MATHEMATICS AND STATISTICS FOR HEALTH SCIENCES

Sean Saunders

Sheridan

Irene Lee

HUMBER

FEATURES

- Aligned to ONCAT's College System Exemplar Course Outlines: Standard & Advanced
- Interactive Online Resources
  - eTextbook
  - Lessons
  - Quizzes/Assignments
  - Solution Manual
  - PPTs
- Instructor Tools
  - Dashboards
  - Administrative Features

Vretta

COLLABORATION

MATHEMATICS
For Health Sciences

Irene Lee
Thambyrajah Kugathasan
Sean Saunders

STATISTICS
For Health Sciences

Sean Saunders
Thambyrajah Kugathasan
Irene Lee

ALONG WITH REVIEWERS FROM ONTARIO COLLEGES

Vretta

CONTENT

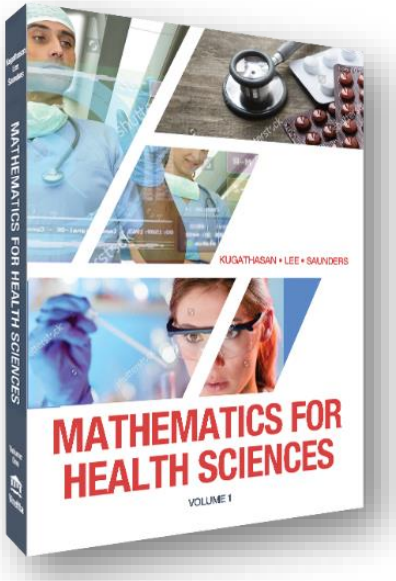
MATHEMATICS

Whole Numbers
Fractions and Decimals
Operations with Exponents and Integers
Basic Algebra
Ratios, Proportions, Percent, and Percent Changes
Units of Measurement
Basic Geometry
Graphs and Systems of Linear Equations
Exponents and Logarithms
Dosage Calculations and Medication Administration

STATISTICS

Introduction to Statistics
Measures of Central Tendency
Measures of Dispersion
Linear Correlation and Regression
Counting Techniques and Probability
Discrete Probability Distributions
Continuous Probability Distributions
Sampling Distributions & Central Limit Theorem
Estimation and Confidence Intervals
Hypothesis Testing

Vretta



1 WHOLE NUMBERS

1.1 Understanding Whole Numbers
1.2 Arithmetic Operations with Whole Numbers
1.3 Factors and Multiples
1.4 Powers, Square Roots, and Order of Operations

- Identify place values of whole numbers.
- Read, write, and round whole numbers correctly.
- Solve problems involving arithmetic operations on whole numbers.
- Determine the least common multiple and highest common factor.
- Perform order of operations with whole numbers.

SAMPLE

A large group of patients agreed to be part of a drug trial for a new drug treating sleeping disorders. 275 of the patients experienced side-effects, while 487 of the patients did not. Of the patients participating in the trial, 313 were male.

a. By rounding the values to the nearest ten, estimate the number of patients that participated in the drug trial.

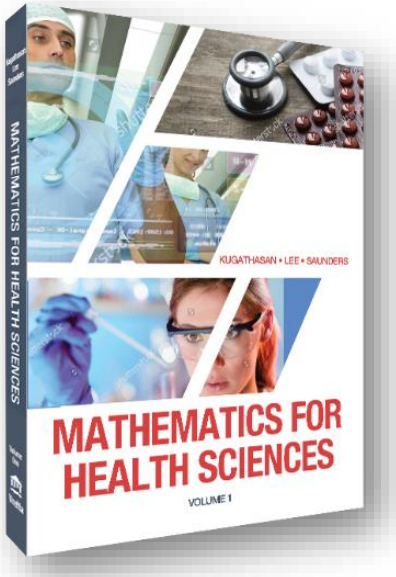
b. Using the original values, calculate the exact number of patients that participated in the drug trial.

c. By rounding the original values to the nearest ten, estimate how many participants were female.

d. Using the original values, calculate the exact number of participants who were female.

There are 22 nurses working in a certain hospital department. 10 of the nurses are wearing blue scrubs and 2 are wearing green scrubs. The rest of the nurses are wearing red scrubs. How many nurses are wearing red scrubs?

