Countdown to Common Core

Shifting to the Common Core

Grades 2–3 Mathematics

Augustyn King Erickson Sebranek

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Thoughtful Learning

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Shifting to the Common Core

Course Objectives

This material helps students learn to analyze, evaluate, and create information, developing the depth of knowledge that the Common Core State Standards require in math and all subjects.

In *Shifting to the Common Core,* students will . . .

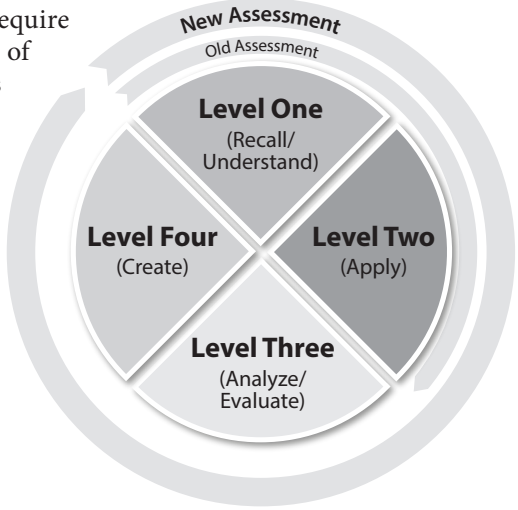
- explore the mathematical problem-solving process;
- analyze word problems using knowns and unknowns;
- identify constants and variables;
- analyze formulas to determine which apply;
- recognize patterns and reasoning in mathematical expressions;
- use mathematical modeling to predict values;
- evaluate mathematical reasoning;
- explain specific problem-solving approaches;
- create new mathematical expressions in order to solve problems;
- model word problems and real-world situations using mathematics.

By developing these deeper-thinking skills, students improve their comprehension in mathematics and across the curriculum, raise their grades, and increase their success on Common Core assessments.

Dear Educator:

You and your students are navigating a time of great change, brought about by the Common Core State Standards and the assessments that measure them. This book will help you and your students succeed.

The Common Core State Standards require students to demonstrate deeper levels of thinking, and as a result, assessments are shifting. Previous high-stakes assessments tested what students could recall, understand, and apply—the first levels of thinking on the chart to the right. The new assessments measure those levels but go much deeper. To succeed on the new assessments, students must demonstrate the ability to carefully analyze information, evaluate it, and create effective responses.



This book teaches your students these three important skills:

1. Analyzing information they receive in text and graphical presentations
2. Evaluating information and testing it for reliability
3. Creating information and organizing it in new forms

In this way, *Shifting to the Common Core* goes far beyond other courses. Instead of just practicing sample test questions, students learn the specific strategies and skills they need to think more deeply. *Shifting to the Common Core* helps students succeed in school, score higher on Common Core assessments, and go farther in college and career.

Thank you for helping your students think more deeply, and thank you for using *Shifting to the Common Core*.

Sincerely,

Chris Erickson
Author

Common Core Mathematical Practices Standards

Sampler

Table of Contents

CCSS Mathematical Practices Standards

Understanding the CCSS and the New Assessments

This page answers frequently asked questions about the Common Core State Standards (CCSS) and the new assessments created to test compliance with these standards.

What are the CCSS?

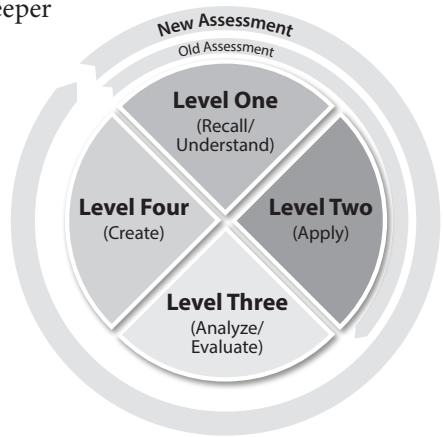
The Common Core State Standards (CCSS) are a set of standards for English/language arts and math that have been adopted by most states. In addition to focusing on knowledge content, these standards also emphasize skills required for college and career readiness: critical thinking, innovation, communication, problem solving, and using information and technology.

