The
Shin-Chu-Mon Companion Dictation Book
Mathematics for 9th grade

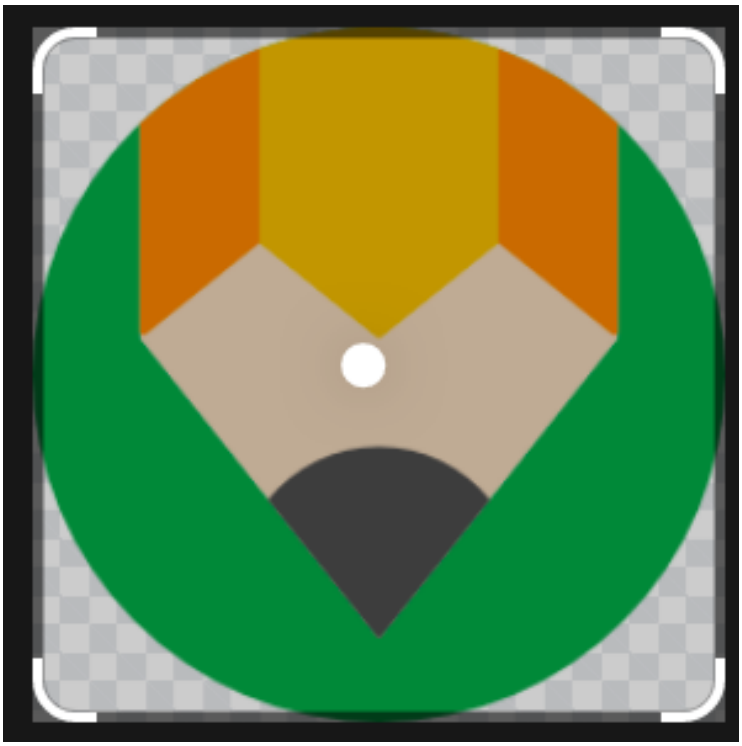

Table of Contents

Chapter 1 Calculating with expressions

Page 6 Overview Calculating with expressions

Page 7

1. Today we will simplify polynomials by using the distributive property.
2. Remember to multiply the sign first then the coefficient.
3. Then we will collect like terms to simplify.
4. When we multiply variables we add exponents.
5. Do you remember monomials, binomials and trinomials?

Page 8

1. We will divide polynomials by monomials today.
2. The definition of division is to multiply by the reciprocal.
3. Remember, when we divide variables we subtract the exponents.
4. Just like multiplication- compute the sign, then the coefficient and then the power of the variable.
5. Do one step at a time and be careful.

Page 9

1. There are four operations with monomials and polynomials.

2. Expressions with fractions can be simplified in two ways.
3. We can find the LCD for the terms in the expression.
4. We can use the distributive property to simplify.
5. We will remove the parentheses then combine like terms.

Page 10

1. Multiplying two binomials is called expanding.
2. We can remove the parentheses by using the distributive property.
3. When we expand two binomials we get a polynomial.
4. After expanding sometimes we will have to collect like terms.
5. Sometimes, the product of two binomials is a binomial.

Page 11

1. We can expand binomials using the vertical method.
2. Multiply in order to line up like terms.
3. If a term has no like terms put a blank under it.
4. We can use this method for a trinomial times a binomial.
5. There are two special types of binomials.

Page 12

1. When expanding binomials we can use a formula.

2. First identify the first terms and the last terms.
3. Net, identify the inside and outside terms.
4. The signs of each binomial are important to notice.
5. Remember, plus time plus or minus time minus is positive.

Page 13

1. Today we will multiply two binomials by the FOIL method.
2. Foil is an anagram for , first, outside, inside and last.
3. First, we multiply the first terms together..
4. Next, we multiply the last terms together.
5. Finally, we multiply the inside terms and outside terms and collect like terms.

Page 14

1. Expanding the special binomial $(a+b)^2$ is easy.
2. First square the first term and the last term.
3. Next double the product of the two terms.
4. Now you will have a trinomial but look out for the sign.
5. The middle term will either be positive or negative.

Page 15

1. A very special binomial form is (a + b)(a - b).
2. When you expand the middle term drops out.
3. This is the case when the expansion becomes a binomial.
4. The result is called the difference of two perfect squares.
5. Remember this is different then (a +b)(a + b).

Page 16

1. The sum of two binomials can take several steps.
2. The foil method is a good step to multiply two binomials.
3. First, multiply the first and multiply the last terms together.
4. Then multiply the inside terms and outside terms together.
5. Be careful, it's easy to make a silly mistake.

Page 17

1. Today we will multiply a trinomial by a trinomial.
2. We will actually use the distributive three times.
3. We will multiply the first term of one binomial by the other three of the second trinomial.
4. Then we will multiply the second term by the other three and then then the third.
5. Finally, we will collect like terms to get the product.

Page 18

1. A binomial is an expression with two terms.
2. A trinomial is an expression with three terms.

3. Expanding a binomial means to multiply the terms.
4. Sometimes a binomial squared is a trinomial.
5. The difference of two perfect squares is a binomial.

Page 19

1. Prime numbers have factors of only one and itself.
2. One is not a prime number because it only has one factor.
3. Two is the only even prime number.
4. Any number can be broken down to a set of times.
5. Find the greatest common factor and the least common factor.

Page 20

1. First step of factoring is to find the GCF.
2. A factor shared by all the terms of a polynomial is the common factor.
3. When we factor out the GCF we get the product of two polynomials.
4. The GCF is always a monomial.
5. Sometimes, we want to factor out the negative sign.

Page 21

1. When factoring a trinomial use the Foil method.
2. If the last term is positive we will add the factors to get the middle term.
3. And if the last term is positive the factors will have the same sign.
4. If the last term is negative we will subtract the factors to get the middle term.
5. If the sign of the middle term is important in factoring..

Page 22

1. Today we will look at two special factoring formulas.
2. FIrst, $a^2 + 2ab + b^2 = (a + b)^2$

3. Second, $a^2 - 2ab + b^2 = (a - b)^2$
4. Do you see the difference between the two formulas?
5. We call these special trinomials- trinomial squares.

