

Mathematics

Assessment Anchors and Eligible Content Aligned to the Pennsylvania Core Standards



Grade

6



Pennsylvania Department of Education
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Pennsylvania System of School Assessment

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Here is a description of each level in the labeling system for the PSSA:

Reporting Category

The Assessment Anchors are organized into four classifications, as listed below.

- A = Numbers and Operations
- B = Algebraic Concepts
- C = Geometry
- D = Data Analysis and Probability

These four classifications are used throughout the grade levels. In addition to these classifications, there are five Reporting Categories for each grade level. The first letter of each Reporting Category represents the classification; the second letter represents the Domain as stated in the Pennsylvania Core Standards for Mathematics. Listed below are the Reporting Categories for Grade 6.

- A-N = The Number System
- A-R = Ratios and Proportional Relationships
- B-E = Expressions and Equations
- C-G = Geometry
- D-S = Statistics and Probability

The title of each Reporting Category is consistent with the title of the corresponding Domain in the Pennsylvania Core Standards for Mathematics. The Reporting Category title appears at the top of each page.

Assessment Anchor

The Assessment Anchor appears in the shaded bar across the top of each Assessment Anchor table. The Assessment Anchors represent categories of subject matter (skills and concepts) that anchor the content of the PSSA. Each Assessment Anchor is part of a Reporting Category and has one or more Anchor Descriptors unified under and aligned to it.

Anchor Descriptor

Below each Assessment Anchor is one or more specific Anchor Descriptors. The Anchor Descriptor adds a level of specificity to the content covered by the Assessment Anchor. Each Anchor Descriptor is part of an Assessment Anchor and has one or more Eligible Content statements unified under and aligned to it.

Eligible Content

The column to the right of the Anchor Descriptor contains the Eligible Content statements. The Eligible Content is the most specific description of the skills and concepts assessed on the PSSA. This level is considered the assessment limit and helps educators identify the range of the content covered on the PSSA.

Reference

In the space below each Assessment Anchor table is a code representing one or more Pennsylvania Core Standards for Mathematics that correlate to the Eligible Content statements.

M06.A-N The Number System

Reporting Category

ASSESSMENT ANCHOR

M06.A-N.1 Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

DESCRIPTOR

ELIGIBLE CONTENT

M06.A-N.1.1 Solve real-world and mathematical problems involving division of fractions.

M06.A-N.1.1.1 Interpret and compute quotients of fractions (including mixed numbers), and solve word problems involving division of fractions by fractions.
Example 1: Given a story context for $(2/3) \div (3/4)$, explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $(a/b) \div (c/d) = (a/b) \times (d/c) = ad/bc$.)
Example 2: How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square mi?
Example 3: How many $2\frac{1}{4}$ -foot pieces can be cut from a $15\frac{1}{2}$ -foot board?

Reference:

CC.2.1.6.E.1

Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

M06.A-N The Number System**Reporting Category****ASSESSMENT ANCHOR****M06.A-N.2** **Compute with multi-digit numbers and find common factors and multiples.****DESCRIPTOR****ELIGIBLE CONTENT****M06.A-N.2.1** Compute with multi-digit numbers using the four arithmetic operations with or without a calculator.**M06.A-N.2.1.1** Solve problems involving operations (+, −, ×, and ÷) with whole numbers, decimals (through thousandths), straight computation, or word problems.**Reference:**

CC.2.1.6.E.2

Identify and choose appropriate processes to compute fluently with multi-digit numbers.

M06.A-N The Number System

Reporting Category

ASSESSMENT ANCHOR

M06.A-N.2 Compute with multi-digit numbers and find common factors and multiples.

DESCRIPTOR

M06.A-N.2.2 Apply number theory concepts (specifically, factors and multiples).

ELIGIBLE CONTENT

M06.A-N.2.2.1 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12.

M06.A-N.2.2.2 Apply the distributive property to express a sum of two whole numbers, 1 through 100, with a common factor as a multiple of a sum of two whole numbers with no common factor.

Example: Express $36 + 8$ as $4(9 + 2)$.

Reference:

CC.2.1.6.E.3

Develop and/or apply number theory concepts to find common factors and multiples.

M06.A-N The Number System

Reporting Category

ASSESSMENT ANCHOR

M06.A-N.3 Apply and extend previous understandings of numbers to the system of rational numbers.

DESCRIPTOR

ELIGIBLE CONTENT

M06.A-N.3.1 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values and locations on the number line and coordinate plane.

M06.A-N.3.1.1 Represent quantities in real-world contexts using positive and negative numbers, explaining the meaning of 0 in each situation (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge).

M06.A-N.3.1.2 Determine the opposite of a number and recognize that the opposite of the opposite of a number is the number itself (e.g., $-(^{-}3) = 3$; 0 is its own opposite).

M06.A-N.3.1.3 Locate and plot integers and other rational numbers on a horizontal or vertical number line; locate and plot pairs of integers and other rational numbers on a coordinate plane.

Reference:

CC.2.1.6.E.4

Apply and extend previous understandings of numbers to the system of rational numbers.

M06.A-N The Number System

Reporting Category

ASSESSMENT ANCHOR

M06.A-N.3 Apply and extend previous understandings of numbers to the system of rational numbers.

DESCRIPTOR

ELIGIBLE CONTENT

M06.A-N.3.2 Understand ordering and absolute value of rational numbers.

