Oregon University System

Mathematics

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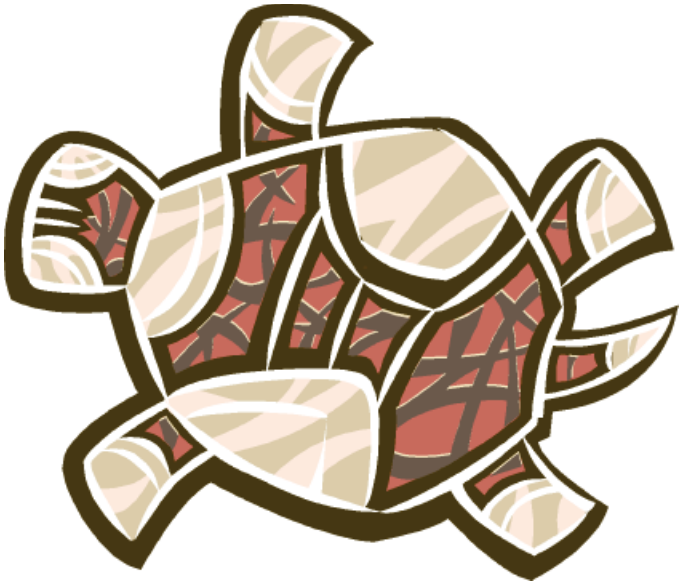

Guide to Teaching and Assessing Proficiency for University Admission

Proficiency-based Admission Standards System

PASS

Oregon University System
Office of the Chancellor
PO Box 3175, Eugene, OR 97403-0175
1-800-961-PASS (7277)
http://pass.ous.edu

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"Promoting access and success for students in higher education."

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PASS

Proficiency-based Admission Standards System

Contents:

PASS Is Part of OUS Admission

Introduction

The PASS standards describe the level of knowledge and skills students need for successful entry into Oregon's public universities. Because PASS aligns college preparation, entry, and placement with students' attainment of standards in middle and high school, students can use it to track their progress and make informed decisions about how to develop the proficiency needed to succeed in higher education.

The PASS standards provide evidence of proficiency that, when added to the four existing requirements for OUS admission (high school graduation, subject area requirements, GPA, and SAT or ACT), paint a comprehensive picture of student preparation. Currently, PASS information may give applicants advantages such as increased competitiveness for scholarships, advanced class placement, and entry into limited-enrollment programs. See each OUS campus's specific application for details on standards and proficiency.

Aligning Undergraduate Admission with K-12 Student Learning

Oregon is already seeing positive outcomes as the result of its pioneering work in aligning K-12 standards and assessments with OUS expectations for student admission, as directed by the Joint Boards of Education.

As reported to both Boards and the legislature in 2003, *The First Year Study* – based on data from more than 6,000 OUS freshmen and 10,000 community college students – found that students who met benchmarked standards in high school were more likely to attain academic success in their first year of college than those who did not. Subsequent data from *The First Year Study* confirms these results with even stronger correlations.

The Joint Boards of Education has been tasked by the Governor with creating a Unified Education Enterprise (UEE), building a student-centered pipeline that maximizes educational opportunity for all Oregon students. In partnership with ODE and the Department of Community Colleges and Work Force Development (CCWD), OUS is examining the current framework of standards and assessments to close the gap between high school exit expectations and the proficiency needed to take the next step into postsecondary education.

To implement the UEE fully, Oregon's high schools and postsecondary institutions need improved student data connections. Much progress has been made in the past three years toward the design and implementation of an electronic K-16 Integrated Data-Transfer System (IDTS). The ODE, CCWD, and OUS are collaborating in constructing the system, with funding from the Oregon legislature. When the system is in place, student applicants will be able, through their high schools, to send OUS and community colleges a more comprehensive set of information about their performance for use in admission and placement.

Even with the targeted completion schedule for the data-transfer system, statewide implementation is still unlikely to be complete for all high schools and students by fall 2007. Therefore, students applying in 2007 are encouraged, but not required, to include evidence of proficiency, if it is available to them, to complement undergraduate admission requirements. Evidence of proficiency may include scores from state assessments, national assessments, and teacher-verified PASS information.

PASS Assessment

Teachers can use any of three methods for assessing PASS proficiency.

1. PASS Teacher Verification (PTV). Teachers are the best source of information about student performance. PTV allows teachers and students to work together to generate a collection of evidence over time that targets specific academic standards. PTV is usually the most accessible way for students to meet the PASS standards. The PASS website, PASS online training, and the *PASS Guides* to each content area contain specific information about PTV. One-day training sessions are available around the state through regional ESDs. To schedule a training, an ESD can call PASS at (800) 961-7277. The Events section of the PASS website lists sessions as they are scheduled.

2. Specific scores from national tests – such as the Advanced Placement, SAT II, ACT, International Baccalaureate, and second-language proficiency tests – can contribute to the determination of PASS proficiency. See the Assessment Guidelines on page 22 for details.

3. State tests and CIM requirements. The Oregon Department of Education and OUS have collaborated to design the Juried Assessment Process, which offers reciprocal agreements for assessing CIM and PASS. Meeting or exceeding the state assessments can be used to meet several of the PASS standards. For example, meeting CIM math problem-solving requirements also meets PASS Mathematics Standard A. Students can also use PASS to meet some state assessments, or meet CIM through designated PASS standards. (See “Reciprocal Assessment Agreements" on page 23 for details.)

PASS offers resources and trainings for teachers.

