



UNITED NATIONS COLLEGE I.E.D.
PREPARATORY WORKSHOP
III TRIMESTER - 2024
MATHEMATICS 10°

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

DELIVERY DATE: November 12th

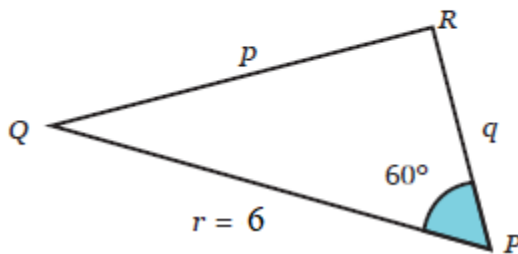
1. In the PQR triangle the following relationships are verified:

$$p^2 = q^2 + r^2 - 2qr\cos P$$

$$q^2 = p^2 + r^2 - 2pr\cos Q$$

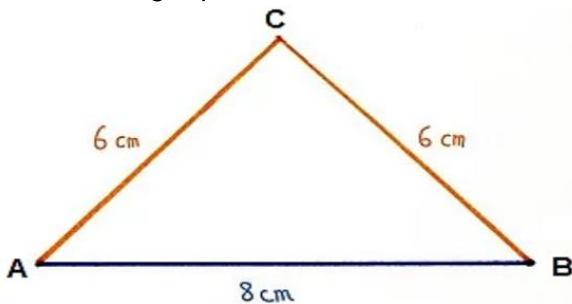
$$r^2 = p^2 + q^2 - 2pq\cos R$$

Remember that
 $\cos 60^\circ = \frac{1}{2}$



It is also known that $r = 2q$. What is the measure of side p ?

2. Based on the triangle shown below, which of the following equalities is true?

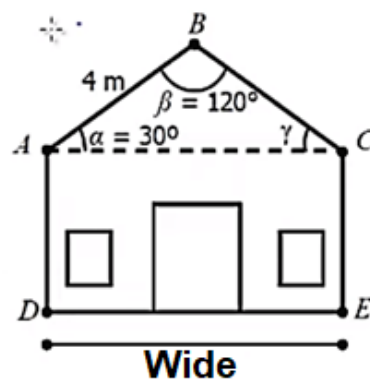


Remember:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

- $8 \sin C = 6 \sin A$ _____
- $6 \sin A = 8 \sin C$ _____
- $6 \sin B = 6 \sin A$ _____
- $3 \sin B = 4 \sin C$ _____

3. The figure represents the front view of a house. ADEC is a rectangle, angle B measures 120° , angle A measures 30° and is congruent to angle C. How **WIDE** is the house?



Remember:

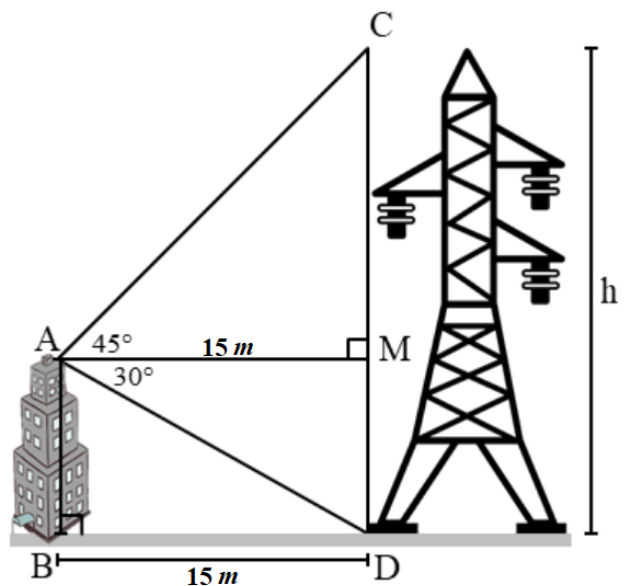
$$\sin 30^\circ = \frac{1}{2}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\sin 120^\circ = \frac{\sqrt{3}}{2}$$

$$\cos 120^\circ = -\frac{1}{2}$$

4. From the roof of a building, Sara observes the highest and lowest part of a tower, as shown in the figure.



If Sara is 15 meters away from the tower, what is the height of the tower?

5. We want to calculate the distance between two points, P and Q, but there is a wall between them. Using a tape measure, check that the distance from P to a certain point R is 3 m and the distance from Q to R is 4 m. It is also known that the angle formed by the PR and QR segments is 60° . Find the distance between P and Q.

