

Mathematics Standards for High School

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C	<p>(.)</p>

Number and Quantity Overview

The Real Number System

- Extend the properties of exponents to rational exponents
- Use properties of rational and irrational numbers.

Quantities

- Reason quantitatively and use units to solve problems

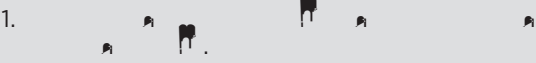


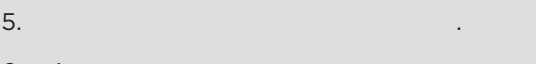
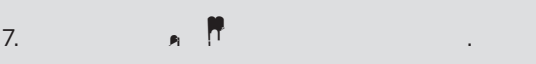
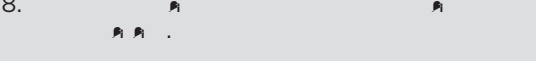


The Complex Number System

- Perform arithmetic operations with complex numbers
- Represent complex numbers and their operations on the complex plane
- Use complex numbers in polynomial identities and equations

Vector and Matrix Quantities

- Represent and model with vector quantities.
- Perform operations on vectors.
- Perform operations on matrices and use matrices in applications.

Mathematical Practices

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 

The Real Number System

N-RN

Extend the properties of exponents to rational exponents.

1. E $a^m \cdot a^n = a^{m+n}$. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.
2. $a^{-n} = \frac{1}{a^n}$.

Use properties of rational and irrational numbers.

3. E $\sqrt{2} + \sqrt{3}$ is irrational; $\sqrt{2} - \sqrt{3}$ is irrational; $\sqrt{2} \cdot \sqrt{3}$ is irrational; $\frac{\sqrt{2}}{\sqrt{3}}$ is irrational.

Quantities

N-Q

Reason quantitatively and use units to solve problems.

1. D $120 \text{ min} = 2 \text{ hr}$; $60 \text{ min} = 1 \text{ hr}$; $30 \text{ min} = \frac{1}{2} \text{ hr}$; $15 \text{ min} = \frac{1}{4} \text{ hr}$.
2. D $1 \text{ hr} = 60 \text{ min}$; $2 \text{ hr} = 120 \text{ min}$; $3 \text{ hr} = 180 \text{ min}$.
3. C $1 \text{ hr} = 60 \text{ min}$; $2 \text{ hr} = 120 \text{ min}$; $3 \text{ hr} = 180 \text{ min}$.

The Complex Number System

N-CN

Perform arithmetic operations with complex numbers.

1. $(a + bi) + (c + di) = (a + c) + (b + d)i$; $(a + bi) - (c + di) = (a - c) + (b - d)i$; $(a + bi)(c + di) = (ac - bd) + (ad + bc)i$; $\frac{a + bi}{c + di} = \frac{(a + bi)(c - di)}{(c + di)(c - di)}$.
2. $i^2 = -1$.
3. (+) F $(a + bi)^2 = a^2 - b^2 + 2abi$.

Represent complex numbers and their operations on the complex plane.

4. (+) $(a + bi) + (c + di) = (a + c) + (b + d)i$.
5. (+) $(a + bi) - (c + di) = (a - c) + (b - d)i$. For example, $(1 + 3i) - (4 - i) = (1 - 4) + (3 + 1)i = -3 + 4i$.



Seeing Structure in Expressions

- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

Arithmetic with Polynomials and Rational Expressions

- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions

Creating Equations

- Create equations and inequalities in one variable and solve them. Understand that the solutions to a linear equation $ax + b = c$ and a linear inequality $ax + b < c$ are all real numbers that satisfy the equation.

Seeing Structure in Expressions

A-SSE

Interpret the structure of expressions

1.
 - a. $3x^2 + 6x + 9 = 3(x^2 + 2x + 3)$. For example, interpret $3(x^2 + 2x + 3)$ as the product of 3 and a trinomial $x^2 + 2x + 3$.
 - b. $3x^2 + 6x + 9 = 3(x + 3)^2$. For example, interpret $3(x + 3)^2$ as the product of 3 and a square $(x + 3)^2$. For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .
2. $4x^2 + 4x + 1 = (2x + 1)^2$. For example, interpret $4x^2 + 4x + 1$ as the square of $2x + 1$.

