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Algebra 1

Algebra 1 continues the study of algebraic concepts. It includes operations with polynomials and matrices, creation and application of linear functions and relations, algebraic representations of geometric relationships, and an introduction to nonlinear functions. Students will be expected to describe and translate among graphic, algebraic, numeric, and verbal representations of relations and use those representations to solve problems. Appropriate technology, from manipulatives to calculators and application software, should be used regularly for instruction and assessment.

Prerequisites

- *Operate with the real numbers to solve problems.*
- *Find, identify, and interpret the slope and intercepts of a linear relation.*
- *Visually determine the line of best fit for a given scatterplot; explain the meaning of the line; and make predictions using the line.*
- *Collect, organize, analyze, and display data to solve problems.*
- *Apply the Pythagorean Theorem to solve problems.*

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Algebra I

GOAL 1: The learner will perform operations with numbers and expressions to solve problems.

- 1.01 Write equivalent forms of algebraic expressions to solve problems.
 - a) Apply the laws of exponents.
 - b) Operate with polynomials.
 - c) Factor polynomials.
- 1.02 Use formulas and algebraic expressions, including iterative and recursive forms, to model and solve problems.
- 1.03 Model and solve problems using direct variation.

GOAL 2: The learner will describe geometric figures in the coordinate plane algebraically.

- 2.01 Find the lengths and midpoints of segments to solve problems.
- 2.02 Use the parallelism or perpendicularity of lines and segments to solve problems.

GOAL 3: The learner will collect, organize, and interpret data with matrices and linear models to solve problems.

- 3.01 Use matrices to display and interpret data.
- 3.02 Operate (addition, subtraction, scalar multiplication) with matrices to solve problems.
- 3.03 Create linear models for sets of data to solve problems.
 - a) Interpret constants and coefficients in the context of the data.
 - b) Check the model for goodness-of-fit and use the model, where appropriate, to draw conclusions or make predictions.

GOAL 4: The learner will use relations and functions to solve problems.

- 4.01 Use linear functions or inequalities to model and solve problems; justify results.
 - a) Solve using tables, graphs, and algebraic properties.
 - b) Interpret constants and coefficients in the context of the problem.
- 4.02 Graph, factor, and evaluate quadratic functions to solve problems.
- 4.03 Use systems of linear equations or inequalities in two variables to model and solve problems. Solve using tables, graphs, and algebraic properties; justify results.
- 4.04 Graph and evaluate exponential functions to solve problems.

Vocabulary
Concepts
Skills

Laws
of
Exponents

Monomial

Binomial

Trinomial

Polynomial

Addition

Subtraction

Multiplication

Division
(with monomials)

Factor
Quadratic
Expressions

Greatest
Common
Factor

Associative
Properties

Commutative
Properties

Distributive
Property

1.01 Write equivalent forms of algebraic expressions to solve problems.

A. Express, in terms of x , the mean of $(4x^2 - 6)$, $(2x^2 + 3x)$, and $(-13x + 3)$.

B. Multiply and simplify: $(c - 8)(c + 2)$

C. Multiply and simplify: $(a - 3)(a^2 - 6a - 7)$

D. Simplify: $x^2(x^2 - 2x) - 3x^2$

E. Simplify: $(6x^2 - 4x - 3) + (x^2 + x - 5)$

F. Simplify: $(6x^2y - 3y^4) - (2x^2y - 10)$

G. Multiply and simplify: $(y^2 - 5)(y^3 - 2y^2 - 1)$

H. Divide and simplify: $(6x^3y^3 - 12x^3y^2 + 8x^6y^5) \div 2xy$

I. Simplify: $\frac{6x^5y^3}{16x^2y^5}$

J. If $5^x \cdot 5^{(x+3)} = 5^{17}$, then $x = ?$

K. In professional baseball, basketball, and hockey, championship series (multiple games between the same opponents) are played to determine the sport's champion. There are two series formats that continue to be used: best three-out-of-five (the first team to win three games is the winner) and best four-out-of-seven (the first team to win four games is the winner). The chance of one team defeating another team in a series can be described by a polynomial where the variable is the first team's record, as a percent, versus the other team for the regular season just completed.

Expand and simplify the polynomial expressions for each series' format.

Three-out-of-five: $w^3 + 3w^3(1 - w) + 6w^3(1 - w)^2$

Four-out-of-seven: $w^4 + 4(1 - w)w^4 + 10(1 - w)^2w^4 + 20(1 - w)^3w^4$

In 2004, the Boston Red Sox defeated the New York Yankees 11 out of the 18 times they played each other during the regular baseball season.