Vretta



2 FRACTIONS AND DECIMALS

2.1 Fractions
2.2 Arithmetic Operations with Fractions
2.3 Decimal Numbers
2.4 Arithmetic Operations with Decimal Numbers
2.5 Arithmetic Operations with Fractions and Decimal Numbers

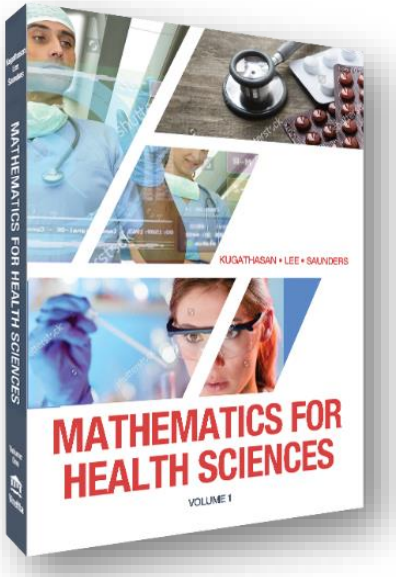
- Identify the types of fractions and perform computations using fractions.
- Read and write decimal numbers correctly.
- Round decimal numbers to the required place values.
- Solve problems involving fractions and decimal numbers.
- Determine the relationship between fractions and decimal numbers.
- Determine the Least or Lowest Common denominator (LCD).
- Perform arithmetic operations with fractions and decimal numbers.

SAMPLE

Cassidy had $\frac{5}{8}$ litres of formaldehyde and used $\frac{1}{3}$ litres of the solution while disinfecting equipment. What quantity of formaldehyde was left?

I bought 2 packs of aspirin at $5.60 per pack and 4 bottles of Benadryl at $6.77 per bottle. I gave the pharmacist a $50 bill. How much change should I get from the pharmacist?

Vretta



3 OPERATIONS WITH EXPONENTS AND INTEGERS

3.1 Exponents
3.2 Roots and Fractional Exponents
3.3 Arithmetic Operations with Signed Numbers
3.4 Significant Digits and Scientific Notation

- Identify the types and properties of exponents.
- Perform arithmetic operations with exponents.
- Identify types of roots.
- Perform computations with roots and fractional exponents.
- Perform arithmetic operations with signed numbers.
- Apply rounding rules using significant digits.
- Perform calculations involving scientific notation.

SAMPLE

Determine the number of significant digits in each of the following numbers and write them in scientific notation:

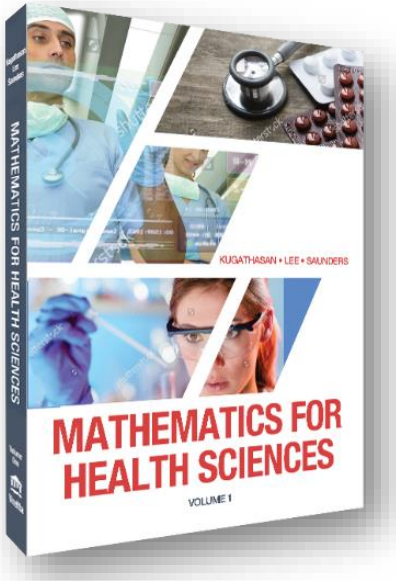
a. 7,100 b. 54.001 c. 0.0072

Perform the arithmetic operations and write the answers in scientific notation. Do not round the answer.

a. $4.65 \times 10^{14} + 9.95 \times 10^{12}$

b. $7.02 \times 10^{-2} + 6.95 \times 10^{-3}$

Vretta



4 BASIC ALGEBRA

4.1 Algebraic Expressions
4.2 Simple Algebraic Equations and Word Problems
4.3 Rearranging Equations and Formulas

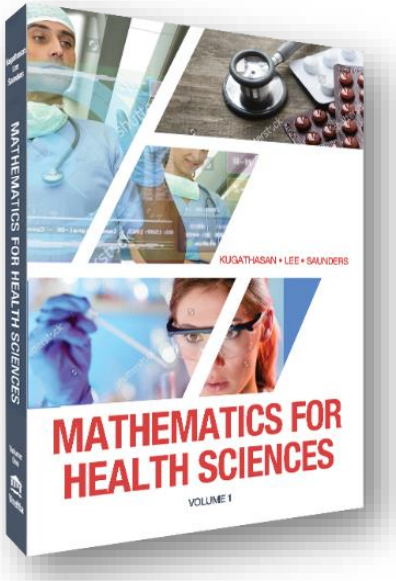
- Perform basic arithmetic operations on algebraic expressions.
- Setup basic linear equations with one variable.
- Solve linear equations with one variable using various arithmetic operations.
- Create, rearrange, and use equations to solve for unknown variables.

