



Mathematics Curriculum Guide

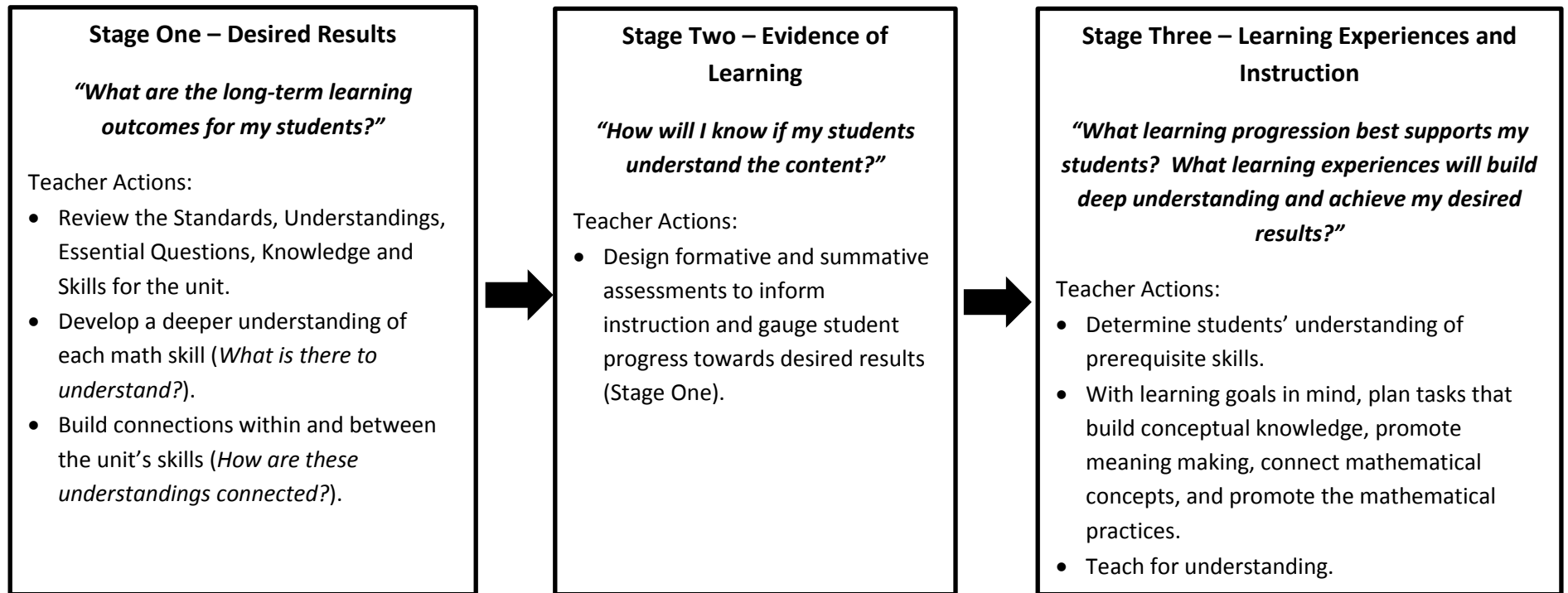
High School Algebra 1

2017-18



Teaching for Understanding

- **Effective instruction begins with clarity about desired learning outcomes and about evidence that indicates learning has occurred, better known as “beginning with the end in mind.” By starting with long-term results and working “backward,” effective lesson planning occurs. The “backward planning” stages for a mathematics unit are:**