PASS assessment builds on practices currently used by teachers to evaluate student performance. Additional training is required for teachers who want to assess PASS collections of student work via PASS Teacher Verification (PTV). Teachers can become “PASS trained” by 1) completing online training, along with a "verification test," at pass.ous.edu/training; 2) attending one of the training sessions PASS offers through ESDs; or 3) through the departmental validation process.

The PASS website contains several resources for teachers, including example collections of student work at varying levels of proficiency, self-paced tutorials on judging student collections, classroom resources that enhance standards-based teaching, PDFs of PASS publications, and dates for scheduled training sessions at ESDs.

PASS Ratings

Students receive a rating for each PASS standard. There are five possible ratings:

PASS Rating	*Description*
(E) Exemplary*	The collection demonstrates an exemplary mastery of the standard and exhibits exceptional intellectual maturity or unique thinking, methods, or talents.
(H) Highly proficient*	The collection demonstrates mastery of the standard at a level higher than entry-level college coursework.
(M) Meets the standard	The collection demonstrates that the student is prepared for entry-level college coursework. (This is the level of proficiency that the majority of admitted students will achieve.)
(W) Working toward the standard	The collection approaches readiness for entry-level college coursework. The level of performance may be improved by: • providing a broader variety of opportunities and conditions of assessment; • providing sufficient evidence to address the range of criteria for the standard; • enrolling in more classes that target this standard.
(N) Not meeting the standard	The collection contains evidence that the student is not prepared to do entry-level college coursework.

*requires external verification

Foundation, College Prep, and Specialized Standards

There are three types of PASS standards: foundation, college prep, and specialized. OUS applicants who want to use the PASS standards to meet the OUS requirement of completing three units of math (a unit is equal to one year) must meet all the foundation and college-prep standards in math (see below). Meeting the specialized standards is recommended for scholarships, class placement, and college credit.

The PASS Math Standards	Foundation	College Prep	Specialized
A. Solve Mathematical Problems*	✓		
B. Perform Algebraic Operations*	✓		
C. Use Geometric Concepts and Models		✓	✓
-or-			
D. Use Probability and Statistics to Collect and Study Data		✓	✓
E. Use Functions to Understand Mathematical Relationships		✓	
F. Represent, Analyze, and Use Advanced Functions			✓

Either C or D can be college prep; the other standard is considered specialized

* May be met by meeting CIM requirements.

Making a Summary Judgment

PASS uses three assessment methods: PASS teacher verification (PTV), state tests and work-sample requirements, and national tests. PTV is the preferred method for most PASS standards because it creates the closest link between instruction and assessment.

A teacher verifies proficiency by judging a collection of student work. This "collection of evidence" contains examples of work that have been assembled by the student and teacher over time in one or more classes. Evidence may include state-required work samples, classroom assignments and tasks, teacher-made tests, projects, exams, and quizzes. Individual work samples – or, in some cases, entire collections – may be used as evidence for more than one standard.

Making a Summary Judgment

Teacher verification is a two-step process:.

Step 1: Consider sufficiency and proficiency

Because sufficiency and proficiency are interrelated, it's important to determine both before you make a summary judgment. For each standard the collection addresses, reacquaint yourself with the descriptions of proficient performance in the Scoring Guide and with the standard's Sufficiency Guidelines.

A *sufficient* collection contains enough evidence to serve as the basis for reliable scoring. The evidence also addresses the range of criteria described in the Scoring Guide and includes work collected under varied opportunities and conditions, including some in-class, on-demand work as well as independent projects.

To determine sufficiency, consider the three bulleted questions at the top of the next page. Also, **carefully examine the descriptions of sufficiency** on the standard's Sufficiency Guidelines page. These were written by experienced PASS teachers and list what a collection should or must include. Many collections that contain proficient work receive a score of W because they do not include sufficient evidence – for example, a piece of on-demand work to supplement the out-of-class work.

***Proficiency* defines student learning in terms of the level and depth of knowledge and skills.** To determine proficiency, you don't need to rate each piece in the collection; a summary judgment is a holistic rating of a collection, not an averaging of its pieces. Some of the standard's criteria may be more crucial than others; refer to the top of each Sufficiency Guidelines page to find the relative importance of the criteria.

You may infer proficiency about some criteria that the collection does not specifically address. The key is to remember that **the overall level of work must convince an objective scorer** that the student would perform at the same level in similar settings and on related criteria.

Step 2: Assign a summary judgment score

When you give a summary judgment score, you're assessing the degree to which the work indicates readiness for entry-level college coursework. **A collection should be scored M if most of the work in it meets the criteria listed in the applicable scoring guide**, even if the level of performance within and across the work in the collection varies.

The PASS ratings are described on page 7. Note that an M (meets the standard) does NOT equal a "C" in the traditional letter-grading system: an M indicates that the student is prepared to do entry-level college work. In an evaluation of more than 4,000 collections, 40% were in the M range, 13% were in the H (highly proficient) range, and only 2% were in the E (exemplary) range.

To increase the confidence of your judgments, it's a good idea to cross-score some of your collections with other teachers in your content area. Cross-scoring helps you feel confident that, given the same collection, properly trained colleagues would reach the same conclusion about its merits.

Summary Judgment Score Sheet

STEP 1 Consider Sufficiency of Evidence and Proficiency of Performance

Note: Sufficiency and proficiency are interrelated. Determine both before making a summary judgment.

SUFFICIENCY:

Determine sufficiency of evidence.

PROFICIENCY:

Determine proficiency of performance.

Exceeds the Standard (E or H)

Most of the work in the collection shows an exemplary (E) mastery of the standard or mastery at a level higher (H) than entry-level college coursework.

