

Step Up to *Writing*[®] in Math

**Math-Focused
Writing Strategies
Grade 9**



**VOYAGER SOPRIS
LEARNING™**

Today's Agenda

- **What is *Step Up to Writing in Math*?**
- **Implementing *Step Up to Writing in Math***
- **Reading and Understanding Word Problems**
- **Vocabulary**
- **Summarizing Text and Writing about Graphs**
- **Writing for Assessments**
- **Asking and Answering Questions**



Writing in Math-Reflection

On a scale of 1 – 5 with 5 being highest, how would you rate your interest in writing?

Do you remember writing in a Math class as a student? If yes, what did you write about?

In what ways is writing in Math beneficial?

Do you ask your students to write in your Math class? What kinds of writing do they do?



“Frequently, we may think we understand something when we only recognize it; we confuse familiarity with understanding. This becomes obvious when we have to explain it in writing.”

Sandra Keith

Using Writing to Teach Mathematics



When students write, they....

- **Reflect on their learning**
- **Clarify, refine, and organize their thinking**
- **Discover errors or solutions**
- **Give meanings to words by using them in an appropriate context**
- **Make their thinking concrete**
- **Deepen their understanding**
- **Demonstrate what they have learned**
- **Analyze and evaluate their ideas**
- **Retain what they have learned**



#3 Construct viable arguments and critique the reasoning of others

- Understand and use stated assumptions, definitions, and previously established results in constructing arguments
- Make conjectures and build a logical progression of statements to explore the truth of their conjectures
- Justify conclusions, communicate them to others, and respond to the arguments of others



#3 Construct viable arguments and critique the reasoning of others (continued)

- Reason inductively about data, making plausible arguments that take into account the context from which the data arose.
- Compare the effectiveness of two plausible arguments; distinguish correct logic or reasoning from that which is flawed; and, if there is a flaw in an argument, explain what it is.



#6 Attend to precision

- Communicate precisely to others
- Use clear definitions in discussions with others and in their own reasoning



What is *Step Up to Writing in Math?*



3-1: Four-Step Summary Paragraph

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- A summary is a short text that includes the key ideas of a unit, chapter, article, lecture, and so on.
- Summaries keep the same tone as the original piece; they do not contain an opinion and do not require a formal conclusion.

The *Step Up to Writing* four-step approach to summary writing is called the I-V-F strategy.



Implementing *Step Up to Writing in Math*



Two- and Three-Column Notes

Notes become more valuable as a study guide when students organize information on a page so it is easy to see and to use.

- 1. Fold or write lines that divide a sheet of paper into either two or three parts.**
- 2. Label the top of the note page with name, date, subject, and a topic for the notes. The topic can be written in the form of a question that guides students' note taking.**



Two- and Three-Column Notes

- 3. Take notes one paragraph at a time. Read a paragraph, then reread for note taking.**
- 4. Use words or phrases—not complete sentences.**
- 5. List big ideas/major details in the left column. Add subtopics, examples, minor details, etc., in the second column. Use dashes and dots to show the hierarchy of details.**
- 6. Reserve the 3rd column for comments, connections, illustrations, insights, sketches, etc.**



1. What role does *SUTW in Math* play in my classroom?
2. How do I use *SUTW in Math*?
3. When do I use *SUTW in Math*?
4. How do I integrate *SUTW in Math* into my curriculum?
5. How do I get started?
6. How do I use the *SUTW in Math* materials?



- **Reading comprehension improves when students take notes. Students take more effective notes—and require less time to do so—when they can follow a note-taking format that their teacher has modeled and explained.**
- **Ask students to explain why they think this method helps with organizing notes.**
- **After the class has finished taking notes, ask students to refer back to the purpose for note taking and evaluate whether they have met that goal.**



Using the Teacher's Guide

Each of the seven sections is clearly marked at the top of the page and is further divided into subsections by topic or concept. The subsections correspond to the labels on the accompanying Tools pages.