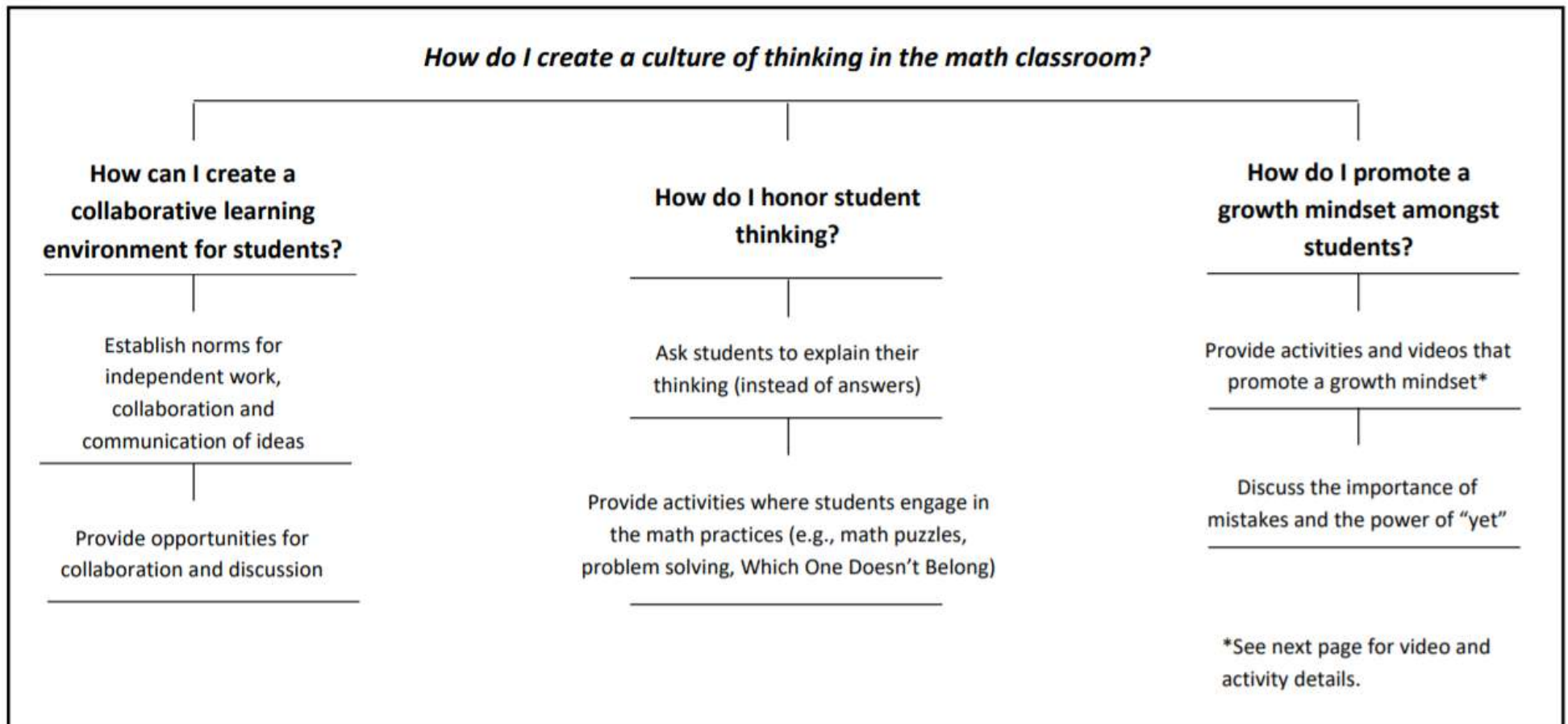


- During the first three weeks of school, teachers will dedicate time during math instruction to create a mathematical mindset. A menu of activities can be selected by teachers to establish a healthy classroom environment, prepare students to engage in inquiry and problem-solving, and promote a positive growth mindset (see pages 3-4).



Create a Culture of Thinking

- Creating a culture of thinking in the math classroom is a dedicated process that takes place throughout the entire school year. In order to lay the foundation, teachers will spend time during the first three days of school providing students with activities that establish an engaging learning community focused on problem solving, discourse and metacognition.



Creating a Growth Mindset

Background

- The way a student reacts to academic challenges is directly related to whether or not the student has a growth mindset. The gap in student performance widens over time between those with a growth mindset and those with a fixed mindset.
- Teachers play a key role in developing growth mindset in students. To create a growth mindset culture, focus on the power of mistakes (download Jo Boaler’s “Positive Classroom Norms”). Praise the process, not the person.
- Simply telling students to have a growth mindset can backfire. A scientific explanation about how intelligence works – that the brain can get stronger and smarter with new learning – has been demonstrated to be effective.
- Reiterating the message “just try harder” can also be problematic. A growth mindset isn’t about trying harder. Students need to understand why they should put in effort and how to deploy that effort.

Secondary Videos

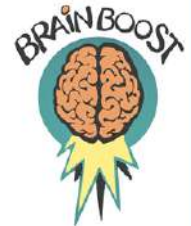
- Neuroplasticity (2:03)
<https://www.youtube.com/watch?v=ELpfYCZa87g>
- The science behind Growth Mindset (3:04)
<https://www.youtube.com/watch?v=WtKJrB5rOKs>
- Four Boosting Math Messages from Jo and Her Students (8:35)
<https://www.youcubed.org/students/>
- John Legend: Success through effort (2:01)
<https://www.youtube.com/watch?v=LUtcigWSBsw>

Discussion Questions

- How do you feel when you make a mistake? Why?
- How do you think other people see you when you make a mistake?
- Have you ever discovered something new from making a mistake?
- Have you ever felt proud of making a mistake?
- Has a mistake ever made you think more deeply about a problem? (start non-academic and then talk about how the lessons apply to academics)

Four Boosting Math Messages

- 1) Everyone can learn math to high levels!
- 2) Believe in yourself! You can do whatever you want to do!
- 3) Struggle and mistakes are really important. Keep going when times get hard!
- 4) Speed is not important in math. Mathematicians think deeply about math!



www.youcubed.org at Stanford University

The Power of “Yet”

- Turn a fixed mindset comment into a growth mindset statement by adding ‘yet’ to the end of the comment.
- Video: Sesame Street: Janelle Monae – Power of Yet (2:41) <https://www.youtube.com/watch?v=XLeUvZvuvAs>
- When grading student work, be it formative or summative, create a cut off point for what you would consider mastery. All work that does not meet this expectation is marked NOT YET. When returned to students, explain that they are to revise work and provide guidelines and structure for students to fix their assignments and demonstrate mastery.

Activities

- Design a poster comparing growth and fixed mindsets
- Write growth mindset hashtags and post around the classroom
- Turn the transfer goals into “I will...” statements
- Challenge students with a math puzzle and focus on using growth mindset language (I can’t get the answer... yet)
- Answer a “Dear Abby” letter from a student who feels like a failure
- Give each student a piece of paper. Ask them to crumple it up and throw it at the board with the feelings they have when they make a mistake in math. Get them to retrieve the paper, uncrumple it, and color each line with different colors. Tell your students that these lines represent all the synaptic activity that happens when a mistake is made. Explain how they can learn from mistakes. Ask them to keep the paper and stick it into a notebook or folder to look at when they make a mistake. This physical reminder prompts students to use mistakes to strengthen their brain every time they open their notebook.

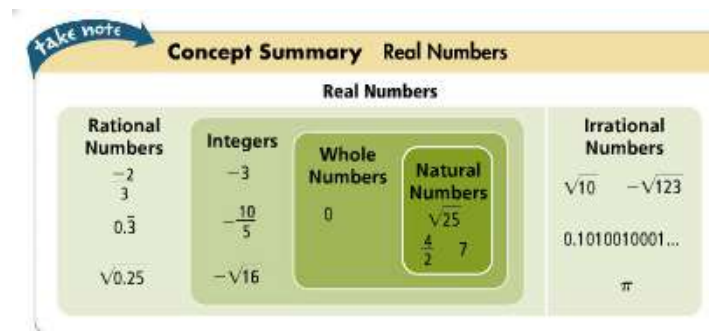


Unit 1: Foundations for Algebra (Chapter 1)

In this unit students will review the work of the last three years to apply properties of real numbers, distributive property, additive inverse property, and the multiplicative inverse property to real world situations. The ultimate goal of this unit is for students to review variables and expressions and explore real-number operations.

Common Misconceptions:

- **Order of Operations:** Students might think the rule for multiplication and division tells you to do multiplication and then division, or the rule for addition and subtraction tells you to do addition and then subtraction. Students need to learn that multiplication and division are on the same level and should be applied from left to right. Addition and subtraction are on the same level and should also be applied from left to right, but only after any multiplication and division in the problems.
- **Common Errors With Real Numbers:** Some students have difficulty understanding the relationships among the various sets of numbers. See the visual below.





