VIETNAM INTERNATIONAL APPLIED MATHEMATICS COMPETITION

MOCK TEST LEVEL 5

INTERMEDIATE

(Grade 9 - 10)

I. MULTIPLE CHOICE QUESTIONS

Question 1. A farmer stocked a newly dug pond with 1000 fish fingerlings. It is known that each year, the number of fish in the pond increases by x times the initial number, and x is constant. By changing the farming techniques and fish feed, after two years, the number of fish in the pond is 36000. What is the annual growth rate of the fish population in the pond? Assume the growth rate each year is constant.

A. 2 **B.** 5 **C.** 3 **D.** 4

Question 2. An wants to buy some notebooks and pens to prepare for the new school year. The price of 1 notebook is 5,000 VND, and the price of 1 pen is 3,000 VND. An has a total of 76,000 VND. An wants to buy a total of 18 items (including both notebooks and pens). How many notebooks and how many pens did An buy?

A. 10 notebooks, 8 pens B. 11 notebooks, 7 pens

C. 12 notebooks, 6 pens D. 9 notebooks, 9 pens

Question 3. A publishing house needs to print at most 500 books with two printing options:

- Printer A: Fixed cost is 2,000,000 VND, and each book costs an additional 10,000 VND.
- Printer B: Fixed cost is 4,000,000 VND, and each book costs an additional 8,000 VND. How many books should the publishing house print to minimize the total cost, and what is that optimal cost?

A. Print 500 books using Printer A, total cost 7,000,000 VND

B. Print 500 books using Printer B, total cost 8,000,000 VND

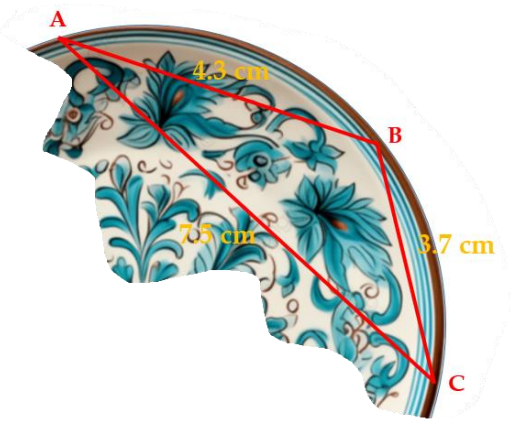
C. Print 1,000 books using Printer B, total cost 12,000,000 VND

D. Print 1,500 books using Printer B, total cost 16,000,000 VND

Question 4. A rectangular football field has an area of 600 m^2. It is known that if the length is decreased by 5 m and the width is increased by 5 m, the field becomes a square. What was the original length of the football field (round the result to the first decimal place)?

A. 30 B. 31 C.32 D.33

Question 5. In an archaeological excavation of an ancient tomb, archaeologists found a broken ancient circular disk. The archaeologists want to restore the shape of this disk. To determine the radius of the disk, the archaeologists took 3 points on the disk and measured them, obtaining the results as shown in the figure (AB=4.3 cm, BC=3.7 cm, CA=7.5 cm). What is the radius of this disk?



A. 5,73 *cm*. **B.** 6,01 *cm*. **C.** 5,85 *cm*. **D.** 4,57 *cm*.

Question 6. Nam has the following schedule:

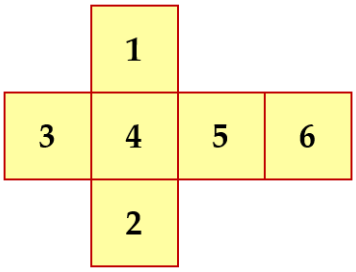
- Motorbike maintenance is done once every 15 days, with the first maintenance on January 5, 2025 (Sunday).
- Health check-ups are done once every 20 days, with the first check-up on January 10, 2025 (Friday).

Today is December 25, 2025 (Thursday). What is the next closest day after today when An has both the maintenance and the health check-up on the same day? What day of the week is that?