Meets the Standard (M)

Most of the work in the collection is consistent with the descriptions of proficient performance in the standard's Scoring Guide and allows inferences about knowledge and skills.

Does Not Meet the Standard (W or N)

STEP 2 Assign a Summary Judgment Score

Proficient

☐ E	**Exemplary***	If there is sufficient evidence to make a confident judgment AND if the student's work consistently exceeds the criteria in the Scoring Guide, then the summary judgment score is E.
or		
☐ H	**Highly proficient***	If there is sufficient evidence to make a confident judgment AND if the student's work meets and regularly exceeds the criteria in the Scoring Guide, then the summary judgment score is H.
☐ M	**Meets the standard**	If there is sufficient evidence to make a confident judgment AND if the student's work meets the criteria in the Scoring Guide, then the summary judgment score is M.

* needs some form of external verification

Not Proficient

☐ W	**Working toward the standard**	If there is insufficient evidence to make a confident judgment OR if the collection does not include enough work at the proficient level to meet the criteria in the Scoring Guide, then the summary judgment score is W.
or		
☐ N	**Not meeting the standard**	If the collection doesn't address the standard OR if the student clearly doesn't possess the skills addressed by the standard, then the summary judgment score is N.

Collection ID: _____ Judge: _____ Date: _____

Summary Chart of PASS Standards and Criteria for Mathematics

Standard What students must be able to do:	Criteria What students should demonstrate:
A: Solve Mathematical Problems Apply mathematical problem-solving strategies to problems from within and outside mathematics; devise, implement, and evaluate processes and solutions; select and use appropriate models, operations, and technologies.	**A1: Formulation and Understanding:** Understand and formulate problems; select or provide relevant information; use mathematical concepts, models, and representations. **A2: Processes and Strategies:** Consider and choose among various strategies, algorithms, models, and concepts to devise and carry out solutions. **A3: Verification:** Evaluate processes, strategies, calculations, and solutions to verify reasonableness; explore alternative approaches, extensions, and generalizations. **A4: Communication:** Represent and communicate reasoning processes, solutions, ideas, and conclusions; use correct mathematical terminology, symbols, and notation.
B: Perform Algebraic Operations Use numeric and algebraic operations and mathematical expressions to solve equations and inequalities.	**B1: Solving Equations and Inequalities:** Solve equations and inequalities numerically, graphically, and/or algebraically. **B2: Estimate and Compute:** Use computation, estimation, and mathematical properties to solve problems; use estimation to check the reasonableness of results, including those obtained by technology. **B3: Use of Matrices:** Use matrices to organize and analyze information and to solve problems.
C: Use Geometric Concepts and Models Represent and solve problems with two- and three-dimensional geometric models, properties of figures, analytic geometry, and right-triangle trigonometry.	**C1: Recognition and Analysis of Geometric Figures:** Represent, interpret, and analyze a wide variety of geometric figures and their properties using drawings, models, and the Cartesian coordinate system. **C2: Direct and Indirect Measurement:** Use geometry and right-triangle trigonometry to determine measurements. **C3: Use of Geometric Models:** Use geometric relationships, spatial reasoning, and models to solve problems.

Standard What students must be able to do:	Criteria What students should demonstrate:
D: Use Probability and Statistics to Collect and Study Data Use probability and statistics in the study of various disciplines, situations, and problems; understand and apply valid statistical methods and measures of central tendency, variability, and correlation in the collection, organization, analysis, and interpretation of data.	**D1: Use of Probability:** Understand and apply concepts of probability. **D2: Organization and Display of Data:** Create charts, tables, and graphs to display data; use displays to draw inferences, make predictions, and solve problems. **D3: Use, Analyze, and Interpret Data:** Develop and evaluate inferences and predictions that are based on data. **D4: Statistical Investigation:** Design, conduct, and critique statistical experiments, simulations, or surveys; collect data.
E: Use Functions to Understand Mathematical Relationships Use patterns and functions to represent relationships between variables and to solve problems; interpret and understand the connections among symbolic, graphic, and tabular representations of linear, quadratic, and exponential functions.	**E1: Representation and Recognition of Functions:** Represent functions using and translating among words, tables, graphs, and symbols; recognize and distinguish a variety of classes of functions. **E2: Analysis of Functions:** Understand and analyze features of a function and limitations on the domain of a function. **E3: Use of Functions as Models:** Model situations and solve problems using a variety of functions.
F: Represent, Analyze, and Use Advanced Functions Analyze the nature and behavior of more-advanced functions, including trigonometric, logarithmic, general polynomial, and rational, and use such functions to model mathematical relationships.	**F1: Manipulation and Solution of Advanced Functions:** Simplify expressions and solve equations involving advanced functions. **F2: Representation and Recognition of Advanced Functions:** Represent advanced functions using and translating among words, tables, graphs, and symbols; recognize and distinguish classes of advanced functions. **F3: Analysis of Advanced Functions:** Understand and analyze the behavior of advanced functions. **F4: Use of Advanced Functions as Models:** Model situations and solve problems using a variety of advanced functions.

A

Scoring Guide for PASS Standard A

Solve Mathematical Problems

Apply mathematical problem-solving strategies to problems from within and outside mathematics; devise, implement, and evaluate processes and solutions; select and use appropriate models, operations, and technologies.

Criteria

A1: Formulation and Understanding

Understand and formulate problems; select or provide relevant information; use mathematical concepts, models, and representations.

A2: Processes and Strategies

Consider and choose among various strategies, algorithms, models, and concepts to devise and carry out solutions.