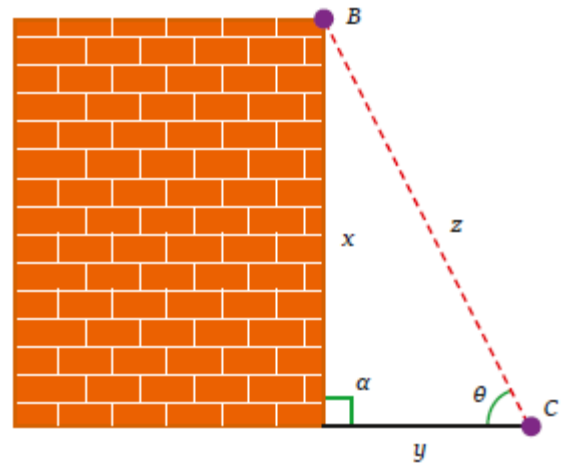
6. Carlos and Felipe decide to compete in races around a park. The park is shaped like a triangle with vertices A, B and C, angles $B=46^\circ$; $C=74^\circ$ and sides $AC = 7$ Km and $AB = 9$ Km.

Carlos starts from vertex A and Felipe starts from vertex B. The goal for both is vertex C, but each one must pass through the vertex from which the other friend started, before heading towards C. If they both run at the same speed and they leave at the same time, which of the two friends will reach the finish line first?

7. Pedro is making a triangular flower garden. One side is surrounded by the terrace and another side is surrounded by the fence. Pedro plans to place a stone border on the third side. If the length of the terrace is 10 meters, the length of the fence is 15 meters and they are at an angle of 120° , how many meters do you need to create of the stone border?

8. A group of students wants to hang a wooden slat at school. To determine how long the wooden slat should be, they drew a diagram that represents the situation:

- The red dotted line represents the wooden slat, which goes from point B to point C.
- The variables x , y , z , α and θ represent some measures of the situation, which form a right triangle.



Write in front of each statement whether it is TRUE or FALSE regarding whether it is possible to determine the length of the strip z by knowing two additional measurements than those shown in the diagram.

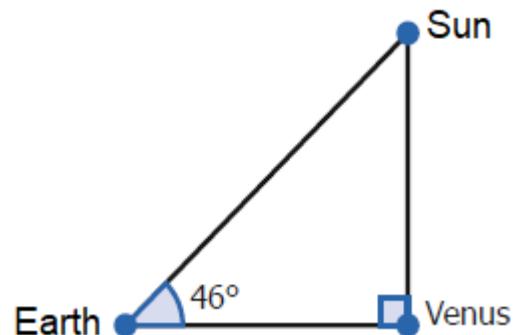
• No, because it is necessary to know the measurements of the height x , the angle α and the distance y to use a trigonometric ratio. _____

• Yes, because a trigonometric ratio can be used with the measure of the angle θ and the measure of the distance y . _____

• No, because it is necessary to know the measurements of the three internal angles of the triangle that is formed. _____

• Yes, because a trigonometric ratio can be used with the measure of the height x and the measure of the angle α . _____

9. When Venus, the Earth and the Sun form an angle of 46° , a right triangle is also formed, as shown in the figure..



Remember:

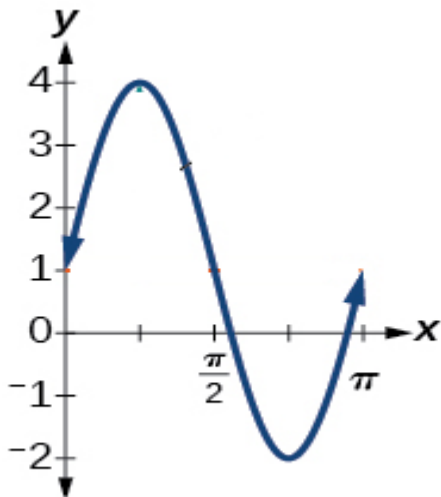
$$\sin \theta = \frac{\text{Opposite side}}{\text{Hypotenuse}}$$

$$\cos \theta = \frac{\text{Adjacent side}}{\text{Hypotenuse}}$$

If the distance between the Earth and the Sun is approximately 150 million kilometers, which of the following expressions allows us to determine the distance from Venus to the Sun, measured in millions of kilometers?

$\frac{150}{\sin 46^\circ}$	$\frac{150}{\cos 46^\circ}$
$150 \sin 46^\circ$	$150 \cos 46^\circ$

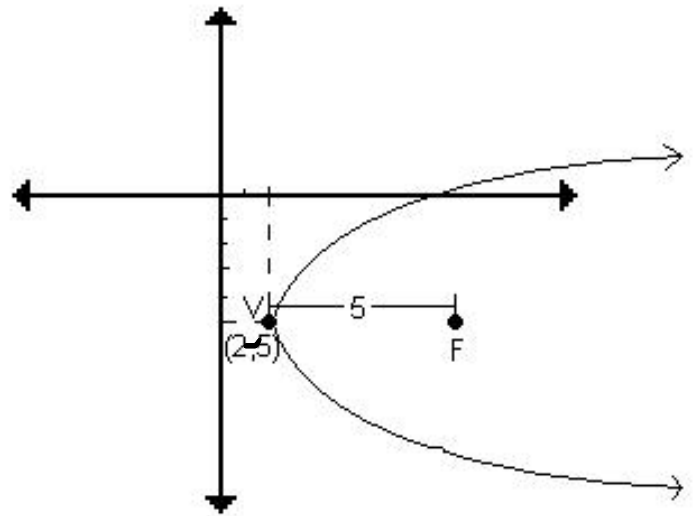
10. From the following function, determine the amplitude, period, and maximum value.



