



**UNITED NATIONS COLLEGE IED**  
**PREPARATORY WORKSHOP FOR COMPETENCIES TEST**  
**FIRST TERM**  
**MATH 10<sup>th</sup>**



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

**Delivery date: April 2nd, 2024**

1. In the following expressions,  $x$  and  $y$  they are any real numbers:

$$\begin{array}{ccc} \sqrt{x^2 + y^2} & x + y & \sqrt{(x + y)^2} \\ \text{(1)} & \text{(2)} & \text{(3)} \end{array}$$

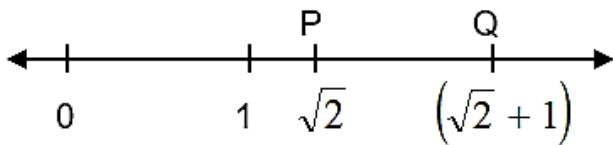
Which of the following statements, about expressions (1), (2) and (3), is or are TRUE?

- a) Expressions (1) and (3) are equivalent. \_\_\_\_\_
- b) Expressions (2) and (3) are equivalent. \_\_\_\_\_
- c) Expressions (1) and (2) are equivalent. \_\_\_\_\_

2. It is correct to state that  $\sqrt{x - y}$ , with  $x = 1$  and  $y = 5$ , is equivalent to 2? Why?

**ANSWER QUESTIONS 3 TO 6 ACCORDING TO THE FOLLOWING INFORMATION**

Two real numbers have been located on the following number line: P and Q.



Based on the information above, write whether each of the following statements is TRUE or FALSE.

3. Between the points P and Q it is not possible to locate another irrational number because  $(\sqrt{2} + 1)$  is the next number of  $\sqrt{2}$ . \_\_\_\_\_

4. Between the points P and Q it is possible to locate the irrational number  $\sqrt{3}$ . \_\_\_\_\_

5. Between the points P and Q it is only possible to locate rational numbers. \_\_\_\_\_

6. An irrational number that is between P and Q is  $\frac{\sqrt{2} + 1 - \sqrt{2}}{1}$ . \_\_\_\_\_

7. In the following algebraic expression  $a$ ,  $b$  and  $c$  represent any real numbers:

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- Find the numerical value of the expression if:  
 $a = 5$        $b = -1$        $c = 2$
- Is the resulting number real or complex? Explain your answer.

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

In the following equation,  $p$  represents the number of individuals in a population that varies over time, and  $t$  represents the time elapsed in years:

$$p = 1,5(2^{t/4})$$

8. What is the number of individuals when 8 years have passed?

9. If the number of years passed doubles, does the number of individuals also double? Explain your answer.

10. The area of an equilateral triangle can be found only by knowing the length of its sides. For this the following formula is used:

$$\frac{\sqrt{3}}{4} l^2$$

where  $l$  represents the side of the triangle.

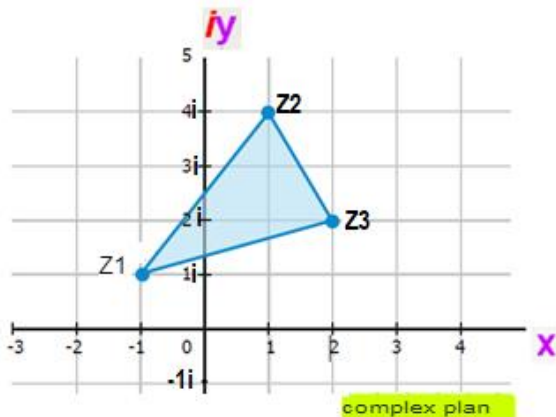
Taking into account the previous information, what is the area of an equilateral triangle with side 2?

11. A simple proper fraction is one in which the numerator is less than the denominator; for example,  $\frac{3}{8}$ ,  $\frac{12}{23}$ ,  $\frac{32}{50}$  ... as long as the numerator and denominator are natural numbers. In what interval of the number line will a proper simple fraction be located? Explain your answer.

12. Ana wants to place the painting of the figure in a niche that measures 2 meters long by 1.5 meters wide. Does the painting fit in that space? Explain your answer.

