[4th Kyu] Section 2: Application Test

1 There are two fish tanks, A and B. Tank A can hold 27 L of water and tank B can hold 36 L of water.

(1) Write the ratio of the volume of tank A to the volume of tank B in simplest form.

(2) 35 fish are divided into the two tanks such that the ratio of the number of fish in tank A to tank B is equal to the ratio of their volumes. Find the number of fish in tank A and in tank B.

2 Becky walks at a speed of 80 m per minute. Answer the following and include units in your answer.

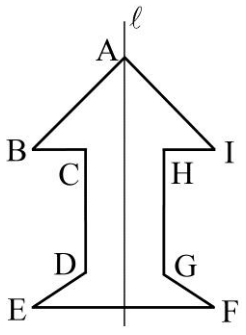
(3) It takes 8 minutes for Becky to go to school from her home. Find the distance, in m, to school from her home.

(4) The distance to a station from her home is 2 km. How long, in minutes, does it take for Becky to go to the station from her home?

3 The figure on the right has axis of symmetry ℓ.

(5) Find the vertex that is symmetric to vertex C with respect to ℓ.

(6) Find the side that is symmetric to side GF with respect to ℓ.



4 17 added to a number is equal to 15 subtracted from that number then multiplied by 5. Let that number be x and answer the following.

(7) Write the equation in terms of x. (*Expression skill*)

(8) Find the value of x.

5 Researchers made a guideline for physical activities using two measurements.
The metabolic equivalent of task (MET) is used as a unit expressing the intensity of physical activities as multiples of resting metabolic rate. The exercise (Ex) is used as a unit expressing the quantities of physical activities. The relationship between MET and Ex is

$$1\,\text{Ex} = 1\,\text{MET} \times 1\,\text{hour}.$$

Doing physical activities with 23 Exs or more in a week is thought to be good for health. For example, if you do physical activities of 4 METs for 2 hours, the Exs you consume is calculated by

$$4\,\text{METs} \times 2\,\text{hour} = 8\,\text{Exs}.$$

The table on the right shows the relationship between various physical activities and the corresponding physical intensity (MET). Physical activities are divided into two parts, sports and life activities.

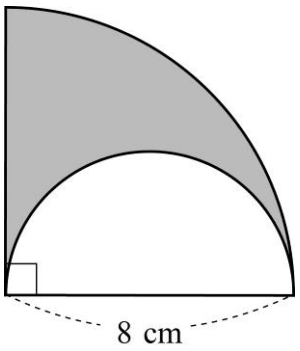
METs	Physical activities	
	Sports	Life activities
3	Bowling	Walking
4	Ping-pong	Cycling
5	Baseball	Playing with animals (running)
6	Basketball	Moving furniture
7	Tennis	
8	Swimming	Going up stairs

(9) How many Exs do you consume when you move furniture for 2 hours?

(10) Linda swims for 1 hour and plays basketball for 5 hours in a week. Find the total amount, in Exs, of physical activities she consumes in a week from the two activities.

(11) Emily planned to consume 23 Exs in a week by playing tennis and ping-pong. If she plays tennis for 1 hour in a week, at least how many hours does she have to play ping-pong for in a week? Include units in your answer.

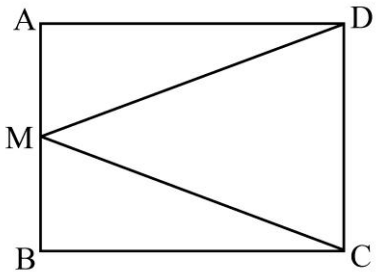
6 In the diagram on the right, there is a semicircle of diameter 8 cm in a sector whose radius is 8 cm and its central angle is $90°$. Include units in your answer and use π for the ratio of the circumference of a circle to its diameter.



(12) Find the area, in cm^2, of the sector whose radius is 8 cm and its central angle is $90°$.

(13) Find the area, in cm^2 of the shaded part. Write the steps leading to your answer.

7 The diagram shows rectangle ABCD. Let M be the midpoint of side AB. When connecting point M to vertices C and D, $\angle AMD = \angle BMC$ will be proven in the simplest way using congruent triangles.



(14) Which two triangles should be shown to be congruent?

(15) Which conditions are required to prove that the two triangles in your answer for (14) are congruent? Choose three conditions from the following and write the corresponding letters.

(a) $AD = BC$ (b) $MD = MC$ (c) $AM = BM$
(d) $\angle AMD = \angle BMC$ (e) $\angle MAD = \angle MBC$ (f) $\angle ADM = \angle BCM$

(16) Explain in words the condition for congruent triangles in your answer for (14).

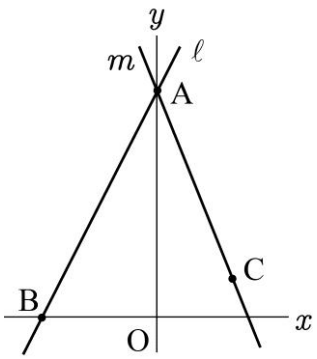
8 In the diagram on the right, each number from 1 to 16 is assigned to each of the 16 squares so that the sum of the 4 numbers in any row, column or diagonal is the same. (This kind of square is called a magic square) Seven numbers are already assigned. (*Organizing skill*)

a	14	15	b
12	c	6	d
e	f	10	g
h	i	3	16

(17) Find the sum of four numbers in a row, column or diagonal.

(18) Find the numbers for a and h.

9 In the diagram on the right, the straight line $y = 2x + 6$, denoted by ℓ, passes through the y-axis and x-axis at A and B, respectively. The coordinates of point C is (2, 1). Let m be the straight line that passes through points A and C.



(19) Find the coordinates of point B.

(20) Find the equation of straight line m. Write the steps leading to your answer. (*Expression skill*)