What are PARCC and Smarter Balanced?

Two organizations have received federal "Race to the Top" grants to develop assessments that measure the full range of skills required by the Common Core State Standards. One organization is called PARCC, which stands for the Partnership for Assessing Readiness for College and Careers. The other organization is called the Smarter Balanced Assessment Consortium. The tests developed by these organizations use a combination of traditional testing methods, innovative technology, and written responses to measure students' abilities.

How do these tests differ from previous high-stakes tests?

The new assessments go beyond previous tests to assess greater depths of knowledge. Previous assessments tested depth of knowledge at levels 1 and 2: recalling information and applying it in straightforward ways. The new assessments test these levels as well as levels 3 and 4: analyzing information received in a variety of forms and using it to create new forms. These assessments use innovative testing strategies, new technology, and human scoring to test these deeper levels of thinking.

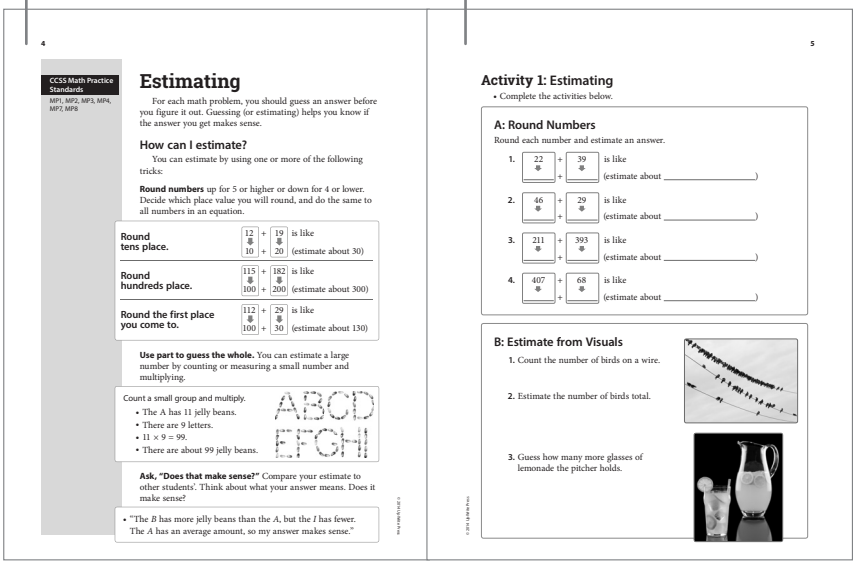


30 Minutes to Success

In this book, you'll find spreads organized with instructional material on the left and activities on the right. Follow this simple plan to fit these modules into your lesson schedule:

- 10 minutes for presenting the instruction on the left
- 10 minutes for students to complete the activity on the right
- 10 more minutes for class discussion afterward

Instruction (10 minutes) | **Activity** (10 minutes)



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CCSS Math Practice Standards
MP1, MP2, MP3, MP4, MP7, MP8

Estimating

For each math problem, you should guess an answer before you figure it out. Guessing (or estimating) helps you know if the answer you get makes sense.

How can I estimate?

You can estimate by using one or more of the following tricks:

Round numbers up for 5 or higher or down for 4 or lower. Decide which place value you will round, and do the same to all numbers in an equation.

Round tens place.	12 + 19 → 10 + 20	is like (estimate about 30)
Round hundreds place.	115 + 182 → 100 + 200	is like (estimate about 300)
Round the first place you come to.	112 + 29 → 100 + 30	is like (estimate about 130)

Use part to guess the whole. You can estimate a large number by counting or measuring a small number and multiplying.

Count a small group and multiply.