Topic 1: Foundations for Algebra (Chapter 1)

Transfer Goals		
1) Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution. 2) Effectively communicate orally, in writing, and using models (e.g., concrete, representational, abstract) for a given purpose and audience. 3) Construct viable arguments and critique the reasoning of others using precise mathematical language.		Timeframe: 2 weeks/12 days Start Date: August 17, 2017 Assessment Dates: Sept. 1, 2017
Standards	Meaning-Making	
A-SSE Seeing Structure in Expressions Interpret the structure of expressions. 1. Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. Prepares for: N-RN The Real Number System Use properties of rational and irrational numbers. 3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	Understandings	Essential Questions
	<i>Students will understand that...</i> <ul style="list-style-type: none"> The Order of Operations applies to both numeric expressions, and algebraic expressions. Variables are used to represent quantities that change, or are unknown. Integer rules can be applied to real numbers. Word phrases can be represented with algebraic expressions. Properties: <ul style="list-style-type: none"> Distributive property Properties of real numbers Additive Inverse property Multiplicative Inverse property 	<i>Students will keep considering...</i> <ul style="list-style-type: none"> What is the purpose of using a variable and what do variables represent? How is the distributive property related to order of operations? How is an algebraic expression different than a numeric expression? How can you evaluate an expression? What are the rules you can use for adding, subtracting, multiplying, and dividing real numbers?
	Acquisition	
	Knowledge	Skills
	<i>Students will know...</i> Vocabulary: algebraic expression, numeric expression, constant, variable, evaluate, order of operations, distributive property, additive inverse, multiplicative inverse, opposite, absolute value, real number, coefficient, reciprocal, simplify, base, exponent, power Procedures for: <ul style="list-style-type: none"> Simplifying algebraic expressions Simplifying numeric expressions Evaluating algebraic expressions 	<i>Students will be skilled at and able to do the following...</i> <ul style="list-style-type: none"> Students can distinguish between when a word phrase can be represented with a numeric expression, and with an algebraic expression and explain why it was needed. Student can identify the coefficients, and constants Students will be able to write expressions that represent real world problems and simplify including those involving the area and perimeter of a rectangle or triangle. Students can use addition, subtraction, multiplication, and division rules effectively. Students can use order of operations to simplify numeric expressions and evaluate and simplify algebraic expressions.



Topic 1: Foundations for Algebra (Chapter 1)

Transfer is a student’s ability to independently apply understanding in a novel or unfamiliar situation. In mathematics, this requires that students use reasoning and strategy, not merely plug in numbers in a familiar-looking exercise, via a memorized algorithm.

Transfer goals highlight the effective uses of understanding, knowledge, and skills we seek in the long run – that is, what we want students to be able to do when they confront new challenges, both in and outside school, beyond the current lessons and unit. These goals were developed so all students can apply their learning to mathematical or real-world problems while simultaneously engaging in the Standards for Mathematical Practices. In the mathematics classroom, assessment opportunities should reflect student progress towards meeting the transfer goals.

With this in mind, the revised **PUSD transfer goals** are:

- 1) **Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution.**
- 2) **Effectively communicate orally, in writing, and by using models (e.g., concrete, representational, abstract) for a given purpose and audience.**
- 3) **Construct viable arguments and critique the reasoning of others using precise mathematical language.**

Multiple measures will be used to evaluate student acquisition, meaning-making and transfer. Formative and summative assessments play an important role in determining the extent to which students achieve the desired results in stage one.

Formative Assessment	Summative Assessment
Aligning Assessment to Stage One	
<ul style="list-style-type: none"> • What constitutes evidence of understanding for this lesson? • Through what other evidence during the lesson (e.g. response to questions, observations, journals, etc.) will students demonstrate achievement of the desired results? • How will students reflect upon, self-assess, and set goals for their future learning? 	<ul style="list-style-type: none"> • What evidence must be collected and assessed, given the desired results defined in stage one? • What is evidence of understanding (as opposed to recall)? • Through what task(s) will students demonstrate the desired understandings?
Opportunities	
<ul style="list-style-type: none"> • Discussions and student presentations • Checking for understanding (using response boards) • Ticket out the door, Cornell note summary, and error analysis • <i>Performance Tasks</i> within a Unit • Teacher-created assessments/quizzes 	<ul style="list-style-type: none"> • Unit assessments • Teacher-created quizzes and/or mid-unit assessments • <i>Illustrative Mathematics</i> tasks (https://www.illustrativemathematics.org/) • Performance tasks



Topic 1: Foundations for Algebra (Chapter 1)

The following pages address how a given skill may be assessed. Assessment guidelines, examples and possible question types have been provided to assist teachers in developing formative and summative assessments that reflect the rigor of the standards. *These exact examples cannot be used for instruction or assessment, but can be modified by teachers.*

Unit Skills	SBAC Targets (DOK)	Standards	Examples
<ul style="list-style-type: none"> Students can distinguish between when a word phrase can be represented with a numeric expression, and with an algebraic expression and explain why it was needed. Student can identify the coefficients, and constants. Students will be able to write expressions that represent real world problems and simplify including those involving the area and perimeter of a rectangle or triangle. Students can use addition, subtraction, multiplication, and division rules effectively. Students can use order of operations to simplify numeric expressions and evaluate and simplify algebraic expressions. 	<p>Select and use appropriate tools strategically. (1,2)</p> <p>Apply mathematics to solve well-posed problems in mathematics and arising in everyday life, society, and the workplace. (2,3)</p> <p>Use properties of rational and irrational numbers. (1,2,3)</p> <p>Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3, 4)</p>	<p>A-SSE Seeing Structure in Expressions Interpret the structure of expressions.</p> <ol style="list-style-type: none"> Interpret expressions that represent a quantity in terms of its context. <ol style="list-style-type: none"> Interpret parts of an expression, such as terms, factors, and coefficients. <p>Prepares for: N-RN The Real Number System Use properties of rational and irrational numbers.</p> <ol style="list-style-type: none"> Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. 	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Simplify the expression:</p> $2(1 + c) = \boxed{}$ </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Look at the following expression:</p> $2 + h - 5j$ <p>What is the coefficient of j?</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Jason had p coins. Then he found 16 more coins in a drawer. Choose the expression that shows how many coins Jason has now.</p> <p> <input type="radio"/> 16 <input checked="" type="radio"/> $p + 16$ <input type="radio"/> $p - 16$ <input type="radio"/> $16 - p$ </p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>What is the value of $20 - (3 \times 2^3 - 5)$?</p> <p> <input type="radio"/> A -191 <input type="radio"/> B 1 <input type="radio"/> C 11 <input type="radio"/> D 131 </p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>Write an expression in simplified form for the area of the rectangle shown below:</p> <div style="text-align: center; margin: 10px 0;"> </div> </div>