A3: Verification

Evaluate processes, strategies, calculations, and solutions to verify reasonableness; explore alternative approaches, extensions, and generalizations.

A4: Communication

Represent and communicate reasoning processes, solutions, ideas, and conclusions; use correct mathematical terminology, symbols, and notation.

Descriptions of Proficient Performance

Descriptors define types of proficient performance; they are not a checklist.

- clearly and appropriately frames and clarifies a mathematical problem:
  - given a problem, demonstrates an understanding of the context, variables and constraints involved; or
  - given a context from within or outside mathematics, poses a problem, providing appropriate information, variables, and constraints
- uses all relevant information from the problem; identifies and obtains any additional information or resources necessary for solving the problem

- selects, develops, and completes thorough, detailed, efficient, and reasonable processes and strategies
- uses clear and mathematically correct pictures, diagrams, models, and/or symbols to develop the solution
- selects and correctly uses appropriate computational tools and methods
- demonstrates proficient performance in algebra, geometry, and/or probability and statistics, as appropriate to the problem (see Standards B, C, or D)

- reviews and checks strategies and calculations, using an alternative approach when possible to verify reasonableness of results
- reflects on the problem-solving process and uses mathematical knowledge to evaluate how effective it was
- reflects on the solution and uses mathematical knowledge to evaluate how reasonable and appropriate it was
- considers extensions and generalizations of the problem, process, or solution

- clearly represents the reasoning, processes and calculations used to arrive at a solution or develop an idea
- sequences and connects the presentation so that the reader can follow the mathematical thinking from start to finish
- uses mathematical notation, symbols, graphics, and terminology precisely and correctly
- minimizes mechanical errors (spelling, punctuation, paragraphing, etc.) so as not to interfere with clarity of communication

* **Note:** Criteria A1 – A4 align with traits in the State Analytical Trait Scoring Guide. Meeting or exceeding CIM requirements from the State Common Assessment and classroom work samples may be used to meet the requirements of PASS Standard A.

Sufficiency Guidelines for PASS Standard A

A

Over the past few years of judging collections of evidence, math teachers have determined the relative importance of the criteria for Standard A as follows:

- A1 is Critical – substantial evidence required
- A2 is Critical – substantial evidence required
- A3 is Critical – substantial evidence required
- A4 is Critical – substantial evidence required

Guidelines for a Sufficient Collection of Evidence

Does the work sufficiently represent the standard?

The collection MUST include:

- problems (and solutions) or projects demonstrating understanding of mathematical concepts drawn from at least two of the following categories: algebra (Standards B, E, or F), geometry (Standard C), and probability/statistics (Standard D).

  Collections rated H or E are likely to include work from all three categories. (A1).

- demonstration of the ability to use a variety of strategies to solve problems (A2)
- demonstration of the ability to select appropriate mathematical processes and strategies to carry out solutions (A2)
- some evidence of the ability to verify reasonableness using alternative approaches, extensions, or generalizations (A3)
- communication of mathematical reasoning, processes, solutions, ideas, and conclusions using terminology, symbols, and notation (A4)

Have there been sufficiently varied opportunities, circumstances, and conditions for assessment?

The collection MUST include:

- problems and solutions involving varied methods (i.e. graphic, pictorial, numeric, symbolic, verbal, technological)

The collection should include:

- problems solved in a variety of circumstances: over time with access to resources, opportunities for revisions in controlled circumstances, and/or in "on-demand" test conditions

Is there sufficient evidence to be confident that the work represents the student?

The collection MUST include:

- reasonably consistent performance in solving mathematical problems
- at least one assessment conducted under controlled, "on demand" conditions

B

Scoring Guide for PASS Standard B

Perform Algebraic Operations

Use numeric and algebraic operations and mathematical expressions to solve equations and inequalities.

Criteria

B1: Solving Equations and Inequalities

Solve equations and inequalities numerically, graphically, and/or algebraically.

B2: Estimate and Compute

Use computation, estimation, and mathematical properties to solve problems; use estimation to check the reasonableness of results, including those obtained by technology.

B3: Use of Matrices

Use matrices to organize and analyze information and to solve problems.

Descriptions of Proficient Performance

Descriptors define types of proficient performance; they are not a checklist.

- correctly uses operations and properties to simplify algebraic expressions
- selects an effective means of solving a given equation, inequality, or system
- clearly shows the steps in the process selected
- finds the correct (most reasonable) solution - if it exists
- solves a variety of equations and inequalities
- recognizes and selects the most appropriate method for determining an answer: estimation, computation, or a combination of both
- selects and uses an appropriate process and computational or measurement tool (e.g., paper and pencil, calculator, computer software, protractor, ruler)
- identifies and communicates a range of reasonable results
- uses appropriate number representations and operations (e.g., scientific notation, π)
- correctly performs appropriate calculations on real numbers and expressions
- computes correct answers to problems involving direct calculations, interpretation of word problems, and/or charts and graphs
- correctly organizes numeric information into an array of numbers
- correctly performs matrix addition and multiplication
- correctly solves problems (e.g., systems of equations, geometric transformations, etc.) using matrices

Sufficiency Guidelines for PASS Standard B

B

Over the past few years of judging collections of evidence, math teachers have determined the relative importance of the criteria for Standard B as follows:

- B1 is Critical – substantial evidence required
- B2 is Important – some evidence required
- B3 is Useful – minimal evidence required; supplements the summary judgment

Guidelines for a Sufficient Collection of Evidence

Note: The primary assessment method for Standard B is a national or state test, such as the Oregon Statewide Assessment of Math Knowledge and Skills. See the Assessment Guidelines on page 22 for qualifying scores. An alternative assessment method is PASS teacher verification using these criteria:

Does the work sufficiently represent the standard?