- The A has 11 jelly beans.
- There are 9 letters.
- 11 × 9 = 99.
- There are about 99 jelly beans.

Ask, "Does that make sense?" Compare your estimate to other students'. Think about what your answer means. Does it make sense?

- "The *B* has more jelly beans than the *A*, but the *I* has fewer. The *A* has an average amount, so my answer makes sense."

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Activity 1: Estimating

- Complete the activities below.

A: Round Numbers

Round each number and estimate an answer.

1. 22 + 39 is like (estimate about _____)
2. 46 + 29 is like (estimate about _____)
3. 211 + 393 is like (estimate about _____)
4. 407 + 68 is like (estimate about _____)

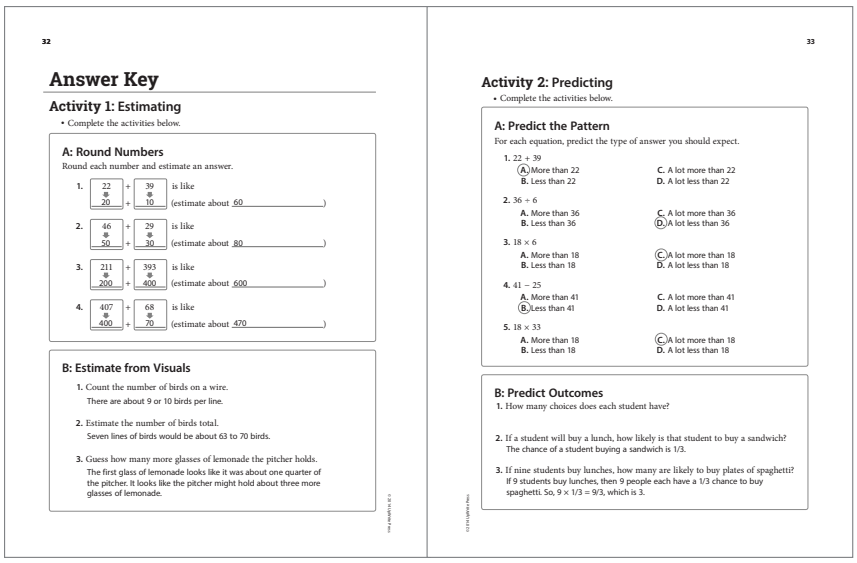
B: Estimate from Visuals

1. Count the number of birds on a wire.
2. Estimate the number of birds total.
3. Guess how many more glasses of lemonade the pitcher holds.

Discussion (10 minutes)

Where will I find answers?

An answer key appears after the lessons. Use this key to check students' answers and to test their understanding.



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Answer Key

Activity 1: Estimating

- Complete the activities below.

A: Round Numbers

Round each number and estimate an answer.

1. 22 → 20 + 39 → 10 is like (estimate about 60)
2. 46 → 50 + 29 → 30 is like (estimate about 80)
3. 211 → 200 + 393 → 400 is like (estimate about 600)
4. 407 → 400 + 68 → 70 is like (estimate about 470)

B: Estimate from Visuals

1. Count the number of birds on a wire.
   There are about 9 or 10 birds per line.
2. Estimate the number of birds total.
   Seven lines of birds would be about 63 to 70 birds.
3. Guess how many more glasses of lemonade the pitcher holds.
   The first glass of lemonade looks like it was about one quarter of the pitcher. It looks like the pitcher might hold about three more glasses of lemonade.

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Activity 2: Predicting

- Complete the activities below.

A: Predict the Pattern

For each equation, predict the type of answer you should expect.

