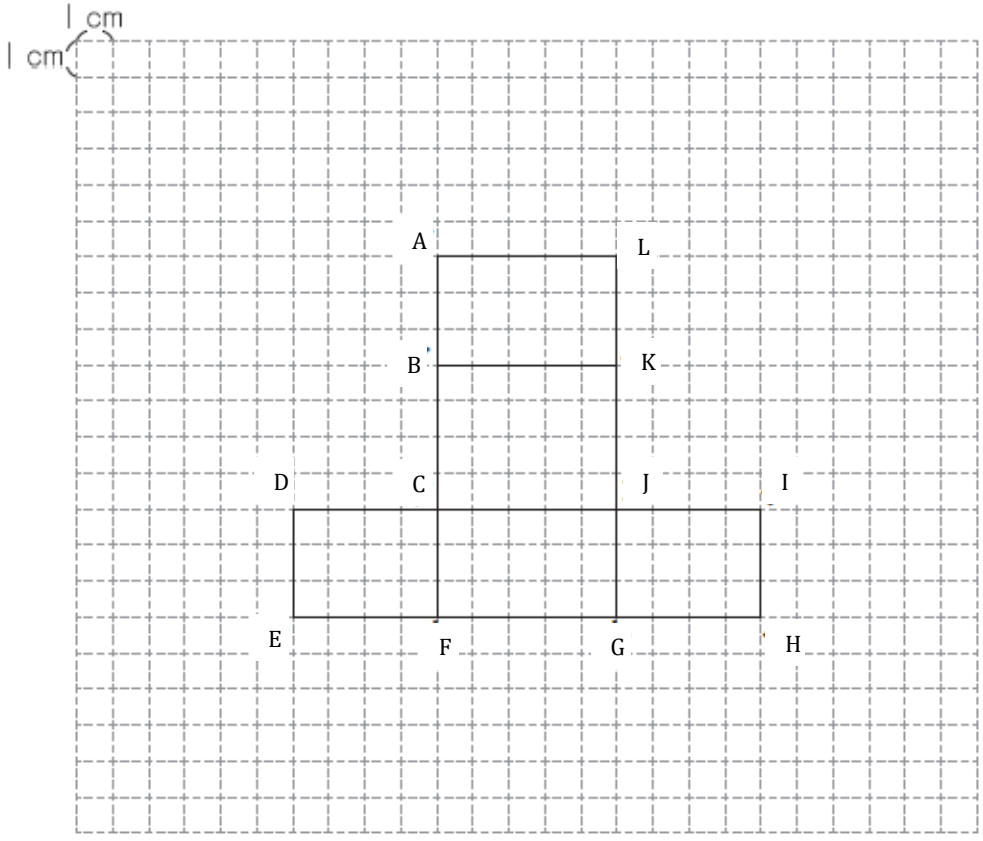


Figure 2

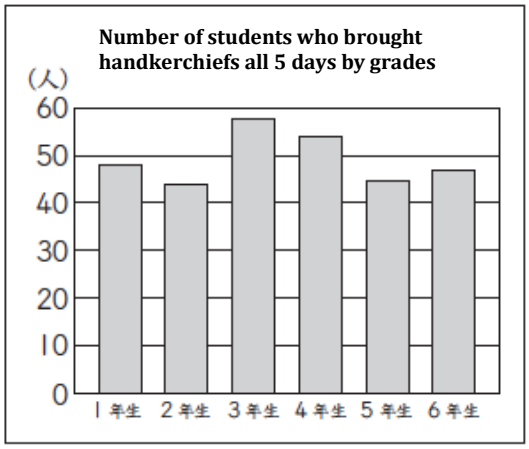
(1) What are the dimensions of the last face? Write the length and width of the rectangle.

(2) The net can be completed by drawing the last face attached to one of the sides shown in **1** through **4** below. Which side is it?
Select one from **1** through **4** and write the number.

1 Side CD
2 Side DE
3 Side GH
4 Side KL

[7] For 5 days, we surveyed all students at the school whether or not they brought their handkerchiefs each day and summarized the results in the 4 graphs below.