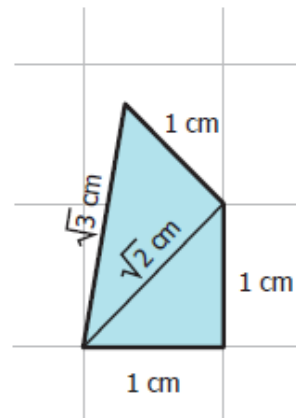


13. In math class the teacher draws the following triangle on a complex plane.



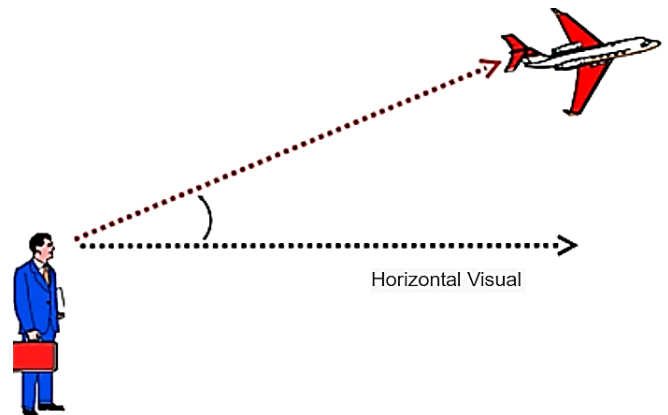
What are the complex numbers that correspond to the vertices  $Z_1$ ,  $Z_2$  and  $Z_3$ ?

14. Magda used a 1 cm square grid to draw the shaded figure, using right triangles.



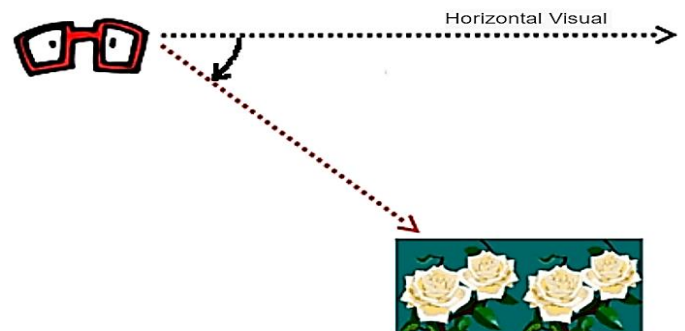
What is the area of the figure that Magda shaded?

**ANSWER QUESTION 15 ACCORDING TO THE FOLLOWING IMAGE**



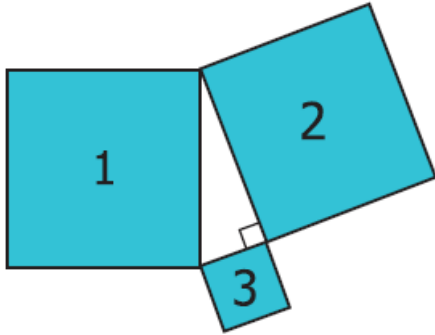
15. The angle shown in the image corresponds to an angle of inclination, an angle of depression, an angle of elevation or an obtuse angle?.

**ANSWER QUESTION 16 ACCORDING TO THE FOLLOWING IMAGE**



16. The angle shown in the image corresponds to an angle between  $270^\circ$  and  $360^\circ$ , a diagonal angle, an angle of depression or an angle of elevation? Explain your answer.

17. The figure shows the structure of three square areas of a property that must be divided between two owners.



The following options are available to divide the available land between the two owners:

**Option 1:** Zone 1 for owner 1, zone 2 for owner 2 and zone 3 divided into parts equal between the two owners.

**Option 2:** Zone 1 for owner 1 and zones 2 and 3 for owner 2.

When comparing the options presented, what is the equitable option for the two owners? Explain your answer.

18. To post an advertising notice, a ladder is placed on a wall 12 meters from the ground (see figure 1). The figures also show the situation from different perspectives and some of the measures involved.

What is the COSINE of the angle  $\theta$  formed by the floor and the ladder?



