



**UNITED NATIONS COLLEGE I.E.D.**  
**PREPARATORY WORKSHOP**  
**III TRIMESTER - 2024**  
**MATHEMATICS 11°**

This workshop must be copied and solved in the mathematics notebook, as a requirement to present the competency-based test.

**DELIVERY DATE: November 12th**

**IN QUESTIONS 1 TO 4 WRITE IN FRONT OF EACH SENTENCE IF IT IS TRUE OR FALSE ACCORDING TO THE FOLLOWING INFORMATION:**

A person who lives in Colombia has investments in dollars in the United States, and knows that the exchange rate of the dollar with respect to the Colombian peso will remain constant this month, with 1 dollar being equivalent to 4,000 Colombian pesos and that his investment, in dollars, will give profits of 3% in the same period. A friend assures him that in pesos his profits will also be 3%.

1. Your friend's statement is correct, since, regardless of the variations in the exchange rate, the proportion in which the investment in dollars increases is the same as in pesos. \_\_\_\_\_
2. Your friend's statement is incorrect, since the exact value of the investment should be known in order to calculate the amount of money he will earn. \_\_\_\_\_
3. Your friend's statement is correct, since 3% represents a fixed proportion in either currency, since the exchange rate will remain constant. \_\_\_\_\_
4. Your friend's statement is incorrect, since 3% represents an increase, which will be greater in Colombian pesos, since in this currency each dollar represents a value 4,000 times greater. \_\_\_\_\_

**ANSWER QUESTIONS 5 TO 7 ACCORDING TO THE FOLLOWING INFORMATION**

To train workers in some departments of a company in basic computing, an institution is hired that offers a 4-module educational plan (see table).

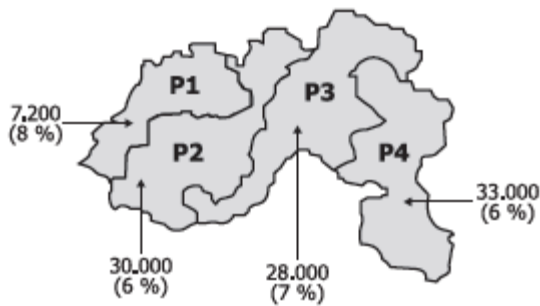
Basic computer training			
Module	Name of the module	Intensity time schedule	Value by time
I	Substantiation	40 h	\$35,000
II	Word processor	30 h	\$30,000
III	Calculation sheet	40 h	\$40,000
IV	Presentation with slides	10 h	\$45,000

The training of each module is done with courses of minimum 20 and maximum 30 people, from the same dependency.

5. The company will pay \$4,200,000 to train the workers of the "Inputs" department in module I. What is the minimum and maximum number of workers that the department could have?
6. If the 50 workers in the "Human Resources" department were charged for module II training, and they all paid the same amount, how much should each one pay for that training?
7. The company pays \$900,000 for the training of the 40 officials of the "Imports" department. According to the amount paid, which module does the training correspond to?

**ANSWER QUESTIONS 8 AND 9 ACCORDING TO THE FOLLOWING INFORMATION:**

The figure shows the number of deaths due to obesity and its percentage of total deaths per year, in four countries. Table 1 shows the classification made by the World Health Organization (WHO) of nutritional status, according to the body mass index (BMI). Table 2 shows the percentage of men and women between 26 and 60 years of age, in certain BMI ranges for P2.



**Figura. Muertes por obesidad.**

Clasificación	IMC (kg/m <sup>2</sup> )
Bajo peso (BP)	< 18,5
Normal (N)	18,5 - 24,9
Sobrepeso (SP)	25,0 - 29,9
Obesidad (O)	≥ 30,0
Obesidad leve (OL)	30,0 - 34,9
Obesidad media (OM)	35,0 - 39,9
Obesidad alta (OA)	≥ 40,0

**Tabla 1. Estado nutricional según IMC.**

**Tabla 2. Porcentaje de la población entre 26 y 60 años de edad, en ciertos rangos de IMC para P2.**

IMC (kg/m <sup>2</sup> )	< 18,5	18,5 - 24,9	25,0 - 29,9	30,0 - 34,9	35,0 - 39,9	≥ 40,0
Mujeres (%)	1	50	30	13	5	1
Hombres (%)	1	34	50	13	1	1

Datos tomados y adaptados de [www.searteriosclerosis.org](http://www.searteriosclerosis.org)

8. Information on obesity needs to be compared with information on deaths caused by another disease in P3. It is known that in P3 the number of deaths from this disease per year is 1,700. Taking this value, multiplying it by one hundred and dividing it by the total number of deaths in P3, we obtain the percentage of deaths caused by this disease. Using the information, Write in front of each statement if it is True or False regarding whether it is possible to determine what percentage of deaths in P3 occur due to this other disease.