A strategy overview is provided at the beginning of each subsection. The overview includes a synopsis of the teaching strategy, a list of accompanying Tools pages, and connections to other aspects of the Teacher's Guide.

Examples illustrate the strategies and give readers

3-5 Framed Paragraphs for Writing About Graphs

A framed paragraph can help students (both typical students and those with limited writing skills) learn to explain or analyze a graph, chart, table, or other graphical representation. Framed paragraphs can also save time. Teachers can create frames, make copies, and have them handy for responses when only a few minutes are available for writing.

Framed paragraphs are an effective way to give students more practice writing about graphs. They also work well for homework assignments and when students work with substitute teachers.

However, they should be used along with the strategies and tools from 3-1 Four-Step Summary Paragraph and 3-3 Writing to Explain a Graph. Framed paragraphs are not a substitute for direct instruction and guided practice. It is important that students learn to work independently as they interpret and write about graphs.

Use Math Tool 3-5 as an example. Make an overhead transparency and student copies as needed. In a guided lesson, complete the work with input from students.

Use the following examples as guides when you create your own framed paragraphs:



Tool 3-3-5

Page 540 Line Graph

The line graph on page 540 shows _____.

First, _____.

_____ It also _____.

Finally, _____.

Math Tools are labeled in the text, below the thumbnail, and again at the end of each section.

Reading and Understanding Word Problems



Why are word problems so difficult for students?

1. **Some problems are poorly written.**
2. **Students often focus on the numbers in a problem and ignore the context for those numbers.**
3. **Students may be overwhelmed by the amount of information in word problems.**
4. **Students may be poor readers or lack confidence as readers.**
5. **Students may have problems with vocabulary.**
6. **Students might be unable to distinguish between important and unimportant information.**
7. **Students may lack the math knowledge that is required to interpret or solve the problem.**
8. **Students do not follow-through with all steps required to answer the problem.**



Using Two-Column Notes to Read and Solve Word Problems

- **Restate the problem**
- **List the facts**
- **List the clue words**
- **Estimate or predict**
- **Illustrate the problem**
- **Solve the problem**
- **Write the final answer in a complete sentence**



Using Two-Column Notes to Read and Solve Word Problems

(front of paper)		(back of paper)	
0			0
Problem/question		Solve	
Facts		final answer in a sentence	
Clue words.			0
Estimate or predict			
Illustrate.			
0			0

Two-Column Fold

June 2014 #36

An animal shelter spends \$2.35 per day to care for each cat and \$5.50 per day to care for each dog. Pat noticed that the shelter spent \$89.50 caring for cats and dogs on Wednesday. Write an equation to represent the possible numbers of cats and dogs that could have been at the shelter on Wednesday. Pat said that there might have been 8 cats and 14 dogs at the shelter on Wednesday. Are Pat's numbers possible? Use your equation to justify your answer. Later, Pat found a record showing that there were a total of 22 cats and dogs at the shelter on Wednesday. How many cats were at the shelter on Wednesday?



Read, Illustrate, and Solve Word Problems

Restate the problem.	1. Write an equation to show the possible number of cats and dogs. 2. Check Pat's numbers. 3. Find the number of cats on Wednesday.
List the facts.	\$2.35 per day for cats, \$5.50 per day for dogs, Shelter spends \$89.50 for both
List the clue words.	Per (multiply), And (add), Shelter spends (total)
Estimate or predict.	8 cats \approx \$18, 14 dogs \approx \$80, Cats + dogs \approx \$98
Illustrate the problem.	$2.35 \cdot \text{cats} + 5.50 \cdot \text{dogs} = \89.50 <p>Let $c = \text{cat}$ and $d = \text{dog}$</p> $2.35c + 5.50d = 89.50$
Solve the problem. $c + d = 22$	$2.35c + 5.50d = 89.50$ $2.35(8) + 5.50(14) = 89.50$ $18.80 + 77.00 = 89.50$ $95.80 \neq 89.50$ <p>Pat's numbers are not possible.</p> $2.35(10) + 5.50(12) =$ $23.50 + 66 = 89.50$ $89.50 = 89.50$
Write the final answer in a complete sentence.	There were 10 cats at the shelter on Wednesday.