Based on the regular season outcomes, what was the probability that Boston would defeat New York in the best four-out-of-seven championship series?

L. Factor: $x^2 - 100$

M. Factor: $3y^2 + 23y + 14$

N. Factor: $8x^2y - 24xy - 40x^2y^2$

O. Factor: $x^3 + 5x^2 + 6x$

P. $2x^2 + \mathbf{b}x + 15$ factors into the form $(2x + \mathbf{f})(x + \mathbf{h})$ where \mathbf{f} and \mathbf{h} are integers. Find all the values of \mathbf{b} , if \mathbf{b} is an integer.

Vocabulary
Concepts
Skills

Equation

Model

Formulas

Evaluate

Sequence

Arithmetic
 Sequence

Geometric
 Sequence

Explicit

$$a_{n+1} = a_n + d$$

$$a_{n+1} = r(a_n)$$

1.02 Use formulas and algebraic expressions, including iterative and recursive forms, to model and solve problems.

A. The simple interest formula for calculating a bank balance is $B_{n+1} = (1 + r)B_n$ where B_n is the beginning balance, B_{n+1} is the balance at the end of the period, and r is the interest rate for the period. How much money would be in a new account after one year (B_1) if the annual interest rate is 5% and the principal (B_0) is \$1000? Suppose you left the balance in the account. What is the new amount after the second year (B_2)? What would the amount be after the end of the third year (B_3)? What is the amount after the fourth year (B_4)?

B. According to Archimedes, "Give me a lever long enough and single-handed I can move the world." In order to use that lever, a formula is

necessary. $\frac{W_1}{W_2} = \frac{D_2}{D_1}$ describes the relationship between weights (W_1 ,

W_2) on a beam and their respective distances (D_1 , D_2) from a fulcrum in order to achieve balance. If you, weighing 145 pounds, need to lift a 400-pound block located 3.5 feet from the fulcrum, how far from the fulcrum must you be?

C. During the investigation of traffic accidents, a piece of evidence that is identified and analyzed is the skid marks left by the cars involved. The formula $S^2 = 30df$ approximates the relationship among the vehicle's minimum speed (S) in mph, the length (d) of the skid marks in feet, and the drag factor (f). A recent accident at an intersection showed skid marks for the two cars involved to be lengths of 36' 7" and 42' 7". Find the minimum speeds of both cars. The drag factor for both vehicles was 0.795.

D. Linda was filling out her state income tax return. Her taxable income for the past year was \$37,405. According to the tax rate schedule her tax is \$765 plus 7% of the amount over \$12,750. According to her W-2 form, she paid \$2517.91 in state taxes. Determine the amount Linda owes or should be refunded.

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**Vocabulary
Concepts
Skills**

E. A soup company decides to increase the height of its cans by 40% but to keep the volume the same. Approximately how much must the radius of the can be decreased to keep the volume constant? ($V = \pi r^2 h$)

F. Suppose you take 100 units of medication for a cold that is eliminated by your system at a rate of 30% per hour. Assume you do not take additional doses. How many hours will it take for your body to have less than 10 units of medication in it?

G. The NCAA uses the following formula to measure the passing efficiency of quarterbacks.

$$\text{Points} = 8.4 \cdot \frac{\text{yards}}{\text{attempts}} + 100 \cdot \frac{\text{completions}}{\text{attempts}} + 330 \cdot \frac{\text{touchdowns}}{\text{attempts}} - 200 \cdot \frac{\text{intercepts}}{\text{attempts}}$$

These 2004 North Carolina college quarterbacks qualified for the NCAA quarterback passing efficiency ratings. Rank them. (The quarterback with the most points would be considered the most efficient passer.)

	Attempts	Completions	Interceptions	Yards	TD
Clark	149	88	9	1065	7
Davis	313	175	15	2104	12
Durant	426	244	9	3150	30
Glenn	188	89	15	1167	6
Hamilton	225	129	14	1093	9
Jones	107	33	7	362	2
Pinkney	339	190	15	2195	18
Schneider	254	150	7	1527	8
White	179	81	14	1049	5
Williams	350	234	10	3109	24

Vocabulary
Concepts
Skills

1.03 Model and solve problems using direct variation.

Constant

Coefficient

Ratio

Proportion

Slope

Rate

$y = kx$

A. At one point during the basketball season, Daniel was hitting 78% (43 out of 55) of his free throws. In his next 20 free throw attempts, how many free throws must he hit to raise his shooting to 80% or better?

