

Mathematics – Grade 11

Adams County/Ohio Valley
Course of Study

Content Standard: Number, Number Sense and Operations Grade 11-12 Benchmarks: A. Demonstrate that vectors and matrices are systems having some of the same properties of the real number system. B. Develop an understanding of properties of and representation for addition and multiplication of vectors and matrices. Content Organizer: Number and Number Systems				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Determine what properties hold for matrix addition and matrix multiplication; e.g., use examples to show addition is commutative and when multiplication is not commutative.				

Mathematical Processes Standard – Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas. Mathematical processes are used in all content areas and should be incorporated within instruction and assessment of the content-specific standards and benchmarks.

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Content Standard: Number, Number Sense and Operations
Grade 11-12 Benchmarks: A. Demonstrate that vectors and matrices are systems having some of the same properties of the real number system. B. Develop an understanding of properties of and representation for addition and multiplication of vectors and matrices.
Content Organizer: Number and Number Systems

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
2. Determine what properties hold for vector addition and multiplication, and for scalar multiplication.				

Mathematical Processes Standard – Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas. Mathematical processes are used in all content areas and should be incorporated within instruction and assessment of the content-specific standards and benchmarks.

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Content Standard: Number, Number Sense and Operations
Grade 11-12 Benchmarks: C. Apply factorials and exponents, including fractional exponents, to solve practical problems. E. Represent and compute with complex numbers.
Content Organizer: Number and Number Systems

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
3. Represent complex numbers on the complex plane.				

Mathematical Processes Standard – Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas. Mathematical processes are used in all content areas and should be incorporated within instruction and assessment of the content-specific standards and benchmarks.

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Content Standard: Number, Number Sense and Operations

Grade 11-12 Benchmarks: D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases.

Content Organizer: Meaning of Operations

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. Use matrices to represent given information in a problem situation.				

Mathematical Processes Standard – Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas. Mathematical processes are used in all content areas and should be incorporated within instruction and assessment of the content-specific standards and benchmarks.

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Content Standard: Number, Number Sense and Operations				
Grade 11-12 Benchmarks: B. Develop an understanding of properties of and representation for addition and multiplication of vectors and matrices.				
Content Organizer: Meaning of Operations				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. Model, using the coordinate plane, vector addition and scalar multiplication.				

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Content Standard: Number, Number Sense and Operations
Grade 11-12 Benchmarks: D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases.
Content Organizer: Computation and Estimation

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
6. Compute sums, differences and products of matrices using paper and pencil calculations for simple cases, and technology for more complicated cases.				

Mathematical Processes Standard – Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas. Mathematical processes are used in all content areas and should be incorporated within instruction and assessment of the content-specific standards and benchmarks.

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Adams County/Ohio Valley
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Content Standard: Number, Number Sense and Operations				
Grade 11-12 Benchmarks: E. Represent and compute with complex numbers.				
Content Organizer: Computation and Estimation				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
7. Compute sums, differences, products and quotients of complex numbers.				

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Content Standard: Number, Number Sense and Operations Grade 11-12 Benchmarks: C. Apply factorials and exponents, including fractional exponents, to solve practical problems. Content Organizer: Computation and Estimation				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
8. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., $27^{2/3} = (27^{1/3})^2 = 9.$				

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Content Standard: Number, Number Sense and Operations

Grade 11-12 Benchmarks: D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases.

Content Organizer: Computation and Estimation

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
9. Use vector addition and scalar multiplication to solve problems.				

Mathematical Processes Standard – Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas. Mathematical processes are used in all content areas and should be incorporated within instruction and assessment of the content-specific standards and benchmarks.

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Content Standard: Measurement				
Grade 11 Benchmarks: A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.				
Content Organizer: Measurement Units				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Determine the number of significant digits in a measurement.				

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Mathematics – Grade 11

Adams County/Ohio Valley
Course of Study

Content Standard: Measurement

Grade 11 Benchmarks: A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.

B. Apply various measurement scales to describe phenomena and solve problems.

Content Organizer: Measurement Units

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
2. Use radian and degree angle measures to solve problems and perform conversions as needed.				