A. February 14, 2026 (Saturday) B. February 19, 2026 (Thursday)

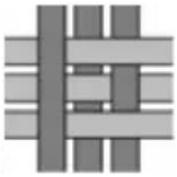
C. February 15, 2026 (Sunday) D. February 18, 2026 (Wednesday)

Question 7. When forming a cube, which numbered face will be opposite to the face with number 4?

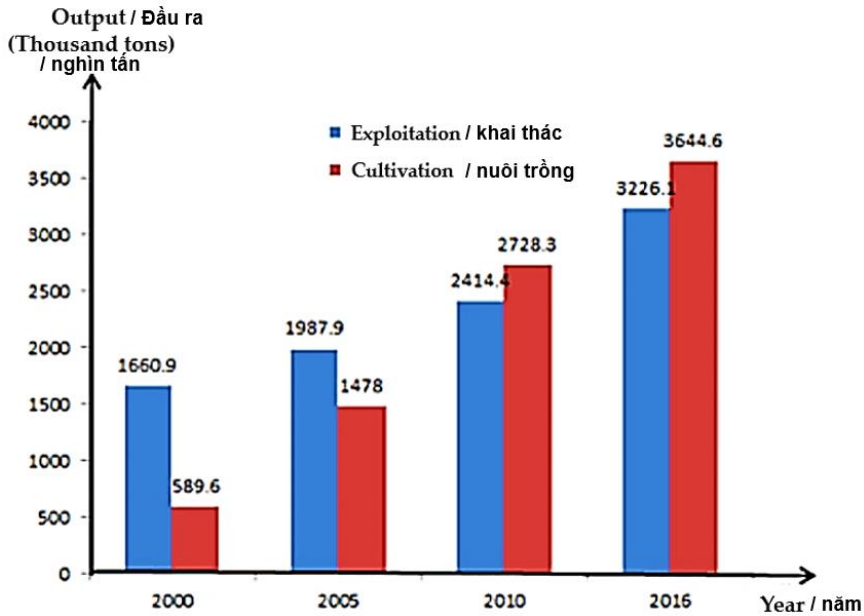


A. 1 B. 3 C. 5 D. 6

Question 8. Six paper strips are woven into a pattern (see below). What do you see when looking at this pattern from behind?

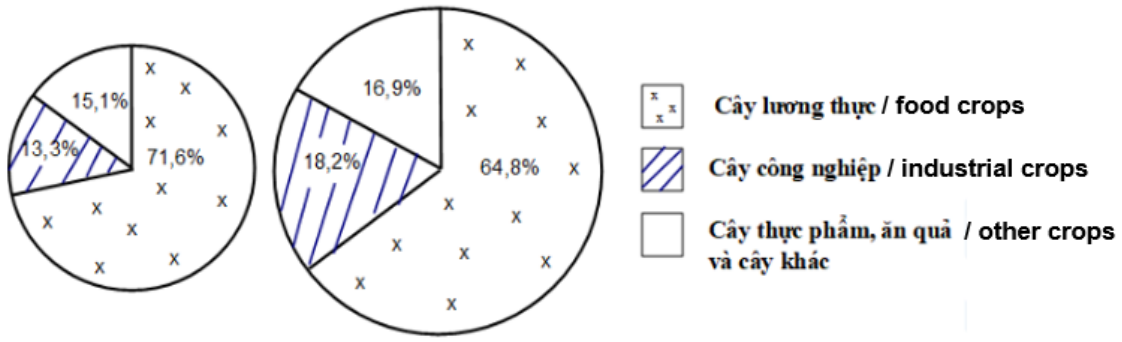
A.  B.  C.  D. 

Question 9. Below is a chart of the exploitation and cultivation output of our country from 2000 to 2016. From what year did the cultivation output exceed the exploitation output?



A. 2000 B. 2005 C. 2010 D.2016

Question 10. Below is a chart of the structure of planted areas for different crop groups in our country in 1990 and 2002. From 1990 to 2002, which of the following statements is true?