1



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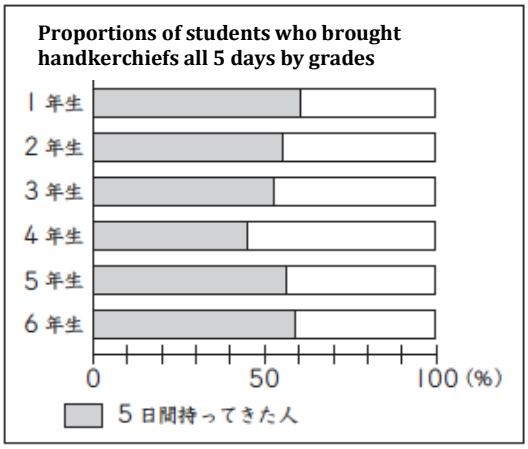

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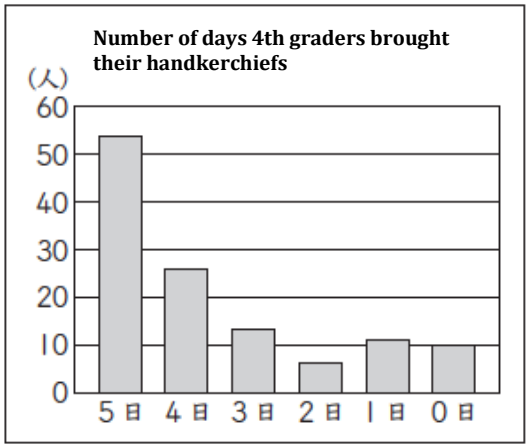
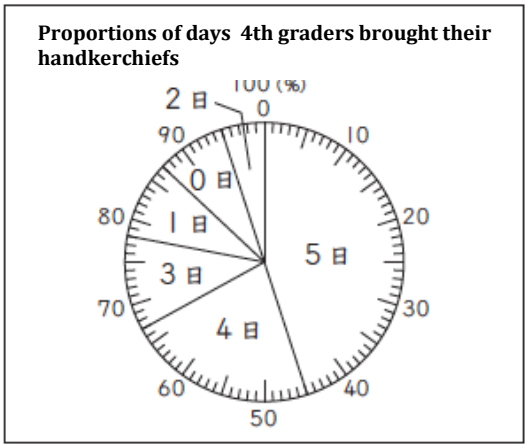


4



<<<<<<{graph 1} Vertical axis: Students
Horizontal axis: Grade 1, Grade 2,... Grade 6 (left to right)

{graph 2} Vertical axis: Grade 1, Grade 2, ... Grade 6 (top to bottom)
Key: Shaded box represents students who brought handkerchiefs all 5 days.
{graph 3} Vertical axis: Students
Horizontal axis: 5 days, 4 days, ... 0 day (from left to right)
{graph 4} Sectors show the number of days.

After examining the 4 graphs, we noticed the following from one graph.

What is noticed

The only grade in which less than a half of all the students in the grade brought their handkerchiefs on all 5 days is Grade 4.

From which of the graph, can we see this?
Select one from graph **1** through **4** and write the number.

[8] We are going to think about ways to determine the number of ○ arranged as shown in Figure 1.

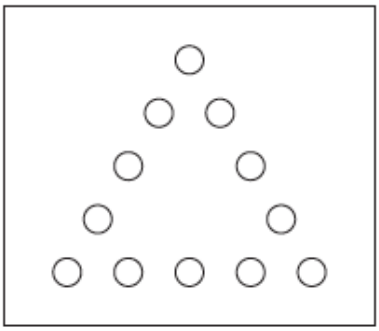


Figure 1

We wrote the expressions to calculate the number of ○ by grouping ○ as shown in Figure 2 and Figure 3.

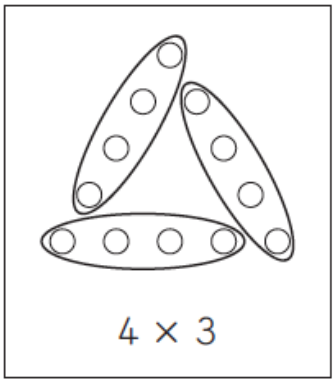


Figure 2

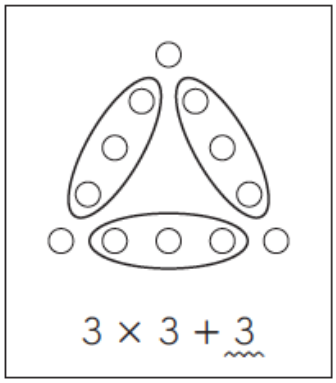


Figure 3

Which ○ does the underlined "3" in the expression for Figure 3 represent?
Shade all ○ that are represented in the figure on the answer sheet.