B. The profits at a video arcade are directly proportional to the number of game machines. If a profit of \$700,000 was made with 150 machines, how much profit would be expected if the number of game machines dropped to 45?

C. The relative values of various currencies change frequently. On February 3, 2003, the British pound had a value of \$1.6475 and the Swiss franc had a value of \$0.7345. How many Swiss francs are equivalent to one British pound?

D. Amusement and theme parks in the United States had a total payroll of \$1.69 billion last year. The average annual salary of park employees was \$15,258 that year. How many people were employed at amusement and theme parks last year?

E. The cost of living indices measure relative price levels for consumer goods and services. In Asheville the index for transportation costs is 107.1. This means transportation costs in Asheville are 107.1% of the national average. Nationally, the weekly cost of food for a family of four is \$165.30. The indices for food costs in Greenville and Wilmington are 94.7 and 107.2, respectively. On average, how much more does a family spend for food in Wilmington compared with a family in Greenville?

F. In baseball, the pitcher's mound is 60 feet, 6 inches from home plate. If Pedro throws a 91-MPH fastball, how long does it take to reach home plate? In Olympics softball, the pitcher's mound is 40 feet from the plate. If Jennie throws a 71-MPH fastball, how long does it take to reach home plate? Which batter, baseball or softball, has to react quicker? Explain.

Maria serves a tennis ball at 105 MPH. How long does it take the ball to reach the opposite baseline 78 feet away? How does this compare with the baseball and softball situations?

G. Nathan earned \$2295.32 this summer working at a camp. Nathan owes no state or federal income tax but must pay the Social Security tax at a rate of 7.65%. How much was withheld from his pay this summer?

Vocabulary
Concepts
Skills

Pythagorean
Theorem

Distance
Formula

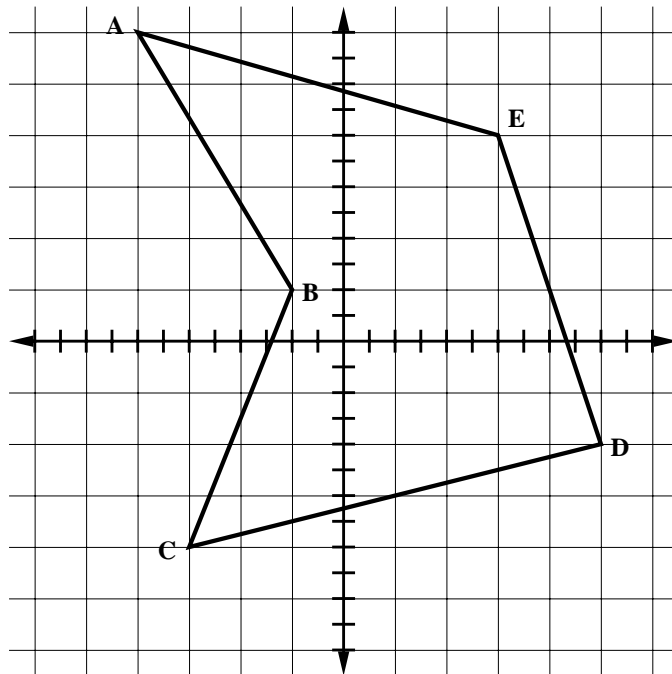
Simplify Irrational
Expressions

2.01 Find the lengths and midpoints of segments to solve problems.

A. Find the perimeter of the triangle with vertices $(4, 0)$, $(-2, -2)$, and $(2, 6)$.

B. Parallelogram ABCD has vertices $(8, 9)$, $(9, 3)$, $(2, 5)$, and $(1, 11)$. What are the coordinates of the intersection of the diagonals? What is the perimeter of ABCD?

