# Academic Standards for Mathematics 



Grades Pre K - High School March 1, 2014

Pennsylvania Department of Education

## PA CORE STANDARDS <br> Mathematics <br> INTRODUCTION

The Pennsylvania Core Standards in Mathematics in grades PreK-5 lay a solid foundation in whole numbers, addition, subtraction, multiplication, division, fractions, and decimals. Taken together, these elements support a student's ability to learn and apply more demanding math concepts and procedures. The middle school and high school standards call on students to practice applying mathematical ways of thinking to real world issues and challenges; they prepare students to think and reason mathematically. Additionally, they set a rigorous definition of college and career readiness by demanding that students develop a depth of understanding and ability to apply mathematics to novel situations, as college students and employees regularly do. Although the standards are not a curriculum or a prescribed series of activities, school entities will use them to develop a local school curriculum that will meet local students' needs.

This document includes PA Core Standards for Mathematical Content and Mathematical Practice. The mathematics standards define what students should understand and be able to do. Mathematical Practice Standards describes the habits of mind required to reach a level of mathematical proficiency.


## PA CORE STANDARDS

## Mathematics

Standards cannot be viewed or addressed in isolation, as each standard depends upon or may lead into multiple standards across grades; thus, it is imperative that educators are familiar with both the standards that come before and those that follow a particular grade level. These revised standards reflect instructional shifts that cannot occur without the integrated emphasis on content and practice.

Standards are overarching statements of what a proficient math student should know and be able to do. The Pennsylvania Assessment Anchors and Eligible Content closely align with the revised standards and are an invaluable source for greater detail.

## Key Points in Mathematics

- The standards stress both procedural skills and conceptual understanding to ensure students are learning and applying the critical information they need to succeed at higher levels.
- K-5 standards, which provide students with a solid foundation in whole numbers, addition, subtraction, multiplication, division, fractions, and decimals, help young students build the foundation to successfully apply more demanding math concepts and procedures, and move into application. They also provide detailed guidance to teachers on how to navigate their way through topics such as fractions, negative numbers, and geometry, and do so by maintaining a continuous progression from grade to grade.
- Having built a strong foundation at $\mathrm{K}-5$, students can do hands-on learning in geometry, algebra, and probability and statistics. Students who have mastered the content and skills through the seventh grade will be well-prepared for algebra in grade 8 .
- High school standards emphasize practicing applying mathematical ways of thinking to real world issues and challenges.


## PA CORE STANDARDS <br> Mathematics

The PA Core Standards for Mathematics detail four standard areas: Numbers and Operations, Algebraic Concepts, Geometry, and Measurement, Data, and Probability. These standard areas are reflective of the reporting categories in the PA Core Assessment Anchors and Eligible Content. The intent of this document is to provide a useful tool for designing curriculum, instruction, and assessment. The grade level curriculum and instructional shifts in mathematics cannot occur without the integrated emphasis on content and practice. The chart below illustrates the four standard areas and the development and progression of the strands, with an understanding that all is framed around the Standards for Mathematical Practice.

| Mathematical Standards: Development and Progression |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Standards for Mathematical Practice |  |  |  |  |  |  |  |  |  |  |  |
| Make sense of problems and persevere in solving them. Construct viable arguments and critique the reasoning of others. Use appropriate tools strategically. <br> Look for and make use of structure. |  |  |  |  |  |  |  | Reason abstractly and quantitatively. <br> Model with mathematics. <br> Attend to precision. <br> Look for and express regularity in repeated reasoning |  |  |  |
|  | PreK | K | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | HS |
| 2.1Numbers andOperations | (A) Counting \& Cardinality |  |  |  |  |  |  |  |  |  |  |
|  | (B) Numbers and Operations in Base Ten |  |  |  |  |  |  | (D) Ratios and Proportional Relationships |  |  | (F) Number and Quantity |
|  |  |  |  |  | (C) Numbers and Operations Fractions |  |  | (E) The Number System |  |  |  |
| $2.2$ <br> Algebraic Concepts | (A) Operations and Algebraic Thinking |  |  |  |  |  |  | (B) Expressions and Equations |  |  | (D) Algebra |
|  |  |  |  |  |  |  |  |  |  | (C) Functions |  |
| 2.3 <br> Geometry | (A) Geometry |  |  |  |  |  |  |  |  |  |  |
| 2.4 Measurement, Data, and Probability | (A) Measurement and Data |  |  |  |  |  |  | (B) Statistics and Probability |  |  |  |

