2010 Grade 6 Mathematics

This is an unofficial translation of 2010 Japanese Achievement Test. Original may be found at
https://www.nier.go.jp/10chousa/10mondai_shou_sansuu_a.pdf
and
https://www.nier.go.jp/10chousa/10mondai_shou_sansuu_b.pdf

2010 Problem Set A

[1] Calculate the following.

(1) 243 − 65

(2) 27 × 3.4

(3) 912 ÷ 4

(4) 8 − 0.5

(5) 6 ÷ 5 (Divide completely and write the quotient as a decimal number.)

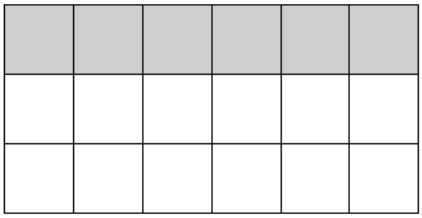
(6) 50 + 150 × 2

[2] Answer the following questions.

(1) There is an 8 m bar which weighs 4 kg.
How many kg will 1 m of this bar weigh? Write the answer and the expression to calculate the answer.

(2) If you divide 2 *l* of juice equally into 3 parts, how many *l* will each part be? Write your answer as a fraction.

[3] Select the fraction that represents the shaded part of the rectangle from **1** through **4** below and write the number.



1 $\frac{1}{4}$

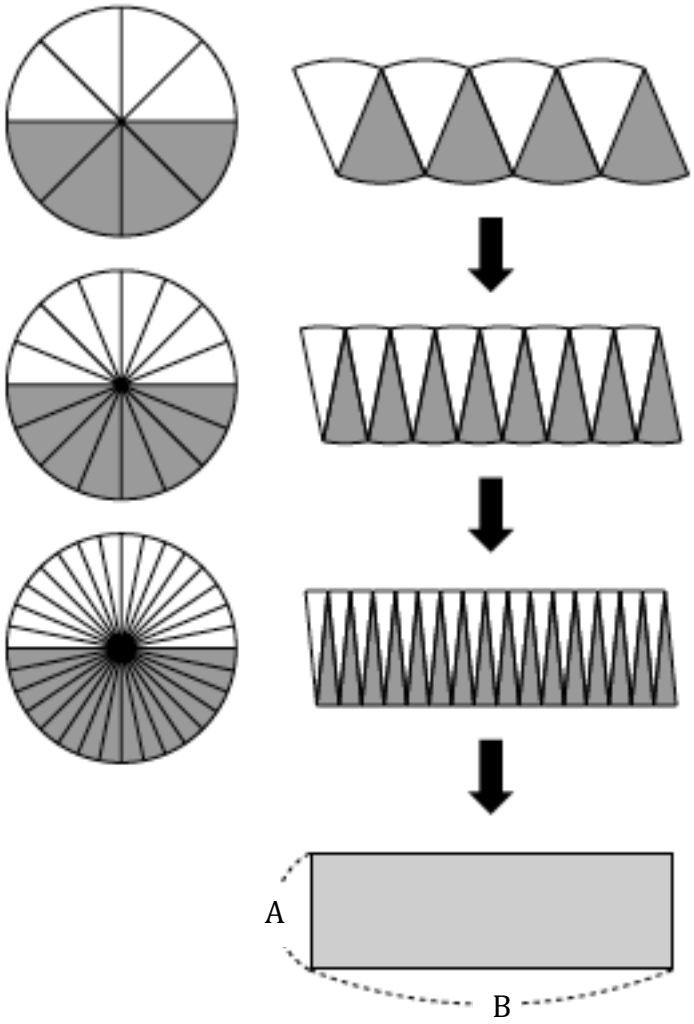
2 $\frac{1}{3}$

3 $\frac{6}{12}$

4 $\frac{2}{3}$

[4] If we split a circle into smaller and smaller segments as shown below and re-arrange them, the result will be a rectangle.

Therefore, the area of a circle is the product of A and B.



(1) Which part of the circle does A come from? Select one from **1** through **4** below and write the number.

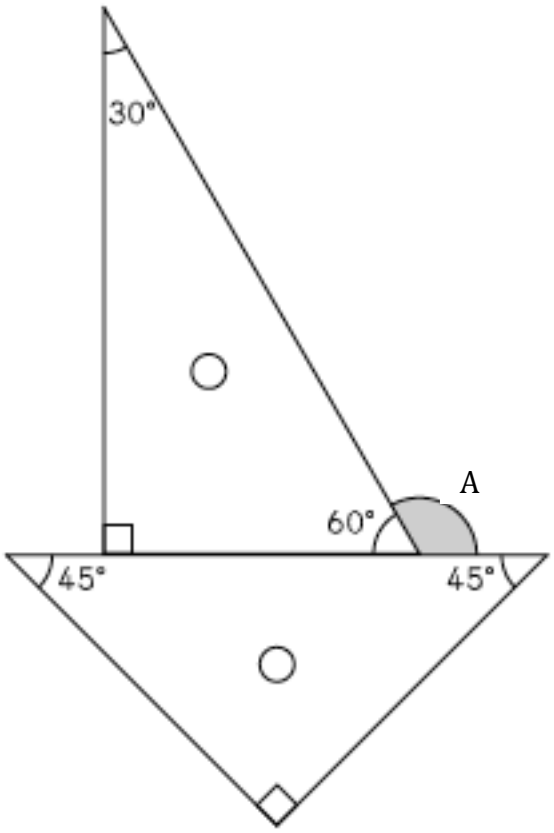
1 Radius
2 Diameter
3 Circumference
4 A half of the circumference

(2) Which part of the circle does B come from? Select one from **1** through **4** below and write the number.

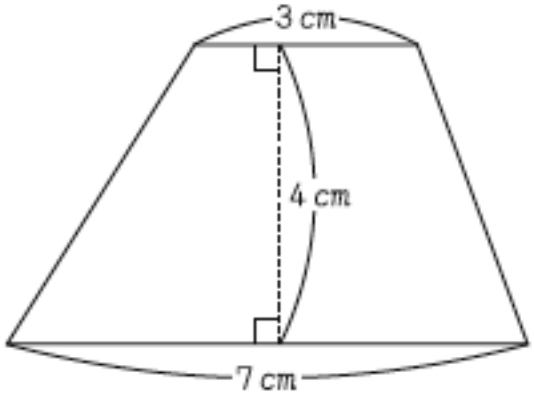
1 Radius
2 Diameter
3 Circumference
4 A half of the circumference

[5] Answer the following questions.