Application Activity

June 2015 #32

A landscaper is creating a rectangular flower bed such that the width is half of the length. The area of the flower bed is 34 square feet. Write and solve an equation to determine the width of the flower bed, to the *nearest tenth of a foot*.



Strategies for Solving Word Problems

2-8: Highlighting or underlining word problems

2-9: Using two-column notes to read and solve word problems

2-10: Hints for Illustrating Word Problems

2-11: Using three-column notes with illustrations to solve a word problem

2-12: Using three-column notes to explain a problem-solving process

2-13: Avoiding common stumbling blocks with word problems

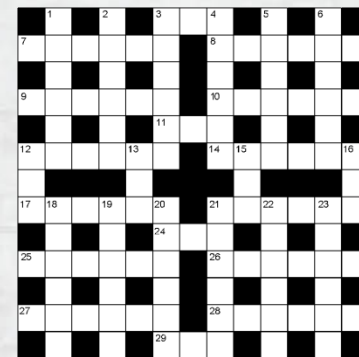


Vocabulary



Vocabulary

**The National Council of Teachers
of Mathematics (NCTM)
Communication Standards
stipulate that instructional
programs should enable students
to “use the language of
mathematics to express ideas
precisely.”**



A strong vocabulary is essential for success in all subject areas. A student's understanding of academic vocabulary is one of the **strongest indicators of academic success.**

To master a new vocabulary term, students must not only learn its definition, but they must also apply the new word in a variety of ways.



1-3: Breaking Down Definitions

- **Help students make sense of definitions by breaking them down into smaller chunks that are easy to read and remember**
- **Useful for comprehending and mastering new terms.**



1-3: Breaking Down Definitions

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- **Instructional Steps**
 - **First Column: Identify the term**
 - **Second Column: Use dashes and dots to outline the definition**
 - **Nouns begin with a category**
 - **Verbs begin with a synonym**
 - **Third Column: Add an example**
 - **Math sentences**
 - **Personal connections**
 - **Illustrations**

Term	Definition Outline	Example, Illustration, Chart, or Table

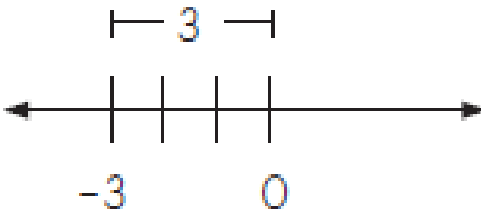


1-3: Breaking Down Definitions

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Breaking Down Definitions

absolute value: a number's distance from zero on a number line

Term	Definition Outline	Example, Illustration, Chart, or Table
<i>absolute value</i>	<ul style="list-style-type: none">- distance• on a number line• from zero to the number	