Topic 1: Foundations for Algebra (Chapter 1)

Transfer Goals

- 1) Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution.
- 2) Effectively communicate orally, in writing, and using models (e.g., concrete, representational, abstract) for a given purpose and audience.
- 3) Construct viable arguments and critique the reasoning of others using precise mathematical language.

Essential Questions:

- What is the purpose of using a variable and what do variables represent?
- How is the distributive property related to order of operations?
- How is an algebraic expression different than a numeric expression?
- How can you evaluate an expression?
- What are the rules you can use for adding, subtracting, multiplying, and dividing real numbers?

Standards: **A-SSE 1a**, **N-RN 3**

Suggested Timeframe: **2 weeks/12 days**

Start Date: **August 17, 2017**

Assessment Dates: **September 1, 2017**

Time	Lesson/Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Resources
1 Day (Aug. 17 th)	Lesson 1-1: Variables and Expressions SMP: 1,3,4,7 (pp. 4-9) A-SSE 1a	<ul style="list-style-type: none"> • How can you use an algebraic expression to represent a word phrase? • How are constant quantities different than variable quantities? • What strategies can you use to help you model and understand word phrases? <p>Inquiry Question Options: p. 4 “Solve It”</p>	<ul style="list-style-type: none"> • Algebraic expressions can be used to represent patterns and word phrases. 	<p>Vocabulary: quantity, variable, algebraic expression, numerical expression, constant, coefficient</p> <ul style="list-style-type: none"> • A variable is a symbol (usually a letter) that represents either an unknown quantity or a quantity that can change. • An algebraic expression is a mathematical phrase that uses one or more variables. • A numeric expression is a mathematical phrase involving numbers and operation symbols, and can be simplified to a constant. 	<ul style="list-style-type: none"> • Students can distinguish between when a word phrase can be represented with a numeric expression, and with an algebraic expression and explain why it was needed. • Students can write expressions with two operations when given a word phrase. • Students can write a word phrase that represents a algebraic expression. • Student can identify the coefficients, and constants in an expression. 	<p>Common Core Problems: 7, 8, 31, 32 (Discuss how a variable with a coefficient represents multiplication), 36, 37, 38, 39</p> <p>Note:</p> <ul style="list-style-type: none"> • Include an example similar to problem 5 on pg.6.
2 Days (Aug. 18 th & 21 st)	Lesson 1-2: Order of Operations and Evaluating Expressions SMP: 1,3,4,6,8 (pp. 10-15) A-SSE 1a	<ul style="list-style-type: none"> • Why is it important to follow the order of operations when simplifying numeric expressions, and evaluating algebraic expressions? <p>Inquiry Question Options: p. 10 “Solve It”</p>	<ul style="list-style-type: none"> • When simplifying an expression, you need to perform operations in the correct order. • When evaluating an expression every operation being performed with the variable, needs to be performed with the number that the variable is equivalent to. 	<p>Vocabulary: evaluate, simplify, base, exponent, power</p> <ul style="list-style-type: none"> • The correct order of operations. • To evaluate an expression when a value is substituted for a variable. • Powers can be used to represent repeated multiplication such as $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$. 	<ul style="list-style-type: none"> • Students will be able to simplify numeric expressions. • Students will be able to evaluate Algebraic expressions using real numbers. • Students will be able to write expressions that model real world situations and evaluate them. 	<p>Common Core Problems: 8, 36, 43, 53, 54, 60</p> <p>1-2 Think about a Plan</p>

Time	Lesson/Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
1 Day (Aug. 22 nd)	Lesson 1-5: Adding and Subtracting Real Numbers SMP: 1,3,4 (pp. 30-36) Prepares for: N-RN 3	<ul style="list-style-type: none"> What are two methods you can use to add and subtract real numbers? How is subtraction related to addition? <p>Inquiry Question Options: p. 30 "Solve It"</p>	<ul style="list-style-type: none"> You can add or subtract any real numbers using a number line model. You can also add or subtract real numbers using rules involving absolute values. 	<p>Vocabulary: absolute value, opposites, additive inverse</p> <ul style="list-style-type: none"> To add two numbers with the same sign, add their absolute values. The sum has the same sign as the addends. To add two numbers with different signs, subtract their absolute values. The sum has the same sign as the addend with the greater absolute value. For every real number a, there is an additive inverse $-a$, and the sum is 0. To subtract a real number, add its opposite. 	<ul style="list-style-type: none"> Students will be able to add and subtract integers, decimals, and fractions. Students will be able to evaluate expressions. Students will to explain reasoning to determine if the value of an expression is positive or negative, and to compare the value of two different expressions. 	<p>Common Core Problems: 33, 34, 35, 47-60, 65, 69</p> <p>1-5 Additional Vocabulary Support</p> <p>1-5 Think about a Plan</p> <p>Note:</p> <ul style="list-style-type: none"> Include an example similar to problem 4 on pg.33. Remind students that writing repeated addition can be written as a product such as $7+7+7+7=4(7)$.
1 Day (Aug. 23 rd)	Lesson 1-6: Multiplying and Dividing Real Numbers SMP: 1,3,4,6,7 (pp. 38-44) Prepares for: N-RN 3	<ul style="list-style-type: none"> How are the rules for addition and subtraction different than the rules for multiplication and division? How are multiplication and division related? Why does the inverse property of multiplication work? <p>Inquiry Question Options: p. 38 "Solve It"</p>	<ul style="list-style-type: none"> The rules for multiplying real numbers are related to properties of real numbers and the definitions of operations. 	<p>Vocabulary: multiplicative inverse, reciprocal</p> <ul style="list-style-type: none"> The product or quotient of two real numbers with different signs is negative. The product or quotient of two real numbers with the same sign is positive. The quotient of 0 and any nonzero real number is 0. The quotient of any real number and 0 is undefined. 	<ul style="list-style-type: none"> Students will be able to multiply and divide real numbers. Students will be able to solve real world problems involving the multiplication and division of real numbers. Students will evaluate expression involving multiplication and division. 	<p>Common Core Problems: 5, 6, 7, 48, 51-53, 60-62, 64-69</p> <p>1-6 Think about a Plan</p> <p>Note:</p> <ul style="list-style-type: none"> Include an example similar to problem 3 on pg.40. Include examples where students evaluate expressions using integer values.