## PA CORE STANDARDS <br> Mathematics

### 2.1 Numbers and Operations



## PA CORE STANDARDS <br> Mathematics

2.1 Numbers and Operations

| The Standards of Mathematical Practices |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | eason abstractly and quantitatively. <br> odel with mathematics. <br> ttend to precision. <br> ook for and express regularity in repeated reasoning. |  |  |
|  | Grade PreK 2.1.PreK | $\begin{gathered} \hline \text { Grade K } \\ \text { 2.1.K } \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 1 \\ 2.1 .1 \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 2 \\ 2.1 .2 \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 3 \\ 2.1 .3 \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 4 \\ \text { 2.1.4 } \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 5 \\ \text { 2.1.5 } \\ \hline \end{gathered}$ |
| Pennsylvania's public schools shall teach, challenge, and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to: |  |  |  |  |  |  |  |
| (C) Numbers \& Operations - Fractions |  |  |  |  | CC.2.1.3.C. 1 <br> Explore and develop an understanding of fractions as numbers. <br> M03.A-F.1.1.1 <br> M03.A-F.1.1.2 <br> M03.A-F.1.1.3 <br> M03.A-F.1.1.4 <br> M03.A-F.1.1.5 | CC.2.1.4.C. 1 <br> Extend the understanding of fractions to show equivalence and ordering. <br> M04.A-F.1.1.1 <br> M04.A-F.1.1.2 | CC.2.1.5.C. 1 <br> Use the understanding of equivalency to add and subtract fractions. <br> M05.A-F.1.1.1 |
|  | Intentionally Blank | Intentionally Blank | Intentionally Blank | Intentionally Blank | Intentionally Blank | CC.2.1.4.C. 2 <br> Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. <br> M04.A-F.2.1.1 <br> M04.A-F.2.1.2 <br> M04.A-F.2.1.3 <br> M04.A-F.2.1.4 <br> M04.A-F.2.1.5 <br> M04.A-F.2.1.6 <br> M04.A-F.2.1.7 | CC.2.1.5.C. 2 <br> Apply and extend previous understandings of multiplication and division to multiply and divide fractions. <br> M05.A-F.2.1.1 <br> M05.A-F.2.1.2 <br> M05.A-F.2.1.3 <br> M05.A-F.2.1.4 |
|  |  |  |  |  | Intentionally Blank | CC.2.1.4.C. 3 <br> Connect decimal notation to fractions, and compare decimal fractions (base 10 denominator, e.g., 19/100). <br> M04.A-F.3.1.1 <br> M04.A-F.3.1.2 <br> M04.A-F.3.1.3 | Intentionally Blank |