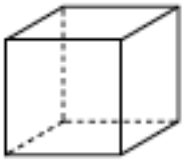
(1) If we place the two set squares as shown below, how many degrees will the measure of angle A be? Write your answer.



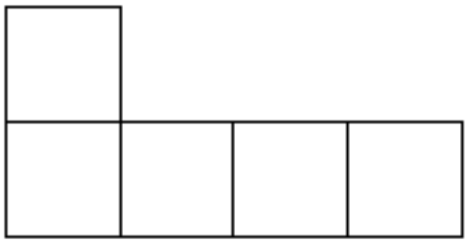
(2) Write the area and the expression to calculate the area of the trapezoid below.



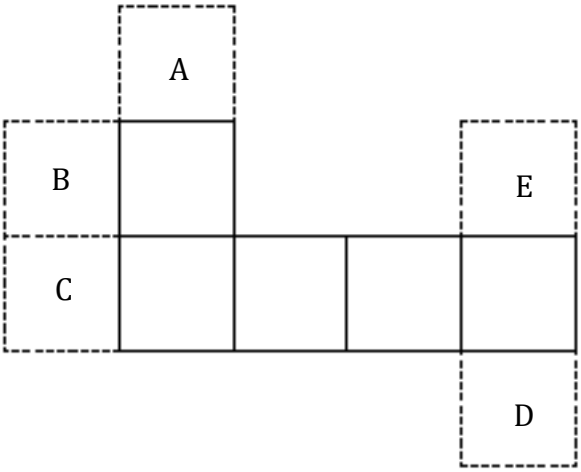
[6] There is a cube like the one shown on the right.
We are going to draw a net for this cube.



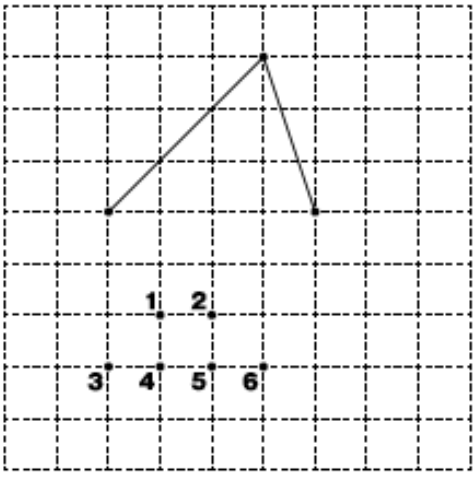
There are 6 faces in a cube. We drew 5 faces as shown below.



In order to complete a net of a cube, where should we draw the last face?
Select one from **A** through **E** below and write the letter.

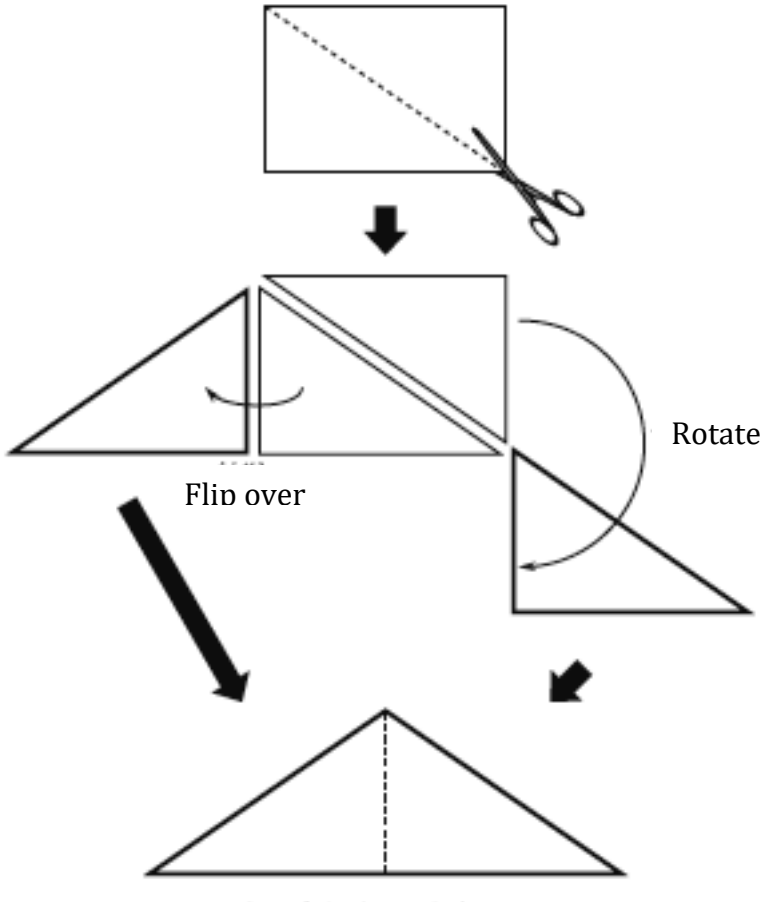


[7] We are drawing a parallelogram on the grid paper shown below.
Where should the final vertex be?
Select one from **1** through **6** and write the number.



[8] There is a rectangle like the one shown in the figure below.

This rectangle is cut into 2 pieces by cutting along the diagonal and re-arranged as shown.



Re-arranged figure

(1) What is the area of the re-arranged figure compared to the area of the original rectangle? Select one from **1** through **4** below and write the number.

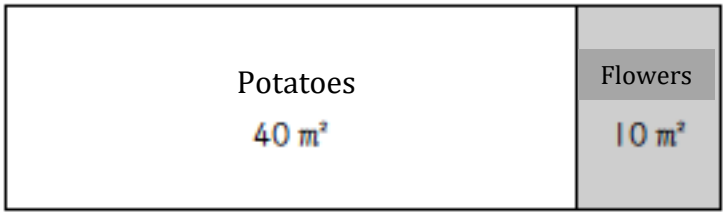
1 The area will be 0.5 times as much.
2 The area will be 1.5 times as much.
3 The area will be 2 times as much.
4 The area will not change.