Page 23

1. Today we will factor a special binomial, $a^2 - b^2$.
2. The factors of $a^2 - b^2$ are $(a + b)(a - b)$.
3. These binomials are called the difference of two perfect squares.
4. We cannot factor a binomial like $a^2 + b^2$.
5. It is very helpful to memorize the perfect squares.

Page 24

1. Always look first for a GCF when factoring.
2. Factor out the GCF and put parentheses around the remaining polynomial.
3. Then we factor and will get three factors.
4. Many times you will forget to factor out the GCF first.
5. We can't always use the FOIL method to factor.

Page 25

1. Sometimes we have to use replacement to factor.
2. We will let x equal a binomial.
3. We will then replace the binomial with the x.
4. Next we will factor out the x.
5. Then we will replace the x with the binomial.

Page 26

1. Today we will review different factoring types.
2. First, we will review prime factorization of natural numbers.
3. Second, we will use the FOIL method to factor.
4. Third, we will factor special trinomials.

5. Lastly, we will factor special binomials.

Page 27

1. We can evaluate a polynomial by substituting numbers.
2. First expand and simplify the polynomial.
3. Sometimes, it will be easier to factor the polynomial first.
4. Trick, $x^2 + y^2 = (x + y)^2 - 2xy$
5. Then we can substitute the numerical values.

Page 28

1. We can use formulas to calculate numeric expressions
2. Formula 1, $(x + a)(x + b) = x^2 +(a + b)x + ab$
3. Formula 2, $(a + b)^2 = a^2 + 2ab + b^2$
4. Formula 3, $(a - b)^2 = a^2 - 2ab + b^2$
5. Formula 4, $(a + b)(a - b) = a^2 - b^2$

Page 29

1. Today we will use expressions to set up a proof.
2. For example, can you prove that an odd number squared minus one is a multiple of 4?
3. Step 1, let n represent any integers, therefore 2n + 1 must be odd.
4. Step 2, now we square (2n + 1) - 1and get $4n^2 + 4n +1 - 1$.
5. Stepn3, simplify to $4n^2 + 4n$ which equals $4(n^2 + n)$

Page 30

1. Today we will use calculations of expressions for figures.
2. Again, we will use variables to represent every case.
3. These problems are very hard, so don't give up.
4. Sometimes, it helps to use numbers to see one case.

5. After using numbers, select a variable for each number.

Page 31

1. Today, we will review the unit for the chapter test.
2. We will evaluate expressions by using substitution.
3. We will review using formulas for simplifying.
4. We will review using variables to make proofs.
5. We will also use variables with concentric circles

Page 32 Comprehension test

Page 33 End- of - chapter problems

Page 34 -35 Complements 1 Complex factoring Greatest common factor and least common multiple

1. Today we will factor more difficult trinomials.
2. The first term is called the quadratic term.
3. These trinomials have a quadratic term with a coefficient bigger than 1.
4. This new coefficient makes factoring more complicated.
5. We will learn how to use a guess and check method to factor.

Chapter 2 Square roots

Page 36 Overview Square roots

Page 37

1. The square root of 16 is 4 or - 4.

2. We use the terms radical sign, radicand and index.
3. We can also use the plus or minus sign.
4. We can simplify $\sqrt{4}$ is 2 called the positive square root.
5. $(-\sqrt{13})2$ equals 13. Parentheses make a difference.

Page 38

1. Today's lesson is about the relative size of square roots.
2. If a > b then the $\sqrt{a} > \sqrt{b}$.
3. If a < b then the $\sqrt{a} < \sqrt{b}$.
4. Look out! Are the two statements above always true.
5. Negative numbers become smaller as their absolute value increases.

Page 39

1. We will now work with only natural numbers.
2. Do you remember what the set of natural numbers is?
3. Answer the following about $\sqrt{2}$ and its integer portion.
4. Do you remember what the set of integers is?
5. When expressing $\sqrt{2}$ as a decimal use the first decimal place.

Page 40

1. Rational numbers can be expressed as a fraction.
2. Irrational numbers cannot be expressed as a fraction.
3. All non perfect square roots are irrational.
4. Irrational numbers have an infinite number of decimals but no repeating pattern.

5. Some rational numbers have recurring decimals like ⅓.

Page 41

1. Today's classwork is a review of square roots.
2. Some square roots are irrational with infinite decimals.
3. Natural numbers are only positive numbers.
4. Integers are the positive and negative whole numbers.
5. Some fractions have a recurring decimal.

Page 42

1. Today's classwork is multiplying and dividing radical expressions.
2. When we multiply we can multiply the radicands.
3. When we divide we can put the radicands in one radical sign.
4. We cannot leave a radical in the denominator.
5. The rules : $\sqrt{a} * \sqrt{b} = \sqrt{ab}$ and $\sqrt{a} / \sqrt{b} = \sqrt{a/b}$.

Page 43

1. Today's lesson is to convert between $\sqrt{a}$ and b$\sqrt{a}$.
2. The important idea- no radicant can have a perfect square factor.
3. This means that $\sqrt{8}$ can be changed to $\sqrt{2 * 4}$ or $2\sqrt{2}$.
4. This also means that $2\sqrt{2}$ is the same as $\sqrt{2 * 4} = \sqrt{8}$.
5. We have to keep a list of perfect squares in our minds.

Page 44

1. Today's lesson is about rationalizing the denominator.
2. This happens when we have a radical in the denominator.
3. Rationalizing means changing a radical into a rational number.
4. We will be multiplying by one albeit a funny one.
5. There are three main rules for simplifying radicals

Page 45

1. Today's lesson is about multiplying and dividing radicals.
2. We will multiply the radicands but have to look out!
3. Remember no randicand can have perfect square factors.
4. We can find those perfect square factors before multiplying.
5. Also remember the three rules for simplifying radicals.