2015 Problem Set B

[1] Parallelograms have the following properties.

Properties of Parallelograms

In a parallelogram,

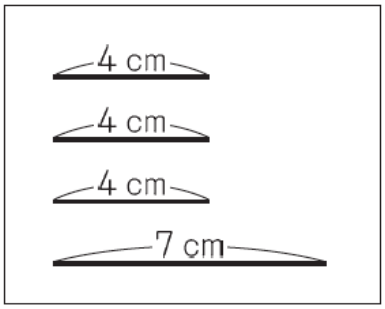
A. two pairs of opposite sides are each parallel.

B. two pairs of opposite angles are each equal in their measures.

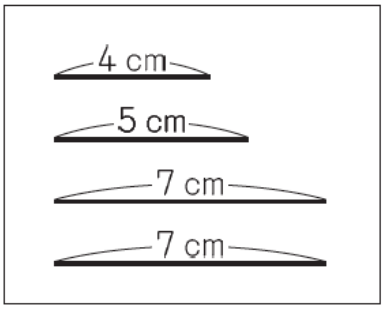
C. **two pairs of opposite sides are each equal in their lengths.**

(1) Select the set of sides that can form a parallelogram from **1** through **4** below and write the number.

1



2



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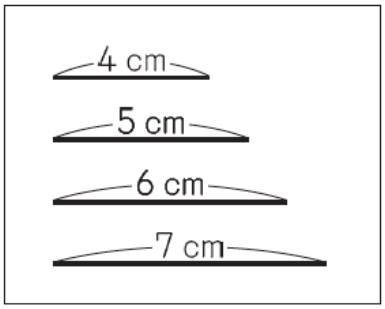

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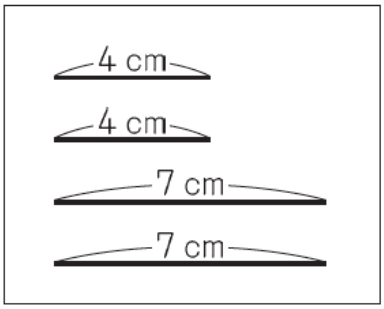
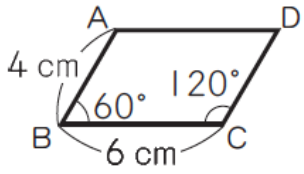
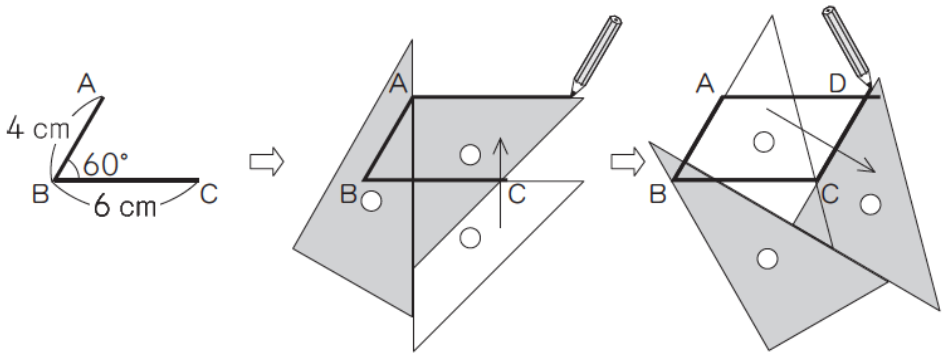


(2) Next, we are going to draw Parallelogram ABCD.