Figura 1

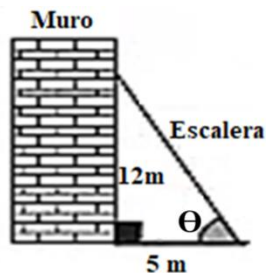
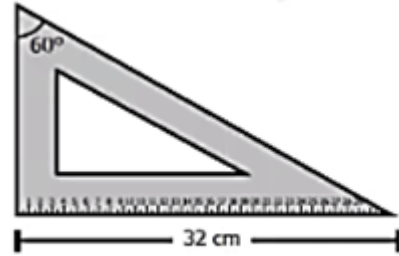


Figura 2

19. A **Cartabón** bevel is a template used in technical drawing and has the shape of a scalene right triangle, so that its hypotenuse measures twice the length of the shorter cathetus. If the longest cathetus of a cartabón measures 32 cm, as shown in the figure, what is the measurement of its hypotenuse?

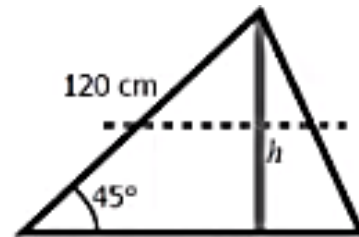


Figura

**REMEMBER:**

$$\begin{aligned} \sin 30^\circ &= \frac{1}{2}; & \sin 60^\circ &= \frac{\sqrt{3}}{2}; \\ \cos 30^\circ &= \frac{\sqrt{3}}{2}; & \cos 60^\circ &= \frac{1}{2}; \\ \tan 30^\circ &= \frac{1}{\sqrt{3}}; & \tan 60^\circ &= \sqrt{3}; \end{aligned}$$

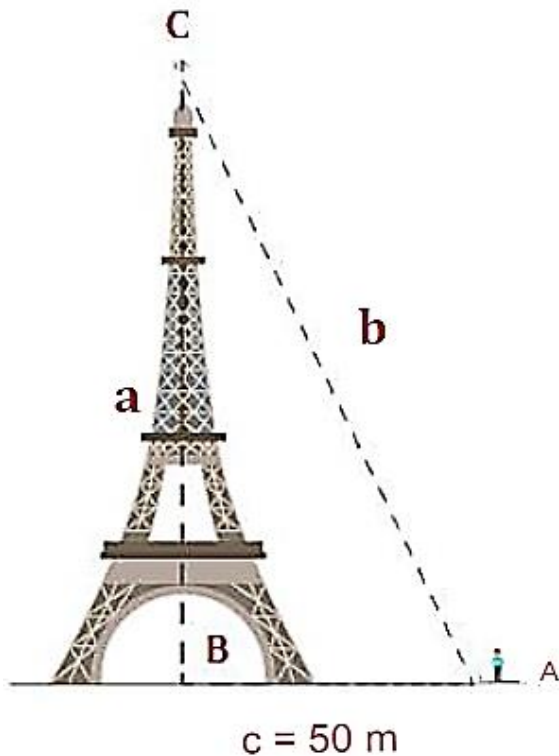
20. The dotted line in the figure shows a cut made in a triangle. The cut is parallel to the base and cuts in HALF at height  $h$ , which is perpendicular to the base..



Figura

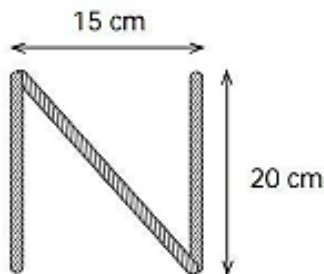
To make the cut, the height was determined  $h$  of the triangle, using the trigonometric ratio  $\text{Sin}(45^\circ) = \frac{h}{120}$ , then was divided  $h$  by two. Once this procedure was carried out, what is the approximate distance at which the height of the triangle was cut?

21. Find the height of the tower with the data provided by the engineering team.



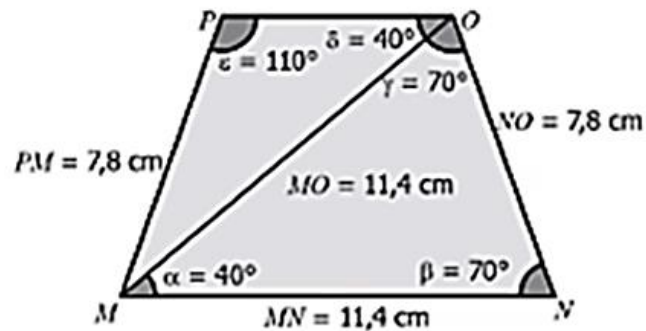
- ✓ Segment AB = 50 m
- ✓ length between the child and the tip of the tower is 328 meters.
- ✓ Elevation angle  $81^\circ$

22. A letter "N" has been built with three wooden slats; The vertical slats measure 20 cm and are 15 cm apart. How long is the diagonal stripe?