C. Find the perimeter of ABCDE.



Vocabulary
Concepts
Skills

Slope

Altitude

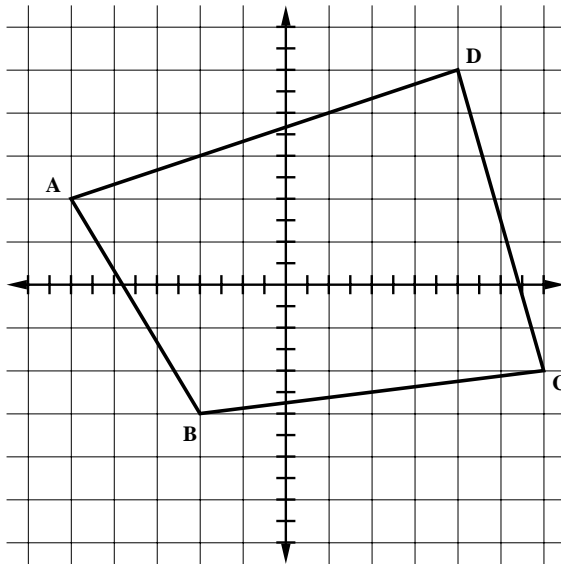
$$y - y_1 = a(x - x_1)$$

$$f(x) = ax + b$$

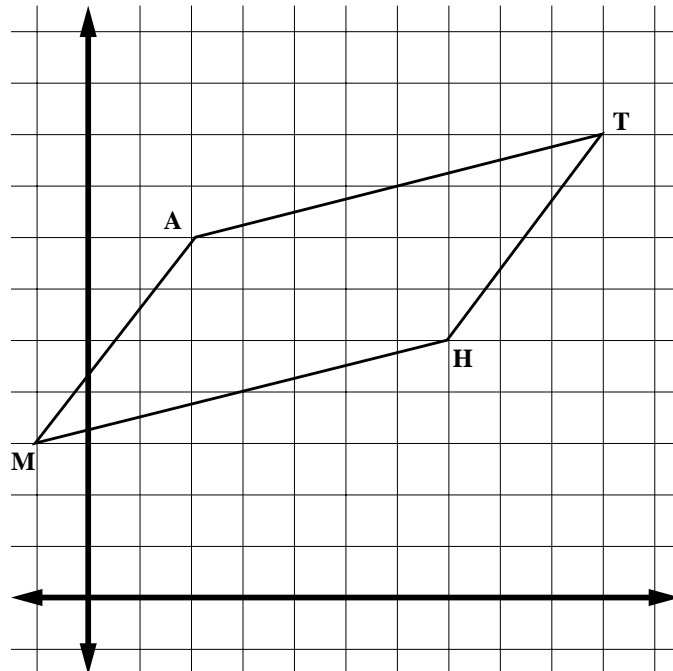
$$Ax + By = C$$

2.02 use the parallelism or perpendicularity of lines and segments to solve problems.

A. Connect the midpoints of the sides of ABCD consecutively to form a new quadrilateral. Which special quadrilateral is it? Justify.



B. Give the equation of the line that includes an altitude of parallelogram MATH.



C. $\triangle ABC$ is a right triangle with vertices A (-3, 3) and B (2, 2) and $m\angle A = 90$. What is the equation for \overleftrightarrow{AC} ?

Vocabulary
Concepts
Skills

Ordered
Array

Dimensions

Row

Column

Elements

Interpolation

3.01 Use matrices to display and interpret data.

A. The matrix below displays the calories used per minute by body weight during walking/running. Identify trends or patterns in the data. Each morning George jogs through his neighborhood at a rate of ten minutes per mile. If he weighs 165 pounds, how many calories is he using per minute?

Weight (lbs.)	100	120	150	170	200	220
Walking (15 min / mile)	3.9	4.6	5.8	6.6	7.8	8.5
Jogging (11 min / mile)	6.1	7.3	9.1	10.4	12.2	13.4
Running (8 min / mile)	9.4	11.3	14.1	16.0	18.8	20.7

B. The matrix below shows the values of various fuels for the period 1993-2000. The value of each unit is given in dollars.

	1993	1994	1995	1996	1997	1998	1999	2000
Regular Gasoline (gallons)	1.11	1.11	1.15	1.23	1.23	1.06	1.17	1.51
Premium Gasoline (gallons)	1.30	1.31	1.34	1.41	1.42	1.25	1.36	1.69
Heating Oil (gallons)	0.91	0.88	0.87	0.99	0.98	0.85	0.88	1.31
Diesel Fuel (gallons)	0.60	0.55	0.56	0.68	0.64	0.49	0.58	0.94
Natural Gas (1000ft ³)	6.16	6.41	6.06	6.34	6.94	6.82	6.69	7.71

Generally, how have the prices of the fuels changed during the period? Which fuel shows the least/greatest change? If there is a general trend among the fuel prices, are there any that do not follow the trend? Which ones?