## PA CORE STANDARDS <br> Mathematics

### 2.2 Algebraic Concepts



## PA CORE STANDARDS <br> Mathematics

### 2.3 Geometry

| Make sense of problems and persevere in solving them. Construct viable arguments and critique the reasoning of others. Use appropriate tools strategically. Look for and make use of structure. |  |  |  | Reason abstractly and quantitatively. <br> Model with mathematics. <br> Attend to precision. <br> Look for and express regularity in repeated reasoning. |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Grade PreK 2.3.PreK | Grade K 2.3.K | $\begin{gathered} \hline \text { Grade } 1 \\ 2.3 .1 \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 2 \\ 2.3 .2 \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 3 \\ 2.3 .3 \end{gathered}$ | Grade 4 2.3.4 | $\begin{gathered} \hline \text { Grade } 5 \\ 2.3 .5 \end{gathered}$ |
| Pennsylvania's public schools shall teach, challenge, and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to: |  |  |  |  |  |  |  |
| 恶 | CC.2.3.PreK.A. 1 <br> Identify and describe shapes. | CC.2.3.K.A. 1 <br> Identify and describe two- and threedimensional shapes. | CC.2.3.1.A. 1 <br> Compose and distinguish between two- and threedimensional shapes based on their attributes. | CC.2.3.2.A. 1 <br> Analyze and draw twoand three-dimensional shapes having specified attributes. | CC.2.3.3.A. 1 <br> Identify, compare, and classify shapes and their attributes. <br> M03.C-G.1.1.1 <br> M03.C-G.1.1.2 | CC.2.3.4.A. 1 <br> Draw lines and angles and identify these in two-dimensional figures. <br> M04.C-G.1.1.1 | CC.2.3.5.A. 1 <br> Graph points in the first quadrant on the coordinate plane and interpret these points when solving real world and mathematical problems. <br> M05.C-G.1.1.1 <br> M05.C-G.1.1.2 |
| $\begin{aligned} & \text { O} \\ & \text { ভ } \end{aligned}$ | CC.2.3.PreK.A. 2 <br> Analyze, compare, create, and compose shapes. | CC.2.3.K.A. 2 <br> Analyze, compare, create, and compose two- and three-dimensional shapes. | CC.2.3.1.A. 2 <br> Use the understanding of fractions to partition shapes into halves and quarters. | CC.2.3.2.A. 2 <br> Use the understanding of fractions to partition shapes into halves, quarters, and thirds. | C..2.3.3.A. 2 <br> Use the understanding of fractions to partition shapes into parts with equal areas and express the area of each part as a unit fraction of the whole. <br> M03.C-G.1.1.3 | C.2.3.4.A. 2 <br> Classify twodimensional figures by properties of their lines and angles. M04.C-G.1.1.2 | CC.2.3.5.A. 2 <br> Classify two-dimensional figures into categories based on an understanding of their properties. <br> M05.C-G.2.1.1 |
|  | Intentionally Blank | Intentionally Blank | Intentionally Blank | Intentionally Blank | Intentionally Blank | CC.2.3.4.A. 3 <br> Recognize symmetric shapes and draw lines of symmetry. M04.C-G.1.1.3 | Intentionally Blank |

## PA CORE STANDARDS <br> Mathematics

2.4 Measurement, Data, and Probability

## The Standards of Mathematical Practices

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics
Attend to precision.
Look for and express regularity in repeated reasoning.

|  | Grade PreK 2.4.PreK | $\begin{gathered} \hline \text { Grade K } \\ 2.4 . \mathrm{K} \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 1 \\ 2.4 .1 \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 2 \\ 2.4 .2 \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 3 \\ 2.4 .3 \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 4 \\ 2.4 .4 \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 5 \\ 2.4 .5 \\ \hline \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |
|  | CC.2.4.PreK.A. 1 <br> Describe and compare measurable attributes of length and weight of everyday objects. | CC.2.4.K.A. 1 <br> Describe and compare attributes of length, area, weight, and capacity of everyday objects. | CC.2.4.1.A. 1 <br> Order lengths and measure them both indirectly and by repeating length units. | CC.2.4.2.A. 1 <br> Measure and estimate lengths in standard units using appropriate tools. | CC.2.4.3.A. 1 <br> Solve problems involving measurement and estimation of temperature, liquid volume, mass, and length. <br> M03.D-M.1.2.1 <br> M03.D-M.1.2.2 <br> M03.D-M.1.2.3 | CC.2.4.4.A. 1 <br> Solve problems involving measurement and conversions from a larger unit to a smaller unit. $\begin{aligned} & \text { M04.D-M.1.1.1 } \\ & \text { M04.D-M.1.1.2 } \\ & \text { M04.D-M.1.1.3 } \\ & \text { M04.D-M.1.1.4 } \end{aligned}$ | CC.2.4.5.A. 1 <br> Solve problems using conversions within a given measurement system. <br> M05.D-M.1.1.1 |
|  | Intentionally Blank | Intentionally Blank | CC.2.4.1.A. 2 <br> Tell and write time to the nearest half hour using both analog and digital clocks. | CC.2.4.2.A. 2 <br> Tell and write time to the nearest five minutes using both analog and digital clocks. | CC.2.4.3.A. 2 <br> Tell and write time to the nearest minute and solve problems by calculating time intervals. <br> M03.D-M.1.1.1 <br> M03.D-M.1.1.2 | CC.2.4.4.A. 2 <br> Translate information from one type of data display to another. M04.D-M.2.1.3 | CC.2.4.5.A. 2 <br> Represent and interpret data using appropriate scale. M05.D-M.2.1.2 |
|  | Intentionally Blank | Intentionally Blank | Intentionally Blank | CC.2.4.2.A. 3 <br> Solve problems and make change using coins and paper currency with appropriate symbols. | CC.2.4.3.A. 3 <br> Solve problems and make change involving money using a combination of coins and bills. <br> M03.D-M.1.3.1 <br> M03.D-M.1.3.2 <br> M03.D-M.1.3.3 | Intentionally Blank | Intentionally Blank |