SAMPLE

How many litres of water need to be added to 30 litres of a 15% saline solution to make a saline solution that is 10% saline?

A pharmacist uses a markup rate of 115% for over-the-counter medications. If he purchased a shipment of Tylenol from a wholesaler for a unit price of $3.72 per bottle, what price should he sell each bottle of Tylenol for?

Vretta



5 RATIOS, PROPORTIONS, PERCENT, AND PERCENT CHANGE

5.1 Ratios
5.2 Proportions
5.3 Percent
5.4 Percent Change

- Identify ratios and rates to compare quantity.
- Set up ratios and use them to solve problems involving allocation and sharing of quantities.
- Solve problems by finding unknown quantities using proportions as equivalent sets of ratios.
- Allocate quantities on a proportionate basis using pro-ration as an application of proportions.
- Convert percents to equivalent fractions and decimal numbers.
- Solve percent problems using different methods.
- Calculate base, rate, or portion of quantities, expressed in percents.
- Identify the terminology used in percent change.
- Use percents to measure percent increase and decrease.

SAMPLE

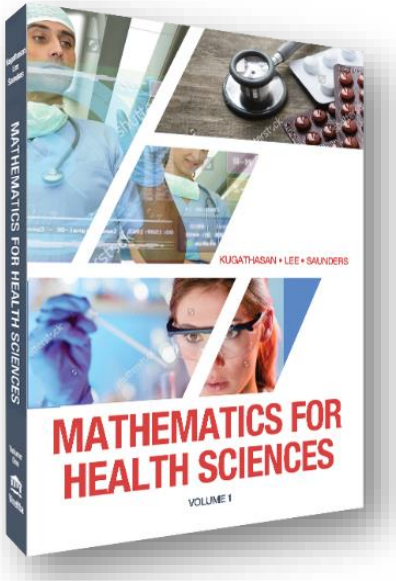
Emily was planning to make a phosphate buffer solution. She used 10 mL of potassium phosphate dibasic (K_2HPO_4) and 14 mL of mono-potassium phosphate (KH_2PO_4).

a. What is the ratio of the solutions in her buffer?

b. If she decides to reduce the quantity of mono-potassium phosphate to 4.5 mL, calculate the new ratio of the solutions in her buffer solution.

If blood-glucose meters that sell in stores for $30 each are being offered online for $24 each, calculate the percent discount offered online.

Vretta



6 UNITS OF MEASUREMENT

6.1 Metric System of Measurement
6.2 US Customary and Household System of Measurement
6.3 Conversion Between Metric and US Customary Units
6.4 Temperature Measures
6.5 Roman Numerals
6.6 Time Conversions

- Read, write, and interpret symbols and prefixes used in the metric and US Customary systems of units.
- Convert within metric units and within US Customary and household units of length, mass, and capacity.
- Convert between metric and US Customary units of length, mass, and capacity.
- Convert units of temperature between the Celsius scale, Fahrenheit scale, and Kelvin scale.
- Read and write Roman Numerals
- Understand the relationship between Military Time and Standard Time

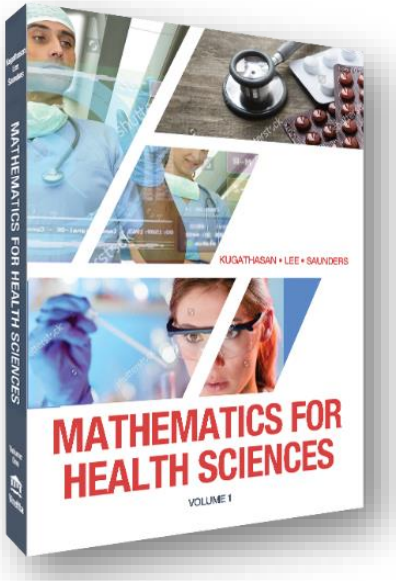
SAMPLE

A patient suffering from hypothermia has her temperature go up by 3 °C every 15 minutes with a heat blanket. If her current temperature is 89.5 °F, how long until the patient is at 37 °C?

An ambulance travelled 23 km to North York General Hospital. From there, it travelled another 125 mi to another hospital. Calculate the total distance travelled, in (a) kilometres and (b) miles.

An OR nurse ordered 31 gal of IV fluids. At the end of the night, 32 L of the solution are remaining. Calculate the quantity of IV fluid used, in (a) gallons and (b) litres.