Page 46

1. Today we will approximate values of square roots.
2. To approximate the values we will need to be given some values.
3. For instance, the $\sqrt{6}$ is about 2.449 and the $\sqrt{60}$ is about 7.746
4. Given these approximates can you estimate the value of $\sqrt{60000}$?
5. We will have to look for a perfect square factor.

Page 47

1. Today we will multiply and divide radical expressions.
2. Do you remember the three rules for radicals?
3. No randicand can have a perfect square root factor.
4. No randicand can be a fraction.
5. There can not be a radical in the denominator.

Page 48

1. Today we will add and subtract radicals.
2. We add radicals like variables.
3. The radicands have to be the same to add or subtract.
4. The number in front of the radical changes but not the radicand.
5. Sometimes we will have to simplify the radicands first.

Page 49

1. Today, we will use the four arithmetic operators.
2. Do you remember what PEMDAS means?
3. Be careful to multiply and divide first.
4. We can divide before we multiply to simplify.
5. Do not be afraid to show all your steps.

Page 50

1. Today, we will use our special expanding formulas.
2. Do you remember how to foil?
3. Do you remember how to multiply $(x + 2)^2$
4. Do you remember the difference of two perfect squares?
5. Do you remember how to multiply radicals?

Page 51

1. Today we will evaluate expressions using two different methods.
2. Method 1, we can directly substitute the values into the expression.
3. Method 2, we can use the factoring method.
4. Let's see what method you prefer.
5. I am thinking that the substitute method is easier.

Page 52

1. Today, we will play with square roots and prime factorization.
2. For example, if $\sqrt{24n}$ is an integer, what does n have to equal to give the lowest integers?
3. We could try by just guessing values for n starting with 1.
4. Another method is to break 24 into its primes- 2x2x2x3.
5. So what do we need to multiply each factor to make them perfect squares.

Page 53

1. We have learned how to simplify radicals.
2. The radicand is the value under the radical sign.
3. Rule 1 if radicals, randicand can have no perfect square factors.
4. Rule 2, the randicand can not be a fraction.
5. Rule 3, a radical cannot be in the denominator.

Chapter 3 Quadratic equations

Page 59

1. $Ax^2 - b = 0$ is a quadratic equation.
2. We will learn how to solve quadratic equations.
3. We will isolate the quadratic term first.
4. Then we will take the square root of each side.
5. We can write the solution as plus or minus with $\pm$.

Page 60

1. Today we will solve quadratic equations with a trinomial square.
2. First, we will take the square root of each side.
3. Next, we will isolate the quadratic term.
4. Finally, we will take the square root of each side.
5. Did you notice, quadratic equations can have two solutions?

Page 61

1. Today we will learn how to complete the square.
2. Some quadratic equations cannot be factored.
3. So we will make the equation a trinomial square.
4. How? Take half of the linear term and square it and add it to both sides.
5. Now we can factor the equation as a trinomial square.

Page 62

1. Today we will learn about the quadratic formula.
2. The formula comes from completing the square of a standard quadratic equation.
3. The standard form is ax2 + bx + c.
4. We will substitute the coefficients into the formula.
5. We will get two solutions most of the time.

Page 63

1. Today we will use factoring to solve quadratic equations.
2. We will let the equation equal 0.
3. We then factor the equation into two binomials.
4. What must be true of one or both of these binomials?
5. Sometimes, we get only one solution but we call it a double root.

Page 64

1. Today we will use the three ways to solve a quadratic equation.
2. First method, the easiest ,try to use factoring.
3. Second method, if the linear term is even, try to complete the square.
4. Third method always works - use the quadratic formula.
5. You should be able to use the best method for each equation.

Page 65

1. Watch out for equations that contain a binomial.
2. First,get the x by itself and then take the square root of both sides.
3. Sometimes, we need to put the equation into the square form.
4. You must be good at factoring to solve equations.
5. Don’t forget about perfect squares and trinomial squares.

Page 66

1. Today, we will work with problems about values of variables.
2. We will use substitution to find the value of a.
3. Find the value of a and the other solution to the quadratic equation.
4. There are three consecutive natural numbers whose sum is 33.
5. The square of a number is 8 larger than 2 times the original number.

Page 67

1. Today we will use quadratic equations to solve problems about numbers.
2. For example, two positive numbers have a difference of 5.
3. The two numbers also have a product of 84.
4. How can we write the two numbers in terms of x.
5. If one number is x then the other number is x + 5?

Page 68

1. Today we will look at problems about figures.
2. We will define variables and set up quadratic equations.
3. We will solve these equations by factoring.
4. We have to be careful as one of the solutions might not work.
5. Can you guess what values will not make sense?

Page 69

1. Today we will look at problems about graphs of functions.
2. In the figure on the right, the vertices are O(0,0) and A(4,0).
3. We will use the function $y = ax + b$.
4. We will substitute the values of the vertices to get a system of equations to solve.
5. Then we can substitute those values back in.

Page 70

1. Today we will have problems with ratios.
2. A retail price is the price a customer pays.
3. A sales price is the price after a certain discount.
4. The profit is the sales price minus what the store paid for the product.
5. The mark up is the percentage added to what the store paid for the product.

Page 71

1. Today we will use the quadratic formula to solve problems.
2. Do you remember the quadratic formula?
3. We will first take the given and write a quadratic equation to solve.
4. Remember, that we often get two solutions but use only one of them.
5. The verb ‘is ‘often acts as an equal sign.

Page 72

1. Today we will again use the quadratic equation to solve problems.
2. We can solve a quadratic in one of three ways.
3. Factoring is the easiest way to solve a quadratic.
4. Unfortunately, some quadratic equations will not factor.
5. Completing the square is also another way to solve quadratic equations.

Page 73

1. Today we will continue solving problems using quadratic equations.
2. In the first problem we will use linear equations to find coordinates of point B.
3. In the second problem we will use a system of linear equations.
4. In the fourth problem we will use a given formula for shooting a rocket.
5. The last problem we will enlarge a rectangle and find how the area changes.

