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Quantitative Reasoning

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Alta Quantitative Reasoning is a one- to two-semester course intended for students who require quantitative literacy skills. Many students pursuing a degree that has a general education math requirement will take this course. To develop this course, Knewton used four main sources of content: OpenStax Introductory Statistics, OpenStax Prealgebra, Washington Open Course Library, and videos from an Online Stat book developed by Rice University, University of Houston, and Tufts University, along with a team of Subject Matter Experts. The SMEs come from diverse backgrounds and are all accomplished academics in the field of mathematics, and have experience teaching and designing quantitative reasoning courses. Alta Quantitative Reasoning covers the breadth of quantitative reasoning topics, and also provides the necessary depth to ensure the course is manageable and engaging for instructors and students alike.

Alta Quantitative Reasoning has two instructional sequences for every learning objective, giving students multiple opportunities to learn new concepts. Between our text, video, and original SME content, we were able to solicit ideas from quantitative reasoning instructors from community colleges to Ph.D- granting universities. Alta Quantitative Reasoning provides a level of academic rigor, while also promoting relevance and accessibility for students. Knewton has added current and relevant contexts and examples to instruction and assessments.

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Quantitative Reasoning | Table of Contents

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  - Graph equations by plotting points
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    - Find the area of a triangle
    - Find the area of complex polygons

15.6 Circles

- Circles
    - Find the circumference and area of circles
    - Find the area of complex shapes including circles

15.7 Perimeter

- Perimeter and Applications
    - Calculate perimeter
    - Solve application problems involving area and perimeter

15.8 Volume and Surface Area

- Volume and Surface Area of Round Conventional Solids
    - Find the volume and surface area of rectangular solids
    - Find the volume of spheres, cylinders, and cones
    - Find the surface area of spheres and cylinders
- Volume and Surface Area of Edged Conventional Solids
    - Find the volume and surface area of non-rectangular prisms
    - Find the volume and surface area of a pyramid
    - Use Euler's polyhedron formula to understand the relationship between vertices, edges, and faces in a polyhedron

15.9 Transformations

- Reflections and Translations
    - Reflect a polygon across an axis
    - Translate a polygon given a translation vector
    - Perform a glide reflection on a polygon
- Rotations
    - Rotate a polygon given an angle of rotation and a center of rotation outside the polygon
    - Rotate a polygon given an angle of rotation and a center of rotation inside the polygon

15.10 Symmetry

- Symmetry
    - Determine if a polygon has reflective symmetry across an axis
    - Determine if a polygon has rotational symmetry about a point

Chapter 16: Graph Theory

16.1 Introduction to Graph Theory

- Modeling Relationships with Graphs
    - Recognize equivalent graphs
    - Construct a simple graph to model relationships using information given
- Basics of Graph Theory
    - Determine the degree of a vertex
    - Identify adjacent vertices

        - Recognize circuits
        - Distinguish between connected and disconnected graphs

16.2 Types of Circuits

- Euler Paths and Euler Circuits
    - Identify Euler paths and circuits
    - Determine if a graph has a circuit using Euler's theorem
    - Solve application problems using Euler's theorem
    - Implement Fleury's algorithm to find Euler circuits when they exist
- Hamilton Paths and Hamilton Circuits
    - Identify a Hamilton path and a Hamilton circuit for a given graph
    - Determine the number of Hamilton circuits in a graph

16.3 Weighted Graphs

- Weighted Graphs
    - Identify the optimal Hamilton circuit using the brute force method
    - Identify the optimal Hamilton circuit using the nearest neighbor method

16.4 Trees

- Trees
    - Identify a tree
    - Develop a spanning tree for a given graph

Chapter 17: Voting

17.1 Voting Methods - Identifying a Winner

- Voting Methods - Winning by Plurality
    - Identify elements of a preference table
    - Choose the winner of an election using the plurality method
    - Determine the winner of an election using the Borda count method
- Comparison Voting Methods
    - Decide the winner of an election using the plurality with elimination method
    - Select the winner of an election using the pairwise comparison method

17.2 Determine a Voting Systems Fairness

- Criterion of Voting Methods - Majority, Head to Head count, and Monotonicity
    - Determine a voting systems fairness using the majority criterion
    - Determine a voting systems fairness using the head to head count criterion
    - Determine a voting system's fairness using the monotonicity criterion
- Criterion and Comparison of Voting Methods
    - Determine a voting system's fairness using the irrelevant alternatives criterion
    - Choose the best voting system for a given election

17.3 Apportionment Methods

- Apportionment Methods by Calculating Quotas
    - Determine the standard quota for a state given its population
    - Calculate the lower and upper quotas for a state given its population
- Apportionment Methods - Hamilton, Jefferson, Adam and Webster Methods
    - Use Hamilton's method of determining apportionment
    - Use Jefferson's method of determining apportionment
    - Use Adam's method of determining apportionment
    - Use Webster's method of determining apportionment
- Flaws of the Apportionment Methods
    - Identify where the Alabama paradox occurs
    - Identify where the population paradox occurs
    - Identify where the new states paradox occurs
    - Choose the best apportionment system for a given region

Chapter 18: Basic Math Appendix

18.1 Introduction to Numbers

- Number Theory
    - Understand and identify prime and composite numbers
    - Find the GCF and LCM of two or more numbers
    - Find the prime factorization of a number

18.2 Operations with Integers

- The Integers
    - Understand integers and find opposites of numbers
    - Order and compare integers
    - Understand and evaluate absolute value
    - Evaluate an absolute value expression
- Working with Integers
    - Understand additive inverse
    - Understand distance in terms of absolute value
- Adding and Subtracting integers
    - Add integers
    - Subtract integers
    - Add and subtract integers
    - Add and subtract integers using order of operations
- Multiply and Divide integers
    - Multiply integers
    - Divide integers

18.3 Introduction to Rational Numbers

- The Rational Numbers
    - Understand fractions and their models
    - Find equivalent fractions
    - Convert between fractions and mixed numbers
- Converting between Representations
    - Convert decimals to fractions
    - Convert fractions to decimals
    - Convert a repeating decimal to a fraction

18.4 Operations with Fractions

- Operations on Fractions - Multiplication
    - Multiply fractions
    - Find reciprocals of fractions
    - Divide fractions
- Combining Fractions
    - Add and subtract fractions with like denominators
    - Add and subtract fractions with unlike denominators
    - Add or subtract fractions with a common denominator
    - Add or subtract fractions with different denominators
    - Add and subtract fractions in applications

18.5 Ratios

- Ratios and Proportions
    - Solve ratio and unit rate problems
    - Understand and find unit rate
    - Understand ratios
- Advanced Ratios
    - Solve fractional ratio problems
    - Understand fractional ratios

18.6 Sequences and Series

- Sequences of Rational Numbers
    - Write the terms of a sequence defined by an explicit formula
- Arithmetic Sequences
    - Find the common difference of an arithmetic sequence
    - Write terms of an arithmetic sequence
    - Write an explicit formula for an arithmetic sequence
- Sums of Series and Notation
    - Evaluate expressions using summation notation
    - Find the sum of a finite arithmetic series

- Geometric Sequences
    - Find the common ratio of a geometric sequence
    - Write terms of a geometric sequence
    - Write an explicit formula for a geometric sequence
    - Find the sum of a finite geometric series

18.7 Slopes of Equations of lines

- Slopes of Equations of lines
    - Write the equation of a line parallel to a given line
    - Write the equation of a line perpendicular to a given line