Vretta



7 BASIC GEOMETRY

7.1 Lines and Angles
7.2 Classification and Properties of Plane Figures
7.3 Perimeters and Areas of Plane Geometric Figures
7.4 Surface Areas and Volumes of Common Solid Objects

- Recognize and use various notations to represent points, lines, line segments, rays, and angles.
- Classify angles and determine the angle relationships between parallel lines and transversals.
- Classify triangles, quadrilaterals, and polygons based on properties of their sides and angles.
- Apply properties of similar and congruent triangles in solving problems involving triangles.
- Compute the perimeter and area of plane figures, such as triangles, quadrilaterals, and circles.
- Compute the surface area and volume of common three-dimensional solid objects.

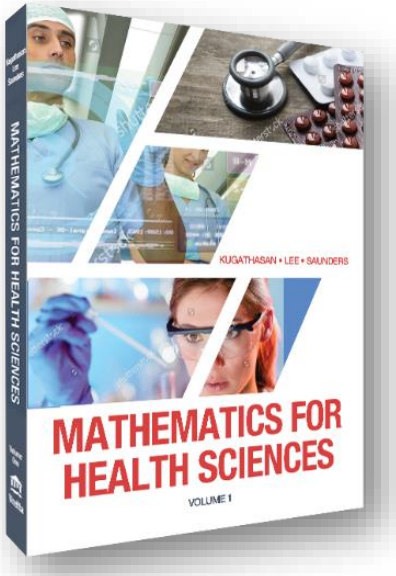
SAMPLE

Determining the Speed of a Lab Sample in a Centrifuge

A centrifuge has a diameter of 50.5 cm. If the centrifuge rotates at a maximum speed of 9° per millisecond (i.e. one-thousandth of a second), determine the speed at which the lab samples on the rim of the centrifuge are moving (in m/s, rounded to the nearest hundredth of a m).

A sling is fashioned from a bandage by paramedics for a patient with a dislocated shoulder. The bandage must be cut so that the longest edge is twice the distance from the hand to the shoulder. If the arm is 45 cm from the hand to the elbow and 35 cm from the elbow to the shoulder, what length must the longest edge of the bandage be cut to, assuming the elbow is at a 90° angle?

Vretta



8 GRAPHS AND SYSTEMS OF LINEAR EQUATIONS

8.1 Rectangular Coordinate System
8.2 Graphing Linear Equations
8.3 Solving Systems of Linear Equations with Two Variables, Graphically
8.4 Solving Systems of Linear Equations with Two Variables, Algebraically
8.5 Solving Application Problems With Two Unknowns

- Identify the basic terminology of rectangular coordinate systems.
- Express linear equations in standard form and slope-intercept form.
- Determine the slope and y-intercept of a line from its equation.
- Construct a table of values for a linear equation.
- Graph a linear equation using a table of values, the slope and y-intercept, and x- and y- intercepts.
- Determine the equation of a line from a graph.
- Determine the equations of parallel and perpendicular lines.
- Classify systems of linear equations.
- Solve linear systems graphically.
- Solve linear systems using the method of substitution or elimination.
- Setup and solve systems of linear equations to solve application problems.

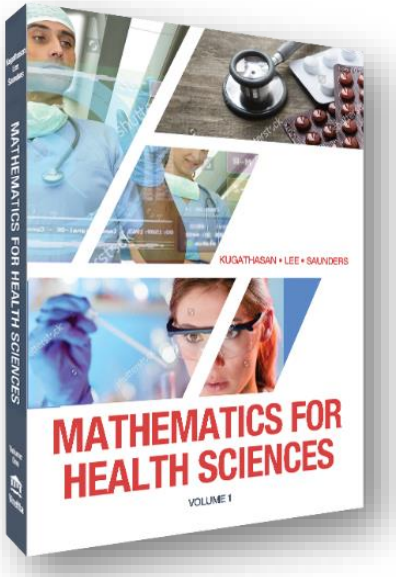
SAMPLE

Solving Mixture Problems

A chemist needs 2 L of an 8% solution of hydrochloric acid. He has a 10% hydrochloric solution and a 5% hydrochloric solution on hand. How many litres of each solution should he use to create his desired solution?

There are a total of 130 alcohol wipes (each costing 25 cents) and gauze strips (each costing 10 cents) in a supply room. If the materials are worth $27.70 in total, how many alcohol wipes and gauze strips are there?