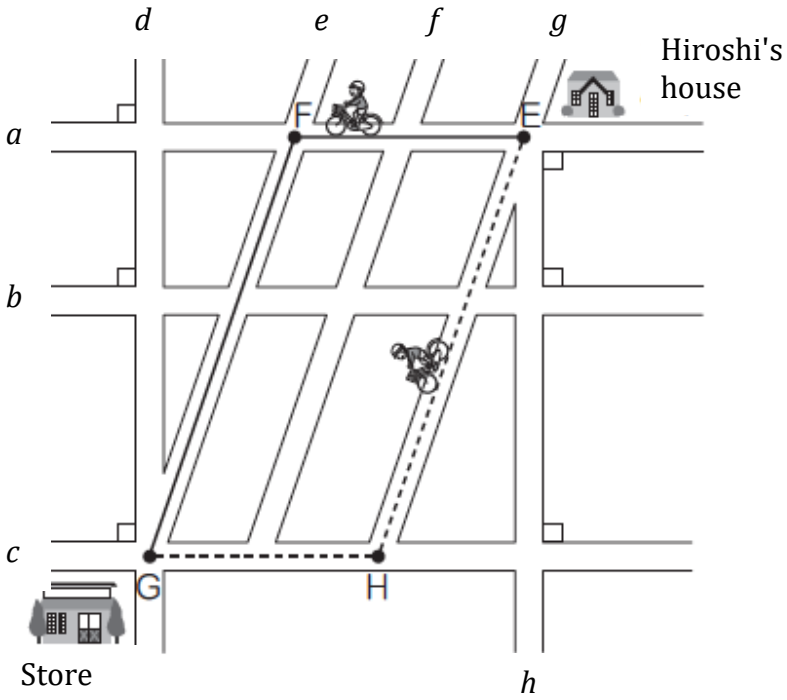
As shown in the figure below, we first drew sides AB and sides BC so that angle B will be 60°. Then, using a pair of set squares, we drew a line that goes through point A and another line that goes through point C.



The drawing method above is based on which property of parallelograms?

From the properties of parallelograms A, B, and C, select one and write the letter.

(3) Hiroshi is thinking about a shortcut to go from his house to a store using the map shown below.



- Streets *a*, *b* and *c* are parallel.
- Streets *e*, *f* and *g* are parallel.
- Streets *a*, *b* and *c* are perpendicular to street *d*.
- Streets *a*, *b* and *c* are perpendicular to street *h*.

He then compared the route ——— which turns at Intersection F and the route - - - which turns at Intersection H using the reasoning shown below.

Hiroshi's Reasoning

The lengths of EF and HG are equal, and the lengths of FG and EH are also equal. Therefore, the sum of the lengths of EF and FG is equal to the sum of the lengths of EH and HG.

From this, we can say that the route ——— which turns at Intersection F and the route - - - which turns at Intersection H are equal in their lengths.

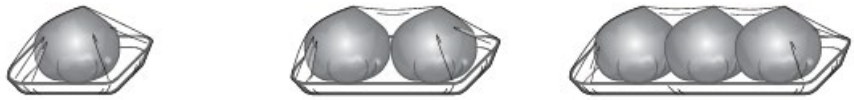
We can explain the lengths of EF and HG are equal, and the lengths of FG and EH are also equal in **Hiroshi's reasoning** if we use a property of a figure we can identify in the map.

What figure do we need to identify? Also, what property of the figure do we need to use?

Write the name of the figure and the property using words and labels in the map.

[2] Takako was asked to go to a store.

(1) First, she is going to buy 7 tomatoes. At the store, tomatoes are sold in packages as shown below.



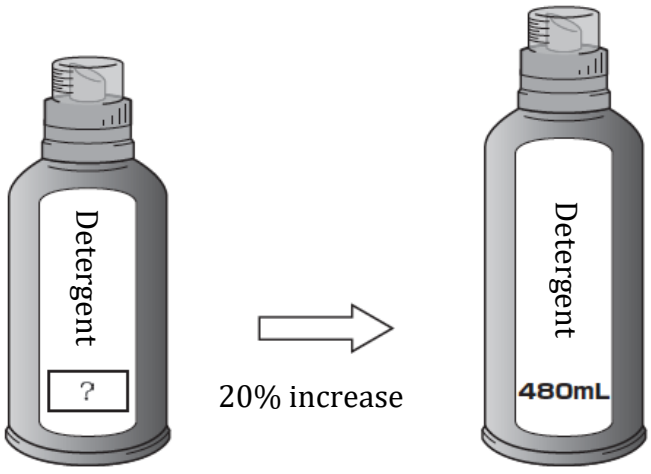
Pack of 1 100-yen	Pack of 2 180-yen	Pack of 3 270-yen

What combination of packages will result in the lowest price for 7 tomatoes? Select one from **1** through **4** below and write the number. Also, write the price for the selected combination of packages.

1 Buy 7 packs of 1 tomato.
2 Buy 3 packs of 2 tomatoes and 1 pack of 1 tomato.
3 Buy 2 packs of 2 tomatoes and 1 pack of 3 tomatoes.
4 Buy 2 packs of 3 tomatoes and 1 pack of 1 tomato.

(2) Next, she is going to buy a bottle of detergent. The detergent she uses at home is being sold in a bottle that has 20 % more detergent than before. The amount of detergent after the increase is 480 mL.