(2) Select the name of the re-arranged figure from **1** through **5** below and write the number.

1 Right triangle
2 Isosceles triangle
3 Equilateral triangle
4 Parallelogram
5 Rhombus

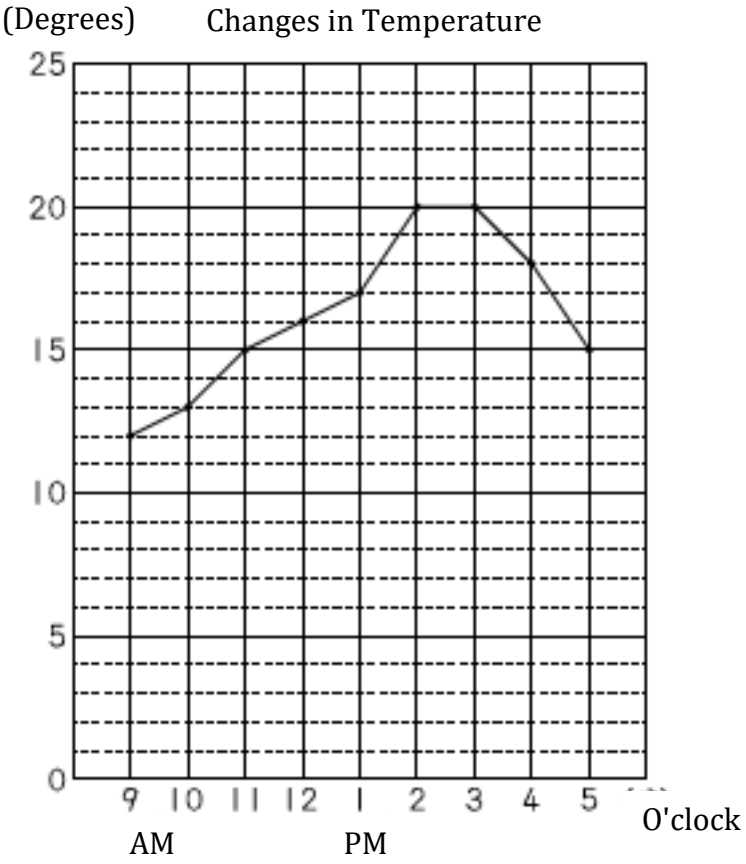
[9] Answer the following questions.

(1) The figure below shows the garden at Toshiko's school.



What is the proportion of the area where potatoes are planted, 40 m^2, compared to the total area of the school garden, 50 m^2? Write your answer.

(2) The broken line graph below shows the change in temperatures on a certain day.



The largest one hour increase in temperatures happened between what time and what time? Write your answer.

2010 Problem Set B

[1] Kyoko and her friends are discussing the problems they created during a mathematics lesson.

(1) Kyoko wrote the following problem.

Problem to find the regular price of one pencil

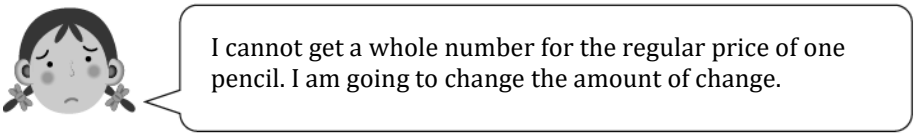
I bought 3 pencils of the same regular price. I paid with a 500-yen coin and received the change of 100-yen. How much is the regular price for one pencil?

1 pencil [ ]-yen

Next, Kyoko solved the problem and said the following.

Method to figure out the regular price of one pencil
{In a box}

500 − 100 - 400
400 ÷ 3 = 133.3 …



Kyoko

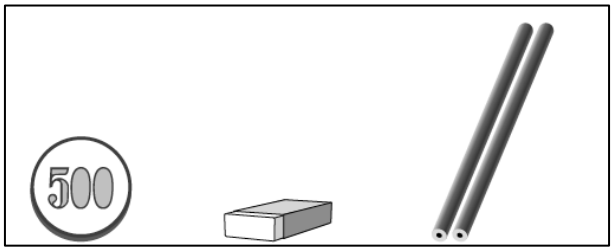
In Kyoko's problem, how should the amount of change be changed so that the regular price for one pencil will be a whole number? Select from **1** through **4** below and write the number.

1 400-yen
2 300-yen
3 200-yen
4 150-yen

(2) Next, Kyoko and her friends are thinking about the calculation to find the amount of change for the problem below.

Problem to find the amount of change

I bought a 50-yen eraser and 2 150-yen pencils and gave a 500-yen coin.
How much is the change?



1 eraser 50-yen 1 pencil 150-yen

Naomi shared her calculations as follows.

Naomi's idea

Total Price

[1 eraser] [2 pencils]
50 + 150 × 2 = 350

Amount of change

[Amount Paid] [Total Price]
500 − 350 = 150

Answer 150-yen

After listening to Naomi's idea, Kyoko said the following.

Kyoko

Because the expression to find the amount of change is
[Amount Paid] − [Total Price],
we can combine the 2 calculations Naomi shared into one expression,
500 − 50 + 150 × 2.

Then, Kenta said the following.

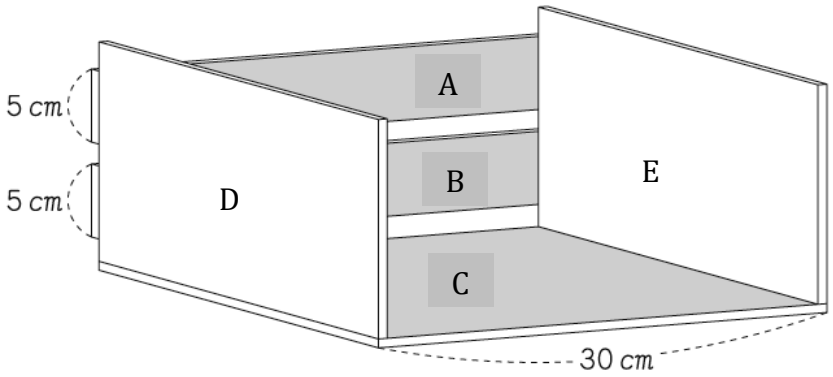
Kenta

Kyoko's expression will not give the change of 150-yen. If we use ( ), we can find the correct answer.