Rewrite rational expressions

6.

$$\frac{p(x) + q(x)}{r(x)}$$

$$\frac{a(x)}{b(x)}$$

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6. $(-\infty, -1) \cup (1, \infty)$.
7. $(-\infty, -1) \cup (1, \infty)$. For example, find the points of intersection between the line $y = 3x$ and the parabola $y^2 = 3x$.
8. $(-1, 1)$.
9. $(-\infty, -1) \cup (1, \infty)$.

Represent and solve equations and inequalities graphically

10. $(-\infty, -1) \cup (1, \infty)$.
11. E $y = f(x)$ and $y = g(x)$ are functions defined on the interval $[-1, 1]$. The functions $f(x)$ and $g(x)$ are defined by $f(x) = g(x)$; $f(x) > g(x)$; $f(x) < g(x)$.
12. $(-\infty, -1) \cup (1, \infty)$.

Mathematics | High School—Functions

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Interpreting Functions

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Interpreting Functions

F-IF

Understand the concept of a function and use function notation

1. Understand that a function from one set to another set assigns to each element in the first set exactly one element in the second set. Use function notation. Understand that the graph of a function on a coordinate plane consists of all ordered pairs $(x, f(x))$.
2. Understand that a function is a rule that assigns to each input x exactly one output $f(x)$.
3. Understand that the graph of a function on a coordinate plane consists of all ordered pairs $(x, f(x))$. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.

Interpret functions that arise in applications in terms of the context

4. For a function that models a relationship between two quantities, interpret key features of the graph and table in terms of the situation. Key features include:

Intercept	0	74	71	0	71	0	3
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9. C $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$. For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Building Functions

F-BF

Build a function that models a relationship between two quantities

1.
 - a. D $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$. For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.
 - b. C $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.
 - c. (+) C $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$. For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.
2. $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.

Build new functions from existing functions

3. $f(kx)$, $f(x+k)$, $f(x) + k$, $kf(x)$, $k(f(x))$, $f(kx)$, $f(x+k)$, $f(x) + k$, $kf(x)$, $k(f(x))$; k is a constant. E $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
4. F $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.
 - a. $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.
 - b. (+) $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.
 - c. (+) $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.
 - d. (+) $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.
5. (+) $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.

Linear, Quadratic, and Exponential Models

F-LE

Construct and compare linear, quadratic, and exponential models and solve problems

1. D $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.
 - a. $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.
 - b. $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.
 - c. $f(x)$ and $g(x)$ are functions defined on the interval $(-\infty, \infty)$.

2. C f and g are functions defined on the interval $[-1, 3]$. The function f is defined by $f(x) = x^2 - 2x + 1$, and the function g is defined by $g(x) = x^2 - 1$.
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4. F f and g are functions defined on the interval $[-1, 3]$. The function f is defined by $f(x) = x^2 - 2x + 1$, and the function g is defined by $g(x) = x^2 - 1$.





Geometry Overview

Congruence

- Experiment with transformations in the plane
- Understand congruence in terms of rigid motions
- Prove geometric theorems
- Make geometric constructions

Similarity, Right Triangles, and Trigonometry

- Understand similarity in terms of similarity transformations
- Prove theorems involving similarity
- Define trigonometric ratios and solve problems involving right triangles
- Apply trigonometry to general triangles

Circles

- Understand and apply theorems about circles
- Find arc lengths and areas of sectors of circles

Expressing Geometric Properties with Equations

- Translate between the geometric description and the equation for a conic section
- Use coordinates to prove simple geometric theorems algebraically