## PA CORE STANDARDS <br> Mathematics

### 2.4 Measurement, Data, and Probability

The Standards of Mathematical Practices

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.

|  | Grade PreK 2.4.PreK | 2.4.K Grade K | $\begin{gathered} \hline \text { Grade } 1 \\ 2.4 .1 \end{gathered}$ | 2.4.2 Grade 2 | 2.4.3 Grade 3 | 2.4.4 Grade 4 | 2.4.5 Grade 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Pennsylvania's public schools shall teach, challenge, and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to: |  |  |  |  |  |  |  |
|  | CC.2.4.PreK.A.4 <br> Classify objects and count the number of objects in each category. | CC.2.4.K.A. 4 <br> Classify objects and count the number of objects in each category. | CC.2.4.1.A. 4 <br> Represent and interpret data using tables/charts. | CC.2.4.2.A. 4 <br> Represent and interpret data using line plots, picture graphs, and bar graphs. | CC.2.4.3.A. 4 <br> Represent and interpret data using tally charts, tables, pictographs, line plots, and bar graphs. <br> M03.D-M.2.1.1 <br> M03.D-M.2.1.2 <br> M03.D-M.2.1.3 <br> M03.D-M.2.1.4 | CC.2.4.4.A. 4 <br> Represent and interpret data involving fractions using information provided in a line plot. <br> M04.D-M.2.1.1 <br> M04.D-M.2.1.2 | CC.2.4.5.A. 4 <br> Solve problems involving computation of fractions using information provided in a line plot. <br> M05.D-M.2.1.1 |
|  | Intentionally Blank | Intentionally Blank | Intentionally Blank | Intentionally Blank | C..2.4.3.A. 5 <br> Determine the area of a rectangle and apply the concept to multiplication and to addition. <br> M03.D-M.3.1.1 <br> M03.D-M.3.1.2 | Intentionally Blank | CC.2.4.5.A. 5 <br> Apply concepts of volume to solve problems and relate volume to multiplication and to addition. <br> M05.D-M.3.1.1 <br> M05.D-M.3.1.2 |
|  |  |  |  | CC.2.4.2.A. 6 <br> Extend the concepts of addition and subtraction to problems involving length. | C..2.4.3.A. 6 <br> Solve problems involving perimeters of polygons and distinguish between linear and area measures. <br> M03.D-M.4.1.1 | C..2.4.4.A. 6 <br> Measure angles and use properties of adjacent angles to solve problems. <br> M04.D-M.3.1.1 <br> M04.D-M.3.1.2 | Intentionally Blank |