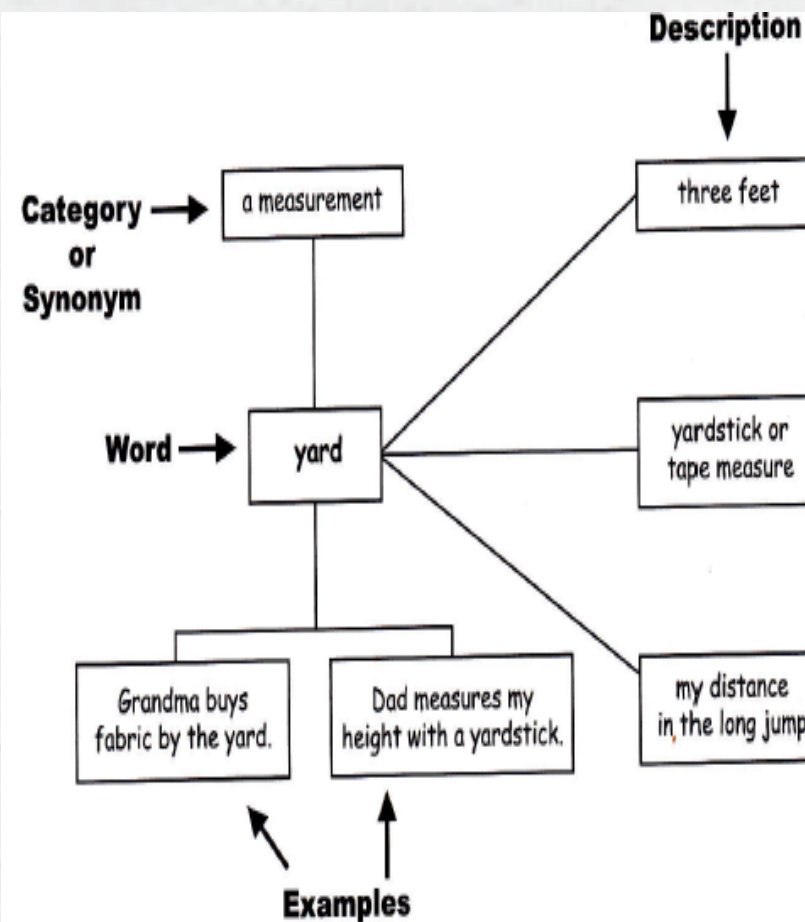
- 1. Think of a mathematical term your students need to know.**
- 2. Create a template with a sheet of notebook paper**
- 3. Start with a formal definition**
- 4. Break down the definition to create a student-friendly definition**



Concept Maps

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- **Concept Maps enable students to demonstrate a thorough understanding of a concept or term.**
- **A Concept Map places a word, its category (for nouns) or a synonym (for verbs), descriptive terms, and examples in a chart-like format.**



Application Activity

- 1. Think of a mathematical term your students need to know.**
- 2. Create a Concept Map using Math Tool S-1-6a**



- **Concept Maps show everything a student knows about a particular term.**
- **These maps also serve as an outline that students can use to write a definition paragraph of the term.**

Additional Idea

Give students a partially completed concept map as an assessment. Ask them to fill in the remainder of the map, then write a detailed definition paragraph.



1-4: Homonyms, Homophones, and Homographs

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- Help students see the connections and differences between words they use in everyday life and words they use in math
- **Homonyms or multiple meaning words**
 - plane
 - range
- **Homophones**
 - pi
 - pie



1-4: Words that Look and/or Sound Alike

Word	How might you use this word in ordinary life?	How might you use this word in math?
1. pie	<i>For Thanksgiving my grandma always makes pumpkin <u>pie</u>.</i>	<i>If you divide the circumference of a circle by its diameter, you get the number <u>pi</u>.</i>
2. slope	<i>The ski <u>slope</u> looked very steep.</i>	<i><u>Slope</u> is the rate of change. The <u>slope</u> of a line is calculated by dividing the change in "y" by the change in "x" (rise/run).</i>



Have students write riddles about the words or concepts you are covering in class.

Creating and solving riddles is a great way to increase student retention of the meaning of words or concepts.



Riddles Meet Five Standard Criteria

- 1. Riddles are written in first person:** I have the power to multiply.
- 2. Riddles have facts:** If you trace my path, I never go straight.
- 3. Riddles give hints:** You'll find me whispering in the ear of my base buddy.
- 4. Riddles end in the same question:** What (or who) am I?
exponent
- 5. Riddles often have only four lines but can have five or six if needed.**



Choose a vocabulary term/concept with which your students struggle.

Then write a riddle!



- **Writing a riddle about a word or concept requires knowledge, the ability to synthesize information, and creativity.**
- **It is quite challenging!**

Additional Idea

Have students create a book of classroom riddles, with illustrations.



