

SHSAT Lesson 8: Coordinate Plane

In this lesson:

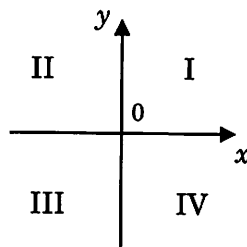
Cartesian coordinates: Points, lines, and shapes in a coordinate system.

What you must know

Definitions

The coordinate plane consists of two perpendicular lines: the horizontal **x-axis** (*abscissa*) and vertical **y-axis** (*ordinate*). Point $O(0, 0)$ is **the origin**, which can be thought of as a starting point. If you want to place point $P(a, b)$ on the coordinate plane, you would start at the origin and make a steps to the right (if $a > 0$) or to the left (if $a < 0$) and b steps up (if $b > 0$) or down (if $b < 0$).

The plane has **4 quadrants** I, II, III, and IV:



If point $P(a, b)$ is in the first (I) quadrant, a and b are both positive.

If point $P(a, b)$ is in the second (II) quadrant, a is negative, and b is positive.

If point $P(a, b)$ is in the third (III) quadrant, a and b are both negative.

If point $P(a, b)$ is in the fourth (IV) quadrant, a is positive and b is negative.

Any point $P(a, b)$ is a units from the y -axis and b units from the x -axis.

For all problems with coordinates, drawing a graph is very helpful.

Sample Problems

1. Point P (a, b) lies in the second quadrant. Which inequality **must** be true?

A. $a > b$

B. $a = b$

C. $a - b < 0$

D. $a + b > 0$

Solution

In the second quadrant, the x -coordinate is negative, and y -coordinate is positive. That means a is negative and b is positive. Therefore, (A) and (B) are always false, and while (D) can be true, it may not be (depending on the exact values of a and b). However, $a - b < 0$ is **always** true. Therefore the right answer is (C).

2. Which of the following points is the closest to P ($-1, 2$)?

E. ($-2, 2$)

F. ($-1, 1$)

G. ($-1, 0$)

H. ($-0.5, 2$)

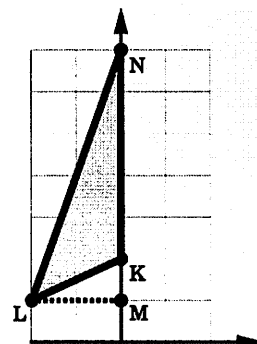
Solution

Note that three of the given points differ by 1 in just one coordinate from P, which means they are 1 unit from P. ($-0.5, 2$), however, differs from P by just 0.5 in one of the coordinates, which means it's 0.5 units from P. The correct answer is (H).

3. Find the area of the triangle KLN, if K ($0, 2$), L ($-2, 1$) and N ($0, 7$).

Solution

It helps to draw the graph and picture the triangle in the coordinate grid. It's convenient to consider the segment MN as a base. The distance from point L to the base MN is the height of triangle KLN. This distance is equal to 2 units, because point L is 2 units from the y -axis, and both points K and N are on the y -axis. KN is the actual base of the triangle, and its length is just the difference in the y -coordinates of K and N, which is $(7 - 2)$. Now, using the base $\times$ height $/ 2$ calculation, we determine that the area of the triangle KLN is equal to $(7 - 2) \times 2 / 2 = 5$ square units.



4. What is the distance from point P $(-5, 7)$ to point Q, which is the result of the reflection of point P over y -axis?

Solution

Point P is 5 units from y -axis; therefore, point Q is also 5 units from y -axis.

Therefore, $PQ = 5 \text{ units} + 5 \text{ units} = \mathbf{10 \text{ units}}$.

Practice Problems

-
1. Point W (x, y) lies in the fourth quadrant. Which inequality must be true?

A. $y > x$
B. $x - y < 0$
C. $x + y > 0$
D. $xy < 0$

2. What is the distance from point A ($-8, -2$) to point B, which is the result of the reflection of point A over x -axis?

E. 4
F. 6
G. 12
H. 16

3. Find the area of triangle CDE, if C ($5, 0$), D ($-2, 0$), and E ($3, 4$).

A. 7
B. 11
C. 13
D. 14

-
4. Point E is the midpoint of the line segment CD, with C ($-2, 0$) and D ($14, 0$). Find the coordinates of point E.

E. ($0, -2$)
F. ($0, 6$)
G. ($6, 0$)
H. ($0, 7$)

5. Which of the following may change when taking an absolute value of a number?

A. Base
B. Sign
C. Precision
D. Magnitude

6. How many non-overlapping squares with a side of 1 unit and a vertex at the origin could be drawn on the coordinate plane?

E. None
F. 2
G. 4
H. Infinitely many

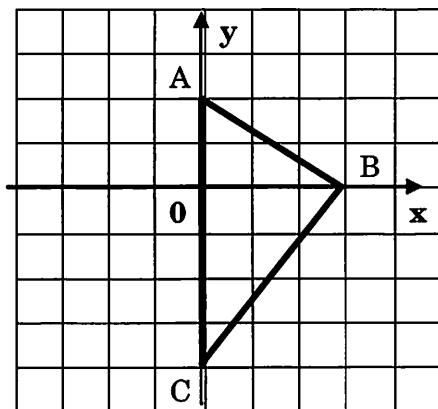
7. If you start at the origin and move 4 units to the right, 4 units up and 4 units to the left, how far from the origin will be your endpoint?