Page 74 Comprehension test

Page 75 End- of - chapter problems

Page 76 - 79 Review 3 Coordinates and functions

Chapter 4 Functions

Page 80 Overview Functions

Page 81

1. Today we will graph the function $y = ax^2$.
2. We will need to know one point on the graph.
3. We will use this point to find a, the constant.
4. Simply, substitute the values of x and y into the function.
5. Once we find a, we can substitute it into the given function.

Page 82

1. Today we will use the proportional function $y = ax^2$.
2. Since it is a proportional function, if we know x and y we can find a.
3. If y is proportional to the square of x, then $y = ax^2$
4. We will solve for x in terms of y.
5. We will also have a rocket problem.

Page 83

1. Today we will graph quadratic functions;
2. The graph of a quadratic function is a curve called a parabola.
3. We can make a table of values and graph each point.
4. First, we will be given a point and will have to find a.
5. If the value of a is negative what happens to the value of y?

Page 84

1. Today we will look at the properties of $y = ax^2$.
2. The vertex is (0,0) and the line of symmetry is x = 0.
3. The graph is symmetric to the y axes.
4. If a >0 then the parabola turns up.
5. If a< 0 then the parabola turns down.

Page 85

1. Today we will graph the function $y = ax^2$ and find the vertex.
2. We will need to know one point on the graph.
3. We will use this point to find a, the constant.
4. Simply, substitute the values of x and y into the function.
5. Once we find a, we can substitute it into the given function.

Page 86

1. Do you remember how to use Roman numerals?
2. Can you find the total length of the sides of a cube?
3. Do you remember how to find the area of a circle?
4. Can you find the area of a trapezoid?
5. Can you find the surface area of a cylinder?

Page 87

1. Today we will restrict the domain of the parabola.
2. When we restrict the domain then we also restrict the range.
3. The domain is the x value and the range is the y value.
4. We have to watch out for the sign of the constant!
5. We will substitute the domain to find the range.

Page 88

1. Find the rate of change when the domain changes.
2. The rate of change is another name for the slope.
3. Do you remember how to find the slope?
4. The slope is the change in y divided by the change in x.
5. We can use the formula a(p + q) to find this rate of change.

Page 89

1. Today we will look at the rate of change in $y = ax^2$.
2. The rate of change is 4 as x increases from 3 to 5.
3. So. when x is 3 y = 9a and when x is 5 y = 25a.
4. Therefore, y increased by 25a - 9a and increased by 5-3.
5. So, 16a/2 = 4 which means a - ½.

Page 90

1. Today we will use the rate of change to find a, the constant.
2. If the rate of change is from 3 to 5 then substitute those into the function.
3. When we substitute into $y = ax^2$ we get 25a and 9a a change of 16a.
4. Therefore, 16a/2 = 4 because 16 is the change in y and 2 the change in x.
5. Remember, we are given the slope which was 4. A = ½.

Page 91

1. In the figure at the right ,point A and point B are on the graph.
2. The respective x coordinates of A and B are -4 and 8.
3. The origin has the coordinate of (0,0).
4. Do you remember that the slope is the change in y over the chang in x?
5. We need to regard OC as the base of both triangles.

Page 92

1. Today we will continue to find the area of the shaded region.
2. We make a system of equations with the given function.
3. We can solve this system and use the points.
4. We will need to determine the base of the triangles.
5. We will need to divide a big triangle into two smaller triangles.

Page 93

1. Today we will find the area of the shaded region.
2. Like yesterday, we will need to find the values for A and B.
3. Then we will need to determine the lengths of the base and height of the triangle.
4. In these problems we have a straight line intersecting a parabola.
5. These problems are difficult but fun to work out.

Page 94

1. Today we will review the properties of the function $y = ax^2$.
2. First, we will find the max and min of the range of the function.
3. Next, we will find the rate of change of a quadratic function.
4. Then we will work with a moving object along a straight line.
5. Lastly, we will review finding the area of a shaded region.

Page 95

1. Let's look at some real life examples of parabolas.
2. A function relates two different values together.
3. We want to find the vertex which is a max or min point.
4. A line of symmetry can be drawn through the vertex.
5. A parabola has the basic form of $y=x^2$.

Page 96

1. Today we will be given a straight line and a parabola.

2. We will also be given two points somewhere on the parabola.
3. We will also be given the distance between the two points.
4. The last set of problems we will be asked to find a.
5. These problems are difficult to solve.

Page 97

1. Today we will look at parabolas and squares.
2. The sides of the square are parallel to the x and y axes.
3. When we are given the x-coordinate we can find the y-coordinate.
4. When one x-coordinate is a the other is -a.
5. We also know that the sides of a square are all equal.

Page 98

1. Today we will graph functions and parallelograms.
2. First,we will need to find the value of a.
3. Then we will need to find the coordinates of the parallelogram.
4. Let the point where side AD intersects the y-axis be F.
5. Then we can see that AF equals DF.

Page 99

1. Today we will look at bisecting areas.
2. A line that passes through one vertex and midpoint of the opposite side bisects the area of the triangle.
3. A line that passes through the point of intersection where the diagonals intersect bisects the area of the parallelogram.
4. We will use these ideas to find the equation of a line that bisects a triangle.
5. We will also do the same with a parallelogram.

Page 100

1. Today we will look at changing shapes with changing areas.
2. In Let's learn the basic , AB//PO in the diagram are parallel.
3. The coordinates of the point P are equal to the another point.
4. That point is where the parabola intersects the line passing through the origin,
5. It will also have the same slope as line AB.

Page 101

1. Today we will work with changing shapes without changing areas.
2. We will also be using quads.
3. Points A, B and C are on line l and have x-coordinates 4, 8 and -6 respectively.
4. Find the expression for the straight line m.
5. Do you remember how to find the slope given two points.

Page 102

1. Point P moves from A to C at a speed of 2cm per second.
2. P and Q will start moving simultaneously for x seconds.
3. The trapezoid board has a seal affixed to it.
4. The border is where the revealed part meets the covered part.
5. Do you remember what perpendicular means?

Page 103

1. Today we will use moving figures and functions.
2. The figure on the right are congruent isosceles right triangles with two 12 cm sides.
3. ΔABC moves along a line l to the left at 2 cm per second.
4. Let y be the area of the overlapping part of the two triangles.
5. The time will be c seconds after C reaches Q.