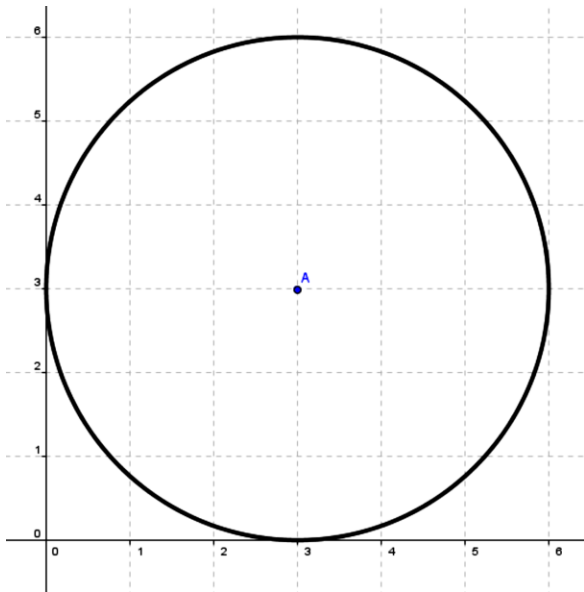
11. Andrés, Betty and Camilo are playing a baseball game. Camilo is 8 meters away from Andrés. An angle of 30° is formed between Camilo, Andrés and Betty and an angle of 53° is formed between Andrés, Betty and Camilo. What is the distance that separates Betty from Camilo?

12. When replacing $x = -4$ e $y = 5$ in the following expression: $\sqrt{x - y}$, can you conclude that the result is a real number? or a complex number? ¿why?

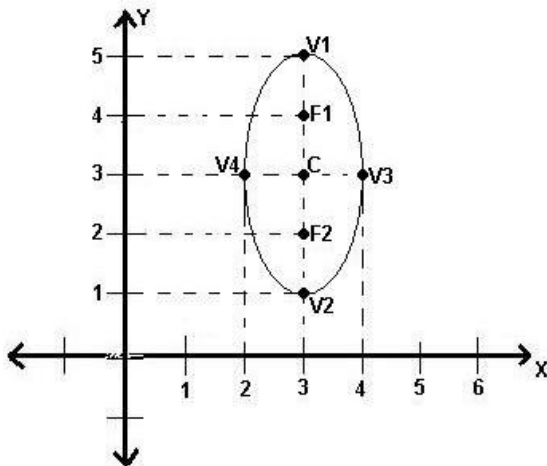
FROM QUESTIONS 13 TO 17 WRITE IN FRONT OF EACH SENTENCE IF IT IS TRUE OR FALSE ACCORDING TO THE FOLLOWING GRAPH:



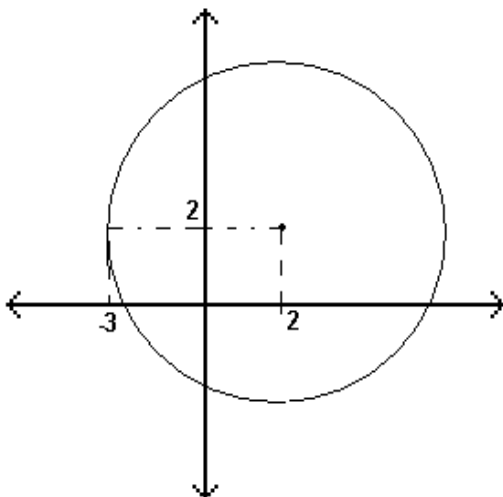
13. The coordinate of the focus is $(-5, 7)$ _____
14. The coordinate of the focus is $(10, -2)$ _____
15. The coordinate of the focus is $(7, -5)$ _____
16. It's half hyperbola. _____
17. It's a parabola _____
18. What is the canonical equation of the parabola shown in the previous image?
19. What is the general equation of the following circumference?