M06.A-N.3.2.1 Write, interpret, and explain statements of order for rational numbers in real-world contexts.
Example: Write $-3^{\circ}\text{C} > -7^{\circ}\text{C}$ to express the fact that -3°C is warmer than -7°C .

M06.A-N.3.2.2 Interpret the absolute value of a rational number as its distance from 0 on the number line and as a magnitude for a positive or negative quantity in a real-world situation.
Example: For an account balance of -30 dollars, write $| -30 | = 30$ to describe the size of the debt in dollars, and recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.

M06.A-N.3.2.3 Solve real-world and mathematical problems by plotting points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Reference:

CC.2.1.6.E.4

Apply and extend previous understandings of numbers to the system of rational numbers.

M06.A-R Ratios and Proportional Relationships

Reporting Category

ASSESSMENT ANCHOR

M06.A-R.1 Understand ratio concepts and use ratio reasoning to solve problems.

DESCRIPTOR

ELIGIBLE CONTENT

M06.A-R.1.1 Represent and/or solve real-world and mathematical problems using rates, ratios, and/or percents.

M06.A-R.1.1.1 Use ratio language and notation (such as 3 to 4, 3:4, $\frac{3}{4}$) to describe a ratio relationship between two quantities.

Example 1: "The ratio of girls to boys in a math class is 2:3 because for every 2 girls there are 3 boys."

Example 2: "For every five votes candidate A received, candidate B received four votes."

M06.A-R.1.1.2 Find the unit rate a/b associated with a ratio $a:b$ (with $b \neq 0$) and use rate language in the context of a ratio relationship.

Example 1: "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is $\frac{3}{4}$ cup of flour for each cup of sugar."

Example 2: "We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger."

M06.A-R.1.1.3 Construct tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and/or plot the pairs of values on the coordinate plane. Use tables to compare ratios.

M06.A-R.1.1.4 Solve unit rate problems including those involving unit pricing and constant speed.

Example: If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

M06.A-R.1.1.5 Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means $\frac{30}{100}$ times the quantity); solve problems involving finding the whole, given a part and the percentage.

Reference:

CC.2.1.6.D.1

Understand ratio concepts and use ratio reasoning to solve problems.

M06.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M06.B-E.1 Apply and extend previous understandings of arithmetic to numerical and algebraic expressions.

DESCRIPTOR

ELIGIBLE CONTENT

M06.B-E.1.1 Identify, write, and evaluate numerical and algebraic expressions.

- M06.B-E.1.1.1** Write and evaluate numerical expressions involving whole-number exponents.
- M06.B-E.1.1.2** Write algebraic expressions from verbal descriptions.
Example: Express the description “five less than twice a number” as $2y - 5$.
- M06.B-E.1.1.3** Identify parts of an expression using mathematical terms (e.g., sum, term, product, factor, quotient, coefficient, quantity).
Example: Describe the expression $2(8 + 7)$ as a product of two factors.
- M06.B-E.1.1.4** Evaluate expressions at specific values of their variables, including expressions that arise from formulas used in real-world problems.
Example: Evaluate the expression $b^2 - 5$ when $b = 4$.
- M06.B-E.1.1.5** Apply the properties of operations to generate equivalent expressions.
Example 1: Apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$.
Example 2: Apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$.
Example 3: Apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$.

Reference:

CC.2.2.6.B.1

Apply and extend previous understandings of arithmetic to algebraic expressions.

M06.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M06.B-E.2 Interpret and solve one-variable equations and inequalities.

DESCRIPTOR

ELIGIBLE CONTENT

M06.B-E.2.1 Create, solve, and interpret one-variable equations or inequalities in real-world and mathematical problems.

M06.B-E.2.1.1 Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

M06.B-E.2.1.2 Write algebraic expressions to represent real-world or mathematical problems.

M06.B-E.2.1.3 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q , and x are all non-negative rational numbers.

M06.B-E.2.1.4 Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem and/or represent solutions of such inequalities on number lines.

Reference:

CC.2.2.6.B.2

Understand the process of solving a one-variable equation or inequality and apply to real-world and mathematical problems.

M06.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M06.B-E.3 Represent and analyze quantitative relationships between dependent and independent variables.

DESCRIPTOR

ELIGIBLE CONTENT

M06.B-E.3.1 Use variables to represent two quantities in a real-world problem that change in relationship to one another.

M06.B-E.3.1.1 Write an equation to express the relationship between the dependent and independent variables.

Example: In a problem involving motion at a constant speed of 65 units, write the equation $d = 65t$ to represent the relationship between distance and time.

M06.B-E.3.1.2 Analyze the relationship between the dependent and independent variables using graphs and tables and/or relate these to an equation.

Reference:

CC.2.2.6.B.3

Represent and analyze quantitative relationships between dependent and independent variables.

M06.C-G Geometry

Reporting Category

ASSESSMENT ANCHOR

M06.C-G.1 Solve real-world and mathematical problems involving area, surface area, and volume.

DESCRIPTOR

ELIGIBLE CONTENT

M06.C-G.1.1 Find area, surface area, and volume by applying formulas and using various strategies.

M06.C-G.1.1.1 Determine the area of triangles and special quadrilaterals (i.e., square, rectangle, parallelogram, rhombus, and trapezoid). **Formulas will be provided.**

M06.C-G.1.1.2 Determine the area of irregular or compound polygons.
Example: Find the area of a room in the shape of an irregular polygon by composing and/or decomposing.