1. 22 + 39
   (A) More than 22 — C. A lot more than 22
   B. Less than 22 — D. A lot less than 22
2. 36 ÷ 6
   A. More than 36 — C. A lot more than 36
   B. Less than 36 — (D) A lot less than 36
3. 18 × 6
   A. More than 18 — (C) A lot more than 18
   B. Less than 18 — D. A lot less than 18
4. 41 − 25
   A. More than 41 — C. A lot more than 41
   (B) Less than 41 — D. A lot less than 41
5. 18 × 33
   A. More than 18 — (C) A lot more than 18
   B. Less than 18 — D. A lot less than 18

B: Predict Outcomes

1. How many choices does each student have?
2. If a student will buy a lunch, how likely is that student to buy a sandwich?
   The chance of a student buying a sandwich is 1/3.
3. If nine students buy lunches, how many are likely to buy plates of spaghetti?
   If 9 students buy lunches, then 9 people each have a 1/3 chance to buy spaghetti. So, 9 × 1/3 = 9/3, which is 3.

Instructor's Note

The deeper-thinking strategies introduced on the left-hand pages in this book can be applied to any math content you are currently studying. If you wish, you can demonstrate these strategies using word problems and formulas from your own classroom in conjunction with, or as an alternative to, the examples provided in this book.

Analyzing, Evaluating, and Creating

To comply with the Common Core and succeed on the new assessments, students need to develop three deep-thinking skills.

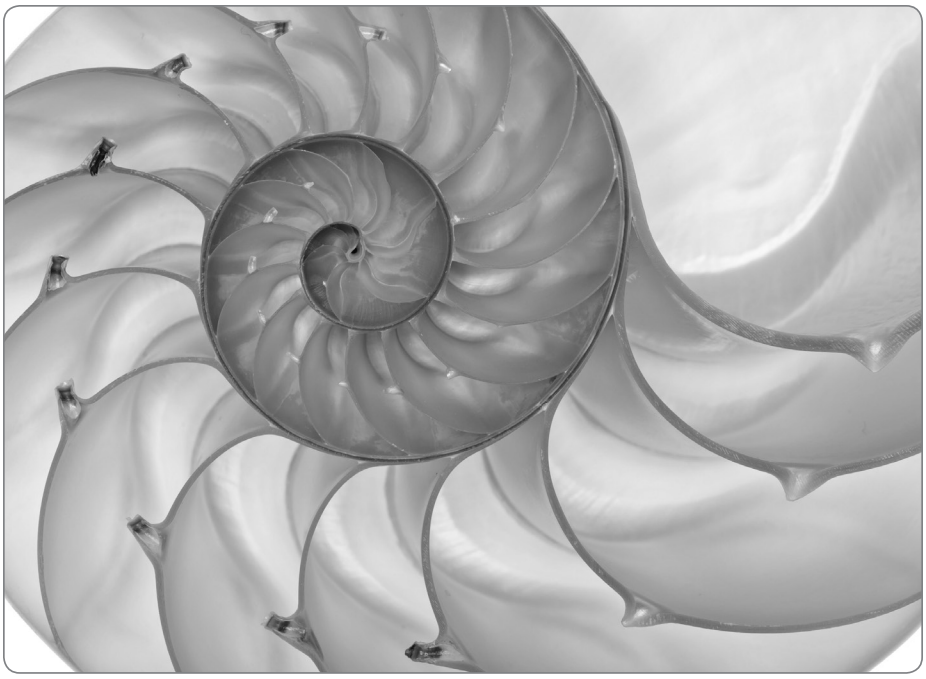
What thinking skills should my students learn?

Your students need to learn strategies for analyzing, evaluating, and creating:

1. **Analyzing** involves closely considering information, breaking it into its parts, exploring how each part works, and discovering how the parts connect to form a whole. This book teaches specific strategies for analyzing word problems, visuals, and expressions in mathematics.

2. **Evaluating** involves deciding the value or worth of information, deciding if it is true, desirable, logical, meaningful, and reliable. This books teaches specific strategies for evaluating formulas, arguments, and reasoning in mathematics.

3. **Creating** involves connecting information in new ways, building mathematical expressions, arguing for specific methods or outcomes, and innovating solutions to complex problems. This book teaches specific strategies for creating formulas, visuals, and explanations in mathematics.