More Strategies for Vocabulary

- **Math Vocabulary Lists (1-1)**
- **Tips for Introducing New Words (1-2)**
- **Word Webs (1-5)**
- **Word Banks (1-7)**
- **Meaningful Sentences (1-8)**
- **Word Maps (1-9)**

Summarizing Text and Writing About Graphs



New standards demand that students not only create and interpret graphs, charts, and tables, but also communicate through speech and writing what they know about graphs, charts, and tables.



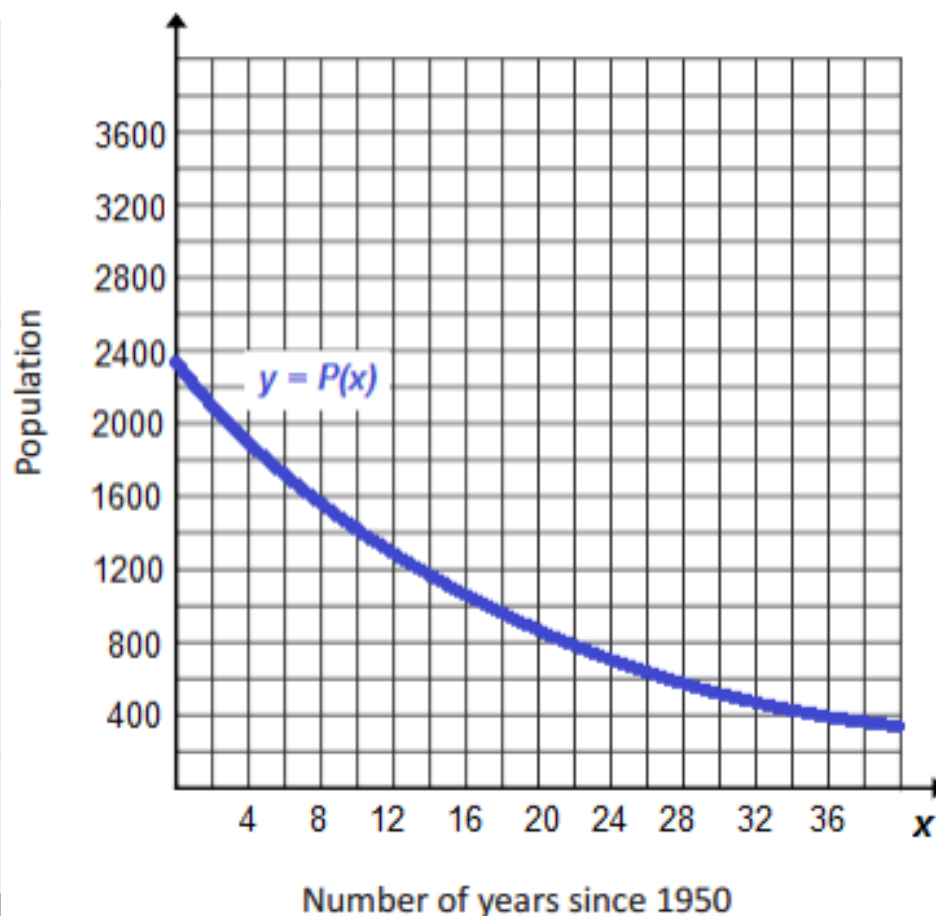
The four steps to write about graphs are:

1. Write an I-V-F topic sentence with a strong action verb that shows the purpose.
2. Rewrite the sentence in the standard way—not broken into three parts.
3. Make a fact outline with complete sentences that support the topic sentence. The sentences will be facts or observations about the graph.
4. Combine the topic sentence and the sentences from the fact outline to write the paragraph.