Place ( ) in the expression on the **answer sheet** so that the calculation will give the correct answer of 150-yen.

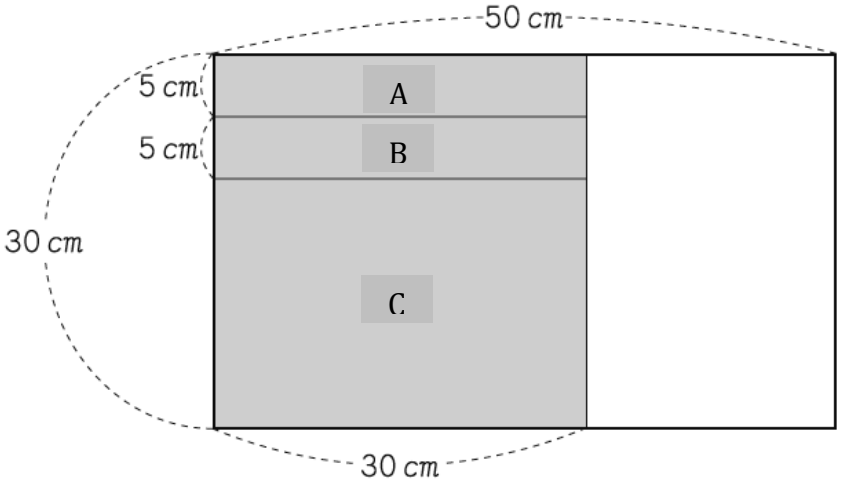
[2] Yoshio and his friends are making a bookcase in the Art class.

(1) Yoshio is planning to make a bookcase shown below.

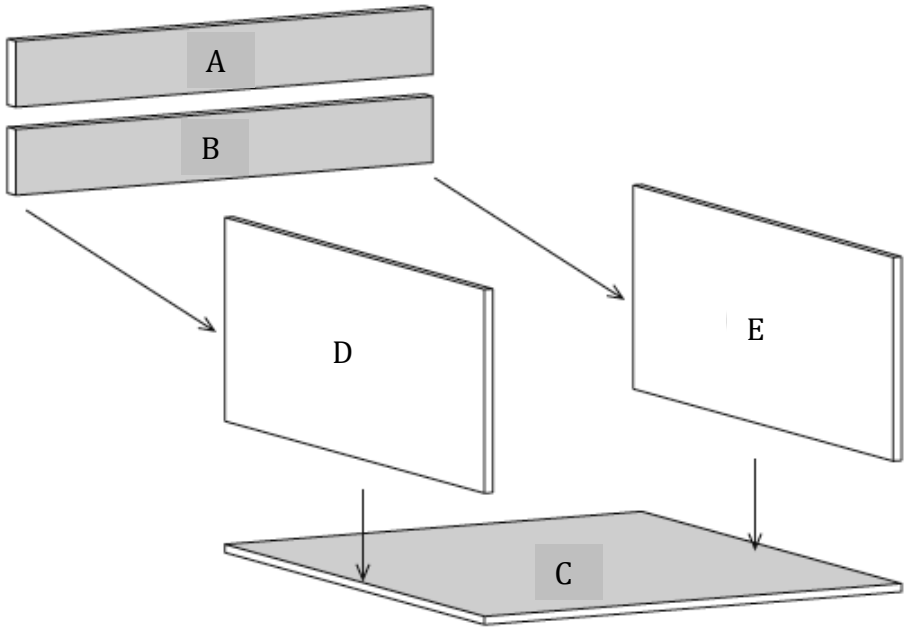


The boards they will use to make this bookcase are like the one shown below. The board is a rectangle with the vertical sides of 30 cm and the horizontal sides of 50 cm.

The rectangular pieces, A, B and C are cut from the region as shown below. From the remaining region, we will make the rectangular pieces D and E so that there will not be any wasted part of the board.



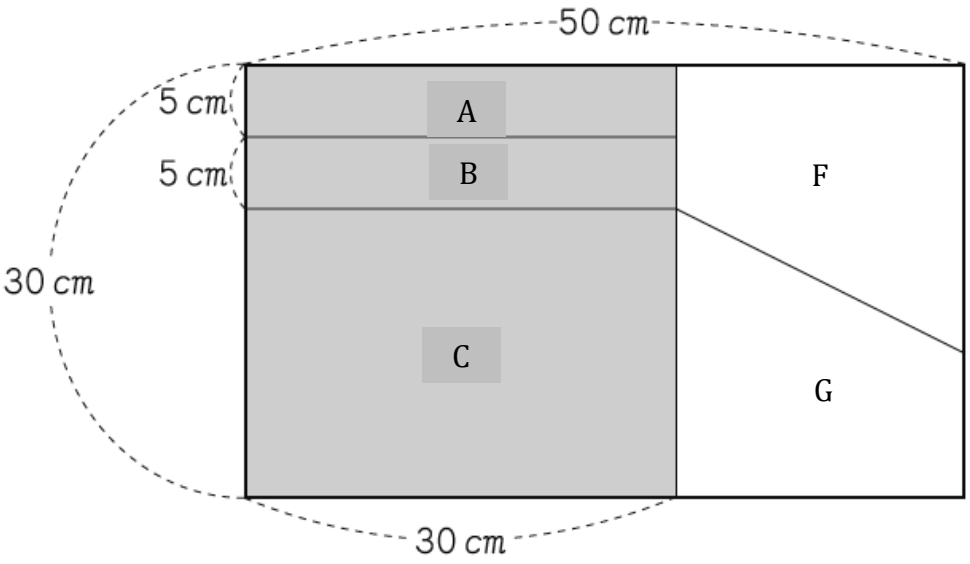
The 5 rectangular pieces will be put together as shown below.



What kind of rectangle the board D is? Write your answer using the words and the lengths of the sides.