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**Vocabulary
Concepts
Skills**

C. The heat index (HI) is the temperature the body feels when heat and humidity are combined. The matrix below shows the HI that corresponds to the actual air temperature and relative humidity.

		Relative Humidity (%)										
		0	10	20	30	40	50	60	70	80	90	100
Air Temperature (°F)	65	–	58	59	60	61	62	63	64	65	66	–
	70	64	64	65	66	67	68	69	70	71	72	72
	75	69	70	71	72	73	74	75	76	77	80	80
	80	73	76	77	79	80	82	83	84	86	88	91
	85	78	80	82	84	86	88	90	93	97	101	108
	90	83	84	87	89	92	96	101	106	112	119	–
	95	87	89	92	96	101	107	114	122	131	142	–
	100	91	94	99	104	111	120	130	141	154	169	–
	105	95	100	106	114	123	135	148	163	181	200	–

Estimate the relative humidity for a HI of 85°F and an air temperature of 85°F.

Estimate the relative humidity for a HI of 95°F and an air temperature of 95°F.

Estimate the relative humidity for a HI of 105°F and an air temperature of 105°F.

Estimate the air temperature for a HI of 85°F and 50% relative humidity.

Estimate the heat index for 65°F and 0% relative humidity.

Estimate the heat index for 82°F and 75% relative humidity.

Vocabulary
Concepts
Skills

Ordered
Array

Dimensions
(rows, columns)

Row

Column

Elements

3.02 Operate (addition, subtraction, scalar multiplication) with matrices to solve problems.

A. Given;

$$\mathbf{A} = \begin{bmatrix} 2 & 6 & 7 \\ 4 & -1 & 4 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 3 & 2 \\ 6 & 1 \\ 4 & 5 \\ 0 & -3 \end{bmatrix} \quad \mathbf{D} = \begin{bmatrix} 1 & 0 \\ 2 & 0 \\ 4 & 4 \\ 0 & 3 \end{bmatrix}$$

$$\mathbf{C} = \begin{bmatrix} 5 & 8 & -4 \\ 4 & 7 & -3 \end{bmatrix}$$

Without a calculator, find $\mathbf{A} + \mathbf{C}$; $4\mathbf{B}$; $3\mathbf{C} - 2\mathbf{A}$; $\mathbf{C} - \mathbf{B}$; $2\mathbf{B} + 5\mathbf{D}$. Justify each result.

B. The matrices below show trade between the United States and its five largest trading partners. For the period shown, find the total value of goods exchanged annually between the United States and its trading partners. Find the balance of trade annually between the United States and its trading partners. Expand the matrices to include the most recent data possible and revisit total value and balance of trade. Discuss any patterns that may be apparent in the resulting matrices.

Exports to ... (billions of dollars)

	1994	1995	1996	1997	1998
Canada	114.4	127.2	134.2	151.8	156.3
China	9.3	11.8	12.0	12.9	14.3
Germany	19.2	22.4	23.5	24.5	26.6
Japan	53.5	64.3	67.6	65.5	57.9
Mexico	50.8	46.3	56.8	71.4	79.0

Imports from ... (billions of dollars)

	1994	1995	1996	1997	1998
Canada	128.4	144.4	155.9	168.2	174.8
China	36.8	45.5	51.5	62.6	71.2
Germany	31.7	36.8	38.9	43.1	49.8
Japan	119.2	123.5	115.2	121.7	122.0
Mexico	49.5	62.1	74.3	85.9	94.7

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Vocabulary
Concepts
Skills

C. Total revenues (in millions of dollars) for several arts, entertainment, and recreational services are shown in matrix **A** and the taxable revenues for the same services are shown in matrix **B**. Determine the tax-exempt revenues for the identified services for 1998 and 1999. The rows and columns are defined as shown below.

	1998	1999
Performing Arts Companies		
Spectator Sports		
Promoters		
Agents and Managers		
Independent Artists, Writers, Performers		
Museums, Historical Sites		
Amusement Parks, Arcades		
Others		

$$A = \begin{bmatrix} 8618 & 8816 \\ 14871 & 15765 \\ 6665 & 7168 \\ 2824 & 3054 \\ 6356 & 6338 \\ 7180 & 7625 \\ 8525 & 8683 \\ 38007 & 40963 \end{bmatrix}$$

$$B = \begin{bmatrix} 5415 & 5458 \\ 14871 & 15765 \\ 5057 & 5438 \\ 2824 & 3054 \\ 6356 & 6338 \\ 582 & 703 \\ 8525 & 8683 \\ 29468 & 31725 \end{bmatrix}$$

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Vocabulary
Concepts
Skills

D. Participation for selected NCAA college sports are shown. Matrix **M** shows male participation and matrix **F** shows female participation during the 1998-1999 school year. The rows and columns are as follows.