Page 104

1. Today we will use various functions.
2. The graph shows the number of seconds that two people can talk on a phone.
3. There is a fixed cost of 10 Y during the hours of 8 am to 7 pm.
4. The cost is also relative to the distance in km separating the caller.
5. Is the cost of a call a function to the distance between the callers?

Page 105

1. Today we will again use graphs and functions.
2. In this problem, $x > 0$ and y is rounded down to the one's place.
3. Equilateral triangles are arranged in a pyramid in tiers.
4. Tier 1 has 1 one triangle and tier 2 has 3 and so on.
5. A 100000- yen article is raised by 10 % every year, find the price for the next year.

Page 106

1. Today we will review the previous problems.
2. We always use the function $y = ax^2$.
3. In the group 1 problems we will use parallel lines.
4. In group two problems we will have segments parallel to the y-axis.
5. In group three problems we will be given a parallelogram.

Page 107

1. Today we will have more review questions.
2. In the group one problem we have a parabola and a line.
3. In group 2 problems we will have a point moving around a rectangle.
4. We will also draw the graph of its movement.
5. In group 3 problems we use a trapezoid.

Page 108 Comprehension test

Page 109 End- of - chapter problems

Page 110 - 113 Review 4 Figures

Chapter 5 Similar figure

Page 114 Overview Similar figures

Page 115

1. Today we will learn about similar figures.
2. Do you remember what similar figures have in common?
3. We need to identify respective sides and angles.
4. Do you know the symbol for similarity?
5. We will also find the center of the similarity.

Page 116

1. Today we will review how to solve proportions.
2. Sometimes we can divide both sides by the GCF.
3. A proportion is an equation with a fraction on both sides.
4. We will cross or multiply to simplify the proportion.
5. We can also say the product of the means equal the product of the extremes.

Page 117

1. Today we will study similar figures.
2. In similar figures, the ratios of corresponding sides are equal.
3. The ratio of the lengths is called the similarity ratio.
4. In similar figures, the ratios of angles are equal.
5. We will find the similarity ratio of similarity figures.

Page 118

1. Today we will review the conditions of similar triangles.
2. First, ratios of all three corresponding sides are the same.
3. Second, we have SAS - two sides in proportion and an equal included angle.
4. Third, if two corresponding angles are equal(AA).
5. We will use one of these methods to prove triangles are similar.

Page 119

1. Today we will use ratios to find sides of similar triangles.
2. Watch out! Make sure you identify the similar triangles.
3. We will use the idea that all sides have the same ratio.
4. We will need to set up a proportion.
5. Finally, we will solve the proportion by cross multiplying.

Page 120

1. Today we will learn who to prove triangles similar.
2. Will have to remember the three ways to prove triangles are similar.
3. Remember, AA, ASA or SSS for similarity.
4. We will start with the given and use logic.
5. We will write a paragraph proof.

Page 121

1. Do you remember what an isosceles triangle is?
2. An isosceles triangle has exactly two equal angles.
3. Remember perpendicular means forms right angles.
4. Today, we will also write paragraph proofs.
5. These proofs are very hard.

Page 122

1. Today we will use similar figures in our proofs.

2. Do you remember how similar is different from congruence?
3. What is special about isosceles right triangles?
4. We can use AA to prove triangles are similar.
5. Once we prove triangles are similar the corresponding sides are in proportional.

Page 123

1. Today we will use reduction to solve problems.
2. We will be given a figure with large dimensions.
3. Then we will make a scale drawing at a scale of 1 to 800.
4. We have to watch out for the units- meters to millimeters.
5. So, 20 m becomes 20,000 X 1/800 which equals 25 mm

Page 124

1. Today we will review similar triangles.
2. FIrst we will find the conditions and identify similar triangles.
3. Next we will find the value of x in figures with similar triangles.
4. In the third set of problems we will prove triangles are similar.
5. The last group of problems ask us to find in equilateral triangles.

Page 125

1. Today we will study triangles with a segment connecting two sides.
2. If the connecting segment is parallel to the base then we have proportionality.
3. Why? Because we have similar triangles using AA theorem.
4. We can set up some proportions to solve for different lengths of the sides.
5. Then converse of this law is also true, if sides are in proportion then the vase and segment are parallel.

Page 126

1. Today we will investigate three parallel lines and a transversal.
2. We will prove that the transversal cuts segments proportionality.
3. Once again we will use similar triangles for our proof.

4. We will also set up proportions to solve for the unknown.
5. I think these exercises are not too hard.

Page 127

1. Today we will have more difficult problems
2. But we will use parallel lines and ratios again.
3. We will have to draw some auxiliary lines.
4. These problems will take many steps.
5. Maybe, we do not need to do these?

Page 128

1. Today we will look at midpoints and triangles.
2. We will prove something about the segment that connects the midpoints.
3. We can use the idea of parallel lines to help us.
4. It will be interesting to find a new formula.
5. Do you like proving new formulas based on previous work?

Page 129

1. Today we will use the midpoint theorem i.e. LM = 1/2AB in ΔDAB.
2. We will be given midpoints on line segments.
3. We will use this information to prove sides of triangles are equal.
4. Isosceles triangles have exactly two equal sides.
5. We will have some complicated proofs to write.

Page 130

1. Today we will use angle bisectors and ratios.
2. Look at the diagram and let's see what we can prove.
3. First,we draw the bisector of <A in ΔABC.
4. Next, we draw the extension of AB to point E and for a new triangle.
5. Then we can prove AB:AC = BD:DC.

Page 131

1. Today we will use the centroid of a triangle.
2. A median of a triangle is a segment connecting the midpoint of the side of a triangle to its vertex.
3. A centroid is the intersection of the three medians of the triangle.
4. The centroid divides each median into two segments.
5. The two segments have lengths that are in a ratio of 2:1.