20. From the following ellipse, find the coordinates of the center, foci, and vertices.

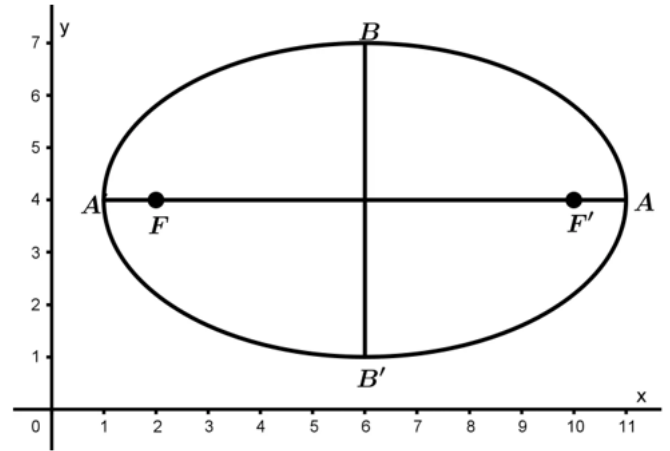


21. What is the canonical equation that satisfies the following graph?

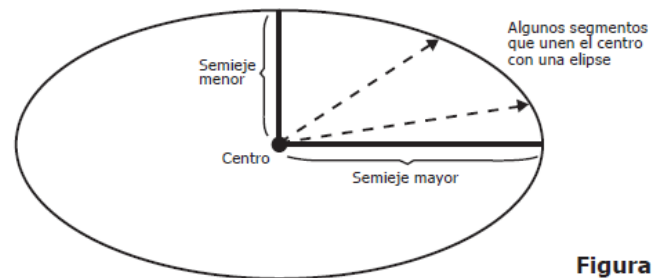


22. To which class of conic does the general equation $x^2 - y^2 - 5 = 0$? Why?

23. What is the canonical equation that satisfies the following graph?



24. In an ellipse, the measure of the semimajor axis is the largest measure of the segments that join the center to a point on the ellipse. Similarly, the semi-minor axis is the shortest measurement of these segments (see figure).



Figura

One person claims that if the measurement of the semimajor axis is equal to that of the semiminor axis, then the ellipse is a circle. The person's statement is:

- true, because an ellipse in which the measure of the semimajor axis is different from the measure of the semiminor axis cannot be a circle.
- false, because with the equality of measurement of the semi-major and minor axes the equality of measurement of all the segments that join the center with the ellipse cannot be guaranteed.
- true, because the measure of any segment that joins the center with the ellipse is between the

measures of the semi-minor and major axes; Therefore, all these measurements will be the same.

- false, because the measurements of the segments that join the center with the ellipse are always different; Therefore, the semi-axes will also have different measurements.

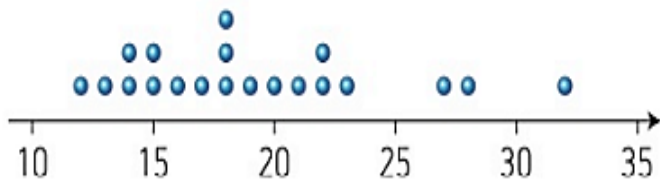
25. Find in each case the measures indicated for the given data set.

25 12 15 9 20 18
15 79 21 20 34 10

- Mean
- Range
- Variance
- Standard deviation

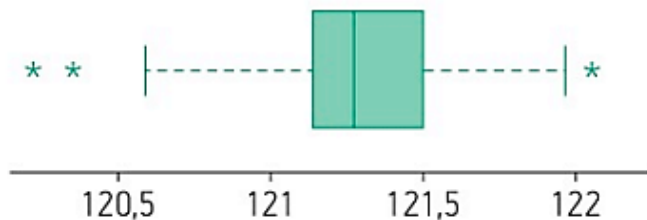
26. Interpret the diagram and infer whether it represents a data set that is dispersed with respect to the mean.

Dot plot.



27. Interpret the plot and infer whether it represents a sparse data set with respect to the mean.

Box-and-whisker plot.



ANSWER QUESTIONS 28 AND 29 ACCORDING TO THE FOLLOWING INFORMATION

The radiation emitted by the elements, which propagates through waves, can be classified according to wavelength, as shown below.

- Infrared: greater than 750 nm
- Visible: between 400 nm and 750 nm
- Ultraviolet: between 10 nm and 400 nm
- X-ray: less than 10 nm

In one study, the wavelength produced by 6 atoms was measured. The results were measured in nanometers and are as follows:

28. What type of radiation is present according to the results obtained?

29. What is the average radiation emitted by the atoms? What is the range of the variation? Determine the variance of the sample. Determine the standard deviation of the sample and propose 2 conclusions.

30. The IQ test applied to ninth grade students showed the results shown below:

Hombres:

86	75	93	105	104
111	64	87	103	77
82	70	68	78	81

Mujeres:

91	89	91	86	84
88	86	93	80	97
86	90	86	78	89

Determine which of the two genders is less dispersed in terms of IQ. To do this, use the standard deviation as a criterion for comparison.