M06.C-G.1.1.3 Determine the volume of right rectangular prisms with fractional edge lengths. **Formulas will be provided.**

M06.C-G.1.1.4 Given coordinates for the vertices of a polygon in the plane, use the coordinates to find side lengths and area of the polygon (limited to triangles and special quadrilaterals). **Formulas will be provided.**

M06.C-G.1.1.5 Represent three-dimensional figures using nets made of rectangles and triangles.

M06.C-G.1.1.6 Determine the surface area of triangular and rectangular prisms (including cubes). **Formulas will be provided.**

Reference:

CC.2.3.6.A.1

Apply appropriate tools to solve real-world and mathematical problems involving area, surface area, and volume.

M06.D-S Statistics and Probability

Reporting Category

ASSESSMENT ANCHOR

M06.D-S.1 Demonstrate understanding of statistical variability by summarizing and describing distributions.

DESCRIPTOR

ELIGIBLE CONTENT

M06.D-S.1.1 Display, analyze, and summarize numerical data sets in relation to their context.	M06.D-S.1.1.1 Display numerical data in plots on a number line, including line plots, histograms, and box-and-whisker plots.
	M06.D-S.1.1.2 Determine quantitative measures of center (e.g., median, mean, mode) and variability (e.g., range, interquartile range, mean absolute deviation).
	M06.D-S.1.1.3 Describe any overall pattern and any deviations from the overall pattern with reference to the context in which the data were gathered.
	M06.D-S.1.1.4 Relate the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Reference:

CC.2.4.6.B.1

Demonstrate an understanding of statistical variability by displaying, analyzing, and summarizing distributions.

Mathematics

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Grade

7



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M07.A-N The Number System

Reporting Category

ASSESSMENT ANCHOR

M07.A-N.1 Apply and extend previous understandings of operations to add, subtract, multiply, and divide rational numbers.

DESCRIPTOR

ELIGIBLE CONTENT

M07.A-N.1.1 Solve real-world and mathematical problems involving the four operations with rational numbers.

M07.A-N.1.1.1 Apply properties of operations to add and subtract rational numbers, including real-world contexts.

M07.A-N.1.1.2 Represent addition and subtraction on a horizontal or vertical number line.

M07.A-N.1.1.3 Apply properties of operations to multiply and divide rational numbers, including real-world contexts; demonstrate that the decimal form of a rational number terminates or eventually repeats.

Reference:

CC.2.1.7.E.1

Apply and extend previous understandings of operations with fractions to operations with rational numbers.

M07.A-R Ratios and Proportional Relationships

Reporting Category

ASSESSMENT ANCHOR

M07.A-R.1 Demonstrate an understanding of proportional relationships.

DESCRIPTOR

M07.A-R.1.1 Analyze, recognize, and represent proportional relationships and use them to solve real-world and mathematical problems.

ELIGIBLE CONTENT

- M07.A-R.1.1.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units.
Example: If a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{1}{2} \div \frac{1}{4}$ miles per hour, equivalently 2 miles per hour.
- M07.A-R.1.1.2** Determine whether two quantities are proportionally related (e.g., by testing for equivalent ratios in a table, graphing on a coordinate plane and observing whether the graph is a straight line through the origin).
- M07.A-R.1.1.3** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- M07.A-R.1.1.4** Represent proportional relationships by equations.
Example: If total cost t is proportional to the number n of items purchased at a constant price p , the relationship between the total cost and the number of items can be expressed as $t = pn$.
- M07.A-R.1.1.5** Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$, where r is the unit rate.
- M07.A-R.1.1.6** Use proportional relationships to solve multi-step ratio and percent problems.
Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease.

Reference:

CC.2.1.7.D.1

Analyze proportional relationships and use them to model and solve real-world and mathematical problems.

M07.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M07.B-E.1 Represent expressions in equivalent forms.

DESCRIPTOR

M07.B-E.1.1 Use properties of operations to generate equivalent expressions.

ELIGIBLE CONTENT

M07.B-E.1.1.1 Apply properties of operations to add, subtract, factor, and expand linear expressions with rational coefficients.

Example 1: The expression $\frac{1}{2} \cdot (x + 6)$ is equivalent to $\frac{1}{2} \cdot x + 3$.

Example 2: The expression $5.3 - y + 4.2$ is equivalent to $9.5 - y$ (or $-y + 9.5$).

Example 3: The expression $4w - 10$ is equivalent to $2(2w - 5)$.

Reference:

CC.2.2.7.B.1

Apply properties of operations to generate equivalent expressions.

M07.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M07.B-E.2 Solve real-world and mathematical problems using numerical and algebraic expressions, equations, and inequalities.

DESCRIPTOR

M07.B-E.2.1 Solve multi-step real-world and mathematical problems posed with positive and negative rational numbers.

ELIGIBLE CONTENT

M07.B-E.2.1.1 Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate.
Example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50 an hour (or $1.1 \times \$25 = \27.50).

Reference:

CC.2.2.7.B.3

Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations.

M07.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M07.B-E.2 Solve real-world and mathematical problems using numerical and algebraic expressions, equations, and inequalities.