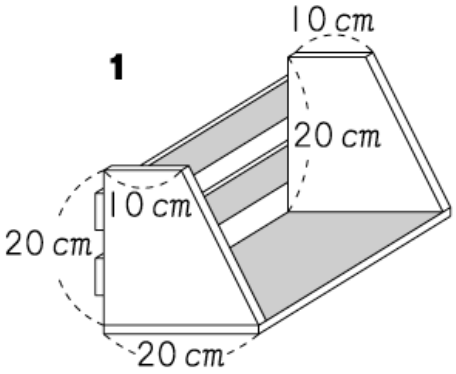
(2) Manami is going to cut the ■ region into Rectangles A, B and C like Yoshio.

She will cut the remaining □ region into 2 congruent trapezoids, F and G, as shown below.



If she cuts the board as shown, how will her bookcase look like when the pieces are put together? Select 2 from **1** through **6** below and write the numbers.

1



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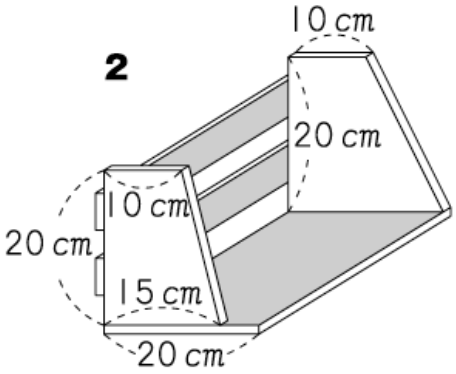
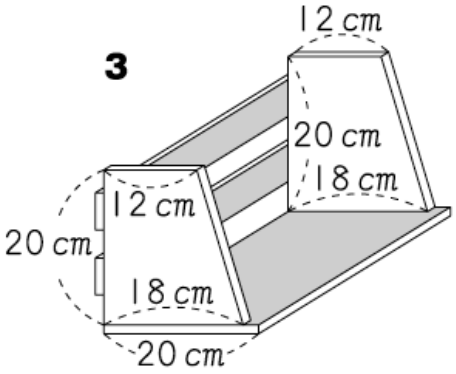
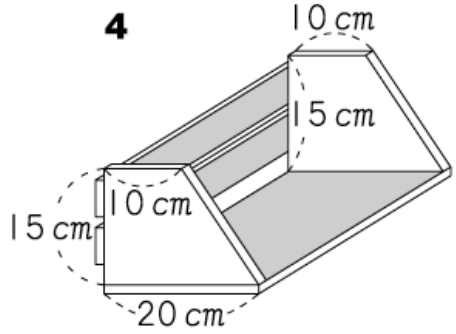


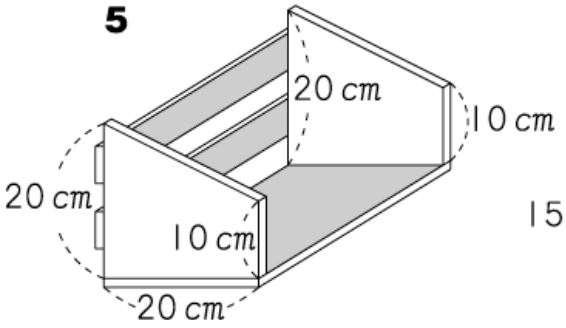
3



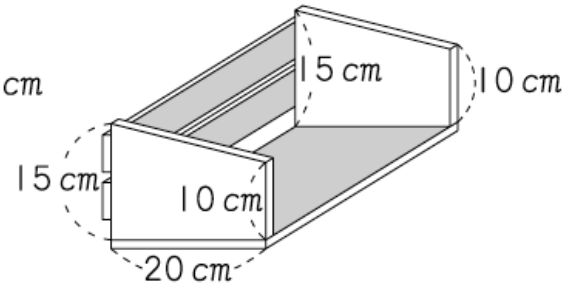
4



5



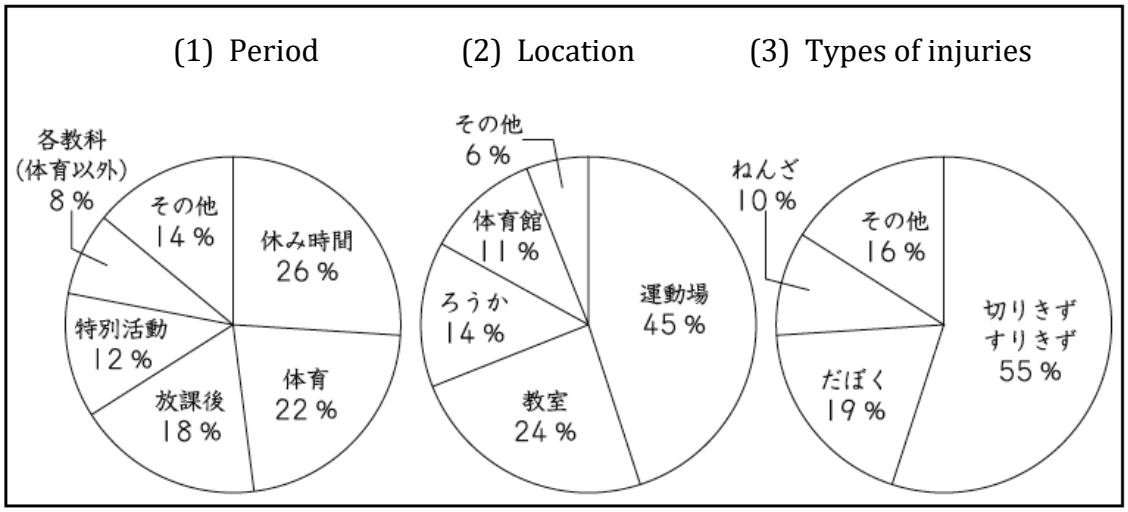
6



[3] Makoto is investigating the accidents that resulted in injuries at his school last year.

(1) First, he is examining the 3 circle graphs shown below. These graphs show the time, location, and the type of injuries.

Injuries at school in a year



>>> Labels in the circle graphs (from the largest sector, clockwise)

Circle graph (1)
- Recess
- PE lesson
- After school
- Special Activity
- Lesson (other than PE)
- Others

Circle (2)
- Playground
- Classroom
- Hallway
- Gym
- Others

Circle (3)
- Cuts/Abrasions
- Bruises
- Sprains
- Others

Where at the school did the most injuries occur? Write your answer.