The collection MUST include:

- solutions to a variety of equations and inequalities and simplification of algebraic expressions (B1)
- demonstration of computation and use of estimation to check reasonableness of answers (B2)
- some use of matrices to organize and/or analyze information (B3)

  Collections rated H or E are likely to include substantial work in matrices (B3)

Have there been sufficiently varied opportunities, circumstances, and conditions for assessment?

The collection MUST include:

- at least one demonstration of knowledge of algebraic operations or use and manipulation of mathematical expressions

The collection should include:

- assessment in a variety of forms, such as tests, projects, and problems

Is there sufficient evidence to be confident that the work represents the student?

The collection MUST include:

- reasonably consistent performance in solving equations and inequalities
- some assessments conducted under teacher supervision

Collections for Standard B may contain work samples developed and scored for CIM, CAM assessments, and problems or projects used as evidence for other PASS standards.

C

Scoring Guide for PASS Standard C

Use Geometric Concepts and Models

Represent and solve problems with two- and three-dimensional geometric models, properties of figures, analytic geometry, and right-triangle trigonometry.

Criteria

C1: Recognition and Analysis of Geometric Figures

Represent, interpret, and analyze a wide variety of geometric figures and their properties using drawings, models, and the Cartesian coordinate system.

C2: Direct and Indirect Measurement

Use geometry and right-triangle trigonometry to determine measurements.

C3: Use of Geometric Models

Use geometric relationships, spatial reasoning, and models to solve problems.

Descriptions of Proficient Performance

Descriptors define types of proficient performance; they are not a checklist.

- recognizes a wide variety of geometric shapes, figures, properties, and relationships in a variety of environments in both two and three dimensions
- analyzes a wide variety of geometric figures in terms of their properties (e.g., parallel lines with transversal, polygons, circles, and triangle congruence/similarity)
- uses coordinate geometry to analyze properties of lines, circles, and figures
- uses coordinate and analytic geometry to understand relationships between lines (parallel, perpendicular, intersecting) and figures
- recognizes and represents geometric transformations (i.e., size and scale changes, dilations, translations, reflections, and rotations)
- formulates and tests conjectures and conclusions
- selects and uses appropriate methods, systems, units, measuring instruments and technology to determine accurate measurements
- determines measurements indirectly, using:
  - accurate scaled drawings
  - similarity, proportion, and congruence
  - right-triangle relationships (Pythagorean theorem, sine, cosine, tangent)
  - properties of geometric figures
- applies appropriate computations to determine:
  - the perimeter and area of basic plane figures (e.g., circles, triangles, quadrilaterals)
  - the volume and surface area of basic solids (e.g., spheres, cones, cylinders, prisms)
- develops clear and accurate geometric models to communicate concepts and relationships
- applies geometry and right-triangle trigonometry to understand and model real-world problems

Sufficiency Guidelines for PASS Standard C

C

Over the past few years of judging collections of evidence, math teachers have determined the relative importance of the criteria for Standard C as follows:

- C1 is Critical – substantial evidence required
- C2 is Critical – substantial evidence required
- C3 is Critical – substantial evidence required

Guidelines for a Sufficient Collection of Evidence

Does the work sufficiently represent the standard?

The collection MUST include:

- analysis of the properties and relationships of a wide variety of two- and three-dimensional geometric figures (C1 & C2)
- use of coordinate geometry to represent and solve problems or demonstrate geometric properties (C1)
- use of properties of congruence and similarity (C1)
- use of geometry and trigonometry to determine measurements (C2)
- use of geometric models to solve problems (C3)

Collections that are rated H or E are likely to include some type of proof (formal, informal, or coordinate).

Have there been sufficiently varied opportunities, circumstances, and conditions for assessment?

The collection MUST include:

- application of geometry in real-world problems

The collection should include:

- assessment in a variety of forms, such as tests, projects, and problems

Is there sufficient evidence to be confident that the work represents the student?

The collection MUST include:

- reasonably consistent evidence of geometric reasoning skills and application of geometric concepts
- some assessments conducted under teacher supervision

Collections for Standard C may contain work samples developed and scored for CIM, CAM assessments, and problems or projects used as evidence for other PASS standards.

D

Scoring Guide for PASS Standard D

Use Probability and Statistics to Collect and Study Data

Use probability and statistics in the study of various disciplines, situations, and problems; understand and apply valid statistical methods and measures of central tendency, variability, and correlation in the collection, organization, analysis, and interpretation of data.

Criteria

D1: Use of Probability

Understand and apply concepts of probability.

D2: Organization and Display of Data

Create charts, tables, and graphs to display data; use displays to draw inferences, make predictions, and solve problems.

D3: Use, Analyze, and Interpret Data

Develop and evaluate inferences and predictions that are based on data.

D4: Statistical Investigation

Design, conduct, and critique statistical experiments, simulations, or surveys; collect data.

Descriptions of Proficient Performance

Descriptors define types of proficient performance; they are not a checklist.