DESCRIPTOR

M07.B-E.2.2 Use variables to represent quantities in a real-world or mathematical problem and construct simple equations and inequalities to solve problems.

ELIGIBLE CONTENT

M07.B-E.2.2.1 Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers.

Example: The perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

M07.B-E.2.2.2 Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p , q , and r are specific rational numbers, and graph the solution set of the inequality.

Example: A salesperson is paid \$50 per week plus \$3 per sale. This week she wants her pay to be at least \$100. Write an inequality for the number of sales the salesperson needs to make and describe the solutions.

Reference:

CC.2.2.7.B.3

Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations.

M07.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M07.B-E.2 Solve real-world and mathematical problems using numerical and algebraic expressions, equations, and inequalities.

DESCRIPTOR

M07.B-E.2.3 Determine the reasonableness of the answer(s) in problem-solving situations.

ELIGIBLE CONTENT

M07.B-E.2.3.1 Determine the reasonableness of answer(s) or interpret the solution(s) in the context of the problem.
Example: If you want to place a towel bar that is $9\frac{3}{4}$ inches long in the center of a door that is $27\frac{1}{2}$ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

Reference:

CC.2.2.7.B.3

Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations.

M07.C-G Geometry

Reporting Category

ASSESSMENT ANCHOR

M07.C-G.1 Demonstrate an understanding of geometric figures and their properties.

DESCRIPTOR

ELIGIBLE CONTENT

M07.C-G.1.1 Describe and apply properties of geometric figures.

- | | |
|----------------------|---|
| M07.C-G.1.1.1 | Solve problems involving scale drawings of geometric figures, including finding length and area. |
| M07.C-G.1.1.2 | Identify or describe the properties of all types of triangles based on angle and side measures. |
| M07.C-G.1.1.3 | Use and apply the triangle inequality theorem. |
| M07.C-G.1.1.4 | Describe the two-dimensional figures that result from slicing three-dimensional figures.
<i>Example: Describe plane sections of right rectangular prisms and right rectangular pyramids.</i> |

Reference:

CC.2.3.7.A.2

Visualize and represent geometric figures and describe the relationships between them.

M07.C-G Geometry

Reporting Category

ASSESSMENT ANCHOR

M07.C-G.2 Solve real-world and mathematical problems involving angle measure, circumference, area, surface area, and volume.

DESCRIPTOR

M07.C-G.2.1 Identify, use, and describe properties of angles and their measures.

ELIGIBLE CONTENT

M07.C-G.2.1.1 Identify and use properties of supplementary, complementary, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

M07.C-G.2.1.2 Identify and use properties of angles formed when two parallel lines are cut by a transversal (e.g., angles may include alternate interior, alternate exterior, vertical, corresponding).

Reference:

CC.2.3.7.A.1

Solve real-world and mathematical problems involving angle measure, area, surface area, circumference, and volume.

M07.C-G Geometry

Reporting Category

ASSESSMENT ANCHOR

M07.C-G.2 Solve real-world and mathematical problems involving angle measure, circumference, area, surface area, and volume.

DESCRIPTOR

ELIGIBLE CONTENT

M07.C-G.2.2 Determine circumference, area, surface area, and volume.

M07.C-G.2.2.1 Find the area and circumference of a circle. Solve problems involving area and circumference of a circle(s). **Formulas will be provided.**

M07.C-G.2.2.2 Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. **Formulas will be provided.**

Reference:

CC.2.3.7.A.1

Solve real-world and mathematical problems involving angle measure, area, surface area, circumference, and volume.

M07.D-S Statistics and Probability

Reporting Category

ASSESSMENT ANCHOR

M07.D-S.1 Use random sampling to draw inferences about a population.

DESCRIPTOR

M07.D-S.1.1 Use random samples.

ELIGIBLE CONTENT

M07.D-S.1.1.1 Determine whether a sample is a random sample given a real-world situation.

M07.D-S.1.1.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest.

Example 1: Estimate the mean word length in a book by randomly sampling words from the book.

Example 2: Predict the winner of a school election based on randomly sampled survey data.

Reference:

CC.2.4.7.B.1

Draw inferences about populations based on random sampling concepts.

M07.D-S Statistics and Probability

Reporting Category

ASSESSMENT ANCHOR

M07.D-S.2 Draw comparative inferences about populations.

DESCRIPTOR

M07.D-S.2.1 Use statistical measures to compare two numerical data distributions.

ELIGIBLE CONTENT

M07.D-S.2.1.1 Compare two numerical data distributions using measures of center and variability.
Example 1: The mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team. This difference is equal to approximately twice the variability (mean absolute deviation) on either team. On a line plot, note the difference between the two distributions of heights.
Example 2: Decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

Reference:

CC.2.4.7.B.2

Draw informal comparative inferences about two populations.

M07.D-S Statistics and Probability

Reporting Category

ASSESSMENT ANCHOR

M07.D-S.3 Investigate chance processes and develop, use, and evaluate probability models.

DESCRIPTOR

ELIGIBLE CONTENT

M07.D-S.3.1 Predict or determine the likelihood of outcomes.

M07.D-S.3.1.1 Predict or determine whether some outcomes are certain, more likely, less likely, equally likely, or impossible (i.e., a probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event).

Reference:

CC.2.4.7.B.3

Investigate chance processes and develop, use, and evaluate probability models.