Common Core Practices

- Instruction in the Standards for Mathematical Practices
- Use of Talk Moves
- Note-taking

- Use of Manipulatives
- Use of Technology
- Use of Real-world Scenarios

- Project-based Learning
- Thinking Maps

Time	Lesson/Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
2 Days (Aug. 24-25)	Lesson 1-7: The Distributive Property SMP: 1,3,4,6,7 (pp. 46-52) A-SSE 1a	<ul style="list-style-type: none"> How are the distributive property and the order of operations related? <p>Inquiry Question Options: p. 46 "Solve It"</p>	<ul style="list-style-type: none"> You can use the distributive property to simplify the product of a number and a sum or difference. An algebraic expression can be simplified by combining the parts of the expression that are alike. 	<p>Vocabulary: Distributive property, term, constant, coefficient, like terms, simplify</p> <ul style="list-style-type: none"> The distributive property allows you to find the product of an algebraic expression and a number. In a later unit the distributive property will be used to factor some algebraic expressions. 	<ul style="list-style-type: none"> Students will be able to simplify algebraic expressions using distributive property and combining like term. Students will be able to explain why two terms are alike or not. Students will be able to write expressions that represent the area, and perimeter of rectangles, and triangles. Students will be able to write expressions that represent real world problems and simplify. 	<p>Common Core Problems: 6, 7, 8, 69, 70, 74, 81</p> <p>*Additional Materials needed with more practice of distributing a negative number, and combining like terms.</p>
1 day (Aug. 28 th)	<p>Quiz Sections 1.1-1.7 Teacher Generated Quiz</p>					
2 Days (Aug. 29-30)	Lesson 1-0: Perimeter and Area SMP: 1,3,4,6,7 (Supplemental) A-SSE 1a	<ul style="list-style-type: none"> How do you determine the perimeter and area of a geometric figure? 	<ul style="list-style-type: none"> The perimeter of a figure is the distance around the figure. The area of a figure is the number of square units contained in the figure. 	<p>Vocabulary: triangle, rectangle, square, polygon, circle, radius, diameter, perimeter, area, composite figure</p> <ul style="list-style-type: none"> The perimeter of a figure is the sum of all sides. Area formulas for the following: triangle, circle, square, and rectangle. The area of a composite figure (determined using the "divide and conquer" method). The area of a shaded region (determined by subtracting the area of the smaller figure from the area of the larger figure). 	<ul style="list-style-type: none"> Students will be able to state the following formulas: Students will be able to find the perimeter and area of geometric figures. Students will be able to determine areas of composite figures and shaded figures. 	<p>Note:</p> <ul style="list-style-type: none"> This lesson is not in the book. Use the attached handouts to supplement the lesson. <p>Problems to emphasize: p 520-521: # 5, 7, 28-33, 35, 37</p>
1 day (Aug. 31 st)	<p>Review Topic 1 Concepts & Skills Use Textbook Resources and/or Teacher Created Items</p>					
1 day (Sept. 1 st)	<p>Topic 1 Assessment (Created and provided by PUSD)</p>					

Algebra 1

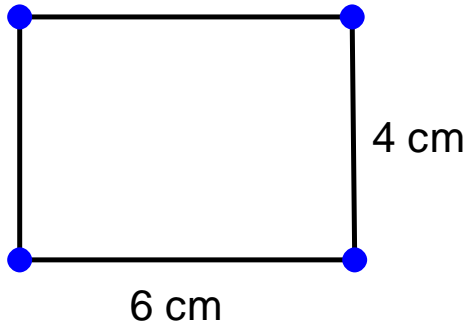
Areas and Perimeters

Find the perimeter of each figure.

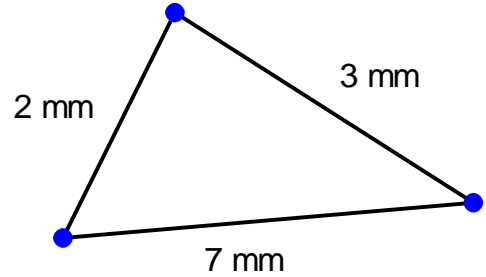
Name _____

Date _____ Period _____

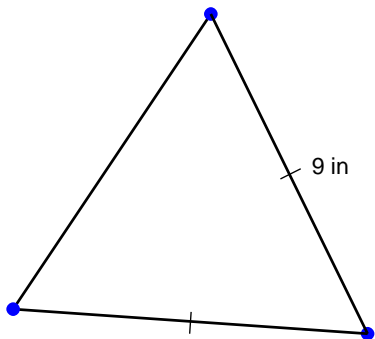
1)



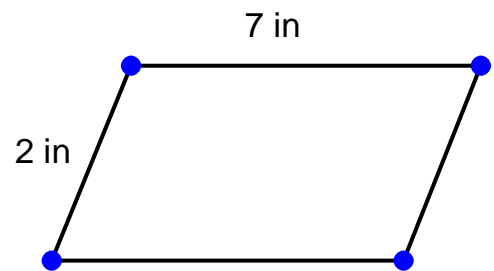
2)