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Content Standard: Measurement

Grade 11 Benchmarks: A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.
C. Estimate and compute areas and volume in increasingly complex problem situations.

Content Organizer: Use Measurement Techniques and Tools

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
3. Derive a formula for the surface area of a cone as a function of its slant height and the circumference of its base.				

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Content Standard: Measurement

Grade 11 Benchmarks: A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.

C. Estimate and compute areas and volume in increasingly complex problem situations.

Content Organizer: Use Measurement Techniques and Tools

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. Calculate distances, areas, surface areas and volumes of composite three-dimensional objects to a specified number of significant digits.				

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Content Standard: Measurement				
Grade 11 Benchmarks: D. Solve problem situations involving derived measurements; e.g., density, acceleration.				
Content Organizer: Use Measurement Techniques and Tools				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. Solve real-world problems involving area, surface area, volume and density to a specified degree of precision.				

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Course of Study

Content Standard: Geometry and Spatial Sense				
Grade 11-12 Benchmarks: B. Represent transformations within a coordinate system using vectors and matrices.				
Content Organizer: Spatial Relationships				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Use polar coordinates to specify locations on a plane.				

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Content Standard: Geometry and Spatial Sense				
Grade 11-12 Benchmarks: B. Represent transformations within a coordinate system using vectors and matrices.				
Content Organizer: Transformations and Symmetry				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
2. Represent translations using vectors.				

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Content Standard: Geometry and Spatial Sense				
Grade 11-12 Benchmarks: B. Represent transformations within a coordinate system using vectors and matrices.				
Content Organizer: Transformations and Symmetry				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
3. Describe multiplication of a vector and a scalar graphically and algebraically, and apply to problem situations.				

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Course of Study

Content Standard: Geometry and Spatial Sense				
Grade 11-12 Benchmarks: A. Use trigonometric relationships to verify and determine solutions in problem situations.				
Content Organizer: Transformations and Symmetry				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines.				

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Mathematics – Grade 11

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Course of Study

Content Standard: Geometry and Spatial Sense

Grade 11-12 Benchmarks: A. Formally define geometric figures. D. Use coordinate geometry to represent and examine the properties of geometric figures.

E. Draw and construct representations of two-and three-dimensional geometric objects using a variety of tools such as straightedge, compass and technology.

Content Organizer: Visualization and geometric Models

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. Identify, sketch and classify the cross sections of three-dimensional objects.				

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Mathematics – Grade 11

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Course of Study

Content Standard: Patterns, Functions and Algebra				
Grade 11-12 Benchmarks: C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities.				
Content Organizer: Use Patterns, Relations, and Functions				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest.				

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Mathematics – Grade 11

Adams County/Ohio Valley
Course of Study

Content Standard: Patterns, Functions and Algebra

Grade 11-12 Benchmarks: C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities.

Content Organizer: Use Patterns, Relations, and Functions

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
2. Translate a recursive function into a closed form expression or formula for the n th term to solve a problem situation involving an interactive process; e.g., find the value of an annuity after 7 years.				

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Adams County/Ohio Valley
Course of Study

Content Standard: Patterns, Functions and Algebra				
Grade 11-12 Benchmarks: A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.				
Content Organizer: Use Patterns, Relations, and Functions				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. Identify families of functions with graphs that have rotation symmetry or reflection symmetry about the y-axis, x-axis, or $y=x$.				

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Course of Study

Content Standard: Patterns, Functions and Algebra

Grade 11-12 Benchmarks: A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.

Content Organizer: Use Algebraic Representations

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
6. Represent the inverse of a function symbolically and graphically as a reflection about $y = x$.				

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Course of Study

Content Standard: Patterns, Functions and Algebra

Grade 11-12 Benchmarks: D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices.

Content Organizer: Use Algebraic Representations

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
7. Model and solve problems with matrices and vectors.				

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Content Standard: Patterns, Functions and Algebra

Grade 11-12 Benchmarks: B. Use the quadratic formula to solve quadratic equations that have complex roots.