Vretta



9 EXPONENTS AND LOGARITHMS

9.1 Exponents
9.2 Exponential Functions
9.3 Logarithms
9.4 Logarithmic Functions
9.5 Applications of Exponential and Logarithmic Functions

- Evaluate powers and exponential expressions using rules of exponents.
- Simplify basic exponential equations.
- Graph exponential functions.
- Identify common logarithms and understand properties of logarithmic expressions.
- Graph logarithmic functions.
- Solve application problems, including growth and decay, pH, hydrogen ion concentration, and sound waves.

SAMPLE

A scientist studying a bacterium notices that the bacteria double every 30 minutes. The initial culture contained 100 bacteria. How many bacteria will be present in 5 hours?

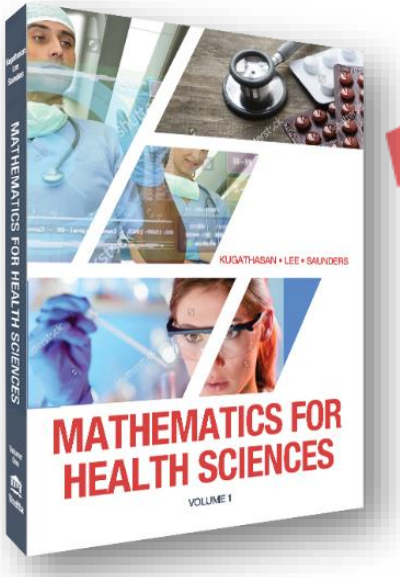
Find the $[H^+]$ concentration of the following substances:

a. Zinc hydroxide with a pH = 8.88

b. Lactic acid with a pH = 3.51

Find the pH of a chemical solution with a hydrogen ion concentration of $3.1627 \times 10_{-5}$, and determine whether it's an acidic or basic solution.

Vretta

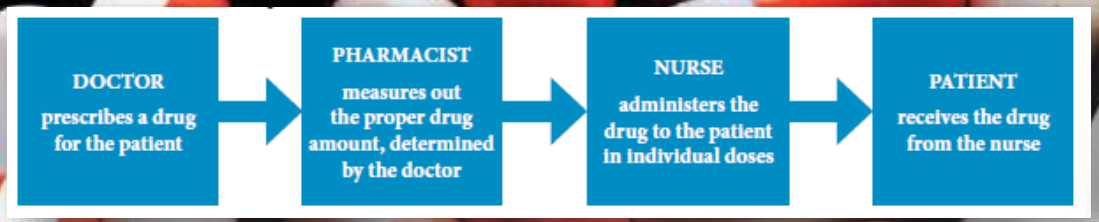


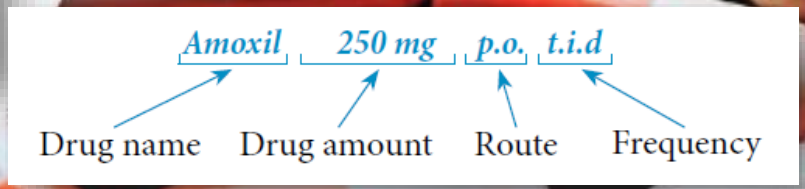
10 DOSAGE CALCULATIONS AND MEDICATION ADMINISTRATION

10.1 Medication Administration
10.2 Oral Medication
10.3 Syringes
10.4 Parenteral Medication - IM/SC Administration
10.5 Parenteral Medication - IV Administration

- Describe the "Six Rights" of safe medication administration.
- Interpret information found on drug labels and on drug orders.
- Calculate doses of oral medication, both in solid and liquid form.
- Calculate doses based on body weight and body surface area.
- Identify various types of syringes, and interpret the calibrations on syringes of various sizes.
- Calculate doses of parenteral medication administered into intramuscular and subcutaneous routes, both in liquid and powder form.
- Calculate doses of parenteral medication administered into intravenous routes, for both replacement/maintenance of fluids and piggyback drug infusions.

