4th Kyu

Section 2 : Application Test

数学検定

PROFICIENCY TEST
IN
PRACTICAL MATHEMATICS

Test Time : 60 minutes

Test Instructions

1. Make sure that you have the correct level (Kyu) test.
2. Do not open the booklet until you are told to do so.
3. Write your name and examinee number on this page.
4. Write your name, examinee number and other necessary information on the answer sheet.
5. Write your answers on the answer sheets provided. Follow any instructions given when solving the problems.
6. If your answer contains a fraction, write the fraction in simplest form by reducing it to lowest terms.
7. You may use a calculator.
8. Turn off your cell phone and do not use it during the test.
9. Ask an examination supervisor if your problem sheets have inconsistent page numbering or missing pages.
10. It is prohibited to disclose the problems to the general public, such as on the Internet, without permission.

Please submit this test upon agreeing to the following "handling of personal information".

Information regarding the handling of all personal information attached to this form

1. Name of Organization : The Mathematics Certification Institute of Japan
2. Title, Affiliation and Contact Information of Personal Information Protection Administrator :
   Title : Personal Information Protection Administrator
   Department: Secretariat Contact Information : 03-5812-8340
3. Purpose for Use of Personal Information : Management of examinee information, marking, and for the purpose of identifying candidates
4. Provision of Personal Information to Third Parties : In cases where an application is made through the organization's office, registration information, names, test level and test results for the purpose of informing certification results via the Internet, fax, mail or electronic mail attachment, etc. will be provided to the applicant.
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   The Mathematics Certification Institute of Japan, Certification Inquiry Desk
   Bunshodo Building 6F, 5-1-1 Ueno, Taito Ward, Tokyo, 110-0005
   Tel : 03-5660-4804 (Monday to Friday 9:30-17:00 not including national holidays, New Year's holidays and organization holidays)
7. Voluntariness of the Provision of Personal Information : Whether to provide personal information to the Organization is entirely up to the examinee. However, if the Organization does not receive accurate information, it may not be possible to provide certain services in an appropriate manner.

Name	
Examinee Number	—

公益財団法人
日本数学検定協会
The Mathematics Certification Institute of Japan

[4th Kyu] Section 2: Application Test

1 There are four basketball teams A, B, C and D. Each team plays every other team once.

(1) How many games does team A play?

(2) Find the total number of games.

2 Answer the following.

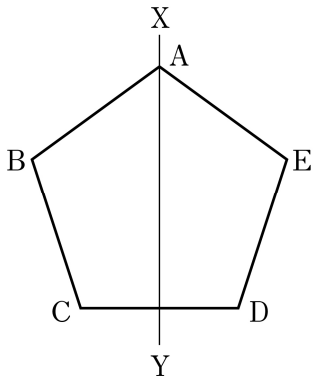
(3) Alice has 30 candies and Billy has 18 candies. Express the ratio of the number of Alice's candies to the number of Billy's candies in simplest form.

(4) Candies are distributed to Charlie and Dan. Charlie gets 24 candies. The following show the ratios of the number of Charlie's candies to the number of Dan's candies. For which ratio does Dan get the greatest number of candies? Choose one and write the corresponding letter.

(a) 1 : 1 (b) 2 : 3 (c) 3 : 4

(d) 4 : 5 (e) 6 : 7 (f) 8 : 9

3 A regular pentagon has several axes of symmetry. Consider the regular pentagon ABCDE shown on the right.



(5) XY is an axis of symmetry. Find the vertex that is symmetric to vertex D with respect to XY.

(6) How many axes of symmetry does the regular pentagon ABCDE have in total including XY?

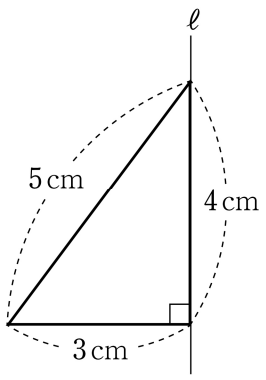
4 Consider the following six numbers.

$$4, \quad \frac{1}{3}, \quad -3, \quad -3.5, \quad -\frac{9}{2}, \quad 0$$

(7) Find the least number.

(8) Find all numbers that become positive numbers when -3 is subtracted from the number.

5 The figure on the right shows a right-angled triangle. A cone is formed by revolving the right-angled triangle about line ℓ. Include units in your answer. Use π for the ratio of the circumference of a circle to its diameter.