Biểu đồ cơ cấu diện tích gieo trồng các nhóm cây năm 1990 và 2002(%)
/ Chart of area structure of planted tree groups in 1990 and 2002 (%)

A. Food crops increased; industrial crops increased

B. Food, fruit, and other trees increased; food crops decreased

C. Industrial crops increased; food crops increased

D. Food crops decreased; food, fruit, and other trees decreased

Question 11. In a meeting room, there are 6 chairs arranged in a row. There are 4 people (A, B, C, D) and 2 empty chairs. How many ways are there to arrange the seating such that all of the following conditions are satisfied: A and B must not sit next to each other. C and D must sit next to each other. No two empty chairs are next to each other.

A. 48 B. 72 C. 96 D. 120

Question 12. Nam rolls a fair 6-sided die (with numbers from 1 to 6) and flips a fair coin. Calculate the probability that: "The number rolled on the die is a prime number and the coin lands on heads (H), OR the number rolled on the die is a multiple of 3 and the coin lands on tails (T)."

A. $\frac{5}{12}$ B. $\frac{7}{12}$ C. $\frac{1}{2}$ D. $\frac{2}{3}$

Question 13. You need to open a 3-digit lock (from 000 to 999). It is known that: the code does not contain the digit 0. Exactly 1 digit is in the correct position compared to the real code. Exactly 1 digit is correct but in the wrong position compared to the real code. You have tried 3 codes and received feedback as shown in the table. What is the exact code?

Attempt	Entered Code	Number of digits in correct position	Number of digits correct but in wrong position
1	1 2 3	1	1
2	3 2 1	0	2
3	4 5 6	0	1

A. 142 B. 214 C. 314 D. 421

Question 14. There are 45 students who took a test. No one scored below 2, and only 4 students scored 10. What is the minimum number of students who could have the same test score (test scores are integers from 1 to 10)?

A. 5 B. 6 C. 7 D. 8

Question 15. In an exam, each correct answer earns 4 points, each incorrect answer deducts 2 points, and not answering deducts 1 point. Minh took the exam consisting of 30 questions and scored 88 points. It is known that the number of questions Minh answered incorrectly is half the number of questions not answered. How many questions did Minh answer correctly?

A. 22 B. 23 C. 24 D. 25

II. SHORT ANSWER QUESTIONS

Question 16. Mr. Nam has two options for borrowing 100 million VND from a bank for 12 months:

- Option 1: Pay interest monthly on the original principal with an interest rate of 0.8%/month.
- Option 2: Loan with decreasing principal balance and an interest rate of 1%/month (both principal and interest paid monthly). After 12 months, which payment method is cheaper?

Question 17. A production facility can produce two types of goods, I and II, from raw materials A and B. The daily supply of raw materials A and B is at most 12 and 18 units, respectively. To produce one unit of good I, 2 units of raw material A and 3 units of raw material B are required. To produce one unit of good II, 3 units of raw material A and 4 units of raw material B are required. The selling prices of goods I and II are 7 and 5 million VND, respectively. Furthermore, it is known that the daily consumption of good I does not exceed 3 units; the consumption of good II does not exceed 1 unit. The problem is to determine how many units of each good should be produced daily to maximize total revenue.

Question 18. Consider a cross **Aa x aa** resulting in F1. From F1, 3 individuals are randomly selected. What is the probability that all 3 individuals are genetically different?

Question 19. The following chemical equation is not balanced:

$$a\mathrm{CuO} + b\mathrm{NH_3} \rightarrow c\mathrm{Cu} + d\mathrm{N_2} + e\mathrm{H_2O}$$

Use the method of setting up a system of linear equations to determine the smallest positive integer coefficients *a, b, c, d, e* such that the equation is balanced. Calculate $P = a + b + c + d + e$