	Teams	Athletes
Basketball		
Cross Country		
Golf		
Gymnastics		
Lacrosse		
Soccer		
Swimming / Diving		
Tennis		
Indoor Track		
Outdoor Track		
Volleyball		

$$\mathbf{M} = \begin{bmatrix} 980 & 15710 \\ 827 & 10935 \\ 716 & 7695 \\ 26 & 375 \\ 197 & 6193 \\ 717 & 18238 \\ 381 & 7559 \\ 769 & 7729 \\ 526 & 16943 \\ 637 & 20401 \\ 79 & 1124 \end{bmatrix} \qquad \mathbf{F} = \begin{bmatrix} 1001 & 14365 \\ 891 & 12042 \\ 364 & 2933 \\ 90 & 1490 \\ 213 & 4749 \\ 790 & 17520 \\ 458 & 10012 \\ 877 & 8492 \\ 560 & 15460 \\ 671 & 18220 \\ 960 & 13194 \end{bmatrix}$$

Determine the total number of teams and participants for each sport.
Determine the difference between male and female participation for each sport.

Vocabulary
Concepts
Skills

- Slope
- Intercepts
- Independent
- Dependent
- Domain
- Range
- Scatter plot
- Best-Fit Line
(linear regression,
method of
least squares)
- Correlation
Coefficient
- Residuals
- Estimation
- Prediction
- Interpolation
- Extrapolation

3.03 Create linear models for sets of data to solve problems.

A. The first class postal rates (PR) for 1958-2002 are shown along with the federal minimum wage (MW) for the corresponding years. Based on the data provided, is there a strong relationship between wages and rates? If so, estimate, based on the data provided, the first class postal rate when the minimum wage is \$5.65. What other variables may affect postal rates?

Year	MW	PR	Year	MW	PR	Year	MW	PR
1958	1.00	0.04	1975	2.10	0.13	1991	4.25	0.29
1963	1.25	0.05	1978	2.65	0.15	1995	4.25	0.32
1968	1.60	0.06	1981	3.35	0.18	1999	5.15	0.33
1971	1.60	0.08	1985	3.35	0.22	2001	5.15	0.34
1974	2.00	0.10	1988	3.35	0.25	2002	5.15	0.37

B. The 1998 movie *Titanic* was one of the top money-earning movies of all time. Create a linear model using the data provided (income in millions of dollars). Define the slope in terms of the information provided. When would you expect sales to have reached the \$500 million mark? Is it safe to predict that sales will reach the \$1 billion mark? Explain.

Week	Income	Week	Income	Week	Income
1	28.638	5	242.748	9	376.27
2	88.425	6	274.599	10	402.561
3	157.467	7	308.1	11	426.983
4	197.881	8	337.355	12	449.157

C. From any vertex of a 4-sided polygon, one diagonal can be drawn. From any vertex of a 5-sided polygon, two diagonals can be drawn. From any vertex of a 6-sided polygon, three diagonals can be drawn. From any vertex of a 7-sided polygon, four diagonals can be drawn. How many diagonals can be drawn from any vertex of a 20-sided polygon? Create an equation that will generate the number of diagonals for n -sided polygons.

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Vocabulary
Concepts
Skills

D. The percent of Americans with at least four years of high school education is shown. Create a linear model (let 1940 be $x = 0$) and estimate the percent of Americans with four years of high school education in 2006. Define the slope of the line with respect to the data. What are the variables that affect the number of people completing high school? How have those variables changed or modified since 1940?

1940	24.1	1980	68.6
1950	33.3	1985	73.9
1960	41.0	1990	77.6
1970	55.2	1995	80.9
1975	62.5	1998	82.9

E. The mean price per gallon of gasoline is shown for the period 1979-2000. Graph the data and describe it. Is it possible to create an algebraic model of the data? Explain. Identify variables that affect the price of gasoline and other petroleum-based products.