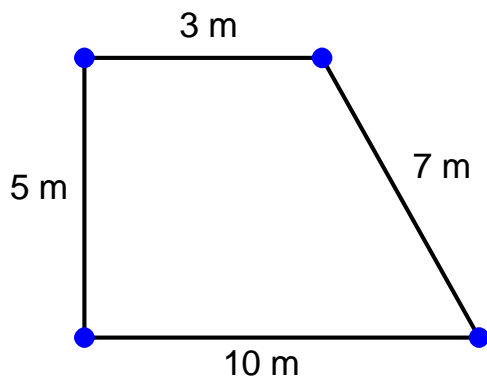
3)



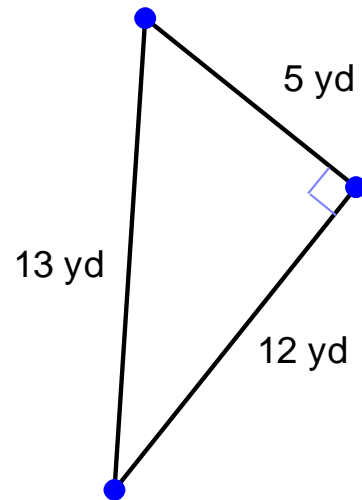
4)



5)



6)



7) The length of the rectangle is 12 inches. The width of the rectangle is 5 inches more than the length. What is the **perimeter** of the rectangle?

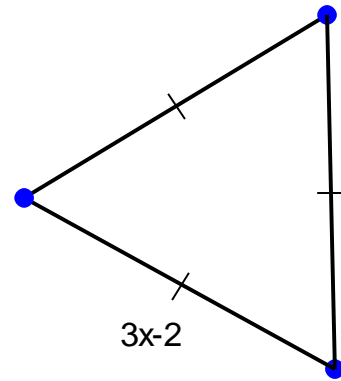
8) The first side of the triangle is 10 cm long. The second side of the triangle is twice as long as the first side. The third side of the triangle is 3 cm less than the first side. What is the **perimeter** of the triangle?

Find the perimeter of each figure.

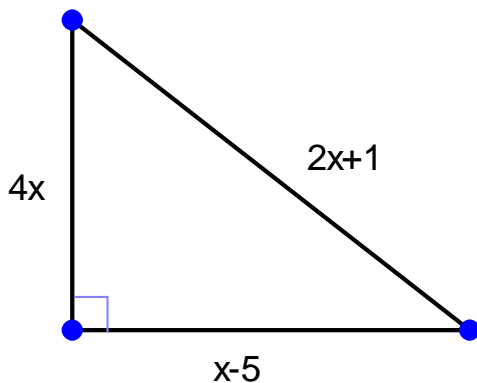
9)



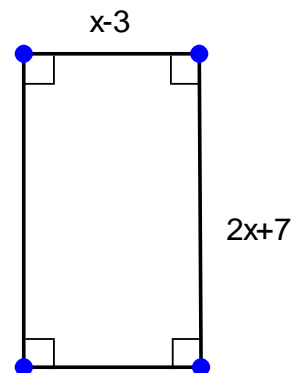
10)



11)

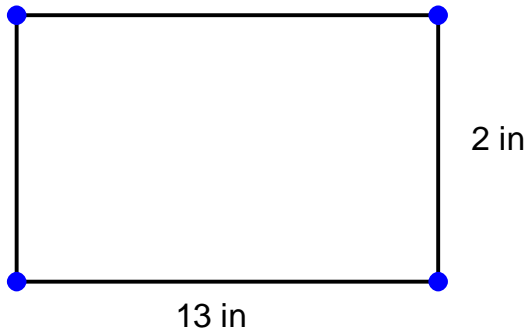


12)

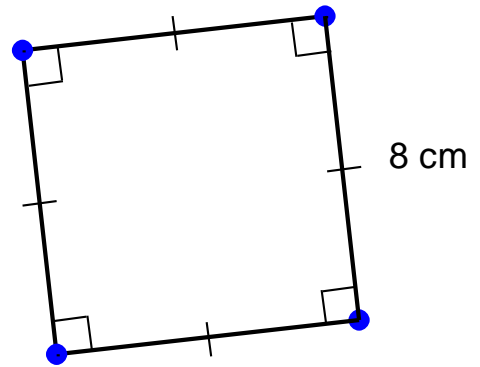


Find the area of each figure. Leave answer in exact form.

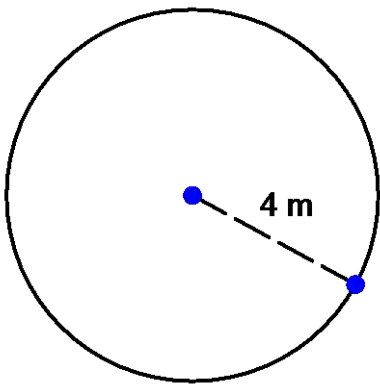
13)



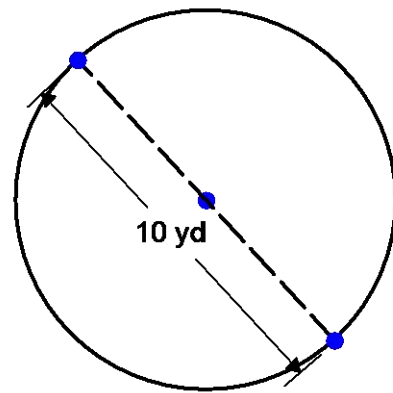
14)



15)



16)



17) The width of the rectangle is 14 yards. The length of the rectangle is 6 less than the width. What is the **area** of the rectangle?

18) The side of a square is 9 inches. What is the **area** of the square?

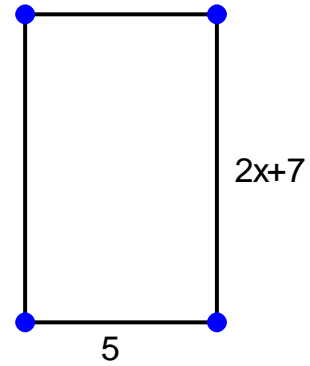
19) The diameter of a circle is 18 mm. What is the area of the circle? Leave answer in exact form.