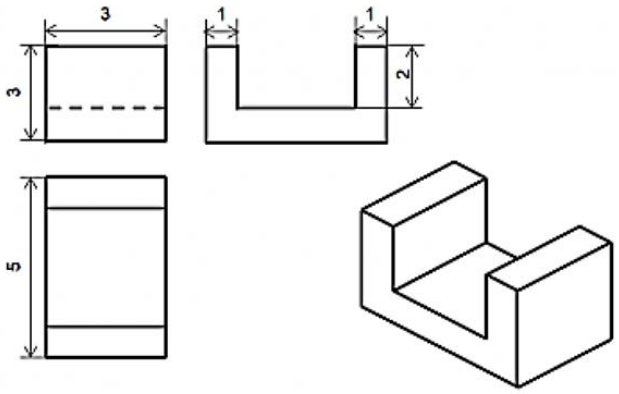
Question 20. A car intends to travel a certain distance at an initial speed of *v (km/h).* If the car increases its speed by 10 *km/h*, it will arrive 3 hours earlier. If the car decreases its speed by 10 *km/h*, it will arrive 5 hours later. Calculate the original speed *v (km/h*) of the car.

Question 21. Given the average rainfall chart for the first 6 months of 2025 in City X (*unit: mm*).

Month	**1**	**2**	**3**	**4**	**5**	**6**
Rainfall	20	35	80	120	180	250

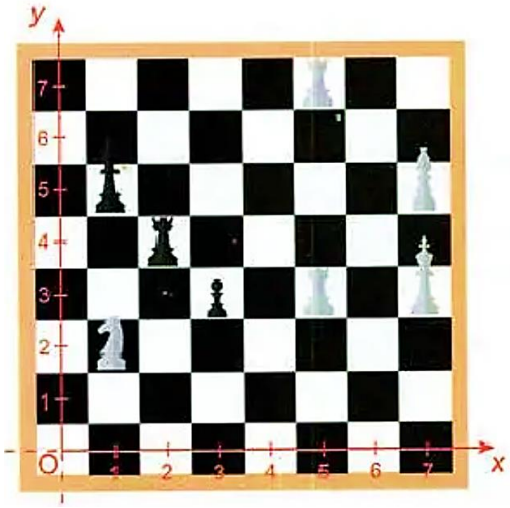
The area of the study region is known to be 15 km^2. Calculate the total volume of rainwater (in m^2) during the first 6 months (from January to June) and state the severity level if the rainfall exceeds 1.5 million m^3 (if it exceeds the threshold, by what percentage does it exceed?).

Question 22. Calculate the value of C given the geometric figure below.



Question 23. A concrete pouring funnel consists of a cylinder at the top connected to a frustum of a cone below, with dimensions as shown in the figure. Calculate the area of sheet metal required to form the funnel? (Round to the nearest square meter)

Question 24. In the figure below, the white knight piece is at coordinates (1;2). After one move, which positions can the knight reach to capture a black piece?



Question 25. A group of students is preparing for their semester exams. The teacher wants to build a machine learning model to predict their scores based on the number of hours they study each day. Data collected from 4 students is as follows:

Study hours/day (x)	1	2	3	4
Score (y)	3	6	7	8

Suppose the teacher proposes a prediction model of the form: y=2x+b (where b∈R,b>0). To measure the quality of this prediction model based on the data, the teacher introduces a quadratic function: $L(b)=\frac{1}{4}\left[\left(y_1-y_1\right)^2+\left(y_2-y_2\right)^2+\left(y_3-y_3\right)^2+\left(y_4-y_4\right)^2\right]$ which is a Loss Function used to determine the discrepancy between the predicted results and the actual values. In computer science, we use Algorithm 1 to find the minimum value of L(b) (Algorithm to approximate the minimum using the sweep method):

ALGORITHM 1

Input:

a: =0; c: =10; $\Delta = 0,1$; min_t: = a; min_L := L(a)

t: = a

while $t \le c$ do

value: = L(t)

if value <min_L then

min_L: = value

min_t = t

end if

t : = t + Δ

end while

Output:

(min_t; min_L)

Using ALGORITHM 1, we calculate the function L(t) at the 9th step and obtain A. Simultaneously, using the aforementioned model and mathematical tools, we find that the function L(b) achieves its minimum value as B (A is referred to as the approximate value of B). What is the difference A - B (all results rounded to the hundredths place)