How many mL was the amount of detergent in the bottle before the amount was increased? Write both the answer and the expression to calculate the answer.



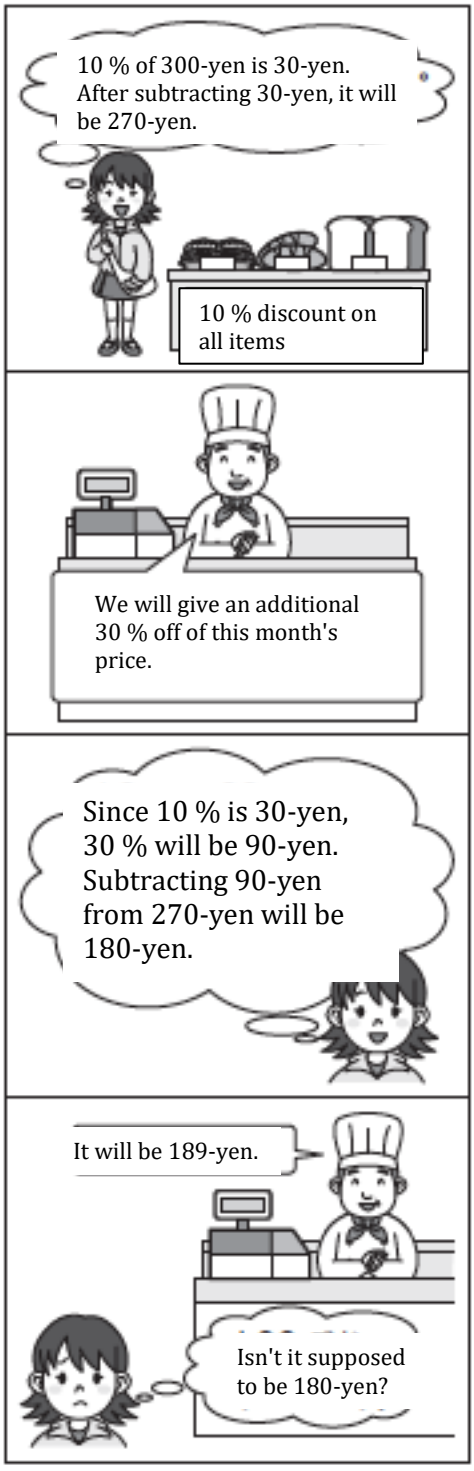
(3) Finally, she is buying a 300-yen bread at the bakery.

This month, the bakery is having a sale where every item is sold at 10 % discount. Therefore, the price of 300-yen bread this month is 270-yen.

Then the baker said, "Today, we will give an additional 30 % off of this month's price."

After hearing that, Takako thought the price of the 300-yen bread will be 180-yen.

However, the actual price was 189-yen, not 180-yen.



After Takako got home, she thought about the way to calculate the sale price.

Takako's Reasoning

(1) Way to determine this month's price (after 10 % discount)

Calculations $300 \times 0.1 = 30$
$300 - 30 = 270$

Answer 270-yen

(2) Way to determine the price after the additional 30 % off this month's price

Calculations $\underline{300} \times 0.3 = 90$
$270 - 90 = 180$

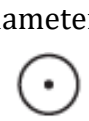
Answer 180-yen

Takako noticed that $\underline{300}$ in (2) above was incorrect.
What is the correct number for _____ ? When you use that number, how will the ☐ change?

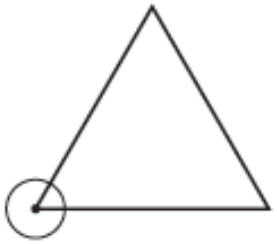
Write the correct number of _____. Also, using that number, write **Calculations** and **Answer** in (2) using words and numbers.

[3] Asako and her friends are drawing lines for softball toss as follows.

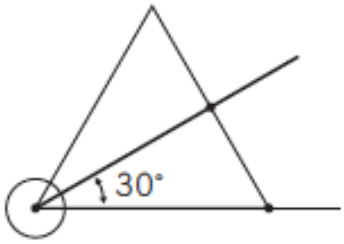
1) Draw a circle with the diameter of 2 m.



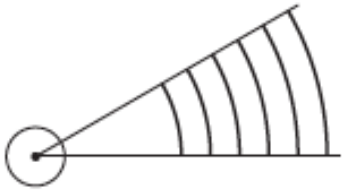
2) Draw an equilateral triangle with the center of the circle in (1) as a vertex.