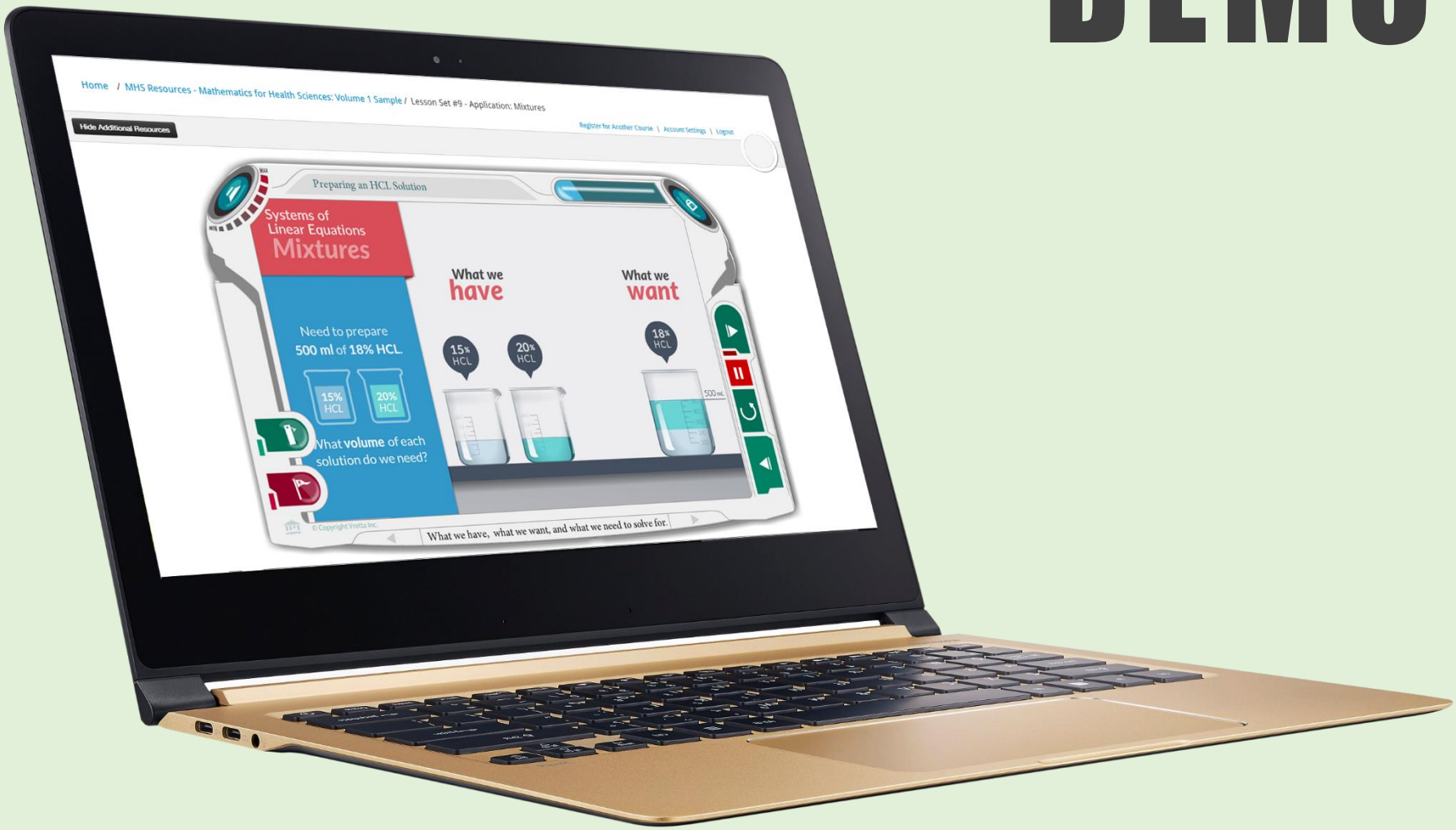
SAMPLE





Vretta

DEMO


Home / MHS Resources - Mathematics for Health Sciences: Volume 1 Sample / Lesson Set #9 - Application: Mixtures
Hide Additional Resources
Register for Another Course | Account Settings | Logout
Preparing an HCL Solution
Systems of Linear Equations
Mixtures
Need to prepare 500 ml of 18% HCL
15% HCL
20% HCL
What volume of each solution do we need?
What we have
What we want
15% HCL
20% HCL
18% HCL
500 mL
© Copyright Vretta Inc.
What we have, what we want, and what we need to solve for.

Vretta

STATISTICS
FOR HEALTH SCIENCES

AVAILABLE
BY OCTOBER 2017

- Introduction to Statistics
- Measures of Central Tendency
- Measures of Dispersion
- Linear Correlation and Regression
- Counting Techniques and Probability
- Discrete Probability Distributions
- Continuous Probability Distributions
- Sampling Distributions & Central Limit Theorem
- Estimation and Confidence Intervals
- Hypothesis Testing

Vretta

CONTACT

MHS@VRETTA.COM

sean.saunders@sheridancollege.ca

irene.lee@humber.ca

Vretta