Content Organizer: Use Algebraic Representations

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
8. Solve equations involving radical expressions and complex roots.				

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Content Standard: Patterns, Functions and Algebra Grade 11-12 Benchmarks: D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. Content Organizer: Use Algebraic Representations				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
9. Solve 3 by 3 systems of linear equations by elimination and using technology, and interpret graphically what the solution means (a point, line, plane, or no solution).				

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Mathematics – Grade 11

Adams County/Ohio Valley
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Content Standard: Patterns, Functions and Algebra

Grade 11-12 Benchmarks: A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.

Content Organizer: Use Algebraic Representations

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
10. Describe the characteristics of the graphs of conic sections.				

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Mathematics – Grade 11

Adams County/Ohio Valley
Course of Study

Content Standard: Patterns, Functions and Algebra				
Grade 11-12 Benchmarks: A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.				
Content Organizer: Analyze Change				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation.				

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Mathematics – Grade 11

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Content Standard: Patterns, Functions and Algebra
Grade 11-12 Benchmarks: A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.
Content Organizer: Use Patterns, Relations, and Functions

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
3. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior.				

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Mathematics – Grade 11

Adams County/Ohio Valley
Course of Study

Content Standard: Patterns, Functions and Algebra

Grade 11-12 Benchmarks: A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior. A.

Content Organizer: Use Patterns, Relations, and Functions

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically with technology.				

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Mathematics – Grade 11

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Content Standard: Data Analysis & Probability

Grade 11-12 Benchmarks: C. Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.

Content Organizer: Data Collection

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Design a statistical experiment, survey or study for a problem; collect data for the problem; and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability, causation, correlation and standard deviation.				

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Mathematics – Grade 11

Adams County/Ohio Valley
Course of Study

Content Standard: Data Analysis & Probability Grade 11-12 Benchmarks: C. Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. Content Organizer: Data Collection				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
2. Describe the role of randomization in a well-designed study, especially as compared to a convenience sample, and the generalization of results from each.				

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Mathematics – Grade 11

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Course of Study

Content Standard: Data Analysis & Probability

Grade 11-12 Benchmarks: B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.

Content Organizer: Statistical Methods

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
3. Describe how a linear transformation of univariate data affects range, mean, mode and median.				

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Content Standard: Data Analysis & Probability				
Grade 11-12 Benchmarks: A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.				
Content Organizer: Statistical Methods				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. Create a scatterplot of bivariate data, identify trends, and find a function to model the data.				

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Mathematics – Grade 11

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Content Standard: Data Analysis & Probability Grade 11-12 Benchmarks: A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. Content Organizer: Statistical Methods				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation.				

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Content Standard: Data Analysis & Probability				
Grade 11-12 Benchmarks: B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.				
Content Organizer: Statistical Methods				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
6. Use technology to compute the standard deviation for a set of data, and interpret standard deviation in relation to the context or problem situation.				

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Content Standard: Data Analysis & Probability				
Grade 11-12 Benchmarks: A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.				
Content Organizer: Statistical Methods				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
7. Describe the standard normal curve and its general properties, and answer questions dealing with data assumed to be normal.				

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Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
8. Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions, and make predictions.				

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Mathematics – Grade 11

Adams County/Ohio Valley
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Content Standard: Data Analysis & Probability

Grade 11-12 Benchmarks: C. Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.

Content Organizer: Statistical Methods

Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
9. Evaluate validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques.				

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Mathematics – Grade 11

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Course of Study

Content Standard: Data Analysis & Probability				
Grade 11-12 Benchmarks: A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.				
Content Organizer: Probability				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
10. Understand and use the concept of random variable, and compute and interpret the expected value for a random variable in simple cases.				

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Mathematics – Grade 11

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Content Standard: Data Analysis & Probability				
Grade 11-12 Benchmarks: None				
Content Organizer: Probability				
Grade Level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
11. Examine statements and decisions involving risk; e.g., insurance rates and medical decisions.				

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