M07.D-S Statistics and Probability

Reporting Category

ASSESSMENT ANCHOR

M07.D-S.3 Investigate chance processes and develop, use, and evaluate probability models.

DESCRIPTOR

ELIGIBLE CONTENT

M07.D-S.3.2 Use probability to predict outcomes.

M07.D-S.3.2.1 Determine the probability of a chance event given relative frequency. Predict the approximate relative frequency given the probability.

Example: When rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times but probably not exactly 200 times.

M07.D-S.3.2.2 Find the probability of a simple event, including the probability of a simple event **not** occurring.

*Example: What is the probability of **not** rolling a 1 on a number cube?*

M07.D-S.3.2.3 Find probabilities of independent compound events using organized lists, tables, tree diagrams, and simulation.

Reference:

CC.2.4.7.B.3

Investigate chance processes and develop, use, and evaluate probability models.

Mathematics

Assessment Anchors and Eligible Content Aligned to the Pennsylvania Core Standards



Grade

8



Pennsylvania Department of Education

www.pdesas.org

www.education.state.pa.us

April 2014

Pennsylvania System of School Assessment

The Assessment Anchors, as defined by the Eligible Content, are organized into cohesive blueprints, each structured with a common labeling system that can be read like an outline. This framework is organized first by Reporting Category, then by Assessment Anchor, followed by Anchor Descriptor, and then finally, at the greatest level of detail, by an Eligible Content statement. The common format of this outline is followed across the PSSA.

Here is a description of each level in the labeling system for the PSSA:

Reporting Category

The Assessment Anchors are organized into four classifications, as listed below.

- A = Numbers and Operations
- B = Algebraic Concepts
- C = Geometry
- D = Data Analysis and Probability

These four classifications are used throughout the grade levels. In addition to these classifications, there are five Reporting Categories for each grade level. The first letter of each Reporting Category represents the classification; the second letter represents the Domain as stated in the Pennsylvania Core Standards for Mathematics. Listed below are the Reporting Categories for Grade 8.

- A-N = The Number System
- B-E = Expressions and Equations
- B-F = Functions
- C-G = Geometry
- D-S = Statistics and Probability

The title of each Reporting Category is consistent with the title of the corresponding Domain in the Pennsylvania Core Standards for Mathematics. The Reporting Category title appears at the top of each page.

Assessment Anchor

The Assessment Anchor appears in the shaded bar across the top of each Assessment Anchor table. The Assessment Anchors represent categories of subject matter (skills and concepts) that anchor the content of the PSSA. Each Assessment Anchor is part of a Reporting Category and has one or more Anchor Descriptors unified under and aligned to it.

Anchor Descriptor

Below each Assessment Anchor is one or more specific Anchor Descriptors. The Anchor Descriptor adds a level of specificity to the content covered by the Assessment Anchor. Each Anchor Descriptor is part of an Assessment Anchor and has one or more Eligible Content statements unified under and aligned to it.

Eligible Content

The column to the right of the Anchor Descriptor contains the Eligible Content statements. The Eligible Content is the most specific description of the skills and concepts assessed on the PSSA. This level is considered the assessment limit and helps educators identify the range of the content covered on the PSSA.

Reference

In the space below each Assessment Anchor table is a code representing one or more Pennsylvania Core Standards for Mathematics that correlate to the Eligible Content statements.

M08.A-N The Number System

Reporting Category

ASSESSMENT ANCHOR

M08.A-N.1 Demonstrate an understanding of rational and irrational numbers.

DESCRIPTOR

ELIGIBLE CONTENT

M08.A-N.1.1 Apply concepts of rational and irrational numbers.

- | | |
|----------------------|---|
| M08.A-N.1.1.1 | Determine whether a number is rational or irrational. For rational numbers, show that the decimal expansion terminates or repeats (limit repeating decimals to thousandths). |
| M08.A-N.1.1.2 | Convert a terminating or repeating decimal to a rational number (limit repeating decimals to thousandths). |
| M08.A-N.1.1.3 | Estimate the value of irrational numbers without a calculator (limit whole number radicand to less than 144).
<i>Example:</i> $\sqrt{5}$ is between 2 and 3 but closer to 2. |
| M08.A-N.1.1.4 | Use rational approximations of irrational numbers to compare and order irrational numbers. |
| M08.A-N.1.1.5 | Locate/identify rational and irrational numbers at their approximate locations on a number line. |

Reference:

CC.2.1.8.E.1

Distinguish between rational and irrational numbers using their properties.

CC.2.1.8.E.4

Estimate irrational numbers by comparing them to rational numbers.

M08.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M08.B-E.1 Demonstrate an understanding of expressions and equations with radicals and integer exponents.

DESCRIPTOR

ELIGIBLE CONTENT

M08.B-E.1.1 Represent and use expressions and equations to solve problems involving radicals and integer exponents.

- M08.B-E.1.1.1** Apply one or more properties of integer exponents to generate equivalent numerical expressions without a calculator (with final answers expressed in exponential form with positive exponents).
Properties will be provided.
Example: $3^{12} \times 3^{-15} = 3^{-3} = 1/(3^3)$
- M08.B-E.1.1.2** Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of perfect squares (up to and including 12^2) and cube roots of perfect cubes (up to and including 5^3) without a calculator.
Example: If $x^2 = 25$ then $x = \pm\sqrt{25}$.
- M08.B-E.1.1.3** Estimate very large or very small quantities by using numbers expressed in the form of a single digit times an integer power of 10 and express how many times larger or smaller one number is than another.
Example: Estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9 and determine that the world population is more than 20 times larger than the United States' population.
- M08.B-E.1.1.4** Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Express answers in scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology (e.g., interpret 4.7EE9 displayed on a calculator as 4.7×10^9).