- uses experimental or theoretical probability to represent and interpret situations or problems
- represents and calculates compound probabilities for dependent, independent, conditional, and mutually exclusive events
- calculates and represents experimental probability through simulation
- calculates and represents theoretical probability using various methods (diagrams, tables, area models, counting techniques, technology, etc.)
- uses probability concepts (e.g., random variable) to design and conduct simulations, including sampling, data analysis, and/or interpretation
- finds and interprets an expected value for a given situation
- develops informative tables, plots, and graphic displays (histograms, scatter plots, stem and leaf plots, box and whiskers, etc.) to accurately represent and study data
- interprets information represented in tables, plots, and graphs
- draws defensible inferences from data using graphical representations (line of best fit, histograms, etc.)
- determines trends, the nature of distributions, and predicted values using graphical representations of data
- analyzes data displays to evaluate the reasonableness of claims, reports, studies, and conclusions
- uses appropriate methods and technology to compute statistics
- uses appropriate symbols and terms to represent statistics
- applies statistical measures of frequency, center, spread, and correlation in the representation and analysis of data (including the normal distrubution)
- draws appropriate inferences or makes predictions (including comments on their validity and reliability) that are supported by the data collected
- reviews and critiques the investigative design, data collection, and analysis for sources of error and bias
- analyzes bivariate data and identifies the type of function that could be used to model the data
- states questions, hypotheses, or predictions that can be investigated through the use of statistical methods and/or probability simulation
- plans, tests, and/or critiques investigative designs (and/or surveys), considering issues of randomization, appropriate data, and effective data-gathering techniques
- develops and conducts one or more investigations of reasonable complexity and depth, drawing appropriate conclusions

Sufficiency Guidelines for PASS Standard D

D

Over the past few years of judging collections of evidence, math teachers have determined the relative importance of the criteria for Standard D as follows:

- D1 is Critical – substantial evidence required
- D2 is Critical – substantial evidence required
- D3 is Critical – substantial evidence required
- D4 is Useful – minimal evidence required; supplements the summary judgment

Guidelines for a Sufficient Collection of Evidence

Does the work sufficiently represent the standard?

The collection MUST include:

- at least one probability simulation, experiment, or problem (D1)
- problems/projects involving display, analysis, and interpretation of data (D2 & D3)
- problems or exercises involving basic descriptive and inferential statistics (D3)
- use of probability and statistics in varied disciplines or contexts

Collections rated H or E are likely to include a statistical investigation that demonstrates soophistication in design, analysis, and interpretation.

Have there been sufficiently varied opportunities, circumstances, and conditions for assessment?

The collection MUST include:

- use of probability and statistics in more than one circumstance: tests, problems, projects, investigations, and/or evaluating the validity of statistical investigations and claims
- demonstration of aspects of statistical investigation (display, analysis, and interpretation) either in one complete investigation or as separate components of directed investigations

Is there sufficient evidence to be confident that the work represents the student?

The collection MUST include:

- reasonably consistent performance in the use of probability and statistics
- some assessments conducted under teacher supervision

Collections for Standard D may contain work samples developed and scored for CIM, CAM assessments, and problems or projects used as evidence for other PASS standards from other content areas.

E

Scoring Guide for PASS Standard E

Use Functions to Understand Mathematical Relationships

Use patterns and functions to represent relationships between variables and to solve problems; interpret and understand the connections among symbolic, graphic, and tabular representations of linear, quadratic, and exponential functions.

Criteria

E1: Representation and Recognition of Functions

Represent functions using and translating among words, tables, graphs, and symbols; recognize and distinguish a variety of classes of functions.

E2: Analysis of Functions

Understand and analyze features of a function and limitations on the domain of a function.

E3: Use of Functions as Models

Model situations and solve problems using a variety of functions.

Descriptions of Proficient Performance

Descriptors define types of proficient performance; they are not a checklist.

- recognizes, represents, and interprets linear, quadratic, and exponential functions
- sketches the graph of a function presented in symbolic, tabular, or worded form
- correctly determines the symbolic form of a function from specific characteristics of the function and its graph (slope, vertex, intercepts, etc.)
- creates an accurate table of values for a function presented in symbolic, graphic, or worded form
- identifies the class to which a function belongs; recognizes when a function does *not* belong to any of the listed classes
- determines if a relation in any form is a function
- uses understanding of a class of functions in the analysis of a particular function
- correctly determines the domain and range of a function
- evaluates a function (determines f (x) given x) presented in symbolic, tabular, or graphic form
- correctly generates ordered pairs and calculates the rate of change between two ordered pairs
- accurately interprets points, intervals, slopes, and rates of change
- accurately identifies and interprets the meaning of x- and y-intercepts
- simplifies expressions and solves equations
- understands and analyzes the functional relationship between inputs and outputs in real-world situations
- models real-world situations and represents observed patterns with appropriate functions
- selects an appropriate function class to model a real-world situation
- correctly interprets situations or solves problems using functions, their representations and properties

Sufficiency Guidelines for PASS Standard E

E

Over the past few years of judging collections of evidence, math teachers have determined the relative importance of the criteria for Standard E as follows:

- E1 is Critical - substantial evidence required
- E2 is Critical - substantial evidence required
- E3 is Critical - substantial evidence required

Guidelines for a Sufficient Collection of Evidence

Does the work sufficiently represent the standard?

The collection MUST include:

- translations between words, tables, graphs, and symbols (E1)
- understanding and analysis (E2) of the three classes of functions listed in E1
- determination of the symbolic form from the characteristics of the function (E2)
- several examples of simplifying expressions and solving equations (E2)
- some use of functions to interpret or model relationships in extended problems or projects, drawn from varied disciplines or real-world contexts (E3)

Have there been sufficiently varied opportunities, circumstances, and conditions for assessment?

The collection MUST include:

- at least one project or problem designed so that the student must choose an appropriate function(s) from among the listed classes of functions to generate a solution

*(**Note**: Collections are often found to be insufficient because the teacher always prompts the choice of functions instead of allowing students to select the most appropriate type.)*

The collection should include:

- assessment in a variety of forms, such as tests, projects, and problems

Is there sufficient evidence to be confident that the work represents the student?

