



Learning Project 7 The Coordinate Plane, Intercepts and Slopes

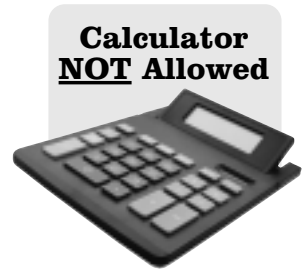
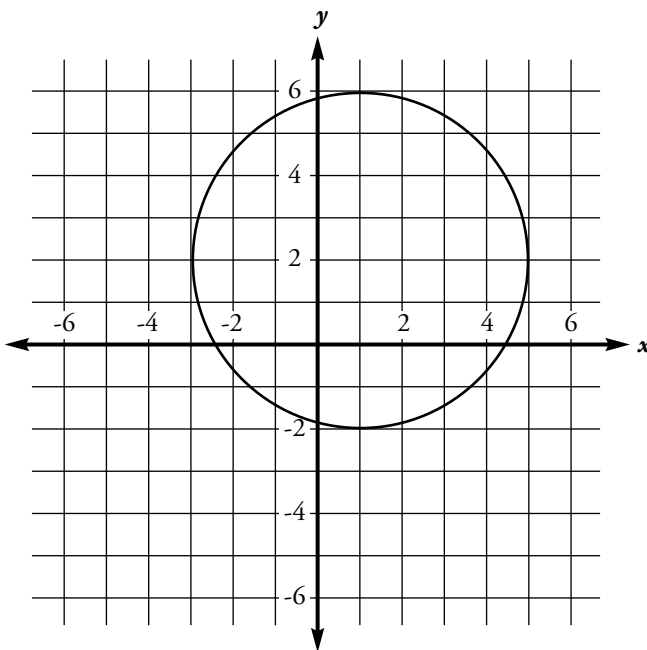
Inquiry Activity 7-1: The Coordinate Plane

(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #22, PA) Calculator not allowed.

Read the question carefully, as you would if taking the actual test.

22. The graph of a circle is shown on the grid below.



What point is the location of the center of the circle?

Do not mark on the graph above.

Mark your answer on the coordinate plane grid on your answer sheet. (Which your instructor will provide.)

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list:
graph, circle, grid, center of circle.

What words and/or symbols are unfamiliar and what do you think they mean?

Cannot know what words the learner will choose.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question.

What are you being asked to find?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess. Try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

In your own words, determine what to look for in the graph.

The center must be equally distant from all points on the circle.

Find the answer and then find and bubble in the correct point on the coordinate plane grid.

Check your answer back in the original graph.

Be ready to explain how you chose your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain how you decided that it was the center of the circle and how you know that the correct point is bubbled in.*

You will not be allowed to make any marks on the test itself. Agree on a reliable method to ensure that the point you have bubbled in on the answer grid is the one you decided on in the coordinate plane.

You may need an overhead transparency of the graphic in the item as well as one of the coordinate grid so that students can refer to specific points.

Whole class: *Report your group's answer to this question as well as the procedure that you recommend to check that the coordinate grid is bubbled in correctly.*

The traditional (x,y) coordinate method will be discussed in a later phase of this inquiry. At this point, you should praise their creativity and problem-solving abilities without referring to a 'better' way.

Take notes on any different ways that others used to find the answer.

5. Reflecting, Extending and Evaluating.

We recommend that you use this stimulus again during the geometry Learning Project when you are discussing area and perimeter. For now, focus on the characteristics of a circle, the coordinate system, and adding and subtracting with negatives. For some groups, each of these could be an entire lesson itself.

Reflecting: *Think about what you learned.* (A group activity or instructor led.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.



The discussion will take off from wherever the students left it in the previous step. If they had difficulties recognizing where the center of the circle should be in the graph, that geometric concept should be the first order of business. Encourage them to use the vocabulary of circles: radius, diameter, and circumference.

Look up the mathematical definition of the center of a circle in one of your math books. Show that the answer to this problem satisfies the requirement of the definition.

The four points that are on the vertical and horizontal diameters provide easy places to count the number of squares. To show that *all* points on the circle are equidistant from the center, they might mark off the length of the radius on a sheet of paper (or use a ruler) and rotate it around the center.

How many units are there in the radius of this circle? The diameter?

Here the units we are referring to are the spaces between the lines on the graph: 4 for the radius and 8 for the diameter.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

The second idea that was important in answering this question was the marking of the correct point in the coordinate grid. Since we know that there will be two questions on every GED test that use this grid as an answer format, the students should master the concept of the structure of the coordinate graph itself - the axes, the origin, the (x,y) coordinates of points, and the negative numbers that are involved.

Compare the underlying grid in this problem to the one from problem #15 (Inquiry Activity 1-4). How does this one differ? How are they alike?

There are differences in the way that the axes are marked, but the major focus here should be that the grid for this problem has four quadrants. It includes negative numbers on both the x- and y-axes. The grid for problem 15 is similar to the first quadrant of this one where both the variables are positive.

There is a standard method of referring to the points on the coordinate plane. Look up the coordinate system in your math books to find the ordered pair, (x,y), notation for points on the graph. Compare the method you used in this problem to the standard one.

The chances are that the methods that they created above will be somewhat similar to the standard way of noting where a point is. Starting at the origin, determine how far to the left or right the point is located. That number, the x-value, always comes first in the ordered pair. The second number tells how far up or down from the origin the point is located.

Write the (x,y) coordinates of the center of the circle in this problem. Also write the coordinates of the two points on the circle which are directly above and below the center and the two points on the circle which are directly across from the center on the left and the right.

Center (1,2), Above (1,6), Below (1,-2), Left (-3,2), Right (5,2)

Use the exercises in your math book to practice point-plotting and point-naming.

This problem offers the opportunity to bring up the idea of adding and subtracting with positive and negative numbers on a number line. Rather than introducing any rules, encourage the students to make sense of the relationship by counting the units on the graph.

The y -value of the lowest point on the circle is -2 , while the y -value of the highest point is 6 .

What is the distance between the two points? Complete the following equations:

a) $-2 + \underline{\quad} = 6$

b) $6 - \underline{\quad} = -2$

c) $6 - (-2) = \underline{\quad}$

If the students have difficulty here, use the overhead and indicate the two points on the graph and ask the following questions. For a), What do you have to add (move up) to -2 to get to 6 ? For b), What do you have to subtract (move down) from 6 to get to -2 ? For c), What is the distance (or difference) between 6 and -2 ?

Write three similar equations using the x -values, -3 and 5 , of the points to the left and right of the circle and the distance between them.

In your groups, discuss some situations in your life where negative numbers are involved. Write equations involving addition (or subtraction) of these numbers that describe a common situation.

For example, they could use the example of a thermometer where the temperature at 5 pm was 10 degrees and the night-time low was -8 degrees. To answer the question, "How many degrees did the temperature fall?" they could write, $10 - \underline{\quad} = -8$, or $10 - (-8) = \underline{\quad}$

Yardage gains and losses in football also provide an interesting context for some. Elevation above and below sea level, river heights above and below flood level, stories of a building above and below ground level are others.

There will be two questions on the GED math test whose answers will be recorded on the coordinate grid. Make up that kind of a question and ask the other groups to answer it.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Which idea from this activity - the characteristics of a circle, the coordinate system, or adding and subtracting with negative numbers - was the most difficult for you? Which was the easiest? Explain.

Ask for practice exercises if you think you need them.