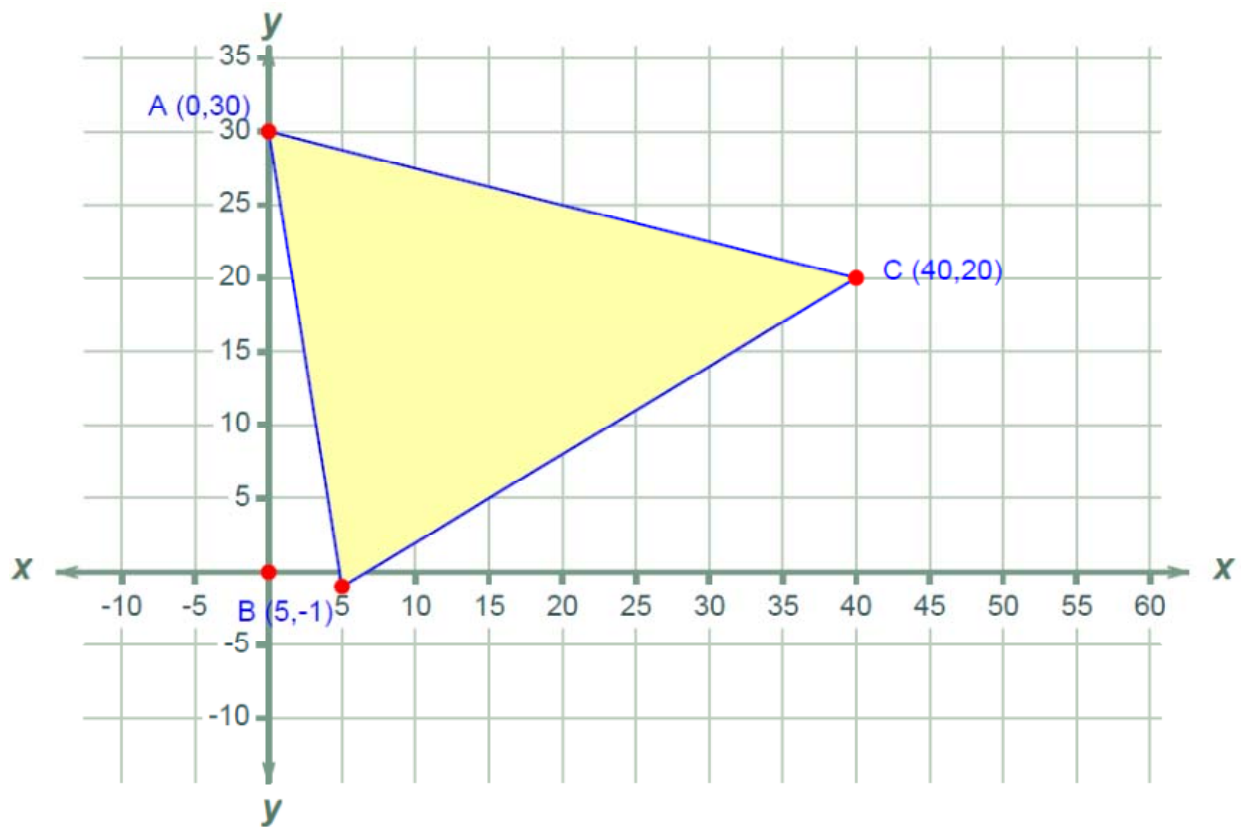


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Coordinate Algebra

Opening Task

Using the graph below, find the equation of an altitude of the triangle.



Focus Task

Solving Linear Equations in Two Variables

Student Materials

Beta Version

Notebooks and Pens

A store sells pens at \$2 and notebooks at \$5.

n = number of notebooks sold.

p = number of pens sold.

The following equations are true:

$$4n = p$$

$$5n + 2p = 39$$



Here is what Dan and Emma think the equations mean:

I think the first equation means that the store sells four times as many notebooks as pens.