The collection MUST include:

- reasonably consistent performance in recognizing, representing, interpreting, and evaluating varied classes of functions, in both classroom exercises/tests and real-world problems
- some assessments conducted under teacher supervision

Collections for Standard E may contain work samples developed and scored for CIM, CAM assessments, and problems or projects used as evidence for other PASS standards.

F

Scoring Guide for PASS Standard F

Represent, Analyze, and Use Advanced Functions

Analyze the nature and behavior of more-advanced functions, including trigonometric, logarithmic, general polynomial, and rational, and use such functions to model mathematical relationships.

Criteria

F1: Manipulation and Solution of Advanced Functions
Simplify expressions and solve equations involving advanced functions.

F2: Representation and Recognition of Advanced Functions
Represent advanced functions using and translating among words, tables, graphs, and symbols; recognize and distinguish classes of advanced functions.

F3: Analysis of Advanced Functions
Understand and analyze the behavior of advanced functions.

F4: Use of Advanced Functions as Models
Model situations and solve problems using a variety of advanced functions.

Descriptions of Proficient Performance

Descriptors define types of proficient performance; they are not a checklist.

- simplifies expressions involving:
  - properties of rational expressions
  - properties of logarithmic functions
  - trigonometric identities
  - properties of general polynomial functions
- solves equations using
  - properties of rational expressions
  - properties of logarithmic functions
  - trigonometric identities
  - properties of general polynomial functions

- recognizes, represents, and interprets rational, logarithmic, trigonometric, and general polynomial functions
- sketches the graph of an advanced function presented in symbolic, tabular, or worded form
- correctly determines the symbolic form of an advanced function from specific characteristics of the function and its graph (slope, intercepts, period, etc.)
- creates an accurate table of values for an advanced function presented in symbolic, graphic, or worded form
- identifies the class to which a function belongs; recognizes when a function does not belong to any of the listed classes
- recognizes and represents inverses of advanced functions
- recognizes and represents composite functions

- determines whether an inverse relation of a function is a function
- uses understanding of classes of advanced functions in the analysis of a particular function
- correctly determines the domain and range of an advanced function
- identifies the restrictions on the domain of a function so that the inverse relation is a function
- identifies and interprets discontinuities, asymptotes, increasing and decreasing intervals, rates of change, and extrema, through informal means
- identifies and interprets features of periodic functions
- determines the limit of a function as x approaches finite values and as x approaches infinity

- models real-world situations and represents observed patterns using rational, logarithmic, trigonometric, general polynomial, and/or composite functions
- selects an appropriate advanced function class to model a real-world situation
- correctly interprets situations or solves problems using advanced functions, their representations, and their properties

Sufficiency Guidelines for PASS Standard F

F

Over the past few years of judging collections of evidence, math teachers have determined the relative importance of the criteria for Standard F as follows:

- F1 is Critical – substantial evidence required
- F2 is Critical – substantial evidence required
- F3 is Important – some evidence required
- F4 is Important – some evidence required

Guidelines for a Sufficient Collection of Evidence

Does the work sufficiently represent the standard?

The collection MUST include:

- demonstration of the ability to recognize advanced function classes and simplify and manipulate them (F1 & F2)
- translations between words, tables, graphs, and symbols (F2)
- analysis of each of the advanced functions (F3)
- some use of the listed functions to interpret or model relationships in extended problems or projects drawn from varied disciplines or real-world contexts (F4)

Have there been sufficiently varied opportunities, circumstances, and conditions for assessment?

The collection MUST include:

- at least one project or problem designed so that the student must choose an appropriate function(s) from the classes of listed functions to generate a solution

*(**Note**: Collections are often found to be insufficient because the teacher always prompts the choice of functions instead of allowing students to select the most appropriate type.)*

The collection should include:

- assessment in a variety of forms, such as tests, projects, and problems

Is there sufficient evidence to be confident that the work represents the student?

The collection MUST include:

- reasonably consistent performance (with and without a calculator) in recognizing, representing, interpreting, manipulating, and evaluating varied classes of advanced functions in classroom exercises/tests and in real-world problems
- some assessments conducted under teacher supervision

PASS Mathematics Assessment Guidelines for 2005-2006

Only one assessment is required per PASS standard. Choose the method that best serves the student.

PASS Standard	Assessment Method	Assessment Code	Working toward (W)	Meets (M)	Highly proficient (H)	Exemplary (E)
A. Solve Mathematical Problems	PASS Teacher Verification (Collection may include CIM work samples)	PTV	W	M	H	E
	CIM problem-solving requirements	CIM-M	W	M		
B. Perform Algebraic Operations	PASS Teacher Verification	PTV	W	M	H	E
	Oregon Statewide Assessment	OSA-M	229	239		
	SAT II Math 1/Calculator	SAT II-M1C	480	500		
	SAT II Math Level I	SAT II-ML1	500	520		
	ACT Math	ACT-M		21		
C. Use Geometric Concepts and Models	PASS Teacher Verification	PTV	W	M	H	E
D. Use Probability and Statistics	PASS Teacher Verification	PTV	W	M	H	E
	IB Math Methods SL	IB-MM	2	3-4	5	6-7
	IB Math Studies SL	IB-MS	2	3-4	5	6-7
	IB Further Math SL	IB-FM	2	3-4	5	6-7
	AP Statistics	AP-ST		2	3-4	5
E. Use Functions	PASS Teacher Verification	PTV	W	M	H	E
	SAT II Math Level I	SAT II-ML1	500	520	670	730
	SAT II Math Level II - Calculator	SAT II-ML2	570	600	750	800
	AP Math/Calculus AB	AP-MCAB			3-4	5
	AP Math/Calculus BC	AP-MCBC		2	3-4	5
	IB Math Methods SL	IB-MM	2	3-4	5	6-7
	IB Math Studies SL	IB-MS	2	3-4	5	6-7
	IB Further Math SL	IB-FM	2	3-4	5	6-7
F. Use Advanced Functions	PASS Teacher Verification	PTV	W	M	H	E
	AP Math/Calculus AB	AP-MCAB			3-4	5
	AP Math/Calculus BC	AP-MCBC		2	3-4	5
	IB Math Methods SL	IB-MM	2	3-4	5	6-7
	IB Further Math SL	IB-FM	2	3-4	5	6-7