Reference:

CC.2.2.8.B.1

Apply concepts of radicals and integer exponents to generate equivalent expressions.

M08.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M08.B-E.2 Understand the connections between proportional relationships, lines, and linear equations.

DESCRIPTOR

M08.B-E.2.1 Analyze and describe linear relationships between two variables, using slope.

ELIGIBLE CONTENT

- M08.B-E.2.1.1** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
Example: Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
- M08.B-E.2.1.2** Use similar right triangles to show and explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane.
- M08.B-E.2.1.3** Derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b .

Reference:

CC.2.2.8.B.2

Understand the connections between proportional relationships, lines, and linear equations.

M08.B-E Expressions and Equations

Reporting Category

ASSESSMENT ANCHOR

M08.B-E.3 Analyze and solve linear equations and pairs of simultaneous linear equations.

DESCRIPTOR

ELIGIBLE CONTENT

M08.B-E.3.1 Write, solve, graph, and interpret linear equations in one or two variables, using various methods.

M08.B-E.3.1.1 Write and identify linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

M08.B-E.3.1.2 Solve linear equations that have rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

M08.B-E.3.1.3 Interpret solutions to a system of two linear equations in two variables as points of intersection of their graphs because points of intersection satisfy both equations simultaneously.

M08.B-E.3.1.4 Solve systems of two linear equations in two variables algebraically and estimate solutions by graphing the equations. Solve simple cases by inspection.
Example: $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.

M08.B-E.3.1.5 Solve real-world and mathematical problems leading to two linear equations in two variables.
Example: Given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Reference:

CC.2.2.8.B.3

Analyze and solve linear equations and pairs of simultaneous linear equations.

M08.B-F Functions

Reporting Category

ASSESSMENT ANCHOR

M08.B-F.1 Analyze and interpret functions.

DESCRIPTOR

M08.B-F.1.1 Define, evaluate, and compare functions displayed algebraically, graphically, or numerically in tables or by verbal descriptions.

ELIGIBLE CONTENT

M08.B-F.1.1.1 Determine whether a relation is a function.

M08.B-F.1.1.2 Compare properties of two functions, each represented in a different way (i.e., algebraically, graphically, numerically in tables, or by verbal descriptions).
Example: Given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

M08.B-F.1.1.3 Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line; give examples of functions that are not linear.

Reference:

CC.2.2.8.C.1

Define, evaluate, and compare functions.

M08.B-F Functions

Reporting Category

ASSESSMENT ANCHOR

M08.B-F.2 Use functions to model relationships between quantities.

DESCRIPTOR

M08.B-F.2.1 Represent or interpret functional relationships between quantities using tables, graphs, and descriptions.

ELIGIBLE CONTENT

- M08.B-F.2.1.1** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values.
- M08.B-F.2.1.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch or determine a graph that exhibits the qualitative features of a function that has been described verbally.

Reference:

CC.2.2.8.C.2

Use concepts of functions to model relationships between quantities.

M08.C-G Geometry

Reporting Category

ASSESSMENT ANCHOR

M08.C-G.1 Demonstrate an understanding of geometric transformations.

DESCRIPTOR

M08.C-G.1.1 Apply properties of geometric transformations to verify congruence or similarity.

ELIGIBLE CONTENT

- | | |
|----------------------|---|
| M08.C-G.1.1.1 | Identify and apply properties of rotations, reflections, and translations.
<i>Example: Angle measures are preserved in rotations, reflections, and translations.</i> |
| M08.C-G.1.1.2 | Given two congruent figures, describe a sequence of transformations that exhibits the congruence between them. |
| M08.C-G.1.1.3 | Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. |
| M08.C-G.1.1.4 | Given two similar two-dimensional figures, describe a sequence of transformations that exhibits the similarity between them. |

Reference:

CC.2.3.8.A.2

Understand and apply congruence, similarity, and geometric transformations using various tools.

M08.C-G Geometry

Reporting Category

ASSESSMENT ANCHOR

M08.C-G.2 Understand and apply the Pythagorean theorem.

DESCRIPTOR

M08.C-G.2.1 Solve problems involving right triangles by applying the Pythagorean theorem.

ELIGIBLE CONTENT

- M08.C-G.2.1.1** Apply the converse of the Pythagorean theorem to show a triangle is a right triangle.
- M08.C-G.2.1.2** Apply the Pythagorean theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. (Figures provided for problems in three dimensions will be consistent with Eligible Content in grade 8 and below.)
- M08.C-G.2.1.3** Apply the Pythagorean theorem to find the distance between two points in a coordinate system.

Reference:

CC.2.3.8.A.3
Understand and apply the Pythagorean Theorem to solve problems.

M08.C-G Geometry

Reporting Category

ASSESSMENT ANCHOR

M08.C-G.3 Solve real-world and mathematical problems involving volume.

DESCRIPTOR

ELIGIBLE CONTENT

M08.C-G.3.1 Apply volume formulas of cones, cylinders, and spheres.