3) Based on the equilateral triangle in (2), draw a line forming a 30° angle.



4) Draw the remaining marks.

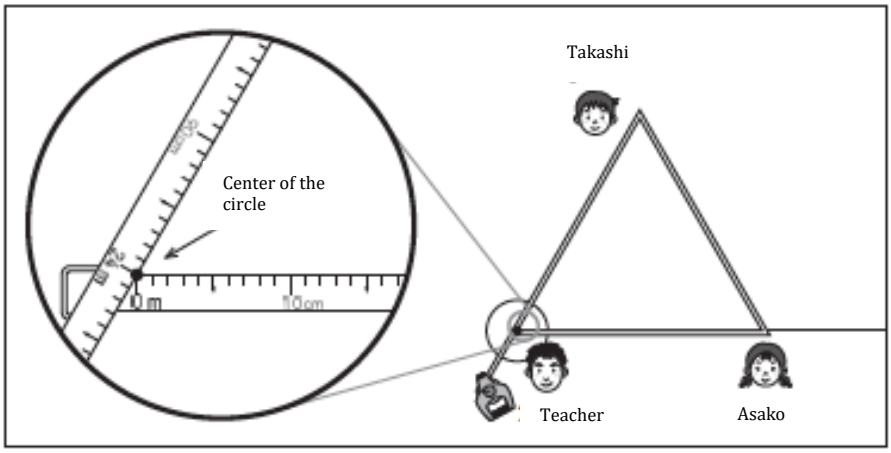


First, they drew the circle.

Next, they are going to make an equilateral triangle using measuring tape as shown in the figure below.

The teacher held the tick marks for "0 m" and "24 m" on the measuring tape and put them at the center of the circle.

He then told Asako and Takashi, "Hold the measuring tape so that we will have an equilateral triangle with the perimeter of 24 m."

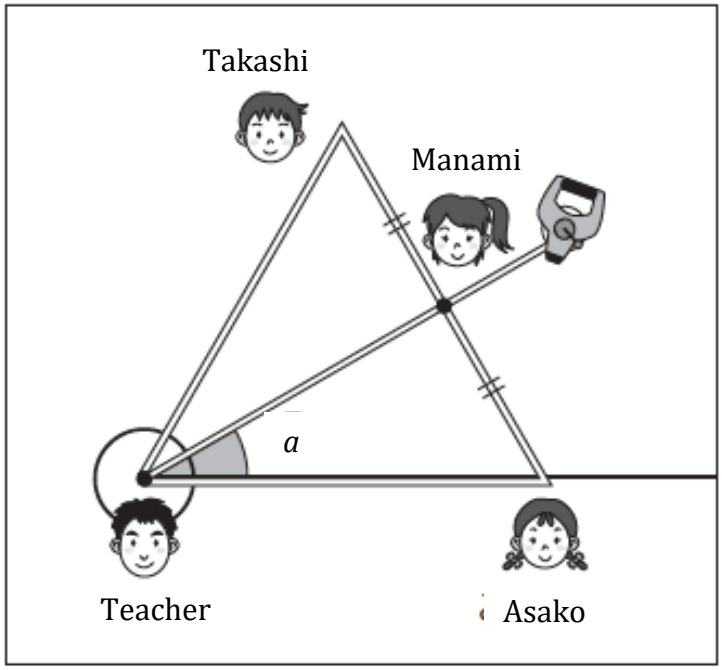


(1) At what tick marks of the measuring tape should Asako and Takashi hold? Write your answers.

Next, they are going to make the 30° angle as follows.

Teacher told Manami to take the measuring tape and place it at the exactly half-way between Asako and Takashi.

He then pointed at (a) and said "We made a 30° angle."




Asako

How was it possible to make a 30° angle using only a measuring tape and no protractor?

After getting home, Asako checked the way to make a 30° angle with a measuring tape using a sheet of paper shaped in an equilateral triangle.

What she tried

I'm going to use Equilateral Triangle ABC as shown in Figure 1. Teacher was at Point A, I was at Point B, and Takashi was at Point C. The mid-point of side BC, D, is where Manami was with the measuring tape.

Then, we drew a line passing through Point A and Point D to make angle (a).

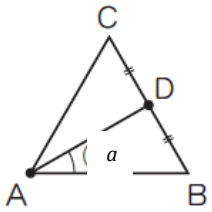


Figure 1

Then, as shown in Figure 2, I cut Equilateral Triangle ABC along the line AD.