- PTV ratings of H or E require external validation. This can be done (1) through the OUS~ODE Moderation Panel, available biannually at no cost, or (2) by department or regional validation, or (3) by attaining H- or E-level scores on national assessments including AP, IB, and SAT II.
- AP and IB assessments at the H or E level do not need additional verification because they include a method of external validation.
- SAT II assessments at the H or E level require external validation by a PTV, AP, or IB rating at the H or E level.
- As data on student proficiency is received and analyzed, required scores may be adjusted. See PASS website for current information.

2005-06 Reciprocal Assessment Agreements between ODE and OUS

The Oregon University System and the Oregon Department of Education offer reciprocal agreements for assessment in the following areas:

- State assessments to meet PASS standards;
- PASS assessment data to meet state requirements for CIM and CAM;
- PASS collections of evidence for juried CIM requirements

State Assessment to PASS

1. Exceeding the Oregon State **writing** requirements (state assessment and work samples) meets PASS English Standard A (Write for Varied Purposes)
2. Meeting or exceeding the Oregon State **math** problem-solving requirements (work samples) meets PASS Math Standard A (Solve Mathematical Problems)
3. Meeting **math** knowledge and skills requirements (score of 239 or better on the Oregon Statewide Assessment) meets PASS Math Standard B (Perform Algebraic Operations)
4. Meeting **science** knowledge and skills requirements (score of 239 or better on the Oregon Statewide Assessment) meets PASS Science Standard A (Know Fundamental Concepts of the Sciences)
5. Exceeding three Oregon State **science** inquiry work samples with at least one score of 5 or 6 in each dimension meets PASS Science Standard B (Design and Conduct Scientific Investigations)
6. Exceeding three Oregon State **social science** analysis work samples with at least one score of 5 or 6 in each dimension meets PASS Social Science Standard A (Analyze Issues and Events)

PASS to State Assessment

1. Meeting PASS **English** Standard A (Write for Varied Purposes) can be used to meet Oregon State **writing** requirements
2. Meeting PASS **English** Standards B (Read from a Variety of Literary Genres and Periods), C (Interpret Literary Works), and D (Conduct Inquiry and Research) can be used to meet Oregon State **reading** requirements.
3. Meeting PASS **English** Standard F (Communicate in Oral, Visual, and Written Forms) can be used to meet Oregon State **speaking** requirements
4. Meeting PASS **Math** Standard A (Solve Mathematical Problems) can be used to meet Oregon State **problem-solving** requirements
5. Meeting PASS **Math** Standards B (Perform Algebraic Operations), C (Use Geometric Concepts and Models) and D (Use Probability and Statistics to Collect and Study Data) can be used to meet Oregon State **math knowledge and skills** requirements
6. Meeting PASS **Science** Standard A (Know Fundamental Concepts of the Sciences) can be used to meet Oregon State science **knowledge and skills** requirements
7. Meeting PASS **Science** Standard B (Design and Conduct Scientific Inquiry) can be used to meet Oregon State **scientific inquiry** requirements
8. Meeting PASS **Social Science** Standard A (Analyze Issues and Events) can be used to meet Oregon State **social science analysis** requirements

Note: Second language requirements for both the state 10th grade benchmark (CIM) and for PASS (M level) are equivalent to the ACTFL Benchmark IV (Novice-High) level. See the PASS Second Language Assessment Guidelines on the PASS website for assessment options. Oregon State (CIM) subject-area endorsements in the arts and the social sciences are determined by local school districts in conjunction with requirements detailed by the Oregon Department of Education.

For information about the **ODE Juried Assessment Process,** which offers reciprocal agreements for assessing CIM and PASS, contact Tony Alpert, Director of Assessment, at (503) 947-5827, or read the 2005-06 Juried Assessment Manual at www.ode.state.or.us/teachlearn/testing/admin/juried/asmtjuriedmanual0506.pdf.

Oregon University System

The Oregon University System schools:

- Eastern Oregon University (La Grande)
- Oregon Institute of Technology (Klamath Falls)
- Oregon State University (Corvallis)
- Portland State University (Portland)
- Southern Oregon University (Ashland)
- University of Oregon (Eugene)
- Western Oregon University (Monmouth)

PASS Contact Information:

Eugene Office:
Phone: (800) 961-PASS (7277) or (541) 346-5799
Fax: (541) 346-5757
Mailing Address: PO Box 3175 / Eugene, OR 97403-0175
Delivery Address: 1431 Johnson Lane / Eugene, OR 97403-0175

Portland Office:
Phone: (503) 725-5711
Fax: (503) 725-5709
Mailing Address: PO Box 751 / Portland, OR 97207-0751
Delivery Address: 506 SW Mill, Suite 530 / Portland, OR 97201

PASS Website: http://pass.ous.edu/