- Yes, because by adding the number of deaths from the countries, the total number of deaths is obtained, which allows the requested percentage to be calculated. \_\_\_\_\_
- Yes, because we only need to know the total number of deaths in P3, which is obtained with the information in the figure. \_\_\_\_\_
- No, because the figure is missing data on the total number of deaths in each country. \_\_\_\_\_
- No, because P3 data is information on deaths due to obesity. \_\_\_\_\_

9. A person's BMI is calculated by dividing their weight (in kg) by their height (in m) squared. A man from P2 who is 30 years old, weighs 75 kg, and has a height of  $\frac{3}{2}$  m, What group are you part of?

10. In a game, a die is thrown twice and the winner is won if on the second roll the result is double what was obtained on the first throw. What is the probability of winning?

11. A hotel communications system uses the digits 2, 3, 4, and 5 to assign a different 4-digit telephone extension number to each room. How many hotel rooms can have a telephone extension?

12. In an educational institution there are two courses in the eleventh grade. The number of men and women in each course is listed in the table:

	Curso 11A	Curso 11B	Total
Number of women	22	23	45
Number of men	18	12	30
<b>Total</b>	<b>40</b>	<b>35</b>	<b>75</b>

The probability of choosing an eleventh grade student at this institution who is a woman is  $\frac{3}{5}$ . This value corresponds to the ratio between the total number of women and what other data?

13. In a factory, a survey is administered to employees to find out the means of transportation they use to get to work, and then decide whether to implement a route service. The results showed, among others, these three conclusions on a group of 100 employees who live near the factory and who travel only by bus or on foot:

- 60% of the group are women.
- 20% of women travel by bus.
- 40% of men get around by walking.

Build a table that compares the variables man, woman, bus, walking and that corresponds to the given data.

14. You can find rational numbers larger than an integer  $k$ , so that they are increasingly closer to it, by calculating  $k + \frac{1}{j}$  (with  $j$  positive integer).

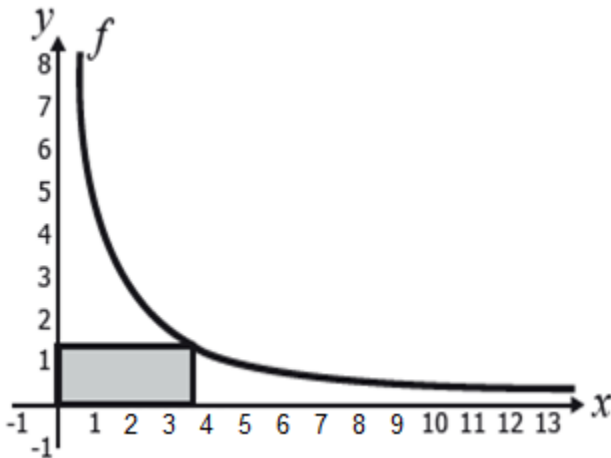
The larger  $j$  is, the closer the constructed rational will be to  $k$ . How many rational numbers can be constructed close to  $k$  and less than  $k + \frac{1}{11}$ ? Explain.

15. The area of rectangles that can be constructed from the origin, the axes, and a point that belongs to the graph of the function:

$$f(x) = \frac{5}{x}, \text{ where } x > 0,$$

It is described with the expression:

$$A_x = xf(x).$$



Represent on a Cartesian plane the variation that corresponds to  $A_x$ .

**ANSWER QUESTIONS 16 TO 18 ACCORDING TO THE FOLLOWING INFORMATION**

The Family Housing Subsidy (FHS) is a contribution provided by the State that constitutes a complement to savings, to facilitate the acquisition, construction or improvement of a social housing solution for citizens.

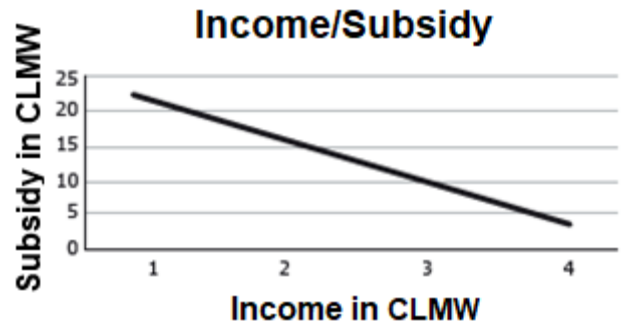
Below is the table of income in current legal monthly minimum wages (CLMW) and the subsidy to which you are entitled, for a certain year.