Find the area of each figure. Leave answer in exact form.

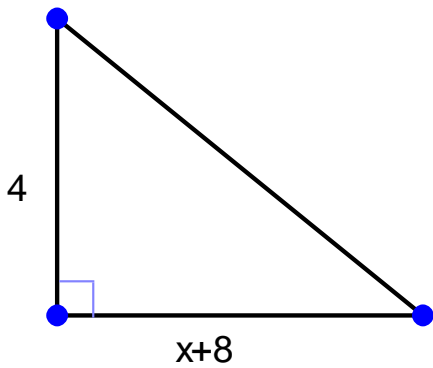
20)



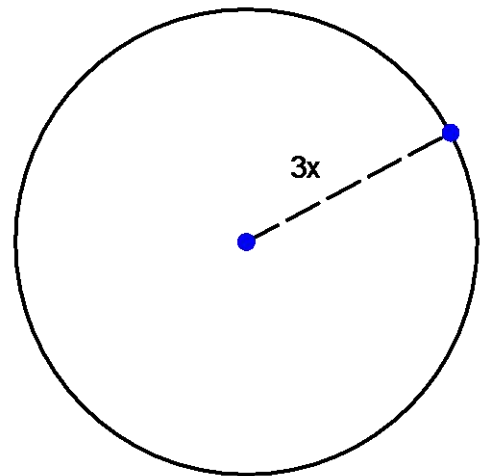
21)



22)

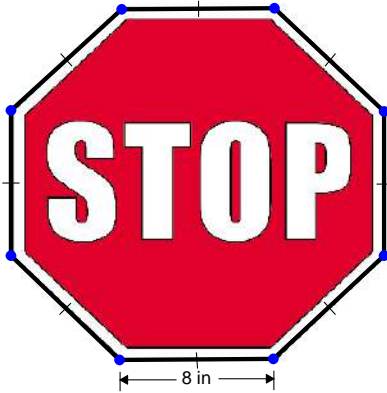


23)

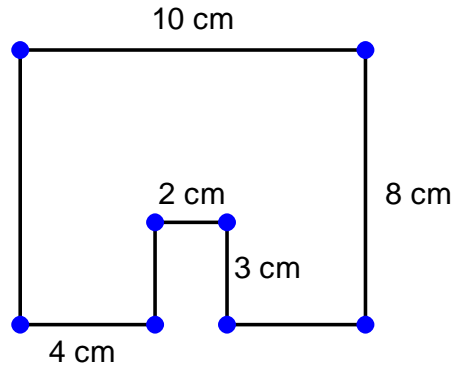


Find the perimeter of each figure.

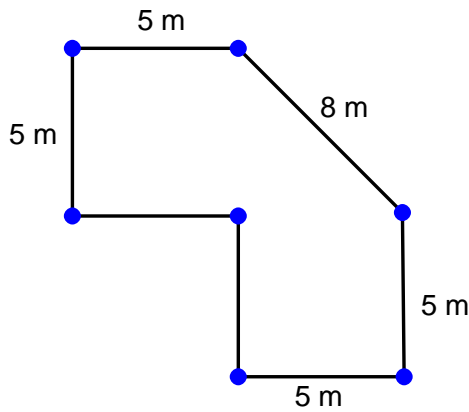
1)



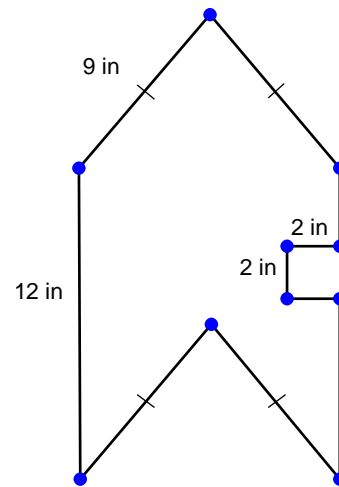
2)



3)

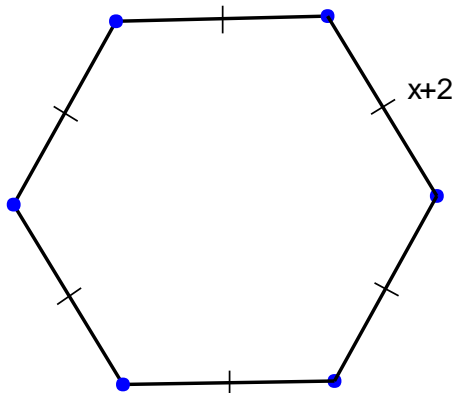


4)



Find the perimeter of each figure.

5)

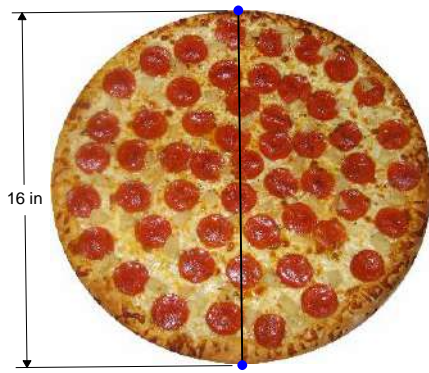


6)

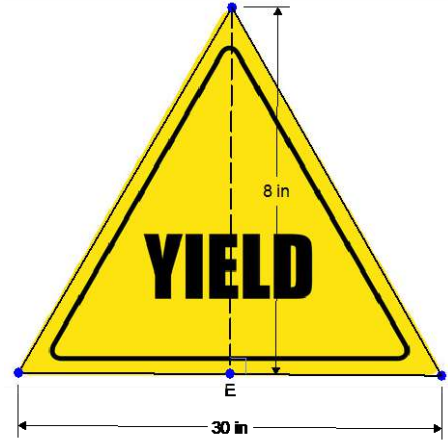


Find the area of each figure. Leave answer in exact form.