M08.C-G.3.1.1 Apply formulas for the volumes of cones, cylinders, and spheres to solve real-world and mathematical problems. **Formulas will be provided.**

Reference:

CC.2.3.8.A.1

Apply the concepts of volume of cylinders, cones, and spheres to solve real-world and mathematical problems.

M08.D-S Statistics and Probability

Reporting Category

ASSESSMENT ANCHOR

M08.D-S.1 Investigate patterns of association in bivariate data.

DESCRIPTOR

M08.D-S.1.1 Analyze and interpret bivariate data displayed in multiple representations.

ELIGIBLE CONTENT

- M08.D-S.1.1.1** Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative correlation, linear association, and nonlinear association.
- M08.D-S.1.1.2** For scatter plots that suggest a linear association, identify a line of best fit by judging the closeness of the data points to the line.
- M08.D-S.1.1.3** Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
Example: In a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

Reference:

CC.2.4.8.B.1

Analyze and/or interpret bivariate data displayed in multiple representations.

M08.D-S Statistics and Probability

Reporting Category

ASSESSMENT ANCHOR

M08.D-S.1 Investigate patterns of association in bivariate data.

DESCRIPTOR

M08.D-S.1.2 Understand that patterns of association can be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.

ELIGIBLE CONTENT

M08.D-S.1.2.1 Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible associations between the two variables.

Example: Given data on whether students have a curfew on school nights and whether they have assigned chores at home, is there evidence that those who have a curfew also tend to have chores?

Reference:

CC.2.4.8.B.2

Understand that patterns of association can be seen in bivariate data utilizing frequencies.

GENERAL DESCRIPTION OF SCORING GUIDELINES FOR MATHEMATICS OPEN-ENDED QUESTIONS

- 4 – The response demonstrates a *thorough* understanding of the mathematical concepts and procedures required by the task.**

The response provides correct answer(s) with clear and complete mathematical procedures shown and a correct explanation, as required by the task. Response may contain a minor “blemish” or omission in work or explanation that does not detract from demonstrating a *thorough* understanding.

- 3 – The response demonstrates a *general* understanding of the mathematical concepts and procedures required by the task.**

The response and explanation (as required by the task) are mostly complete and correct. The response may have minor errors or omissions that do not detract from demonstrating a *general* understanding.

- 2 – The response demonstrates a *partial* understanding of the mathematical concepts and procedures required by the task.**

The response is somewhat correct with *partial* understanding of the required mathematical concepts and/or procedures demonstrated and/or explained. The response may contain some work that is incomplete or unclear.

- 1 – The response demonstrates a *minimal* understanding of the mathematical concepts and procedures required by the task.**

- 0 – The response has no correct answer and *insufficient* evidence to demonstrate any understanding of the mathematical concepts and procedures required by the task for that grade level.**

Response may show only information copied from the question.

Special Categories within zero reported separately:

BLK (blank).....Blank, entirely erased, or written refusal to respond

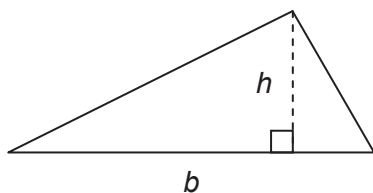
OTOff task

LOEResponse in a language other than English

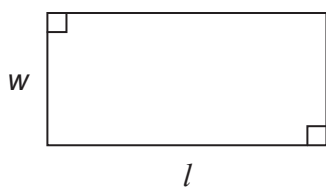
ILIllegible

Formulas that you may need to work questions on this test are found below.
You may refer back to this page at any time during the mathematics test.

2015
Grade 6

Triangle

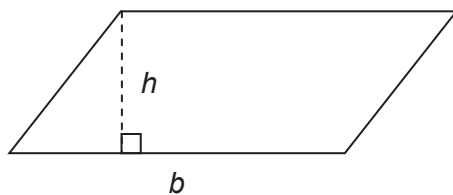
$$A = \frac{1}{2}bh$$

Rectangle

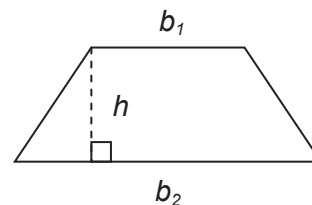
$$A = lw$$

Square

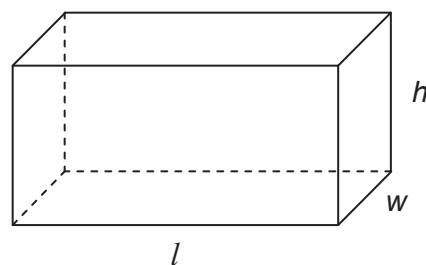
$$A = s^2$$

Parallelogram

$$A = bh$$

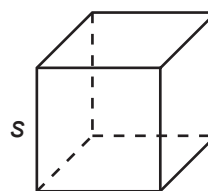
Trapezoid

$$A = \frac{1}{2}h(b_1 + b_2)$$

Rectangular Prism

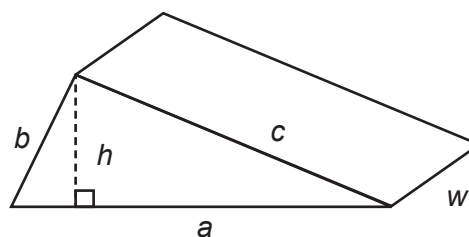
$$V = lwh$$

$$SA = 2lw + 2lh + 2wh$$

Cube

$$V = s \cdot s \cdot s$$

$$SA = 6s^2$$

Triangular Prism

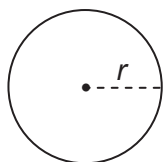
$$SA = ah + aw + bw + cw$$

Formulas that you may need to work questions on this test are found below.
 You may refer back to this page at any time during the mathematics test.
 You may use calculator π or the number 3.14.