**FAMILY HOUSING SUBSIDY (FHS)**

Ingresos (SMMLV)		Valores \$		Valor de SFV en SMMLV
Desde	Hasta	Desde	Hasta	
0	1	0	535.600	22
1	1,5	535.601	803.400	21,5
1,5	2	803.401	1.071.200	21
2	2,25	1.071.201	1.205.100	19
2,25	2,5	1.205.101	1.339.000	17
2,5	2,75	1.339.001	1.472.900	15
2,75	3	1.472.901	1.606.800	13
3	3,5	1.606.801	1.874.600	9
3,5	4	1.874.601	2.142.400	4

16. With the FHS plus the savings that the family has and the credit obtained from a financial institution, the home can be purchased. What is the correct procedure to estimate the value of the credit that should be requested from the bank?

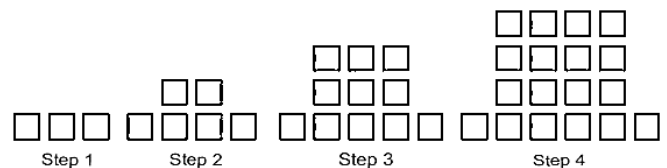
17. A person who observes the information in the table creates the graph presented below.



The graph presents an inconsistency. Why?

18. A family with income between 0 and 1 in current legal monthly minimum wages (CLMW) receives a subsidy equivalent to how many times the subsidy received by a family between 3.5 and 4 current legal monthly minimum wages (CLMW).

19. Observe the following pattern:



If the pattern continues, the amount of that should be used in step 50, is:

20. If the general term of a sequence is:

$$a_n = (-1)^{(n-1)}$$

What are the first 10 terms of the sequence? What kind of sequence is it?

21. Observe the following equalities:

$$\begin{aligned}4 - 1 &= 3 \\16 - 1 &= 15 \\64 - 1 &= 63 \\256 - 1 &= 255 \dots\end{aligned}$$

Which of the following expressions would be equivalent to the previous equalities? Circle.

$2^{n+2} - 1$	$4^{n+2} - 1$
$2^{2n} - 1$	$4^{2n} - 1$

22. The terms of a certain sequence are calculated with the following procedure:

**Step 1:** The first term of the sequence is  $f(1) = 1$

**Step 2:** The term of position  $n$  is calculated using the term of the sequence  $n - 1$ , by means of the formula

$$f(n) = 1 + \frac{1}{f(n-1)} \quad \text{Por ejemplo:}$$

$$f(2) = 1 + \frac{1}{f(2-1)}$$

$$f(2) = 1 + \frac{1}{f(1)}$$

$$f(2) = 1 + \frac{1}{1} =$$

$$f(2) = 2$$

So what will be the value of  $f(3)$ ? and of  $f(4)$ ?

23. A bacterial population has a growth given by the function:

$$p(t) = 1000 + 500t^2$$

$t$  being measured in hours.

Find:

- The average speed of growth.
- The instantaneous speed of growth for  $t = 10$  hour.

24. The equation of a rectilinear motion is:

$$e(t) = t^3 - 48t$$

At what moment is the speed zero? Find the acceleration at that instant.

25. The height  $s$  at time  $t$  of a coin falling from the World Trade Center is given by the function

$$s(t) = -15t^2 + 1200$$

$s$  measured in feet and  $t$  in seconds.

- Find the average speed of fall of the coin.
- Find the instant speed for  $t = 3$  and  $t = 4$ .
- Find the average speed in the interval  $[2, 4]$
- How long does it take to fall to the floor?
- Calculate the speed of the coin when it hits the floor.

For the following free fall problems use the function:

$$s(t) = -18t^2 + v_0t + s_0$$

- A projectile is thrown out from the surface of the Earth, with an initial speed of 385 ft/s. Find the average speed and find the speed after 5 and 10 seconds.
- If a stone falls from 126 feet high. What is its speed when it hits the floor?
- To estimate the height of a building, a stone falls from the top. Find the height of the building, if it is known that the stone hits the floor 6 seconds after it is released.
- Find the dimensions of a rectangle with a perimeter of 100 m, whose area is the maximum possible.
- Ricardo has a piece of cardboard measuring 14 dm by 10 dm and wants to cut the corners, as shown in the figure, to then make the necessary folds and assemble a box. Determines the height of the box that guarantees the maximum possible volume.

