
Geometry and Measurement

Geometry—Most Missed Questions

According to the analysis of GEDTS data, geometry is an area with which students have difficulty. The data indicates that GED candidates often lack the procedural abilities needed to read and extract information necessary to solve a problem. Although a formulas page is included as part the GED Mathematics Test, candidates had difficulty understanding conceptually how to set up problems to be solved.

Because of the difficulty that GED candidates have in setting up and solving geometric problems, it is important that students discover why formulas work, so that they can then apply them in different settings.

According to the analysis of the GED Mathematics Test, skill gaps identified among GED candidates include the inability to:

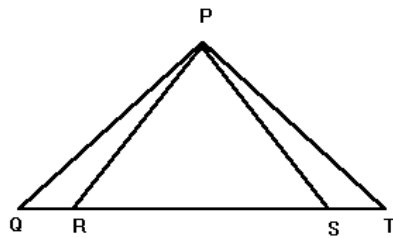
- Recognize visual cues in order apply the correct formula.
- Understand and apply the Pythagorean Theorem to different situations. GED candidates were most likely to make conceptual errors when attempting to answer these questions. They incorrectly applied the formula by adding or subtracting the sides of the triangle. This error pattern indicates that the candidates did not possess a deep understanding of possible triangles.
- Partition irregular shapes to calculate area. GED candidates lacked the problem-solving skills necessary to view different ways of calculating area by separating a complex problem into simpler component parts.
- Compare properties of geometric figures of different shapes. GED candidates did not correctly apply numerical algorithms when asked to increase and/or decrease the sides of a figure and calculate the percentage of change.
- Express a mathematical problem using variables. Conceptual question types were difficult for GED candidates to answer, especially when variables, rather than numeric values, were used.
- Understand the relationships between angles and parallel lines.

GED-Type Question Samples

The following are examples of GED-type questions for each area that simulate the types of questions most often missed by GED candidates. The following questions were developed by Kenn Pendleton, GEDTS Mathematics Specialist. They address each of the areas in graphic literacy identified by the analysis of the GED Mathematics Test.

Sample Question

In the following diagram of the front view of the Great Pyramid, the measure of the angle PRQ is 120 degrees, the measure of the angle PQR is 24 degrees, and the measure of the angle PST is 110 degrees. What is the measure of the angle RPS in degrees?



COMMON STUDENT ERRORS

This question requires that candidates grid their answers. They do not have numeric clues as to what type of number the question is seeking. From the analysis, it appeared that GED candidates were unable to locate the necessary angle and lacked an understanding of angles, including the degrees in specific types of polygons. It is important that students understand:

- There are 180 degrees in every triangle.
- There are 180 degrees in a line.

In words, students need to understand that:

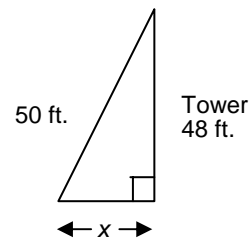
- Angle PRQ = 120 degrees so Angle PRS has 60 degrees
(180 degrees – 120 degrees = 60 degrees)
- Angle PST has 110 degrees so Angle PSR has 70 degrees
(180 degrees – 110 degrees = 70 degrees)
- So, triangle PRS has 60 + 70 degrees in two of its angles to equal 130 degrees
(60 degrees + 70 degrees = 130 degrees)
- Therefore, the third angle RPS is 180 – 130 degrees or 50 degrees.
(180 degrees – 130 degrees = 50 degrees)

Sample Question

One end of a 50-ft cable is attached to the top of a 48-ft tower. The other end of the cable is attached to the ground perpendicular to the base of the tower at a distance x feet from the base.

What is the measure, in feet, of x ?

- (1) 2
- (2) 4
- (3) 7
- (4) 12
- (5) 14



COMMON STUDENT ERRORS

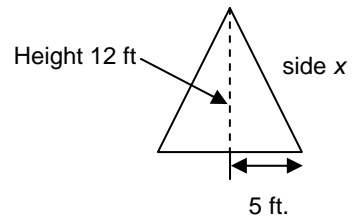
This is an example of a classic Pythagorean Theorem question. However, GED candidates did not attempt to use the formula. Instead they subtracted 48 from 50 to obtain the answer (1) 2. Although not noted by GEDTS, another difficulty students may have on similar problems is that they do not understand that the square root is the opposite of squaring a number.