Finally, I overlapped the two triangles and I found out that they were congruent.

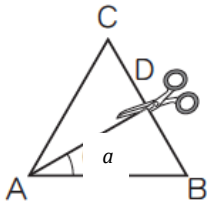


Figure 2

(2) Based on the fact that Triangle ABC is an equilateral triangle and the two triangles obtained after cutting triangle ABC are congruent, explain the reason angle (a) is 30° using words and numbers.

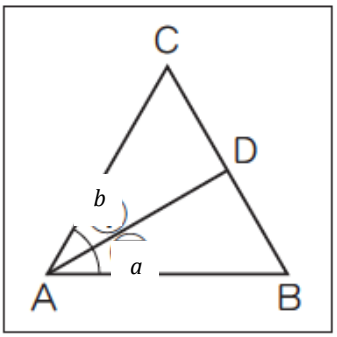


Figure 3

If necessary, you may use the marks shown in Figure 3 below.

[4] As a part of Children's Club activities, children are collecting plastic bottle caps. They were trying to collect 10000 bottle caps in April through July. The numbers of bottle caps collected in 4 months through July are shown in the table below.

Number of bottle caps collected by month through July

Month	April	May	June	July
Bottle Caps	1891	1982	2903	2473

Read the exchanges and answer the following questions.

Manabu

I wonder if we reached our goal.

Haruka

We can check whether or not we reached our goal by using approximate numbers in calculations.
There are 3 ways to make approximate numbers.

- rounding
- rounding down
- rounding up

Yuuto

If we round down each number to thousands and calculate, we get the following.

Actual Numbers	1891 1982 2903 2473
Calculation with approximate numbers	1000 + 1000 + 2000 + 2000 = 6000

Because the sum of the numbers that are less than the actual numbers is 6000, we know that the total number of caps we collected is greater than or equal to 6000.

(1) We are going to calculate after we round each number. Write the numbers in expression (1) and the box (2).

If we round each number to thousands and calculate, we get the following.

Actual Numbers	1891 1982 2903 2473
Calculation with approximate numbers	[ ] + [ ] + [ ] + [ ] = [(2)]

(1)

Because the sum of the numbers that are close to the actual numbers is [(2)], we know that the number of bottle caps we collected is about [(2)].

(2) We are going to calculate after we round up each number. Select the appropriate sentence that should go into (3) from **1** through **4** below and write the number.

If we round up each number to thousands and calculate, we get the following.

Actual Numbers	1891 1982 2903 2473
Calculation with approximate numbers	2000 + 2000 +3000 + 3000 = 10000

We can tell that [(3)].

1 we reached the goal because the sum of numbers that are greater than the actual numbers is 10000.

2 we did not reach the goal because the sum of numbers that are greater than the actual numbers is 10000.

3 we reached the goal because the sum of numbers that are less than the actual numbers is 10000.

4 we did not reach the goal because the sum of numbers that are less than the actual numbers is 10000.

(3) The goal for the number of bottle caps to collect between September and December is also 10000. The number of bottle caps collected through November is shown in the table below.

Number of bottle caps collected by month through Nobember

Month	September	October	November
Bottle Caps	3009	2514	2120

Haruka thought about approximately how many bottle caps they need to collect in December to reach the goal as follows.

Haruka's Idea

Calculate the total number of bottle caps collected in 3 months as follows.