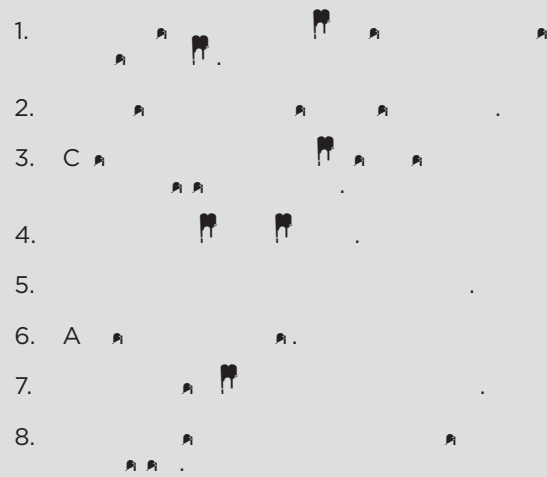
Geometric Measurement and Dimension

- Explain volume formulas and use them to solve problems
- Visualize relationships between two-dimensional and three-dimensional objects

Modeling with Geometry

- Apply geometric concepts in modeling situations


Mathematical Practices



Congruence

G-CO

Experiment with transformations in the plane

1. 
2. 
3. 

Find arc lengths and areas of sectors of circles

5. D

Expressing Geometric Properties with Equations**G-GPE****Translate between the geometric description and the equation for a conic section**

1. D
2. D
3. (+) D

Use coordinates to prove simple geometric theorems algebraically

4. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, -3)$ lies on the circle centered at the origin and containing the point $(0, 2)$.
- 5.
6. F
7. ~~NO E(1) 30-60~~

Interpreting Categorical and Quantitative Data

- Summarize, represent, and interpret data on a single count or measurement variable
- Summarize, represent, and interpret data on two categorical and quantitative variables
- Interpret linear models

Interpreting Categorical and Quantitative Data

S-ID

Summarize, represent, and interpret data on a single count or measurement variable

1. Summarize categorical data by computing the count for each category, and by computing the percentage for each category within a group. Use appropriate technology to produce a bar chart for categorical data. Summarize quantitative data by computing the mean, standard deviation, and range. Use appropriate technology to produce a normal distribution curve for quantitative data. Summarize the distribution of data on a quantitative variable by computing the mean, standard deviation, and range. Use appropriate technology to produce a normal distribution curve for quantitative data.
2. Summarize categorical data by computing the count for each category, and by computing the percentage for each category within a group. Use appropriate technology to produce a bar chart for categorical data. Summarize quantitative data by computing the mean, standard deviation, and range. Use appropriate technology to produce a normal distribution curve for quantitative data. Summarize the distribution of data on a quantitative variable by computing the mean, standard deviation, and range. Use appropriate technology to produce a normal distribution curve for quantitative data.
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Summarize, represent, and interpret data on two categorical and quantitative variables (S-ID.10) (S-ID.11) (S-ID.12)

4. $P(A|B) = \frac{P(A \cap B)}{P(B)}$ and $P(B|A) = \frac{P(A \cap B)}{P(A)}$.
5. $P(A|B) = \frac{P(A \cap B)}{P(B)}$ and $P(B|A) = \frac{P(A \cap B)}{P(A)}$.
6. E

Conditional Probability and the Rules of Probability **S-CP**

Understand independence and conditional probability and use them to interpret data

1. D $P(A|B) = \frac{P(A \cap B)}{P(B)}$ and $P(B|A) = \frac{P(A \cap B)}{P(A)}$.
2. A and B are independent events if $P(A|B) = P(A)$ and $P(B|A) = P(B)$.
3. $P(A|B) = \frac{P(A \cap B)}{P(B)}$ and $P(B|A) = \frac{P(A \cap B)}{P(A)}$.
4. C $P(A|B) = \frac{P(A \cap B)}{P(B)}$ and $P(B|A) = \frac{P(A \cap B)}{P(A)}$. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
5. $P(A|B) = \frac{P(A \cap B)}{P(B)}$ and $P(B|A) = \frac{P(A \cap B)}{P(A)}$. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

Mathematical Practice 3: Data Analysis and Interpretation



3. (+) D ;
 For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.

4. (+) D ;
 For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?

Use probability to evaluate outcomes of decisions

5. (+) ;