Sample Question

The height of an A-frame storage shed is 12 ft. The distance from the center of the floor to a side of the shed is 5 ft.

What is the measure, in feet, of x ?

- (1) 13
- (2) 14
- (3) 15
- (4) 16
- (5) 17



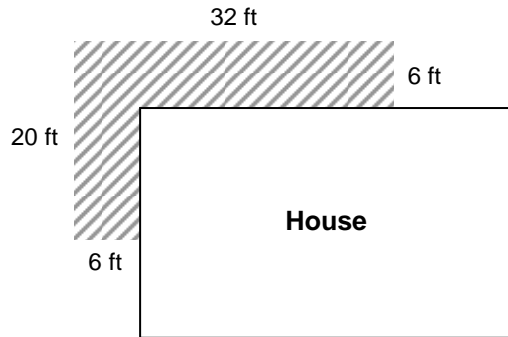
COMMON STUDENT ERRORS

This is an example of a classic Pythagorean Theorem question. However, GED candidates did not attempt to use the formula. Instead they added 12 and 5 to obtain the answer (5) 17. This question looks different from the first item on Pythagorean Theorem because the height is calculated within the triangular figure rather than on the side. GED candidates must understand that the measure of any side of a triangle must be less than the sum of the measures of the other two.

Sample Question

An L-shaped flower garden is shown by the shaded area in the diagram. All intersecting segments are perpendicular.

What is the area of the garden?



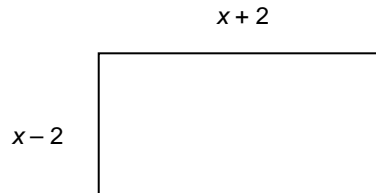
COMMON STUDENT ERRORS

Although this is a simple calculation problem, GED candidates did not partition the figure into simpler segments in order to figure the area accurately. GED candidates may not always see a simple solution for a problem and thus create an incorrect algorithm to solve the problem.

Sample Question

Which expression represents the area of the rectangle?

- (1) $2x$
- (2) x^2
- (3) $x^2 - 4$
- (4) $x^2 + 4$
- (5) $x^2 - 4x - 4$



COMMON STUDENT ERRORS

This question requires that GED candidates have conceptual understanding of what formula represents area. This is an example of where substituting a number for the variable would have assisted the candidate in correlating an answer to each of the expressions.

Incorporating Geometry into the Classroom

Measurement and geometry are used daily in real life. Instructors should take advantage of everyday situations to help their students build confidence and competency with geometric topics. Moving towards teaching in context requires that the instructor incorporate more large- and small-group activities into the classroom and use more real-life materials.

The following is a beginning list of materials that could be used to provide more context-based instruction in the areas of measurement and geometry:

- Provide students with real-world experiences when teaching geometric concepts. This will allow students to explore how and why formulas and theorems exist, as well as develop application skills. Sample activities for measurement and geometry could include:
 - Developing a “road trip” through using maps and distance formulas.
 - Making a recipe where proportions must be increased or decreased in measurement.
 - Using real-world measurement tools for a project, such as remodeling the classroom. Students would need to have appropriate measurements to obtain the necessary information for how much paint, flooring, molding, etc., would be needed, as well as setting up the room design by using a scale model of the room and furniture for purposes of arrangement
- Have students explore and research how they use geometry in the workplace or in their daily lives. Build on students’ own understanding of measurement and geometry. Sometimes students use certain math processes without being able to use the correct terms for them.
- Focus on angle relationships. Have students locate all of the different types of angles in the classroom and explore angle relationships.
- Have students “build” the ideal school. Building uses many of the geometric formulas and applications with which students need to be familiar. Begin by having students think about what it takes to build a school. Have them develop questions that must be asked, such as:
 - What shape will the building be?
 - How many classrooms are needed?
 - How many square feet are required for the appropriate number of classrooms?
 - How many and what size of windows and doors will be used?
 - What size parking lot is needed?

Have students develop a blueprint that includes their ideas for the “perfect school.”