"Mathematics is the door and key to the sciences."

—Roger Bacon

Shifting to the Common Core: Mathematics 2–3

Mathematics is much more than adding, subtracting, multiplying, and dividing. It is using numbers to think more deeply about the world. Math allows us to test ideas before we try them in reality.

The Common Core State Standards emphasize deeper-thinking skills: analyzing information, evaluating its worth, and creating new information. These lessons help elementary students develop deeper-thinking skills. Students will learn specific strategies for working with word problems, testing answers, and creating formulas.

Lesson Preview

- **CCSS Math Anchor Standards**
- **Estimating and Predicting**
- **Multiplying and Dividing**
- **Figuring Out Word Problems**
- **Reading Tables**
- **Using Number Lines**
- **Using Graphs**
- **Working with Fractions**
- **Comparing Equations**
- **Working with Formulas**
- **Using Variables**
- **Creating Formulas**
- **Explaining Your Work**

Common Core Anchor Standards for Math

CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.
Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.
Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to 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. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

CCSS.Math.Practice.MP4 Model with mathematics.
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

CCSS.Math.Practice.MP5 Use appropriate tools strategically.
Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a Web site, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

CCSS.Math.Practice.MP6 Attend to precision.
Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school, they have learned to examine claims and make explicit use of definitions.

CCSS.Math.Practice.MP7 Look for and make use of structure.
Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

CCSS.Math.Practice.MP8 Look for and express regularity in repeated reasoning.
Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Assessment for Common Core Mathematics

On the Common Core assessments, students must complete the following tasks:

1. **Major Concepts and Procedures:** Students solve problems involving the major content for their grade level with connections to practices.
2. **Additional and Supporting Concepts and Procedures:** Students solve problems involving the additional and supporting content for their grade level with connections to practice.
3. **Expressing Math Reasoning:** Students express mathematical reasoning by constructing mathematical arguments and critiques.
4. **Modeling Real-World Problems:** Students solve real-world problems engaging particularly in the modeling practice.
5. **Fluency:** Students demonstrate fluency in areas set forth in the standards for content.

CCSS Math Practice Standards

MP1, MP2, MP3, MP4, MP7, MP8

Estimating

For each math problem, you should guess (estimate) an answer before you figure it out. Estimating helps you know if the answer you get makes sense.

How can I estimate?

Use one or more of the following tricks:

Round numbers up for 5 or higher or down for 4 or lower. Decide which place value you will round, and do the same to all numbers in an equation.

Round tens place.	12 → 10 + 19 → 20 is like (estimate about 30)
Round hundreds place.	115 → 100 + 182 → 200 is like (estimate about 300)
Round the first place you come to.	112 → 100 + 29 → 30 is like (estimate about 130)

Use part to guess the whole. You can estimate a large number by counting or measuring a small number and multiplying.

Count a small group and multiply.

- The A has 11 jelly beans.
- There are 9 letters.
- 11 × 9 = 99.
- There are about 99 jelly beans.

Ask, "Does that make sense?" Compare your estimate to other students'. Think about what your answer means. Does it make sense?

- "The *B* has more jelly beans than the *A*, but the *I* has fewer. The *A* has an average amount, so my answer makes sense."

Activity 1: Estimating

- Complete the activities below.

A: Round Numbers

Round each number and estimate an answer.

1. 22 + 39 is like _____ + _____ (estimate about _____)

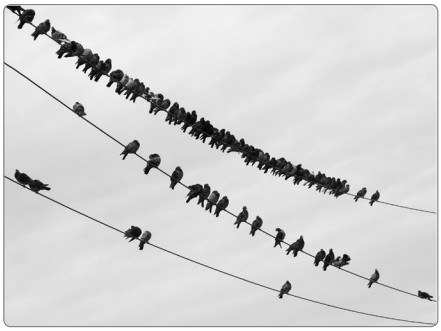
2. 46 + 29 is like _____ + _____ (estimate about _____)

3. 211 + 393 is like _____ + _____ (estimate about _____)

4. 407 + 68 is like _____ + _____ (estimate about _____)

B: Estimate from Visuals

1. Count the number of birds on a wire.



2. Estimate the number of birds total.

3. Guess how many more glasses of lemonade the pitcher holds.

CCSS Math Practice Standards

MP1, MP2, MP3, MP4, MP7, MP8

Predicting

When you predict, you look at patterns right now to guess what might happen in the future.