Next, he is examining the table below that summarized the types of injuries and periods when they occurred at his school last year.

Types of injuries and periods when they occurred

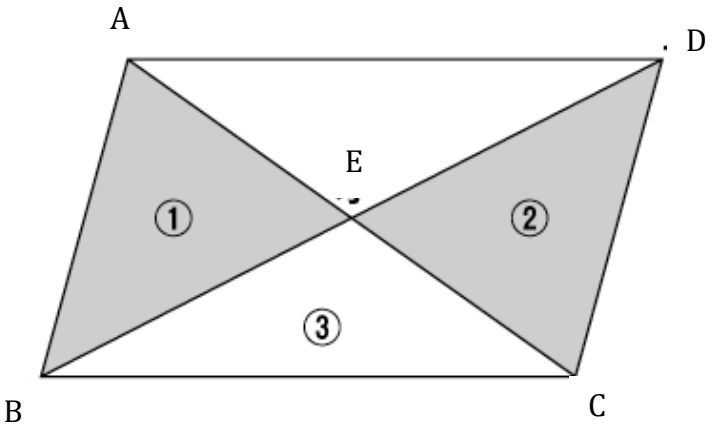
Period Type	Recess	PE lesson	After School	Special Activity	Lesson (other than PE)	Others	Total
Cuts Abrasions	125	91	84	52	31	81	464
Bruises	45	26	36	13	19	17	156
Sprains	17	28	12	9	7	7	80
Others	33	39	15	27	11	12	137
Total	220	184	147	101	68	117	837

(2) What does 36 in the table represent? Write your answer using the words in the table.

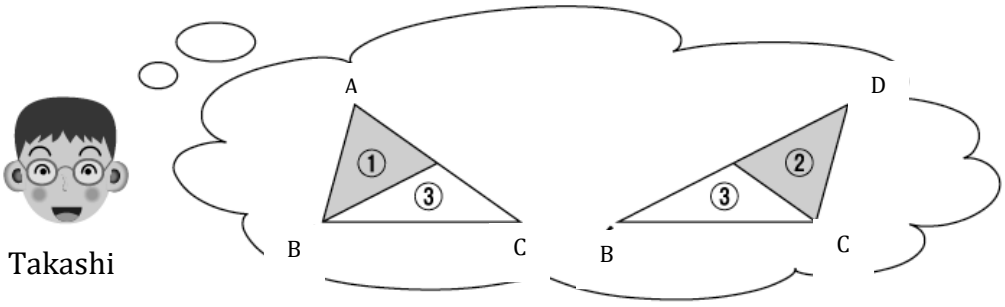
(3) Which of the circle graphs (1) through (3) above was drawn using the data from the ( ) part of the table above. Select one answer from **1** through **4** below and write the number.

1 Circle graph (1)
2 Circle graph (2)
3 Circle graph (3)
4 Circle graphs (1) and (3)

[4] Takashi and his friends are investigating the areas of triangle (1) and triangle (2) they get when they draw 2 diagonals in Parallelogram ABCD.



Takashi noticed that the areas of triangle (1) and triangle (2) are equal.

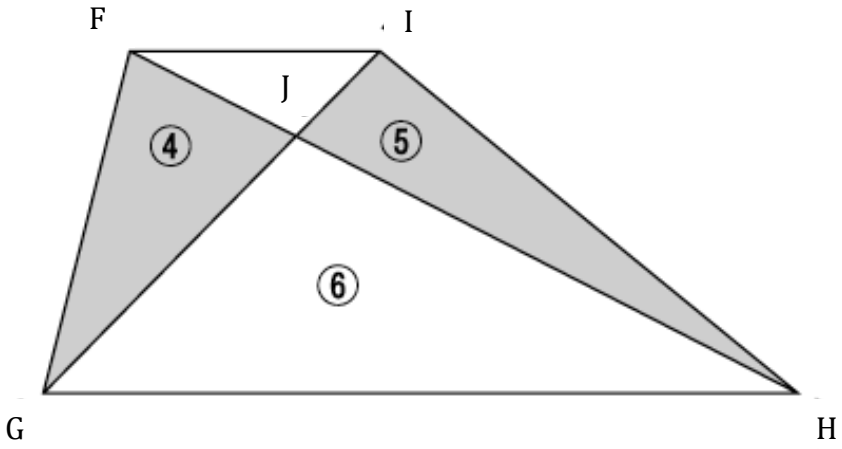


He then explained his reasoning as follows.

Takashi's Explanation

In Triangle ABC and Triangle DBC, the bases and the heights are the same, thus, the areas are equal. Triangle (3) is in common in these 2 triangles. Triangle (1) and Triangle (2) are obtained by subtracting the common Triangle (3) from the triangles of the equal area. Therefore, the areas of Triangle (1) and Triangle (2) are equal.

Next, they are investigating the areas of Triangle (4) and Triangle (5) they get when they draw 2 diagonals in Trapezoid FGHI.



Akane then said the following.

Akane

Triangle (4) and Triangle (5) are shaped differently.
However, if we use Takashi's reasoning, we can tell that their areas are equal.

How can we explain that the areas of Triangle (4) and Triangle (5) are equal **using the same reasoning as Takashi**?
In the [ ] below, write appropriate sentences. Write all your answer on the answer sheet.

Explanation

In Triangle FGH and Triangle IGH
the bases and the heights are the same, thus, the areas are equal.

Write all your answer on the answer sheet.

Therefore, the areas of Triangle (4) and Triangle (5) are equal.