23. When the sun's rays form  $40^\circ$  with the ground, the shadow of a tree measures 18 m. What is the height of the tree?

24. The figure represents the quadrilateral MNOP with the measurements of some of its sides, angles and one of its diagonals.



**Figura**

Argue why the sides PO and MN of the quadrilateral are parallel.

**ANSWER QUESTIONS 25 AND 26 ACCORDING TO THE FOLLOWING INFORMATION.**

In a school, the number of students arriving late was observed for a month; as a result, the following information was obtained.

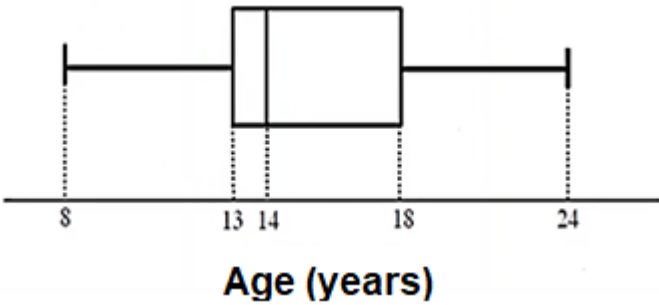
Minimum value = 5
Q1 = 10
Q2 = 15
Q3 = 23
Maximum value = 32

25. Based on the above information, for each of the following statements, write whether it is TRUE or FALSE.

- 50% of the students are late between 10 and 23 days. \_\_\_\_\_
- 25% of the students are late from 5 to 10 days. \_\_\_\_\_
- 25% of students are late less than 10 days. \_\_\_\_\_
- on average, 16 students are late to school daily. \_\_\_\_\_

26. Design the box plot that represents the information obtained.

27. The box-and-whisker plot below represents the age distribution, of a group of people.



What can be inferred from the graph?

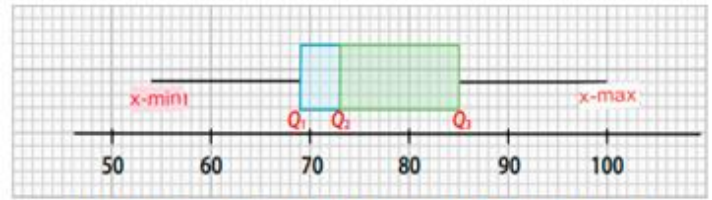
28. The math teacher applied an assessment to 30 ninth grade students. The results are shown below on a scale of 10 to 50 points.

21	48	42	49	42	38
19	41	17	44	38	29
34	44	33	45	47	29
28	38	26	31	27	38
38	32	42	39	37	43

According to the information, write FALSE or TRUE as appropriate.

- At most 45% of the students obtained scores below 38 points. \_\_\_\_\_
- At most 20 % of the students obtained grades lower than 29 points. \_\_\_\_\_
- At most 10 % of the students scored above 46 points. \_\_\_\_\_
- At most 3 % of the students scored above 50 points. \_\_\_\_\_

29. The following box-and-whisker plot represents the scores obtained by a course of 27 ninth-grade students on a Mathematics test.



Points obtained in the Math test

What percentage represent students who scored less than or equal to 85 points?

30. The diagram shown below was made based on the heights of 10 players of the Colombian national team.



Height of 10 players from the Colombian national team

According to the information, write FALSE or TRUE as appropriate.

- 25% of the 10 players are less than 1.77 m tall. \_\_\_\_\_
- 50% of the players are less than 1.81 m tall. \_\_\_\_\_
- 75 % of the players are between 1.74 m and 1.83 m tall. \_\_\_\_\_
- The median height of the 10 players of the Colombian national soccer team is 1.75 m. \_\_\_\_\_