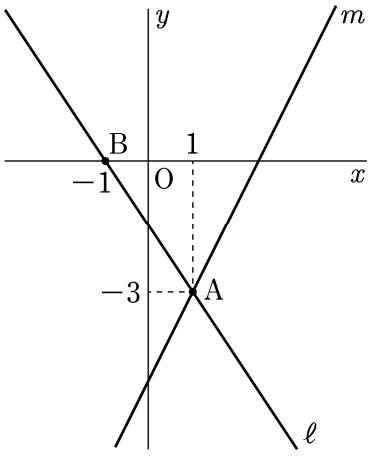


(9) Find the slant height, in cm, of the cone.

(10) Find the base area, in cm^2 of the cone.
(*Measurement skill*)

(11) Find the volume, in cm^3, of the cone. Write the steps leading to your answer. (*Measurement skill*)

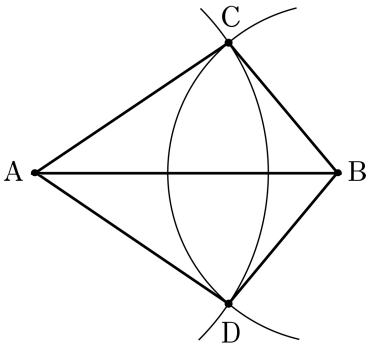
6 Two lines ℓ and m are shown on the right. Line ℓ passes through two points A(1, -3) and B(-1, 0). Line m has a slope of 2 and passes through point A.



(12) Find the equation of line ℓ.

(13) Find the equation of line m.

7 Line segment AB is given. Sara constructed two triangles shown on the right by following the steps below.



1. Draw an arc with its center at A.
2. Draw an arc with its center at B such that the arc crosses the previous arc at two points. Let C and D be the points of intersection.
3. Draw line segments AC, AD, BC and BD.

Answer the following when proving that $\triangle ABC$ and $\triangle ABD$ are congruent in the simplest way.

(14) Which conditions are required to prove that $\triangle ABC$ and $\triangle ABD$ are congruent? Choose three conditions from the following and write the corresponding letters.

(a) $AB = AB$ (b) $BC = BD$ (c) $CA = DA$

(d) $\angle ABC = \angle ABD$ (e) $\angle BCA = \angle BDA$ (f) $\angle CAB = \angle DAB$

(15) Explain in words the condition for proving that $\triangle ABC$ and $\triangle ABD$ are congruent.

(16) Kevin followed the same steps as Sara's construction with different radii for the arcs. In Kevin's construction, $\angle CAB = 50°$ and $\angle CBA = 27°$. In Kevin's construction, find the measurement of $\angle BDA$. Include units in your answer.

8 The table on the right shows the deepest point and average depth for three oceans.

(*Statistical skill*)

Deepest point and average depth

Ocean	Deepest point (m)	Average depth (m)
Pacific	10920	4188
Atlantic	8605	3736
Indian	7125	3872

(17) Which ocean has the least difference between the deepest point and average depth? Also find the difference, in m. Include units in your answer.

(18) The height of Mount Everest, the highest mountain in the world, is 8848 m. How many times greater is the deepest point of the Pacific Ocean than the height of Mount Everest? Round your answer off to one decimal place.

9 A tourist walks to a hotel from a temple along the streets according to the following rule.

> The route from the temple to the hotel is to be as long as possible within the given area without visiting the same intersection twice.

Figure 1, for example, shows a map where the line segments and the crossing points represent streets and intersections, respectively. Point A represents the temple and point B represents the hotel. Within this area, one of the routes that satisfies the condition above is shown in Figure 2. If we call "one block" the length from one intersection to the next intersection, the tourist walks eight blocks in total in Figure 2. Note that every block has the same distance. (*Organizing skill*)

Figure 1

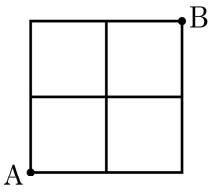


Figure 2

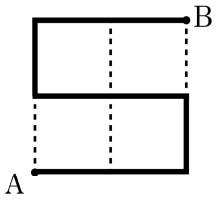


Figure 3

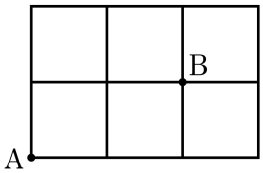
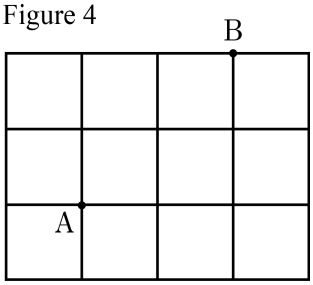


Figure 4



(19) Within the area in Figure 3, what route should the tourist walk from the temple (point A) to the hotel (point B) according to the rule? Draw the route clearly on the answer sheet. Although there are several possible routes, show only one of them.

(20) Within the area in Figure 4, how many blocks does the tourist walk from the temple (point A) to the hotel (point B) according to the rule?