- A. 0 units
 - B. 1 unit
 - C. 3 units
 - D. 4 units
-

8. What is the point of intersection of the vertical line $x = -3$ and horizontal line $y = 2$?

- E. $(3, -2)$
 - F. $(-3, 2)$
 - G. $(2, -3)$
 - H. $(-2, -3)$
-

9. Find the area of the triangle ABC.



- A. 9 sq. units.
- B. 12 sq. units.
- C. 16 sq. units.
- D. 18 sq. units.

10. Which of the following points is closest to the origin?

- E. $(0, 3)$
 - F. $(-3, 0)$
 - G. $(2, 2)$
 - H. $(2, 3)$
-

11. What is the area of a square with two opposite vertices at M $(0, 2)$ and K $(0, -2)$?

- A. 2 sq. un.
 - B. 4 sq. un.
 - C. 6 sq. un.
 - D. 8 sq. un.
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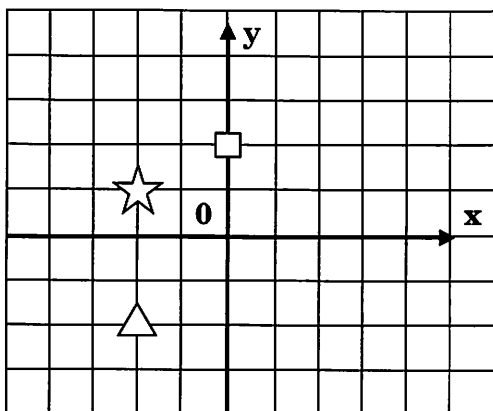
12. Point P (c, d) lies in the third quadrant. Which inequality must be true?

- E. $c > d$
 - F. $c - d < 0$
 - G. $cd > 0$
 - H. $c + d > 0$
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13. What is the distance from the midpoint of AB to the midpoint of BC, if A $(-3, 0)$, B $(-1, 0)$ and C $(7, 0)$?

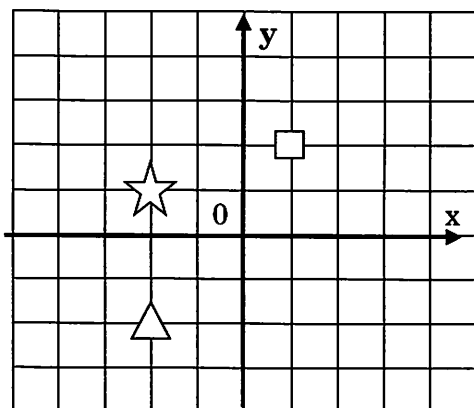
- A. 10
- B. 8
- C. 6
- D. 5

14. Which of the listed figures is closest to the origin?



- E. None
F. Star
G. Triangle
H. Square

15. Which two of the listed figures are the same distance from the origin?



- A. Star and triangle
B. Star and square
C. Square and triangle
D. Cannot be determined

16. What point is exactly 5 units from point A $(-1, -2)$?

- E. $(0, -3)$
F. $(-3, 0)$
G. $(2, 2)$
H. $(-1, -3)$

17. The y -axis is the tangent of a circle with center at C $(-2, 4)$. What is the area of the circle?

- A. 16π
B. 4π
C. 8π
D. 3π

18. What is the diameter of a circle with a center at $(4, -2)$, if one of the points on its circumference is $(4, 0)$?

- E. 4
F. 5
G. 6
H. 7

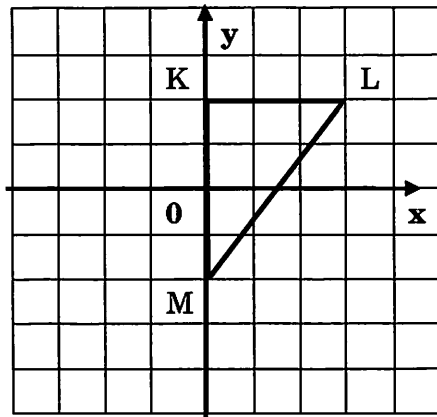
19. Diagonals of a rhombus are on the x -axis and y -axis respectively. The top vertex is at $(0, 8)$. If each side of the rhombus is 10, what is the area of the rhombus?

- A. 108
B. 96
C. 48
D. 24

20. Which of the points below is closest to the x -axis?

- E. $(0, -1)$
- F. $(-1, 2)$
- G. $(-1, -2)$
- H. $(0, 6)$

21. Find the perimeter of the triangle KLM.



- A. 15
- B. 13
- C. 12
- D. 10

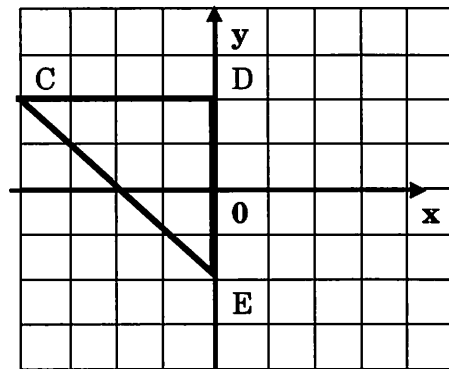
22. How far from the origin is the point D $(-6, -8)$?

- E. 12
- F. 10
- G. 8
- H. 7

23. Which line is not parallel to the line $y = x$?

- A. $y - x = 2$
- B. $y = x - 7$
- C. $y + x = 4$
- D. $3 - y = -x$

24. The isosceles triangle CDE is on the coordinate plane. What is the area of the triangle?



- E. 12
- F. 10
- G. 8
- H. 4

25. If the product of x and y coordinates of a point is negative, this point must be in the:

- A. II quadrant
- B. II or III quadrant
- C. II or IV quadrant
- D. I or IV quadrant