Dan



Emma

I think the second equation means that the store sold 5 notebooks and 2 pens.

Are Dan and Emma correct?

.....

If you think Dan is wrong, explain the mistake and explain what *you* think the equation means.

.....
.....

If you think Emma is wrong, explain the mistake and explain what *you* think the equation means.

.....
.....

Figure out for yourself the number of pens and the number of notebooks sold in the store.

.....
.....
.....

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Coherence Task illustrative mathematics

Kimi and Jordan are each working during the summer to earn money in addition to their weekly allowance. Kimi earns \$9 per hour at her job, and her allowance is \$8 per week. Jordan earns \$7.50 per hour, and his allowance is \$16 per week.

1. Jordan wonders who will have more income in a week if they both work the same number of hours. Kimi says, "It depends." Explain what she means.
2. Is there a number of hours worked for which they will have the same income? If so, find that number of hours. If not, why not?
3. What would happen to your answer to part (b) if Kimi were to get a raise in her hourly rate? Explain.
4. What would happen to your answer to part (b) if Jordan were no longer to get an allowance? Explain.

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Overview of High School Math

CCGPS Coordinate Algebra

The fundamental purpose of Coordinate Algebra is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, organized into units, deepen and extend understanding of linear relationships, in part by contrasting them with exponential phenomena, and in part by applying linear models to data that exhibit a linear trend. Coordinate Algebra uses algebra to deepen and extend understanding of geometric knowledge from prior grades. The final unit in the course ties together the algebraic and geometric ideas studied. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

CCGPS Analytic Geometry:

The focus of Analytic Geometry on the coordinate plane is organized into 6 critical areas. Transformations on the coordinate plane provide opportunities for the formal study of congruence and similarity. The study of similarity leads to an understanding of right triangle trigonometry and connects to quadratics through Pythagorean relationships. The study of circles uses similarity and congruence to develop basic theorems relating circles and lines. The need for extending the set of rational numbers arises and real and complex numbers are introduced so that all quadratic equations can be solved. Quadratic expressions, equations, and functions are developed; comparing their characteristics and behavior to those of linear and exponential relationships from Coordinate Algebra. Circles return with their quadratic algebraic representations on the coordinate plane. The link between probability and data is explored through conditional probability. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

CCGPS Advanced Algebra:

It is in Advanced Algebra that students pull together and apply the accumulation of learning that they have from their previous courses, with content grouped into six critical areas, organized into units. They apply methods from probability and statistics to draw inferences and conclusions from data. Students expand their repertoire of functions to include polynomial, rational, and radical functions. They expand their study of right triangle trigonometry to model periodic phenomena. And, finally, students bring together all of their experience with functions and geometry to create models and solve contextual problems. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

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Deep Understanding Task (Utah)

Use the translation $(x, y) \rightarrow (x + 5, y - 9)$ for questions 1-7.

1. What is the image of $A(-6, 3)$?
2. What is the image of $B(4, 8)$?
3. What is the image of $C(5, -3)$?
4. What is the image of A' ?
5. What is the preimage of $D'(12, 7)$?
6. What is the image of A'' ?
7. Plot A, A', A'' and A''' from the questions above. What do you notice?

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Application Task

The batting averages for the Atlanta Braves for the past two years according to ESPN are listed below. Assuming all things equal, compare the 2011 BA to the 2010 BA. Justify your choices for comparisons.