2015
Grade 7

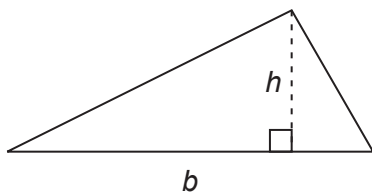
Simple Interest

$$I = Prt$$

Circle

$$C = 2\pi r$$

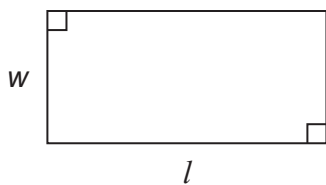
$$A = \pi r^2$$

Triangle

$$A = \frac{1}{2}bh$$

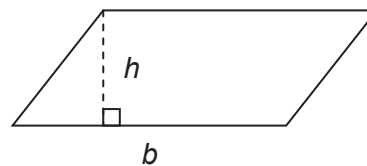
Square

$$A = s^2$$

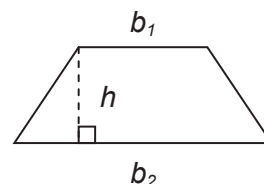
Rectangle

$$A = lw$$

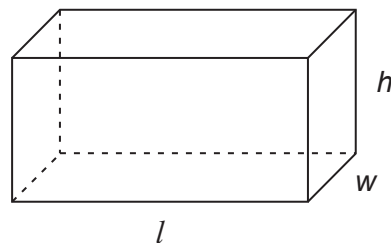
$$P = 2l + 2w$$

Parallelogram

$$A = bh$$

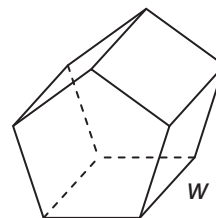
Trapezoid

$$A = \frac{1}{2}h(b_1 + b_2)$$

Rectangular Prism

$$V = lwh$$

$$SA = 2lw + 2lh + 2wh$$

Polygonal Prism

$$V = Bw, \text{ where } B = \text{area of the base}$$

$$SA = Pw + 2B, \text{ where } P = \text{perimeter of base}$$

Formulas that you may need to work questions on this test are found below.

You may refer back to this page at any time during the mathematics test.

You may use calculator π or the number 3.14.

2015
Grade 8

Exponential Properties

$$a^m \cdot a^n = a^{m+n}$$

$$(a^m)^n = a^{m \cdot n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

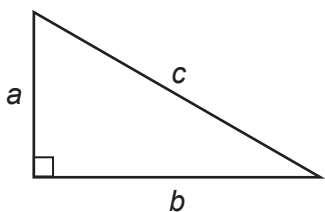
$$a^{-1} = \frac{1}{a}$$

Algebraic Equations

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

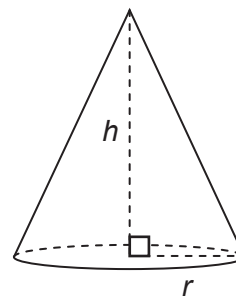
Slope-Intercept Form: $y = mx + b$

Pythagorean Theorem



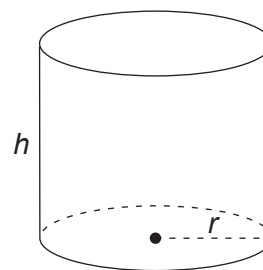
$$a^2 + b^2 = c^2$$

Cone



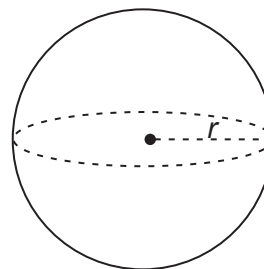
$$V = \frac{1}{3} \pi r^2 h$$

Cylinder



$$V = \pi r^2 h$$

Sphere



$$V = \frac{4}{3} \pi r^3$$

Pennsylvania Common Core Standards
Mathematics

INTRODUCTION

The Pennsylvania Common 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 Common Core Standards for **Mathematics 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 Common Core Standards Mathematical Content and Mathematical Practice	
Standards for Mathematical Content	Standards for Mathematical Practice
2.1 Numbers and Operations A) Counting and Cardinality B) Number and Operations in Base Ten C) Number and Operations—Fractions D) Ratios and Proportional Relationships E) The Number System F) Number and Quantity	<ul style="list-style-type: none">• Make sense of problems and persevere in solving them.• Reason abstractly and quantitatively.• Construct viable arguments and critique the reasoning of others.• Model with mathematics.• Use appropriate tools strategically.• Attend to precision.• Look for and make use of structure.• Look for and make sense of regularity in repeated reasoning.
2.2 Algebraic Concepts A) Operations and Algebra Thinking B) Expressions & Equations C) Functions D) Algebra	
2.3 Geometry A) Geometry	
2.4 Measurement, Data and Probability A) Measurement and Data B) Statistics and Probability	