1979	0.716	1990	1.042
1980	1.131	1991	1.247
1981	1.298	1992	1.073
1982	1.358	1993	1.117
1983	1.230	1994	1.043
1984	1.216	1995	1.129
1985	1.148	1996	1.129
1986	1.194	1997	1.261
1987	0.862	1998	1.131
1988	0.933	1999	0.972
1989	0.918	2000	1.301

*Vocabulary
Concepts
Skills*

Graph

Slope

Intercepts

Domain

Range

Independent

Dependent

Relation

Function

Increasing

Decreasing

Properties
of
Equality

Identities

Commutative
Properties

Associative
Properties

Distributive
Property

Solution

$$y - y_1 = a(x - x_1)$$

$$f(x) = ax + b$$

$$Ax + By = C$$

4.01 Use linear functions or inequalities to model and solve problems; justify results.

A. In 1980, the average price of a home in Greensboro was \$40,000. By 2002, the average price of a home was \$120,000. Create a linear model based on this data. According to the model, how much does the cost of a home change annually? Estimate the price of a home in 1991; 2006.

B. The cost of renting a cab is \$3.00 plus twenty-five cents per mile. What would a twenty-five miles trip cost? Suppose you were charged \$12.75. How many miles did you ride in the cab?

C. The power company uses two different rates to calculate a monthly power bill. For July-October, the basic customer charge is \$6.75 plus \$0.08485 per kilowatt-hour. For November-June, the basic customer charge is \$6.75 plus \$0.07485 per kilowatt-hour. 3% North Carolina sales tax is added for the final charge. If the May and September bills are both \$127, what is the difference in the amount of power (kilowatt-hours) used each month?

D. For the line $y = ax + b$ where $a > 0$ and $b > 0$:
 If b increases and a remains constant, how does the x -intercept change? What happens to the line?
 If a increases and b remains constant, how does the x -intercept change?
 If b is multiplied by -1 and a remains constant, how does the line change?
 If a decreases, getting closer to 0, and b remains constant what happens to the line?

E. A telephone company offers two long distance calling plans. The alpha plan charges \$0.10 per minute and the beta plan charges \$0.07 per minute plus a monthly charge of \$3.95. For a one-month period, describe when each plan is the least expensive. When are costs equivalent?

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Vocabulary
Concepts
Skills

F. Transportation costs for travel between selected cities are shown below. Assume that the costs identified represent a linear trend. Determine the distance at which driving a car is less expensive than riding the train. When does it become cheaper to fly rather than drive? For what distance is the train the most expensive mode of travel? Identify some advantages and disadvantages for each mode of transportation. What other variables affect the cost of travel?

	Distance	Car	Air	Rail
Raleigh – Charlotte	300	\$108	\$224	\$40
Raleigh – New York	1300	\$468	\$169	\$147

Vocabulary
Concepts
Skills

Parabola

Vertex

Domain

Range

Independent

Dependent

Intercepts

Solutions

Zeros

Roots

Coefficients

Increasing

Decreasing

Maximum

Minimum

Properties of Equality

Distributive Property

$$f(x) = ax^2 + bx + c$$

4.02 Graph, factor, and evaluate quadratic functions to solve problems.

A. The function $g(x) = -0.005x^2 + 0.12x + 1.779$ describes the monthly price of gasoline for a recent 18-month period. At what month did the prices reach their peak? How long were the prices above \$2.05? Assuming the function continues to model gasoline prices, how long will it be until the price returns to its initial value of \$1.779 per gallon?

B. The function $c(x) = 0.194x^2 - 2.12x + 18$ models the value of a share of stock in a computer camera company for a recent 12-month period. What was the lowest price of the camera stock? What was the greatest price for the 12-month period? If the function continues to accurately model the value of the stock, will the stock ever double its initial value of \$18? When?

C. Find the exact values of x that satisfy $7(x^2 - 7x - 7) = 67x + 2$.

D. Find the exact values of x that satisfy $4x^2 + 3x - 9 = 6 - x + x^2$.

E. Without a calculator, identify similarities and differences among $y = x^2$, $y = x^2 + 5$, and $y = x^2 - 3$.

F. Without a calculator, identify similarities and differences among $y = x^2$, $y = 2.5x^2$, $y = -1.5x^2$, $y = 0.3x^2$, and $y = -3x^2$.

G. The function $f(x) = -0.019x^2 + 3.04x - 58.87$ describes newspaper circulation (millions) in the United States for 1920-98 ($x = 20$ for 1920). Identify periods of increasing and decreasing circulation. According to the function, when did newspaper circulation peak? When will circulation approximate 45 million?