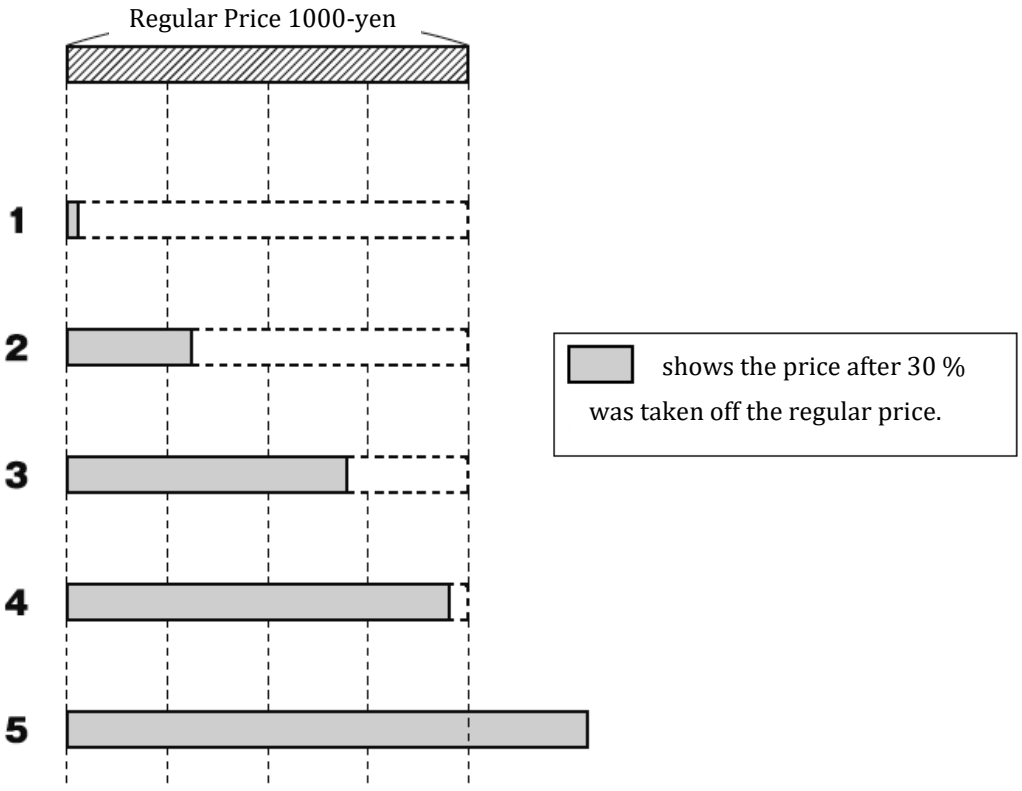
[5] Hiroshi went shopping.

(1) As shown on the right, there is a tag saying, "30% off the regular price," on a cap that sells regularly for 1000-yen.

30% off the regular price

Cap, Regular Price 1000-yen

Which of the following diagrams represents correctly the sale price of 30 % off the regular price compared to the regular price of 1000-yen? Select from **1** through **5** below and write the number.



(2) Hiroshi bought one each of the shirt, pants, and a pair of shoes with the regular prices as shown below.

A

Shirt,
Regular price
1900-yen

B

Pants,
Regular price
3900-yen

C

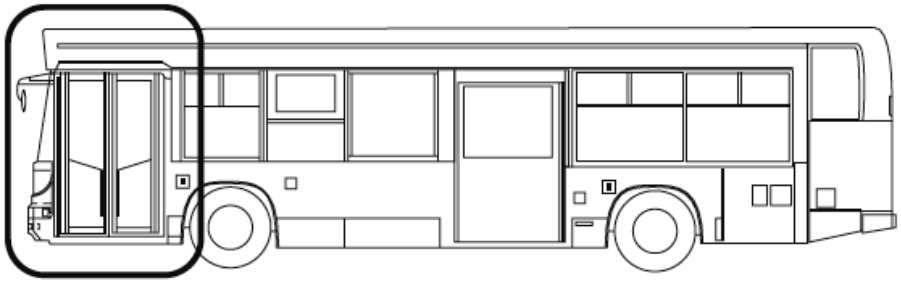
Shoes,
Regular price
5800-yen

Hiroshi has the coupon as shown on the right. On the coupon, it says, "Additional 20 % off on one item."

Coupon
Additional 20 % off on one item

If he uses the coupon on which item, Shirt, Pants, or Shoes, will the amount of discount be the greatest?
Select from **A** through **C** above and write the letter. Also, explain why the amount of discount will be the greatest if he uses the coupon with that item using words and expressions.

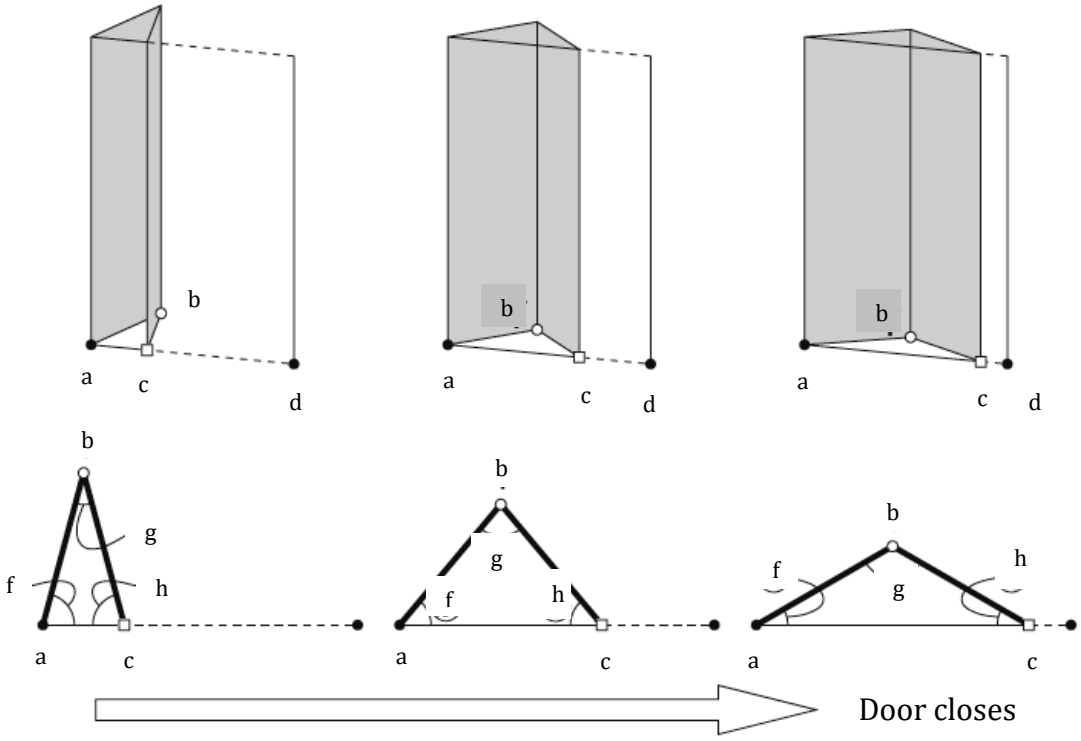
[6] We are going to think about the door on a bus (the part shown in ▯) as shown below. The door opens and closes by folding back in sections.