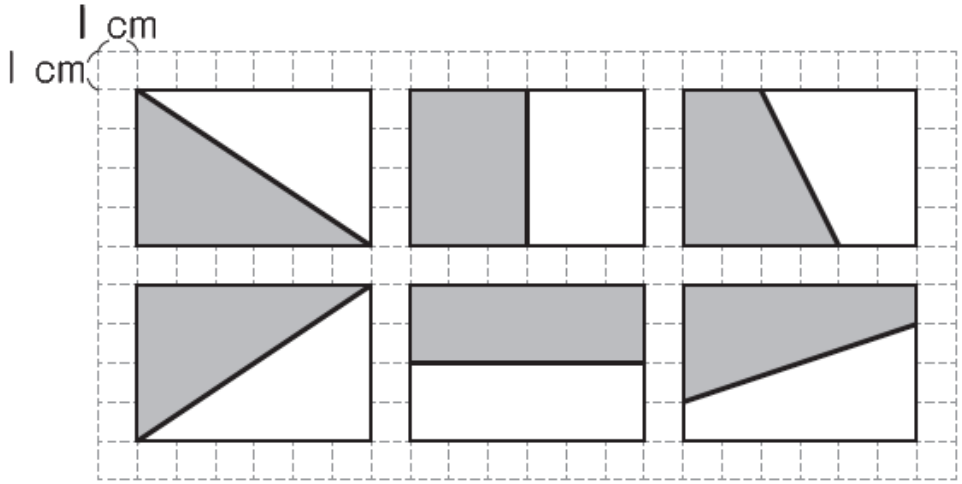
Actual Numbers: 3009 2514 2120

Calculation with approximate numbers: 3000 + 2000 +2000 = 7000

In order to reach our goal of 10000, we need to collect 3000 bottle caps.

Based on Haruka's [Calculations with approximate numbers], we can tell that we need to collect 3000 bottle caps in December. Why can we say that 3000 battle caps are enough to reach the goal without calculating with the actual numbers?
Write the reason using words and numbers.

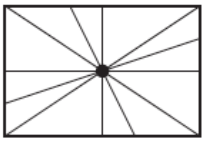
[5] As shown in the following figure, we split a rectangle into 2 congruent figures by drawing a line so that the area of the rectangle can be divided into 2 equal parts.



After looking at the figure, Akane noticed the following.

Akane

If we draw all the lines in one rectangle, we see that those lines are going through a single point as shown in the figure below.



The diagonals of the rectangle are also going through this point.

Based on what Akane noticed, we can tell that if we locate where the diagonals of a rectangle intersect and draw a line passing through it, we can always divide the area of the rectangle into 2 equal parts.

(1) We are going to divide the area of the figure composed of 2 rectangles shown in Figure 1 into 2 equal parts.

First, as shown in Figure 2, find the points where diagonals in each rectangle intersect.

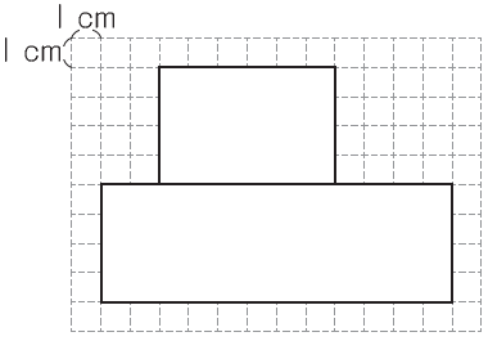


Figure 1

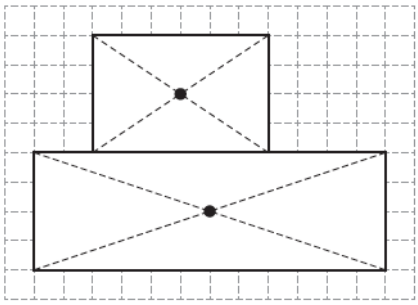


Figure 2

Next, as shown in Figure 3, draw a line that passes through these 2 points. Then, the figure composed of the 2 rectangles have been split into regions E and F as shown in Figure 4.

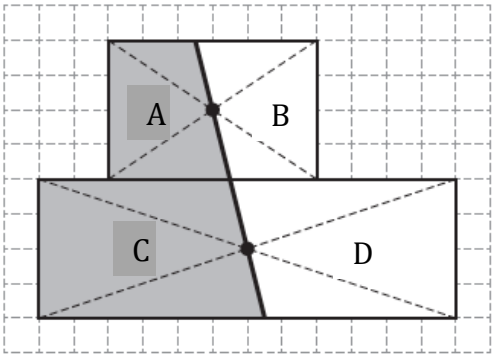


Figure 3

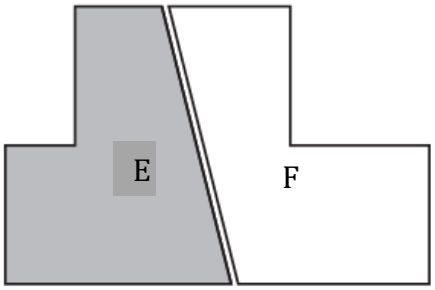


Figure 4

When we do this, the areas of regions E and F are equal. Why are their areas equal?

Write the reason using words, numbers and labels A through F.

(2) We are going to think about the figure composed of 2 squares.

As shown in the figure below, we found the points where the diagonals in each square intersect and drew a line passing through those 2 points.

How many cm^2 is the area of the shaded region ()? Write your answer.