2011

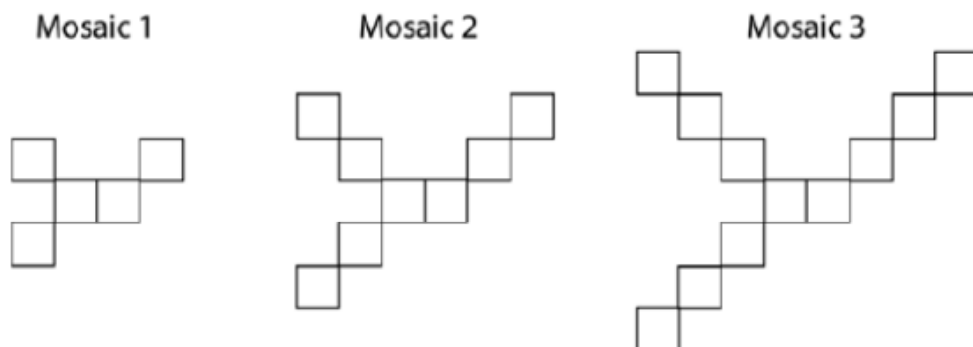
.500, .333, .333, .303, .286, .282, .278, .275, .270, .263, .260, .241, .240, .233, .233, .231, .220, .213, .212, .208, .173, .136, .116, .111, .106, .070, .051, .048, .000, .000, .000

2010

.321, .310, .307, .289, .287, .277, .269, .265, .256, .255, .250, .250, .250, .240, .240, .238, .210, .200, .195, .190, .185, .167, .151, .128, .125, .111, .097, .000, .000, .000, .000, .000, .000, .000, .000

Balanced Approach Task

Mosaics



Reuben learned in art class that a mosaic is made by arranging small pieces of colored material (such as glass or tile) to create a design. Reuben created a mosaic using tiles, then decided on a growing pattern and created a second and third mosaic. Reuben continued his pattern by building additional mosaics. He counted the number of tiles in each mosaic and then represented the data in multiple ways. He thinks he sees a relationship between the mosaic number and the total number of tiles in the mosaic.

1. Represent Reuben's data from the mosaics problem in at least three ways, including a general function rule, to determine the number of tiles in any mosaic.
2. Write a description of how your rule is related to the mosaic picture. Include a description of what is constant and what is changing as tiles are added.
3. How many tiles would be in the tenth mosaic? Use two different representations to show how you determined your answer.
4. Would there be a mosaic in Reuben's set that uses exactly 57 tiles? Explain your reasoning using at least one representation.
5. In Reuben's mosaic, there are 2 tiles in the center. How would the function rule change if the center of the mosaic contained 4 tiles instead? Explain your reasoning using two different representations.

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What's in Coordinate Algebra / Analytic Geometry A

Unit 7	Unit 8	Unit 9
<p>Similarity, Congruence, and Proofs</p> <p><u>Understand similarity in terms of similarity transformations</u> MCC9-12.G.SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. MCC9-12.G.SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. MCC9-12.G.SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.</p> <p><u>Prove theorems involving similarity</u> MCC9-12.G.SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. MCC9-12.G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.</p> <p><u>Understand congruence in terms of rigid motions</u> MCC9-12.G.CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. MCC9-12.G.CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. MCC9-12.G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.</p> <p><u>Prove geometric theorems</u> MCC9-12.G.CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. MCC9-12.G.CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles</p>	<p>Right Triangle Trigonometry</p> <p><u>Define trigonometric ratios and solve problems involving right triangles</u> MCC9-12.G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. MCC9-12.G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles. MCC9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.</p>	<p>Circles and Volume</p> <p><u>Understand and apply theorems about circles</u> MCC9-12.G.C.1 Prove that all circles are similar. MCC9-12.G.C.2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle. MCC9-12.G.C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. MCC9-12.G.C.4 (+) Construct a tangent line from a point outside a given circle to the circle. <u>Find arc lengths and areas of sectors of circles</u> MCC9-12.G.C.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.</p> <p><u>Explain volume formulas and use them to solve problems</u> MCC9-12.G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments. MCC9-12.G.GMD.2 (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. MCC9-12.G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*</p> <p>Transition Standard MCC8.G.9 Know the formulas for the volume of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.</p>

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<p>of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</p> <p>MCC9-12.G.CO.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</p> <p><u>Make geometric constructions</u></p> <p>MCC9-12.G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</p> <p>MCC9-12.G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.</p>		
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