

## Learning Project 4 Algebra/Using Equations

### Inquiry Activity 4-3 Evaluating and Solving Equations

*(Note: Italicized portions should be directed to the students)*

#### 1. Identifying the Problem (Item #9, PA) Calculator Use Allowed

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

9. The standard formula used by mechanics to find the length (L) of a fan belt of a car is as follows:

$$L = 2C + \frac{11(D+d)}{7} + \frac{(D-d)^2}{4C}$$

where D and d are the diameters of the wheels around which the belt runs, and C is the distance between the centers of the wheels.

What is L (in inches) if D = 12 inches, d = 2 inches, and C = 25 inches?

- 1) 39
- 2) 73
- 3) 97
- 4) 121
- 5) 229

**Calculator  
Allowed**



*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?*

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

#### 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.*

*Re-read the question.*

*What is the question asking you to find?*

The length of a fan belt (L).

*What information in the problem is relevant to finding the answer?*

All you need is the formula and the numbers to substitute. The context is not a critical factor.

*What do you know about finding answers to this type of problem?*

They know about equations, parentheses, and exponents – in simpler formats.

#### 3. Planning, Assigning and Performing Tasks

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

*Use your experience with similar problems to make sense of this one.*

*Rewrite the equation, substituting the numbers for each variable.*

*Break the problem up into simpler parts.*



Read the directions for the calculator accompanying the GED Math test (which your instructor will provide) and determine if anything there helps you to use the calculator to solve this problem.

Find the answer and record the steps you used.

Check for the reasonableness of your answer.

Choose one of the answer choices.

Once you've chosen an answer, be ready to defend the way you found it.

(I am told that it would be very unusual if a fan belt were this long, so be prepared for some discussion here.)

Note: At some point in “Performing Tasks,” your assessment may reveal that certain knowledge gaps may need attention. However, allow each student to complete as much of the problem as possible, perhaps giving a few reminders and asking a few leading questions. For example, you might emphasize that they find the answer to each part separately first and keep a record of these partial answers. If needed, remind them that they know how to substitute values into an equation and that they have also seen parentheses and exponents before. By this time the students know the process and realize that they will be able to discuss the problem in the next step with their group so they should just do their best at this point. Keep the focus on the overall process, building on past experiences and Learning Projects where possible.

#### 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 the knowledge, but also to learn it more completely.**

**Small groups:** Compare your answer to others in the group and explain why and how you found your answer and why it is correct.

Agree on the correct way to rewrite the equation, using the numbers instead of the variables.

Look at each part of the problem separately. What number did each of you find for them? Discuss your disagreements and resolve them.

What does  $2C$  equal and how did you find it?

What steps are involved in finding  $\frac{11(D+d)}{7}$ ?

What does  $\frac{(D-d)^2}{4C}$  ask you to do mathematically?

Share how you used your calculator. Take notes describing situations when you entered numbers in a different order and achieved a different result. Explain when and why is entering numbers in a certain order important.

Agree on the correct answer and the step-by-step process to find that answer, both with and without the calculator and share with the whole class.

Did using the calculator make this problem easier or harder? Explain why you think so.

#### 5. Reflecting, Extending and Evaluating

**Reflecting:** Think about what you learned. (A group 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.**

How did your previous learning about algebraic equations in the other Inquiry Activities help you, or your small group, to approach this problem?

How did breaking it down into smaller pieces (step by step) improve your chances of success?

In the last Inquiry Activity, you had to undo the operations that were shown in order to find the value of the unknown. Why didn't you have to use the undo process in this problem?

In this problem the unknown,  $L$ , was already isolated on its side of the equation so you did not have to remove any numbers (terms or factors) by undoing. You merely had to do the operations that were shown.

*What other strategies helped you approach this problem more calmly, that you will need to remember to do future Practice Test problems?*

Students should confirm in the resulting discussion that, although this problem looked overwhelming at first, calling on prior learning, breaking it down into smaller steps, replacing variables and rewriting the problem, all helped them face the problem with more confidence and less anxiety. They also had 5 optional multiple-choice answers from which they could choose, and the use of the calculator.

*Was it important to be a mechanic or to understand car repair, and or to know about fan belts, to answer this question? Why was this context important?*

The power of mathematics in this case was that we could evaluate the abstraction (the formula) without having to understand any mechanical ideas. Even though we could have solved the problem without the mechanic's context, it shows that there is a real world use of algebra, and that everyday trades and industries could require those skills of us.

**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.***

Perhaps students can research in science textbooks to find complex formulas that they can solve even though they do not understand the context.

*Can you think of a standard formula you (or your small group) use in everyday situations? How and when is it applied?*

For instance, in cooking, a student may find he/she always falls back on a standard formula for white sauce. She doubles it or triples it when needed. Or she may change certain parts to create a different result.

*Do some research in science textbooks your instructor supplies to find complex formulas that you can solve even though you may not understand the context, or science, involved.*

*Note that the GED calculator has a Power of 2 key. How is it used? How is the shift key used to undo this operation, and find the square root of a number?*

Practice squaring and finding square roots at this point. Try to emphasize the connection between the two by linking them: that is, because it is true that  $7^2 = 49$ , we know that  $\sqrt{49} = 7$ . Research may be done in the resource books if there is time, or the instructor can just supply practice.

*How could you solve the problem without that key, if you were not comfortable using it?*

*Research your math resources for other algebraic equations using powers.*

They were introduced to this in Inquiry Activity 3-3, but using the calculator was not discussed.

*Once you and your small group are comfortable with the power of 2, or squaring, extend your knowledge to the power of 3, or cubing.*

*Decide how to use the parentheses keys in solving this problem. Does using them make it harder or easier for you? Explain.*

You may want to challenge the students to try to enter the entire expression (the right-hand side of the equation) in the calculator at once, rather than just one part at a time.

**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.***

*How have Learning Projects #3 and #4 built on each other's skills?*

*How can you use the directions for calculator use that accompanies the GED Math Test when actually taking the test?*

*How are you feeling toward algebra now? If you have continued anxiety or frustration, how can the instructor be helpful and give you more practice in areas in which you are not confident?*



## **GED as Project**

### *Pathways to Passing the GED*

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*Has any explanation by a student, about how he/she approached or understood a problem, been clearer or meant more to you than the instructor's? Why and how?*

This is a desired effect of group work. Often students will explain or see a problem in a way that relates better to the student who is stumbling, because they may be thinking in the same way or coming from similar experience.