Page 132

1. Today we will use parallel lines and the ratios of segments.
2. We will have triangles with parallel segments that make proportional segments.
3. Do you remember that a transversal of three parallel lines makes proportional segments?
4. We will use the same properties for trapezoids.
5. In the last two sets of problems we will use extended segments.

Page 133

1. Today we will continue from yesterday's lesson.
2. We will have parallel lines cutting out proportional segments.
3. These problems are a little more complicated.
4. In the last set of problems we will use an angle bisector.
5. Parallel lines create many properties and are found everywhere in real life.

Page 134

1. Today we will study the ratios of areas and volumes.
2. For any two triangles with equal heights, what can we say about their areas?
3. The ratio of the areas is equal to the ratio of their bases.
4. Find the ratios of the areas of ΔABC to ΔABE.
5. What would you think the ratio will be for volume?

Page 135

1. Today we will look at the ratios of areas of similar figures.
2. The ratio of the areas of similar plane figures is equal to the square of the similarity ratio.
3. When the similarity ratio of two plane figures is a:b then the area ratio is a^2:b^2.
4. So, if corresponding sides have a ratio of 14:21 we can find the area ratio.
5. First reduce the ratio to 2:3 and then square to get 4:9.

Page 136

1. Today we will compare the ratios of surface areas and volumes of similar figures
2. The ratio of the surface area is equal to the square of their similarity ratio.
3. The ratio for volumes is the cube of their similarity ratio.
4. Given the similarity ratio is 2:3, give the ratio of their surface area.
5. Given the similarity ratio is 2:3, give the ratio of their volume..

Page 137

1. Today we will review ratios of area and volume.
2. Find the ratio of the areas for each pair of figures.
3. Find the area of ΔDEC when the area of the quad ABCD is 21 cm^2.
4. Find the area of quad ABCD to relative to that of ΔDCE.
5. Find the ratio of the volume of the square pyramid to the triangular one.

Page 138

1. Today we will use similarity to find certain ratios.
2. In quad ABCD on the right, point E divides side BC into two lengths with ratio 1:2
3. F is the midpoint of DC and AE and AF intersect diagonal BD.
4. These problems are very complicated and take many steps.
5. The last problem is very challenging.

Page 139

1. Today we will use ratios of areas.
2. Find the ratio of the areas of ΔAPQ to ΔAEF.
3. What is the area of ΔAPQ relative to that of quad ABCD.
4. Find the ratio of the area of ΔDEQ to that of quad PFRQ.
5. What is the area of quad DQRG relative to that of quad ABCD.

Page 140

1. Today we will use ratios of volumes.
2. ABC is an isosceles right triangle in which AB=AC = 9 cm.
3. Points P and Q are on edges AB and AC respectively.
4. When the plane that passes through P,Q,F and E divides the prism into two blocks.
5. The figure on the right is part of cuboid ABCD - EFGH.

Page 141

1. Today we will use ratios of segments on coordinate planes.
2. In the figure on the right, the coordinates of point A are (-3,12).
3. Point Q is on AB which intersects the y-axis at point P.
4. The parabola on the right is the graph of $y = 1/4x^2$.
5. Find the ratio of the area of ΔPQC to that of quad ABCD.

Page 142

1. Today we will learn about Ceva's and Menelaus's theorems.
2. Cava's theorem comes from a triangle with three lines intersecting inside.
3. The segments have the property BP/PC x CQ/QA xAR/RB = 1.
4. Menelaus' theorem happens when a straight line intersects a side or an extension.
5. The segments then have the property BP/PCxCQ/QAxAR/RB = 1.

Page 143

1. Today we will use similarity in a number of different ways.
2. Find the ratio of the area of ΔAPE to that of quad DQEP.
3. What is the are of ΔBDQ relative to that of ΔABC
4. Find the volume of pyramid P when PA = 9 cm, AB = 10 cm and AC = 8 cm.
5. Find the coordinates of E when AD :DB = 4:1.

Page 144 Comprehension test

Page 145 End- of - chapter problems

Chapter 6 Circles

Page 146 Overview Properties of circles

Page 147

1. Do you remember the vocabulary for circles?
2. Circumference, chord, radius and hypotenuse are some we need to know.
3. Do you remember how to prove triangles are congruent by HL?
4. Do you remember how to use CPCTC to prove sides or angles are equal?
5. A theorem is a statement we have proven to be true.

Page 148

1. A tangent is a line that intersects a circle in exactly one point.
2. If two lines are drawn from the same point tangent to a circle, they are equal.
3. We will use this information to find lengths of tangents.
4. When a tangent to a circle intersects a radius the angle formed is 90°.
5. The word respectively means- in that order.

Page 149

1. Circumscribed circle of a triangle is around the outside.
2. The circumcenter is the center of a circumscribed circle.
3. The perpendicular bisectors of all three sides intersect at the circumcenter.
4. An inscribed circle is inside a triangle and has an incenter.
5. The bisectors of all three angles intersect at the incenter.

Page 150

1. Today we will use proofs in our exercises.
2. We will use the American proof with statements and reasons.
3. We always start proofs with the given information.
4. We then will use that information to prove different questions.
5. We will often use definitions like circumscribed and inscribed circles.

Page 151

1. An inscribed angle has its vertex on the circle not the center.
2. An inscribed angle equals half of the measure of the intercepted arc.
3. Do you remember that a central angle equals the measure of the intercepted arc
4. An arc is simply a part of the circle that has a total measure of 360 degrees.
5. We will first try to prove this inscribed angle theorem.

Page 152

1. Today we will look at more properties of circles.
2. We will use the same properties as yesterday.
3. Central angles and the intercepted arcs are equal.
4. Inscribed angles equal ½ the of the intercepted arc.
5. We will prove that a triangle is isosceles.

Page 153

1. A conditional statement is written in the form of If p then q.

2. For example, If an angle is inscribed in a circle it measure ½ its intercepted arc.
3. The converse of a conditional statement is formed by interchanging the p and q.
4. Can you write the converse of the inscribed angle theorem?
5. The converse of a conditional is not always true.