How can I predict?

Use the following ideas.

1. Find the pattern. Are the numbers getting bigger? Are they getting smaller? Do you think the pattern will continue in the same way?

When adding,
numbers usually get bigger.

- 72 + 16 should be more than 72.

When subtracting,
numbers usually get smaller.

- 72 − 16 should be less than 72.

2. Decide how strong the pattern is. Are the numbers changing in a big way? In a little way? Do you think the numbers will keep changing in the same way?

When multiplying, numbers usually get a lot bigger.

- 24 × 6 should be a lot more than 24.

When dividing, numbers usually get a lot smaller.

- 24 ÷ 6 should be a lot less than 24.

3. Think of what could happen. Count all of the possible ways that a situation could turn out. Then decide how likely one outcome is.

Count the possible outcome.

- Imagine that you have 24 cupcakes.

Decide how likely one outcome is.

- If you have 24 students in class and 24 cupcakes, each student has a one to one chance to get a cupcake (24 cupcakes ÷ 24 students).

Activity 2: Predicting

- Complete the activities below.

A: Predict the Pattern

For each equation, predict the type of answer you should expect.

1. $22 + 9$

A. More than 22
B. Less than 22
C. A lot more than 22
D. A lot less than 22

2. $36 \div 6$

A. More than 36
B. Less than 36
C. A lot more than 36
D. A lot less than 36

3. 18×6

A. More than 18
B. Less than 18
C. A lot more than 18
D. A lot less than 18

4. $41 - 5$

A. More than 41
B. Less than 41
C. A lot more than 41
D. A lot less than 41

5. 18×33

A. More than 18
B. Less than 18
C. A lot more than 18
D. A lot less than 18

B: Predict Outcomes

Imagine that your school cafeteria offers three lunches: a slice of pizza, a plate of spaghetti, or a grilled cheese sandwich.

1. How many choices does each student have?
2. If a student will buy a lunch, how likely is that student to buy a sandwich?
3. If nine students buy lunches, how many are likely to buy plates of spaghetti?

Shifting to the **Common Core**

Course Objectives

These materials help students gain the skills they need to comply with the Common Core and to succeed on its assessments. Students will learn to analyze the information they receive, evaluate it, and synthesize responses that demonstrate deep levels of knowledge.

In *Shifting to the Common Core: Mathematics,* students will . . .

- Understand the mathematical problem-solving process.
- Use known/unknown analysis to understand mathematical prompts in the assessment.
- Identify constants and variables in each situation.
- Analyze formulas to determine which apply.
- Recognize patterns and reasoning in mathematical expressions.
- Use mathematical modeling to predict calculated values.
- Evaluate and critique mathematical reasoning.
- Argue for specific problem-solving approaches.
- Create new mathematical expressions in order to solve problems.
- Model using mathematics.

In *Shifting to the Common Core: English/Language Arts,* students will . . .

- Use close-reading strategies to capture the meaning of complex texts.
- Quickly outline complex texts, summarizing main points.
- Cite textual evidence in a variety of forms.
- Use STRAP analysis to fully understand writing prompts in the assessment.
- Evaluate and critique logical arguments within texts.
- Weigh the effectiveness of support.
- Evaluate the use of literary devices.
- Construct logical arguments, drawing evidence from texts.
- Synthesize information from multiple sources to build meaning.
- Write effective responses to on-demand prompts.

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