Vocabulary
Concepts
Skills

Graph

Intersection

Domain

Range

Parallel

Substitution

Elimination

Solution

4.03 Use systems of linear equations or inequalities in two variables to model and solve problems. Solve using tables, graphs, and algebraic properties; justify results.

A. During the band's fruit sale, five dozen oranges cost as much as four dozen grapefruits. Terry bought two dozen oranges and a dozen grapefruit, spending \$27.30. What was the cost of a dozen oranges?

B. The bill for a lunch of three hamburgers and two drinks is \$9.67. The bill for a lunch of four hamburgers and three drinks is \$13.21. What is the total cost of one hamburger and one drink?

C. For a special order, the Coverup Company manufactured 1200 shirts. Sweatshirts were priced at \$14 each and T-shirts at \$8 each. The company received a total of \$11,400 for the shirts. How many of each type of shirt did the Coverup Company manufacture for this order?

D. A movie theater charges \$7 for an adult's ticket and \$4.50 for a child's ticket. On a recent night, the sale of child's tickets was three times the sale of adult's tickets. If the total amount collected for ticket sales was \$2,009, how many adults purchased tickets?

E. Mildred makes \$4 an hour babysitting and \$7 an hour when she works at a local fast-food restaurant. Her parents do not want her to work more than 20 hours per week. Mildred would like to earn at least \$70 a week. Write a system of inequalities that show the number of hours she could work at each job. Graph the system. Identify at least four possible solutions.

F. The Twin Theater charges \$7.50 for adult tickets and \$4 for children 12 or under. The theater has 470 seats. The manager wants to have a nightly income (two shows) of at least \$5000. Write a system of inequalities for the number of children and adult tickets that can be sold. Identify at least four possible solutions.

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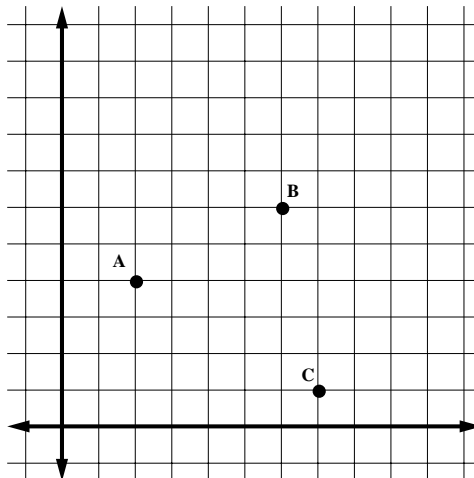
Vocabulary
Concepts
Skills

G. Solve exactly without a calculator; show and justify each step.

$$2x + 3y = 12$$

$$6x - 5y = -24$$

H. A, B, and C are three vertices of a parallelogram. What are the coordinates of the fourth vertex of the parallelogram? Identify all the solutions.



4.04 Graph and evaluate exponential functions to solve problems.

Independent

Dependent

Domain

Range

Increasing

Decreasing

Coefficient

Base

Intercepts

Initial Value

Exponent

$$f(x) = ab^x + c$$

A. In 1998 there were approximately 430,000 people employed in the United States as computer support specialists. According to the US Bureau of Labor Statistics, that number was expected to grow 7% annually. The function $c(x) = 430000(1.07)^x$ describes the growth of specialists after x years (since 1998). According to the function, how many computer support specialists will there be in 2007? When will the number reach one million?

B. A sports utility vehicle (SUV) was purchased for \$23,000 recently. According to the automobile sales association, the buyer can expect the SUV to lose about 11% of its value annually.

The function $v(x) = 23000(0.89)^x$ describes the value of the SUV x years after its purchase. The SUV is valued at half its original price after how many years? In ten years how much could an owner expect to sell the SUV for?

C. In the United States for the period 1980-1998, the function $f(x) = 23.5(0.978735)^x$ describes the fatality rate (fatalities per 100,000) due to motor vehicle accidents ($x = 0$ for 1980). Describe the trend for the period indicated. How is the fatality rate changing annually?

The number of miles traveled increased annually as well as the number of registered motor vehicles for the same period. Are these variables that affect the fatality rate? If not, name several that are.

D. The average weekly food cost for a family of four in 1990 was \$128.30. For the next ten years the weekly food cost increased 2.45% annually. The function $f(x) = 128.3(1.0245)^x$ represents the cost of food for that period. Estimate the weekly food cost for a family of four in 2006. How much has food cost increased since 1990?