Page 154

1. A chord is a segment that connects one point on a circle to another point on the circle.
2. The diameter is a special chord that intersects the center of the circle.
3. Similar triangle \s have equal corresponding angles but the sides are in proportion.
4. We will first try to prove triangles similar by using AA.
5. Do you remember how to step up and solve proportions?

Page 155

1. Today we will work with circles and similar triangles.
2. In the figure on the right, P is the point where the chords intersect.
3. We will try to prove the two triangles are similar.
4. We will use the inscribed angle theorem.
5. We will again have to draw an extension to prove angles are similar.

Page 156

1. Today we will prove similarity using circles.
2. If we are given a circle we probably will use the inscribed angle theorem.
3. Point E is on BCand <AEB = 90 degrees.
4. AB is a diameter and arc BD = arc CD.
5. In the figure at the right,points A, B and C are all on the circumference of a circle.

Page 157

1. Today we will prove similarity using segments of a circle.
2. If arcs are equal then the angles they created are equal.
3. When AB = 4 cm, BC = 6 cm and CA = 5 cm, find the length of DC.
4. Therefore, AC:DC = BC : EC, 5 :DC = 6:9/5, DC = 3/2 cm.
5. The straight line, passing through A and running parallel to chord BC.

Page 158

1. Today we will prove the converse of the inscribed angle theorem.
2. Can you state the converse of the inscribed angle theorem?
3. In the figure at the right, chords AC and BD intersect at point P.
4. When AC = EC and BD = BE prove that A,B, C and D are on the same circumference of the same circle.
5. According to the converse of the inscribed angle theorem points are on the same circumference.

Page 159

1. Today we will review working with inscribed angles.
2. Find the measure of <x in each figure.
3. Find the measurement of the central angle corresponding to arc AD.
4. When AB = 5 and AD = 6 cm, find the length of DE.
5. Two tangents from the same point to the same circle are equal.

Page 160

1. A quadrangle is inscribed in a circle when all four vertices are on the circle.
2. If a quadrangle is inscribed in a circle, then opposite angles equal 180
3. Also, each exterior angle is equal to the interior angle opposite to its adjacent interior angle.
4. Do you remember adjacent means next to ?
5. The converse of 2 and 3 are also true.

Page 161

1. Today's theorem has several parts to understand.
2. First, we need a tangent to a circle that intersects one chord.
3. Next, we need an inscribed angle that cuts out the same arc as the tangent.
4. Now we can prove that the exterior angle is equal to the interior angle.
5. We'll need to study the diagram to understand this one!

Page 162

1. Today we have three intersecting chord theorems.
2. Case number 1 shows that AP * PB = PC * PD.
3. Case number 2 shows that PA* PB = PC * PD
4. Case number 3 shows that PA * PB = PT^{22}
5. We need to look at the figures to understand these cases.

Page 163

1. Intersecting chords in a circle are proportional.
2. The alternate segment theorem relates a tangent to an interior angle.
3. Opposite angles of an inscribed quadrilateral are supplementary.
4. Inscribed triangles formed by intersecting chords are similar.
5. Inscribed angles that share the same arc are equal.

Page 164 Comprehension test

Page 165 End- of - chapter problems

Chapter 7 The Pythagorean theorem

Page 166 Overview The Pythagorean theorem

Page 167

1. Today we will use the pythagorean theorem $a^2 + b^2 = c^2$.
2. We will have to use square roots to solve for a side.
3. Do you remember that the hypotenuse is opposite to the right angle?
4. It might help if you remember some pythagorean triples.
5. If a triangle is a right triangle then $a^2 + b^2 = c^2$.

Page 168

1. Today we will learn how to prove the pythagorean theorem.
2. There are many different ways to prove the theorem.
3. This theorem is very old and has been used for hundreds of years.
4. The pythagorean theorem only works with right triangles.
5. $a^2 + b^2 = c^2$ is probably the most famous mathematical theorem.

Page 169

1. The converse is when we switch the if and then of a conditional statement.
2. Can you write the converse of the Pythagorean Theorem?
3. We use the converse to prove triangles are right triangles.
4. Right triangles have many special features.

5. Right triangles are everywhere in this classroom. Can you see any?

Page 170

1. Today we will use the pythagorean theorem, $a^2 + b^2 = c^2$
2. Do you remember some pythagorean triples?
3. We might have to draw some auxiliary lines as the hypotenuse.
4. We often have to find one unknown first and then use it to find another unknown.
5. Are 12, 16, 20 the sides of a right triangle?

Page 171

1. There are two special right triangles one should learn about.
2. A 45-45-90 right triangle has sides in a ratio of
3. Can you draw and label a 45-45-90 right triangle?
4. A 30-60-90 right triangle has sides in a ration of
5. Can you draw and label a 30-60- 90 right triangle?

Page 172

1. An auxiliary line is just an extra line to create helpful shapes.
2. We can draw an auxiliary line in an isosceles triangle.
3. This auxiliary line will create right triangles.
4. Or, we can draw an auxiliary line in a trapezoid.
5. Often, this creates a square and a right triangle.

Page 173

1. Today we will use the Pythagorean theorems and plane figures.
2. Do you remember the properties of a rhombus?
3. Do you know an interesting way to find the area of a rhombus?
4. For obtuse triangles the height is drawn on the outside.
5. For some polygons, we will make smaller triangles inside the shape.

Page 174

1. Today we will use the Pythagorean Theorem with various triangles.
2. We will have to set up and solve some quadratic equations.
3. For example, a whole side might b 24 cm so one segment is x and the other segment is 24-x.
4. When using a trapezoid, we will draw a height from the two bases.
5. The Pythagorean Theorem has many applications.

Page 175

1. The distance between two points can be found using the Pythagorean Theorem.
2. The distance formula is - $\sqrt{(x1 - x2)2 - (y1 - y2)2}$
3. We will derive the formula today.
4. Vertical lines and horizontal lines are easy to find distance.
5. Remember, that distance always has to be positive.

Page 176

1. Today we will work with the length of chords.
2. A straight line drawn from the center of the circle will bisects the chord.
3. Statement above is only true if the line is perpendicular to the chord.
4. Will use chords from the center which are radii.

