Pre 2nd Kyu

Section 2 : Application Test

Test Time : 90 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 examinee number and name on this page.

4 . Write your name, examinee number and other necessary information on the answer sheets.

5 . Write your answers on the answer sheets provided. Write the steps leading to your answer. However if the problem says "Write only your answer", you do not need to write your steps.

6 . If your answer contains a fraction, write the fraction in simplest form by reducing it to lowest terms.

7 . If your answer contains a radical, write your answer in simplest radical form. For example, $\sqrt{12}$ must be expressed as $2\sqrt{3}$.

8 . You may use a calculator.

9 . Turn off your cell phone and do not use it during the test.

10. Ask an examination supervisor if your problem sheets have inconsistent page numbering or missing pages.

11. It is prohibited to disclose the problems to the general public, such as on the Internet, without permission.

Examinee Number		–	Name	

[Pre-2nd Kyu]   Section 2: Application Test

1 In the figure of circle O with diameter AB, point C lies on the circumference and $AC = 6\,cm$ and $BC = 4\,cm$. (*Measurement skill*)
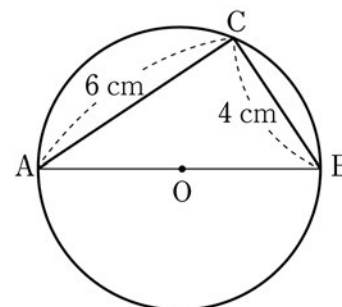
(1)   Find the length of line segment AB.

(2)   Find the length of the side of the square whose diagonal is line segment AB. Write only your answer.
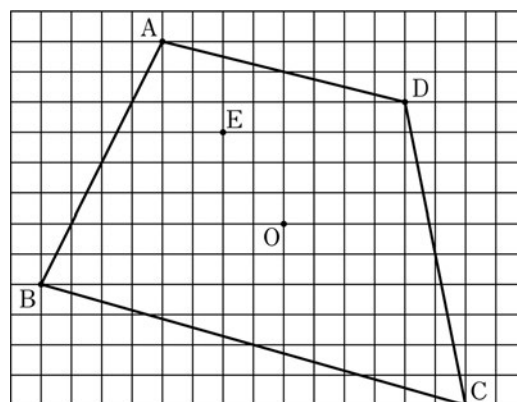
2 Answer the following.

(3)   The figure shows quadrilateral ABCD and two points O and E. Draw quadrilateral EFGH using a ruler that satisfies all the following conditions.

(*Construction skill*)

- Quadrilateral ABCD is similar to quadrilateral EFGH.

- The ratio of the lengths of the corresponding sides of quadrilaterals ABCD to EFGH is 2 : 1.

- Point O is the center of similarity.

3 Answer the following.

(4)   If $a = 3\sqrt{11} - 4\sqrt{7}$ and $b = \sqrt{11} - 2\sqrt{7}$, find the value of $a^2 - 6ab + 9b^2$. Write only your answer.

## 4 Answer the following by using some of the values below.

θ	$\sin\theta$	$\cos\theta$	$\tan\theta$
26°	0.4384	0.8988	0.4877
36°	0.5878	0.8090	0.7265

(5)   Find the value of $\sin 64°$. Round your answer off to three decimal places. Write only your answer.

(6)   A tower stands on horizontal ground as shown in the figure. AB represents the height of the tower. The distance between points B and C is 50 m. Looking at point A from point C, the angle of elevation $\angle$BCA is 36°.
Find the height, in m, of tower AB. Round your answer off to one decimal place.

(*Measurement skill*)
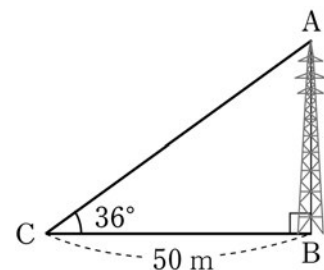
5   Answer the following.

(7)   Let a be a constant. Find the range of values of a such that the quadratic equation $x^2 + (1-3a)x + a^2 - a + 1 = 0$ has two distinct real roots.

6   In a game, a player has a chance to get one of three items, A, B and C. Each item has a level of rarity (★★★ to ★) that indicates how unlikely it is for a player to get it (★★★ is the rarest). The table shows the probability of getting each item. Note that the probabilities are the same for each chance.

Item	Rarity	Probability
A	★★★	$\dfrac{1}{20}$
B	★★	$\dfrac{1}{5}$
C	★	$\dfrac{3}{4}$

(8)   When a player has two chances successively to get items, what is the probability of getting two item As? Write only your answer.

(9)   When a player has three chances successively to get items, what is the probability that the player gets at least one item A or B?

7 Answer the following.

(10) Given a positive integer n, a positive integer N is obtained by performing the following operation.

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① If n is even, N is obtained by multiplying n by $\dfrac{3}{2}$.

② If n is an integer that leaves a remainder of 1 when dividing by 4, N is obtained by dividing $n-1$ by 4, and then multiplying the result by 3, and adding 1.

③ If n is an integer that leaves a remainder of 3 when dividing by 4, N is obtained by dividing $n+1$ by 4, and then multiplying the result by 3, and subtracting 1.

Replace the obtained number N with n and perform the operation repeatedly. For example, starting with $n=17$, the number 12 is obtained by performing the operation six times as follows:

$$17 \xrightarrow{②} 13 \xrightarrow{②} 10 \xrightarrow{①} 15 \xrightarrow{③} 11 \xrightarrow{③} 8 \xrightarrow{①} 12$$

Starting with $n=4$, the number 4 is obtained again by performing the operation several times. Find the least number of operations to obtain the number 4. Write only your answer. (*Organizing skill*)