After observing the way the door closes, Sachiko and Yohei noticed the following.

The door is made up of 2 congruent rectangles joined together. When the door is open, the 2 rectangles are completely matched up.

If we represent the motion of the door as it closes, it will be like the figure below, and there are triangles at the bottom of the door.



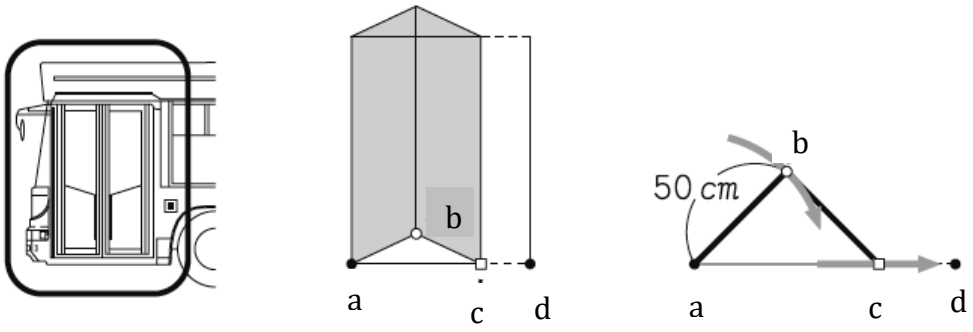
(1) What type of triangle is Triangle **abc** while the door is moving? Select one from **1** through **3** below and write the number.

1 Right triangle
2 Isosceles triangle
3 Equilateral triangle

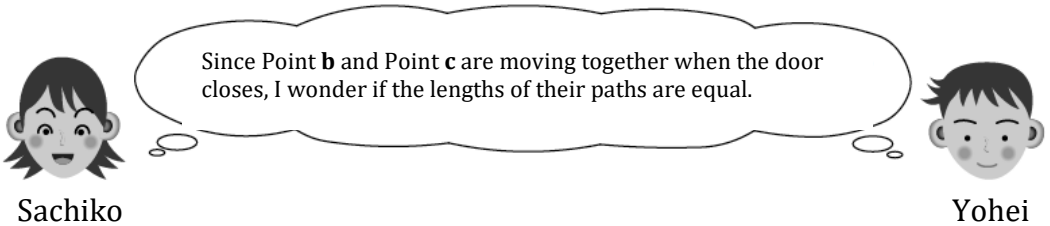
Select the reason that the triangle is always of that type from **A** through **E** below and write the letter.

A Because the lengths of the three sides in Triangle **abc** are equal.
B Because the lengths of side **ab** and side **bc** are equal.
C Because the lengths of side **ac** and side **bc** are equal.
D Because angle **g** is a right angle.
E Because angle **h** is a right angle.

(2) They noticed that Point **b** and Point **c** travel through different paths as shown in the figure below.



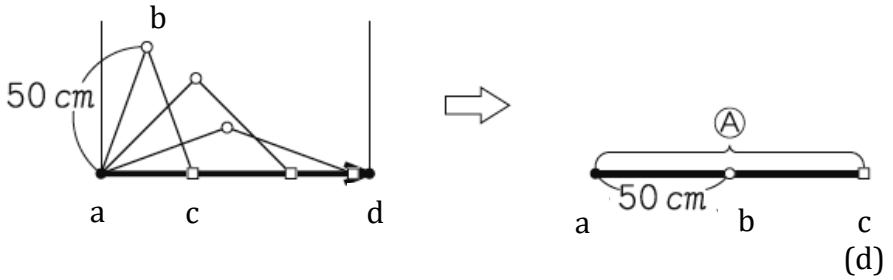
They thought the following



Sachiko Yohei

We are going to compare the length of the path for Point **c** and the length of the path for Point **b**.
The length of side **ab** is 50 cm.

Sachiko thought about the path for Point **c** as follows.

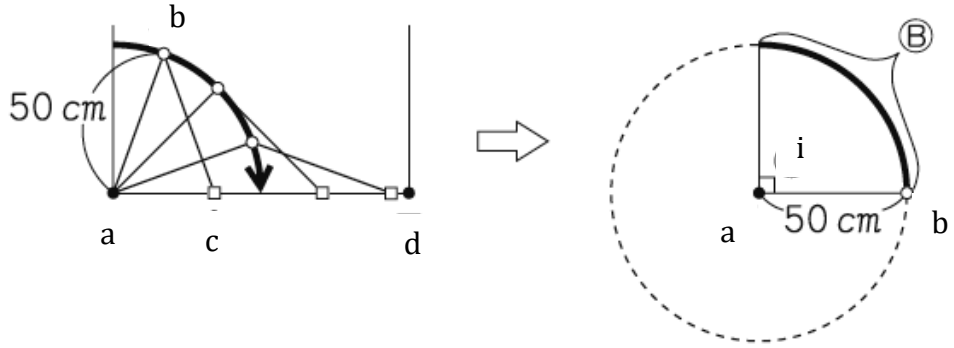


The path for Point **c** (labeled A) is a segment connecting Point **a** and Point **d**.
The length of (A) is twice of the length of side **ab**.

50 × 2 = 100

The length of (A) is 100 cm.

Yohei thought about the path for Point **b** as follows.



The path for Point **b** (B) is a part of a circle centered at point *a* and the radius of side **ab**.
Angle **i** is 90 degrees.

If we compare the length of path for Point **b** (B) and the length of path for Point **c** (A) (100 cm), what can we say?

Select the correct one from **1** through **3** below and write the number.
Also, write the reason you chose the number by using the expression to calculate the length of (B) and words.
Use 3.14 as the value of *pi*.

1 The length of (B) is longer than the length of (A) (100 cm).

2 The length of (B) is shorter than the length of (A) (100 cm).

3 The length of (B) is equal to the length of (A) (100 cm).