5. We will use the Pythagorean Theorem to find certain lengths.

Page 177

1. Today we will find the length of tangents to a circle.
2. Remember that a tangent to a circle and a radius form right angles.
3. Because of the above we will use the Pythagorean Theorem again.
4. We can also have one tangent to two circles.
5. Tangents, chords, and secants all have special properties.

Page 178

1. Today we will review using the Pythagorean Theorem with plane figures.
2. Do you remember the ratios of sides in a 30-6-90 right triangle?
3. Do you remember the ratios of sides in a 45-45-90 right triangle?
4. We will have to draw auxiliary lines to form right triangles.
5. It really helps to remember the basic pythagorean triples.

Page 179

1. Today we will continue using right triangles.
2. We will use linear equations and right triangles.
3. We will use parabolas and right triangles.
4. We will use circle properties and right triangles.
5. Again, right triangles are everywhere in our world.

Page 180

1. Today, we will learn how to find the length of a diagonal in a cuboid.

2. A cuboid is a rectangular prism, and a diagonal connects opposite vertices.
3. We will work with a cuboid with width a, length b and height c.
4. We will prove that the diagonal's length equals $\sqrt{a2 + b2 + c2}$
5. We will also prove that the diagonal of a cube with length a equals $\sqrt{3}a$.

Page 181

1. Today we will find the volume of a square pyramid.
2. A pyramid's name comes from the shape of the base.
3. Remember that the diagonals of a square bisect.
4. Do you know the formula for the volume of a pyramid?
5. Well, here it is, $\frac{1}{3}Bh$.

Page 182

1. Today, we will find the volume and surface area of a cone.
2. We will have to use the slant height of the cone.
3. The volume of a cone is, $\frac{1}{3}Bh$
4. The surface area of a cone is harder to determine.
5. It's formula is , $S = \frac{1}{2}\ell r$ with radius r and arc length l.

Page 183

1. Today we will discuss the Pythagorean Theorem and solids.
2. Let the center of the sphere be O, and A the center of the cut side.
3. We can use this to find the radius of the circular section.
4. We are passing a plane through the top of the sphere.
5. We will also have a sphere inside a cone.

Page 184

1. Today we will continue working with solids.
2. First, we will work with cuboids and the pythagorean theorem.

3. Next, we will work with pyramids and the pythagorean theorem.
4. Then we will work with cones and the pythagorean theorem.
5. Finally, we will work with rotating a figure around a vertical line.

Page 185

1. Today we will continue working with solids.
2. Again, we will use a cube and the pythagorean theorem.
3. Next, we will use a square pyramid and the pythagorean theorem.
4. Then, we will use a cone and the pythagorean theorem.
5. The last problem has a half sphere/

Page 186

1. Today we will solve various problems by applying the Pythagorean theorem.
2. The figure on the right is created by folding a rectangular piece of paper.
3. When this rectangle was folded along the dotted line AE.
4. In square ABCD on the right, M is the midpoint of side AD.
5. The last problem has three equilateral triangles.

Page 187

1. Today we will use similarity and the pythagorean theorem.
2. A intersects Bc perpendicularly at point H.
3. AB and DC intersect at point F, find the length of DF when AB = 60.
4. Straight line l passes through D and is parallel to diagonal AC.
5. Quad ABCDis a square, each of whose sides has a length of 8 cm.

Page 188

1. Today we will continue applying the Pythagorean theorem.
2. Draw a line from A so that it intersects BC perpendicularly.
3. These problems are very difficult and take time to solve.
4. Points A and B are on the circumference of a circle.
5. When the side length of square ABCD is 6 cm.

Page 189

1. Today we will solve even harder problems applying the Pythagorean theorem.
2. What is the shortest distance of the surface of a solid between vertices?
3. The minimum length can be found by unfolding ABEF along AB.
4. What about finding the shortest distance on the surface of a cone.
5. Find the minimum possible length of each string.

Page 190

1. Today we will look at a polygon formed inside a solid.
2. We can put a triangular pyramid in a cube.
3. We can put a regular hexagon in a cube.
4. We can put a trapezoid in a square pyramid.
5. Each of the solids below is a regular tetrahedron.

Page 191

1. Today we will have more problems with solids.
2. Find the length of the line that passes through vertex P.
3. It is also perpendicular to the triangular base ABC.
4. Solid O- ABCD on the right is a square pyramid.
5. Two spheres O and O' are tangent to a cone having a radius of 3 cm.

Page 192

1. Today we will have even harder problems using the Pythagorean theorem.
2. Each side of square ABCD on the right is 12 cm long.
3. The two graphs are those of a function $y = 2x^2$ and $y = ax^2$.
4. Point D is on OB and the extension of CD intersects the circle at point E.
5. Find the length of the point's shortest possible path.

Page 193

1. Today we will have even harder problems using the Pythagorean theorem.
2. Sphere O is placed inside the cone so that the sphere's surface is tangent to the cone's lateral and basal surfaces.
3. Find the radius of this sphere.
4. Solid ABC-DEF is a regular triangular prism whose edges are all equal.
5. Assume that the ray is not reflected when it hits a vertex of the square.

Page 194 Comprehension test

Page 195 End- of - chapter problems

Page 196- 198 Review 5 Organizing and Making Use of Data;Probability

Chapter 8 Sample Surveys

Page 199

1. A census is a survey that includes an entire target group.
2. A sample survey includes only a part of the target group.
3. The population represents the entire target group.
4. A sample and sample size represent the part of an entire target group.
5. Random sampling is the method to select a sample.

Page 200

1. We can use a sample survey to make a fraction.
2. For example, if we have 300 red and white balls we can just make a sample survey of just picking 28.
3. If the sample survey of the 28 was 11 white and 17 red we can make a fraction.
4. In this case we can write 11/28 as the percent of white.
5. Now, we can predict how many white balls are in the population by multiplying 11/28 times 300.

Page 201 Comprehension test & End- of - chapter problems

Page 202- 204 Complements Inequalities

Page 205 Complements Base -n number system