## PA CORE STANDARDS <br> Mathematics

### 2.1. Numbers and Operations

## The Standards of Mathematical Practices

Make sense of problems and persevere in solving them
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure

|  | 2.1.6 Grade 6 | 2.1.7 Grade 7 | 2.1.8 Grade 8 |  | 2.1.HS High School |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Pennsylvania's public schools shall teach, challenge, and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to: |  |  |  |  |  |
|  | CC.2.1.6.D. 1 <br> Understand ratio concepts and use ratio reasoning to solve problems. <br> M06.A-R.1.1.1 <br> M06.A-R.1.1.2 <br> M06.A-R.1.1.3 <br> M06.A-R.1.1.4 <br> M06.A-R.1.1.5 | CC.2.1.7.D. 1 <br> Analyze proportional relationships and use them to model and solve real-world and mathematical problems. <br> M07.A-R.1.1.1 <br> M07.A-R.1.1.2 <br> M07.A-R.1.1.3 <br> M07.A-R.1.1.4 <br> M07.A-R.1.1.5 <br> M07.A-R.1.1.6 | Intentionally Blank | (F) Number and Quantity | CC.2.1.HS.F. 1 <br> Apply and extend the properties of exponents to solve problems with rational exponents. <br> A1.1.1.1.1, A1.1.1.1.2, A1.1.1.3.1, A2.1.2.1.1, A2.1.2.1.2, A2.1.2.1.3, A2.1.2.1.4 <br> CC.2.1.HS.F. 2 <br> Apply properties of rational and irrational numbers to solve real world or mathematical problems. A1.1.1.1.1, A1.1.1.1.2, A1.1.1.3.1, A1.1.1.2.1 <br> CC.2.1.HS.F. 3 <br> Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. $\begin{aligned} & \text { A11.1.2.1.1, A1.1.2.1.2, A1.1.2.1.3, A1.2.1.2.1, A1.2.1.2.2, A2.2.2.1.1, A2.2.2.1.2, A2.2.3.1.1, } \\ & \text { A2.2.3.1.2 } \end{aligned}$ |
| g | CC.2.1.6.E. 1 <br> Apply and extend previous understandings of multiplication and division to divide fractions by fractions. | CC.2.1.7.E. 1 <br> Apply and extend previous understandings of operations with fractions to operations with rational numbers. <br> M07.A-N.1.1.1 <br> M07.A-N.1.1.2 <br> M07.A-N.1.1.3 | CC.2.1.8.E. 1 <br> Distinguish between rational and irrational numbers using their properties. <br> M08.A-N.1.1.1 <br> M08.A-N.1.1.2 <br> A1.1.1.1.1 <br> A1.1.1.1.2 |  | CC.2.1.HS.F. 4 <br> Use units as a way to understand problems and to guide the solution of multi-step problems. A1.1.2.1.1, A1.1.2.1.2, A1.1.2.1.3, A1.2.1.2.1, A1.2.1.2.2, A2.2.2.1.1, A2.2.2.1.2 <br> CC.2.1.HS.F. 5 <br> Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A1.1.2.1.1, A1.1.2.1.2, A1.1.2.1.3, A1.1.2.2.1, A1.1.2.2.2, A1.1.3.1.1, A1.1.3.1.2, A1.1.3.1.3, A1.1.3.2.1, A1.1.3.2.2, A2.2.3.1.1, A2.2.3.1.2 |
|  | CC.2.1.6.E. 2 <br> Identify and choose appropriate processes to compute fluently with multi-digit numbers. <br> M06.A-N.2.1.1 <br> CC.2.1.6.E. 3 <br> Develop and/or apply number theory concepts to find common factors and multiples. <br> M06.A-N.2.2.1 <br> M06.A-N.2.2.2 <br> A1.1.1.2.1 | Intentionally Blank | Intentionally Blank |  | CC.2.1.HS.F. 6 <br> Extend the knowledge of arithmetic operations and apply to complex numbers. A2.1.1.1.1, A2.1.1.1.2, A2.1.1.2.1, A2.1.1.2.2 <br> CC.2.1.HS.F. 7 <br> Apply concepts of complex numbers in polynomial identities and quadratic equations to solve problems. A2.2.1.1.1, A2.2.1.1.2, A2.2.1.1.3, A2.2.1.1.4 |

Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

## PA CORE STANDARDS

Mathematics

### 2.1. Numbers and Operations

## The Standards of Mathematical Practices

Make sense of problems and persevere in solving them
Construct viable arguments and critique the reasoning of others
Use appropriate tools strategically.
Look for and make use of structure.