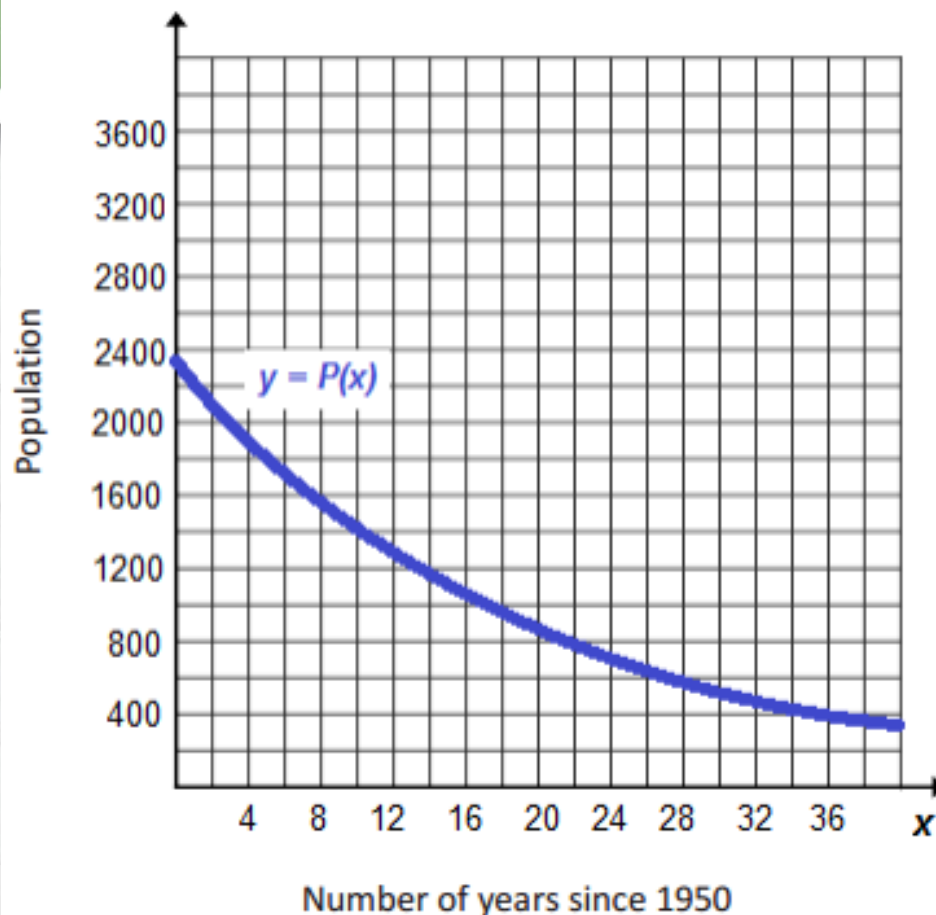


Let's Practice – Mod 3 – Mid Assessment

The population of a remote island has been experiencing a decline since the year 1950. Scientists used census data from 1950 and 1970 to model the declining population. In 1950 the population was 2,350. In 1962 the population was 1,270. They chose an exponential decay model and arrived at the function: $P(x) = 2350(0.95)^x$, $x \geq 0$, where x is the number of years since 1950. The graph of this function is given below.



Let's Practice Cont.



- b. Over what intervals is the function increasing? What does your answer mean within the context of the problem?
- c. Over what intervals is the function decreasing? What does your answer mean within the context of the problem?

Let's Practice Cont.

b. Over what intervals is the function increasing? What does your answer mean within the context of the problem?

There are no intervals in the domain where it is increasing. This means that the population is always decreasing, never increasing.

c. Over what intervals is the function decreasing? What does your answer mean within the context of the problem?

The function is decreasing over its entire domain: $[0, \infty)$. This means that the population will continue to decline, except eventually when the function value is close to zero; then, essentially the population will be zero from that point forward.

Writing for Assessments



**The National Mathematics Advisory Panel (2008)
encourages the use of formative assessment.
“Formative assessment – the ongoing monitoring
of student learning to inform instruction—is
generally considered a hallmark of effective
instruction in any discipline.”**



Explaining Steps to Solve a Word Problem

1. Divide a sheet of paper into four or six sections.
2. Label each section on the front and back of the page.
3. Restate the question from the word problem at the top of the page.
4. Step 1 in solving the problem is listing the facts.
5. In the first *Explain* box, start the explanation with, “First, I listed the facts about...”