7)

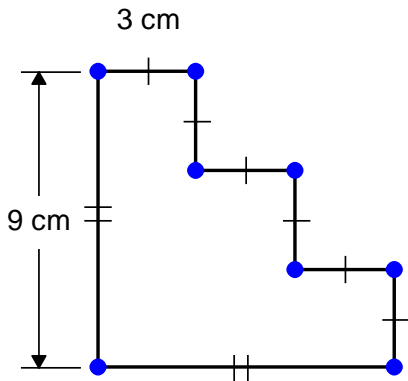


8)

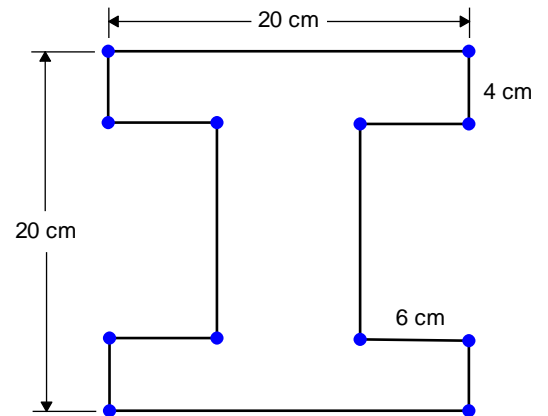


Find the area of each figure. All angles are right angles.

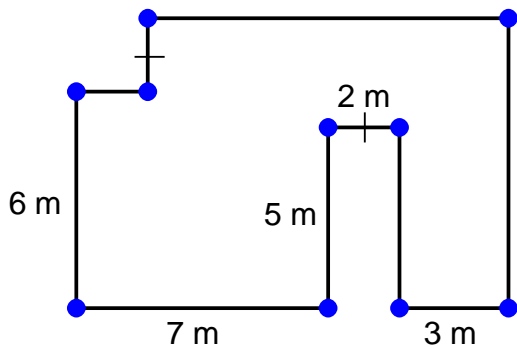
9)



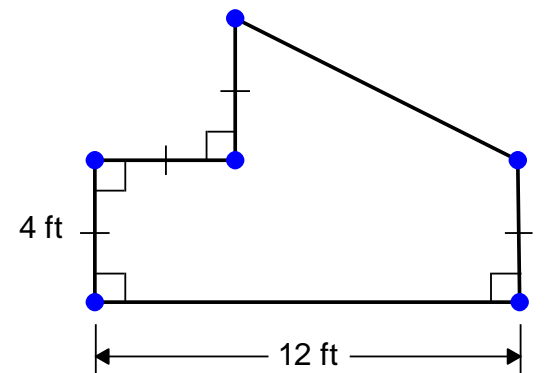
10)



11)

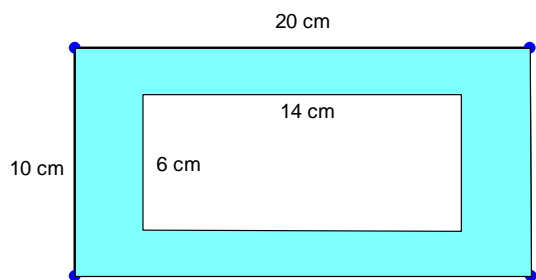


12)

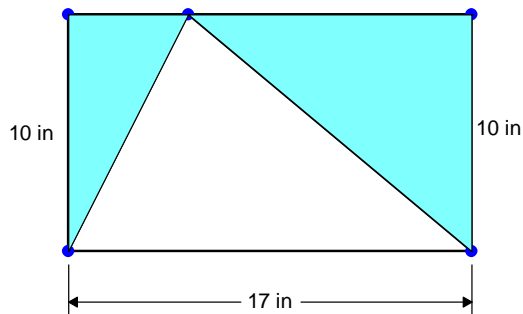


Find the area of each shaded region. All rectangular angles are right angles.

13)

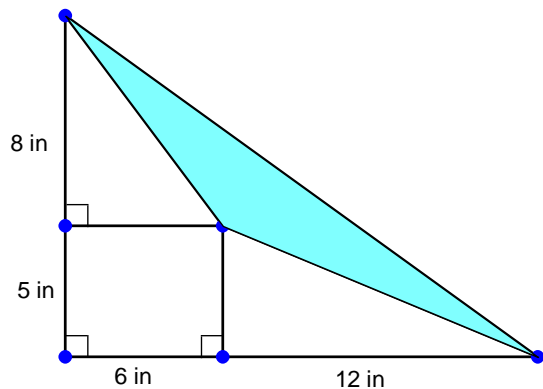


14)

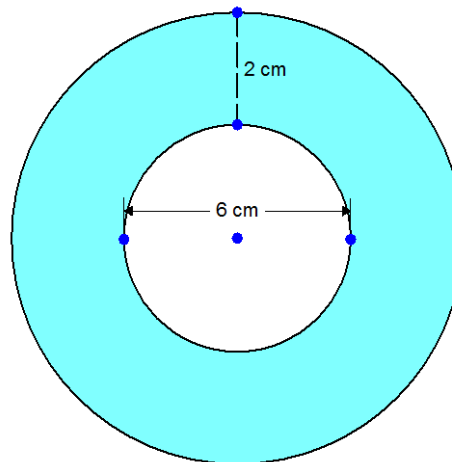


Find the area of each shaded region. Leave answer in exact form.

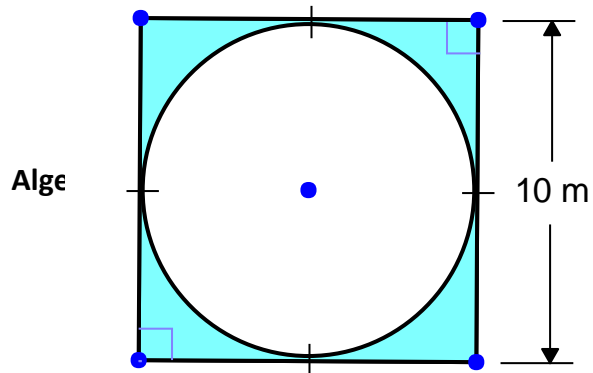
15)



16)



17)



18)