Reason abstractly and quantitatively
Model with mathematics.
Attend to precision
Look for and express regularity in repeated reasoning.
2.1.6 Grade 6 2.1.7 Grade 7
2.1.8 Grade 8


## CC.2.1.6.E. 4

Apply and extend
previous understandings
of numbers to the system
of rational numbers.
M06.A-N.3.1.1
M06 A-N
M06.A-N 3.1 .3
M06.A-N.3.2.1
M06.A-N.3.2.2
M06.A-N.3.2.3

## CC.2.1.8.E. 4 <br> Estimate irrational

numbers by comparing
them to rational numbers.
M08.A-N.1.1.3
M08.A-N.1.1.4
M08.A-N.1.1.5
A1.1.1.1.1

## PA CORE STANDARDS <br> Mathematics

2.2. Algebraic Concepts


## PA CORE STANDARDS <br> Mathematics

2.2. Algebraic Concepts

| The Standards of Mathematical Practices |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Make sense of problems and persevere in solving them. <br> Reason abstractly and quantitatively. |  |  |  |  |  |
|  |  |  |  |  |  |
| Use appropriate tools strategically. Attend to precision. |  |  |  |  |  |
| Look for and make use of structure. |  |  |  |  | Look for and express regularity in repeated reasoning. |
|  | 2.2.6 Grade 6 | 2.2.7 Grade 7 | 2.2.8 Grade 8 |  | 2.2.HS High School |
| Pennsylvania's public schools shall teach, challenge, and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to: |  |  |  |  |  |
| nU0000 | Intentionally Blank | Intentionally Blank | CC.2.2.8.C. 1 |  | CC.2.2.HS.C. 1 <br> Use the concept and notation of functions to interpret and apply them in terms of their context. <br> A1.2.1.1.1, A1.2.1.1.2, A1.2.1.1.3, A1.2.2.1.1, A1.2.2.1.2, A1.2.2.1.3, A1.2.2.1.4, A2.2.1.1.1, <br> A2.2.1.1.2, A2.2.1.1.3, A2.2.1.1.4, G.2.2.2.1, G.2.2.2.2, G.2.2.2.3, G.2.2.2.4, G.2.2.2.5 <br> CC.2.2.HS.C. 2 <br> Graph and analyze functions and use their properties to make connections between the different representations. <br> A1.2.1.1.1, A1.2.1.1.2, A1.2.1.1.3, A1.2.1.2.1, A1.2.1.2.2, A1.2.2.1.1, A2.1.3.1.4, A2.1.3.2.1, <br> A2.1.3.2.2, A2.2.1.1.1, A2.2.1.1.2, A2.2.1.1.3, A2.2.1.1.4 <br> CC.2.2.HS.C. 3 <br> Write functions or sequences that model relationships between two quantities. <br> A1.1.2.1.1, A1.1.2.1.2, A1.1.2.1.3, A1.2.1.1.1, A1.2.1.1.2, A1.2.1.1.3, A1.2.1.2.1, A1.2.1.2.2, <br> A1.2.2.1.3, A1.2.2.1.4, A2.1.3.1.1, A2.1.3.1.2, A2.1.3.1.3, A2.1.3.1.4, A2.1.3.2.1, A2.1.3.2.2, <br> A2.2.1.1.1, A2.2.1.1.2, A2.2.1.1.3, A2.2.1.1.4, A2.2.2.1.1, A2.2.2.1.2, A2.2.2.1.3, A2.2.2.1.4 <br> CC.2.2.HS.C. 4 <br> Interpret the effects transformations have on functions and find the inverses of functions. A1.2.1.2.1, A1.2.1.2.2, A2.1.3.1.3, A2.1.3.1.4, A2.1.3.2.1, A2.2.2.1.1, A2.2.2.1.2, A2.2.2.1.3, A2.2.2.1.4, A2.2.2.2.1 <br> CC.2.2.HS.C. 5 <br> Construct and compare linear, quadratic, and exponential models to solve problems. <br> A1.2.2.1.1, A1.2.2.1.2, A1.2.2.1.3, A1.2.2.1.4, A2.1.3.1.1, A2.1.3.1.2, A2.1.3.1.3, A2.1.3.1.4, <br> A2.2.1.1.1, A2.2.1.1.2, A2.2.1.1.3, A2.2.1.1.4, A2.2.2.1.1, A2.2.2.1.2, A2.2.2.1.3, A2.2.2.1.4, <br> A2.2.2.2.1 <br> CC.2.2.HS.C. 6 <br> Interpret functions in terms of the situations they model. <br> A1.2.1.2.1, A1.2.2.1.2, A1.2.2.1.3, A1.2.2.2.1, A2.1.3.1.3,A2.2.1.1.1, A2.2.1.1.2, A2.2.1.1.3, <br> A2.2.1.1.4, A2.2.2.1.3, A2.2.2.1.4, A2.2.2.2.1 <br> CC.2.2.HS.C. 7 <br> Apply radian measure of an angle and the unit circle to analyze the trigonometric functions. <br> CC.2.2.HS.C. 8 <br> Choose trigonometric functions to model periodic phenomena and describe the properties of the graphs. <br> CC.2.2.HS.C. 9 <br> Prove the Pythagorean identity and use it to calculate trigonometric ratios. G.1.3.2.1, G.2.1.1.1, G.2.1.1.2 |
|  |  |  | Define, evaluate, and compare functions. |  |  |
|  |  |  |  |  |  |
|  |  |  | M08.B-F.1.1.2 |  |  |
|  |  |  | M08.B-F.1.1.3 |  |  |
|  |  |  | A1.1.2.1.1 |  |  |
|  |  |  | A1.2.1.1.2 A1.2.1.2.1 |  |  |
|  |  |  | A1.2.1.2.2 |  |  |
|  |  |  | CC.2.2.8.C. 2 |  |  |
|  |  |  | Use concepts of functions to model relationships |  |  |
|  |  |  | between quantities. |  |  |
|  |  |  | M08.B-F.2.1.1 |  |  |
|  |  |  | M08.B-F.2.1.2 A1.1.2.1.3 |  |  |
|  |  |  | A1.2.1.1.1 |  |  |
|  |  |  | A1.2.1.2.2 |  |  |
|  |  |  | A1.2.2.1.3 |  |  |
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## PA CORE STANDARDS <br> Mathematics

2.3. Geometry


## PA CORE STANDARDS <br> Mathematics

2.4 Measurement, Data, and Probability

## The Standards of Mathematical Practices

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others
Use appropriate tools strategically.
Look for and make use of structure.

Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

|  | Grade 6 2.4.6 | $\begin{gathered} \hline \text { Grade } 7 \\ 2.4 .7 \end{gathered}$ | $\begin{gathered} \hline \text { Grade } 8 \\ 2.4 .8 \end{gathered}$ |  | $\begin{aligned} & \hline \text { High School } \\ & \text { 2.4.HS } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Pennsylvania's public schools shall teach, challenge, and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to: |  |  |  |  |  |
| (B) Statistics and Probability | CC.2.4.6.B. 1 <br> Demonstrate an understanding of statistical variability by displaying, analyzing, and summarizing distributions. <br> M06.D-S.1.1.1 <br> M06.D-S.1.1.2 <br> M06.D-S.1.1.3 <br> M06.D-S.1.1.4 | CC.2.4.7.B. 1 <br> Draw inferences about populations based on random sampling concepts. $\begin{aligned} & \text { M07.D-S.1.1.1 } \\ & \text { M07.D-S.1.1.2 } \end{aligned}$ | CC.2.4.8.B. 1 <br> Analyze and/or interpret bivariate data displayed in multiple representations. <br> M08.D-S.1.1.1 <br> M08.D-S.1.1.2 <br> M08.D-S.1.1.3 <br> A1.2.2.2.1 | Kч!!!qeqo.d pue sousuluens (g) | CC.2.4.HS.B. 1 <br> Summarize, represent, and interpret data on a single count or measurement variable. A1.2.2.1.2, A1.2.3.1.1, A1.2.3.2.1, A1.2.3.2.2, A1.2.3.2.3, <br> CC.2.4.HS.B. 2 <br> Summarize, represent, and interpret data on two categorical and quantitative variables. A1.2.1.1.1, A1.2.1.1.2, A1.2.1.1.3, A1.2.1.2.1, A1.2.1.2.2, A1.2.2.2.1, A2.2.1.1.1, A2.2.3.1.1, A2.2.3.1.2 <br> CC.2.4.HS.B. 3 <br> Analyze linear models to make interpretations based on the data. <br> A1.2.2.2.1, A1.2.3.1.1, A1.2.3.2.1, A1.2.3.2.2, A1.2.3.2.3, A2.2.3.1.1, A2.2.3.1.2 <br> CC.2.4.HS.B. 4 <br> Recognize and evaluate random processes underlying statistical experiments. A1.2.3.3.1, A2.2.3.2.1, A2.2.3.2.2, A2.2.3.2.3 <br> CC.2.4.HS.B. 5 <br> Make inferences and justify conclusions based on sample surveys, experiments, and observational studies. <br> A1.2.3.2.1, A1.2.3.2.2, A1.2.3.2.3, A2.2.3.2.1, A2.2.3.2.2, A2.2.3.2.3 <br> CC.2.4.HS.B. 6 <br> Use the concepts of independence and conditional probability to interpret data. <br> A2.2.3.2.1, A2.2.3.2.2, A2.2.3.2.3 <br> CC.2.4.HS.B. 7 <br> Apply the rules of probability to compute probabilities of compound events in a uniform probability model. <br> A1.2.3.3.1, A2.2.3.2.1, A2.2.3.2.2, A2.2.3.2.3 |
|  | Intentionally Blank | CC.2.4.7.B. 2 <br> Draw informal comparative inferences about two populations. M07.D-S.2.1.1 | CC.2.4.8.B. 2 <br> Understand that patterns of association can be seen in bivariate data utilizing frequencies. <br> M08.D-S.1.2.1 |  |  |
|  | Intentionally Blank | CC.2.4.7.B. 3 <br> Investigate chance processes and develop, use, and evaluate probability models. <br> M07.D-S.3.1.1 <br> M07.D-S.3.2.1 <br> M07.D-S.3.2.2 <br> M07.D-S.3.2.3 <br> A1.2.3.3.1 | Intentionally Blank |  |  |

# PA CORE STANDARDS <br> Mathematics 

## Key Terms for this Document

Standards for Mathematical Content-These standards define what students should know and be able to do in their study of mathematics.
Standards for Mathematical Practice—These standards describe the processes and proficiencies in which all students grades K-12 should engage. Educators must instill these standards of practice in their students so that they become habitual. The standards for mathematical practice should be used as the vehicle to deliver the standards of mathematical content.

Standard Algorithm-A locally agreed upon method of computation which is conventionally taught for solving mathematical problems.
Decimal Fraction-A fraction whose denominator is a power of ten (examples: 2/100, 8/10). These fractions are commonly expressed as decimals.

Unit Fraction-A rational number written as a fraction where the numerator is one and the denominator is a positive integer (example: 1/20).

Bivariate Data-The data involves two variables and is usually represented as a scatter plot.

Rule-A single operation (examples: add 5, multiply by 2 ).