Explaining Steps to Solve a Word Problem

- **Solve the problem, using a separate box for each new operation. (After doing the work on the left, explain each step on the right-hand side.) Use a transition with each explanation (i.e., next, then, finally).**
- **State the final answer in a complete sentence, using key words from the math question, in order to put it into context.**



Explaining Steps to Solve a Word Problem

Math Problem:

Directions: Solve the following algebraic equation. Solve for x .

$$\text{Problem: } 3(x + 4) = 10 + 2(x - 3)$$



Explaining Steps to Solve a Word Problem

Q: $3(x+4) = 10 + 2(x-3)$ Solve for x.	
Step 1 (Facts) $3(x+4) = 10 + 2(x-3)$	Explain First, I wrote the equation.
Step 2 (Solve) $3x + 12 = 10 + 2x - 6$	Explain Next, I got rid of the parentheses by distributing the 3 and the 2
Step 3 (Solve) $3x + 12 = 4 + 2x$	Explain Then I combined like terms on each side of the equal sign. The only like terms were the constant terms on the right side.



Explaining Steps to Solve a Word Problem

<p>Step 4 (Solve)</p> $\begin{array}{r} 3x + 12 = 4 + 2x \\ -2x \qquad \qquad -2x \\ \hline x + 12 = 4 \end{array}$	<p>Explain</p> <p>After that, I subtracted $2x$ from both sides of the equation in order to eliminate the x's on the right-hand side.</p>
<p>Step 5 (Solve)</p> $\begin{array}{r} x + 12 = 4 \\ -12 \quad -12 \\ \hline x = -8 \end{array}$	<p>Explain</p> <p>Finally, I subtracted 12 from both sides to get the answer. Since the coefficient of x is 1, I didn't need to divide the coefficient of x.</p>
<p>Step 6 (Final Answer)</p> $x = -8$	<p>Write in a complete sentence.</p> <p>The answer is $x = -8$.</p>



Explaining Steps to Solve a Word Problem

- 1. Will students always have time to do this during a high-stakes assessment?**
- 2. What is the goal of the strategy?**
- 3. Why does the strategy work?**

Explaining Steps to Solve a Word Problem

- **Before the lesson**
- **During the lesson**
- **Post a list of transitions and verbs**
- **Additional Ideas**
- **Comparing weak and strong sentences**



More Strategies: Writing for Assessments

- **Turning an Explanation into a Formal Paragraph (5-2)**
- **Scoring Paragraphs That Explain Steps in Problem Solving (5-3)**
- **Using Framed Paragraphs to Practice for Writing in Math Assessments (5-4)**
- **Preparing for Other Specific Types of Exam Questions (5-5)**



Asking and Answering Questions



The ability to answer questions quickly and accurately is an important skill for all students.

- **Asking questions can help redirect or clarify thinking and lead to deeper understanding.**
- **Answering questions allows students to demonstrate what they know and allows teachers to assess their understanding.**



Asking and Answering Questions

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Teaching Concrete, Critical, and Creative Questions

- **Concrete questions involve:**
 - Reading the lines
 - An answer that is in the text
 - Everyone having the same answer
- **Critical questions involve:**
 - Reading between the lines
 - Sharing opinions
 - Explaining insights
 - Analyzing
- **Creative questions involve:**
 - Reading beyond the lines
 - Applying knowledge
 - Helping others understand concepts
 - Using knowledge to solve problems or complete tasks



- **The strategies are meant to help you more effectively teach your curriculum and meet your district's and/or state's math standards.**
- **Students of all ages and skill levels can use the strategies.**
- **Start small, trying out one strategy at a time. Then add more to your repertoire to empower students to communicate about math.**



**Based on your learning today,
write 10 words to describe
Step Up to Writing in Math.**

**List 2 strategies that you
learned today that you
will use immediately.**

**What are some ways
that you will implement
Step Up to Writing in Math
right away?**

**Why is it important
for students to learn
a variety of strategies
for writing in Math?**

