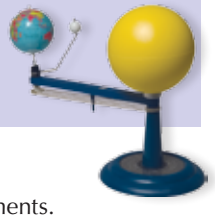
Astronomy

OVERVIEW

In *Astronomy,* students learn about the solar system and their relationship to it from a mathematical perspective. They investigate the Sun-Moon-Earth system and the characteristics, sizes, and distances of planets in the solar system. They construct a small refracting telescope and learn how it functions. They explore gravity and orbits, distinguish between weight and mass, and relate the kinetic energy equation to crater impacts.



STUDENT OBJECTIVES

- Use a planetarium model to investigate Sun-Moon-Earth movements.
- Relate gravity to orbits and distinguish between circular and elliptical orbits.
- Distinguish between weight and mass.
- Use the equation F = ma to calculate force, given mass.
- Learn the characteristics of the Sun and planets.
- Develop scale models comparing sizes and distances in the solar system.
- Explain the differences between reflecting and refracting optical telescopes and calculate magnification.
- Understand the kinetic energy equation KE = 1/2 mv^2 and relate it to crater impacts.
- Express solar system distances in scientific notation.

ACTIVITIES

Students complete three performance assessments: 1) Planetary Motions – use the planetarium model to explain Earth's rotation and revolution, day-night cycles, seasons, and tides; 2) Planetary Distance – develop a scale model of solar system distances and calculate distances using both scientific notation and astronomical units; and 3) Telescopes – identify the parts of a refracting telescope, explain functions of its lenses, define *focal length*, and explain its relationship to magnification.

Chemical Math

OVERVIEW

Are you curious how chemists determine what to put together and just what quantity to use when making things like perfume or medicine? In *Chemical Math*, students see the math that chemists use on a daily basis. Students balance equations, solve inequalities, use scientific notation, and learn basic chemistry concepts. Students use Avogadro's number and create Lewis dot structures of atoms. In *Chemical Math,* the numbers behind chemistry are the focus.

STUDENT OBJECTIVES

- Locate melting points on a number line.
- Calculate and compare densities of different substances.
- Learn the structure of an atom and of the periodic table.
- Express sizes of atoms and atom components using scientific notation.
- Calculate atomic mass based on isotope percentages.
- Explore the mole concept and Avogadro's number.
- Translate and solve algebraic expressions involving masses and moles of substances.
- Explore and solve examples of one- and two-step equations used in chemistry.
- Evaluate serial dilutions using inequalities.

ACTIVITIES

Students complete three performance assessments: 1) Scientific Notation – explain the structure of an atom, show a number in correct scientific notation, convert a given number to scientific notation, and explain the use of scientific notation in chemistry; 2) Balancing Equations – define *equation*, give an example, explain chemical equations, and balance a given equation; and 3) Solving Equations – solve given equations, solve given inequalities, and explain the process of serial dilution.

Confident Consumer

OVERVIEW

In *Confident Consumer*, students use problem-solving techniques to complete activities related to consumer education. Students calculate unit prices, evaluate sales and discounts provided by vendors, calculate the most economical way to purchase food and drinks for a party of 25, evaluate products based on strength and absorbency, and much more. Percents, ratios, and proportions are used extensively throughout *Confident Consumer*.

STUDENT OBJECTIVES

- Learn the definitions of *ratio* and *unit price* and use ratios to calculate unit prices.
- Calculate total price using unit prices and sizes and calculate usable unit prices.
- Use factors beyond unit prices to determine which items are the better value.
- Experiment with paper towels to test absorbency and strength.
- Estimate and calculate the area of three different-size pizzas.
- Calculate the amounts and kinds of pizza and soft drinks to buy for a party.
- Select the least expensive way to buy pizzas and soft drinks and calculate the total cost.
- Compare cell phone plans, graph costs, and determine per-minute costs.

ACTIVITIES

Students complete three performance assessments: 1) Unit Price – explain how to calculate unit price and its relationship to the concept of ratio, calculate unit price, and give examples of units of measure; 2) Paper Towels – determine absorbency and strength ratios for different brands of paper towels; and 3) Comparison Shopping – calculate area using pi and determine the amount of food needed for 25 guests and the best buy to obtain the desired amount of food.

Environmental Math

OVERVIEW

Triangles are the focus of *Environmental Math*, specifically how triangles are used by environmental scientists. Students utilize tools such as transits and protractors to create quadrats, determine distances, and calculate depth. Students also determine heights of objects – such as an inflatable palm tree – using similar triangles. Pythagoras would be proud to see students in action using his theorem.

STUDENT OBJECTIVES

- Use proportions to convert areas from square kilometers to square meters.
- Use both estimation and calculation to determine the square roots of given areas.
- Learn how quadrats are used in environmental science and use square roots to determine quadrat sizes.
- Learn types of angles and triangles and use a triangle to measure height of an object.
- Learn the Pythagorean Theorem, Distance Formula, and Midpoint Formula.
- Use triangles and proportions to calculate height and depth.
- Measure slope in degrees using a protractor and transit and calculate slope using rise over run.

ACTIVITIES

Students complete three performance assessments: 1) Squares and Square Roots – explain and give an example of a perfect square, calculate the square root of 500 using the calculator, and explain completed quadrats; 2) Angles and Triangles – draw and explain acute, obtuse, and right angles; draw a triangle and explain how it is named; explain the Pythagorean Theorem; and 3) Triangulation – sketch and explain how triangles can be used to find distances and heights.

Forensic Math

OVERVIEW

In *Forensic Math*, students create a theory about how a car may have been damaged in a fictional high school parking lot. Students use triangulation and polar coordinates to specify locations of objects within a crime scene and create scaled scene drawings. Tire impressions, footprints, and crime scene photos are used to piece together students' theories. Students find functions describing given relationships, determine slope, and determine the equation of a line.

STUDENT OBJECTIVES

- Create rough sketches of a scene using two different measurement methods.
- Learn about scale and convert measurements using a given scale.
- Use a final sketch to calculate actual distances.
- Learn about anthropometry.
- Record and graph foot length, height, and arm span measurements.
- Use functions to predict a person's height.
- Use the slope-intercept formula to determine the function of a line.
- Use skid speed and turning diameter formulas to analyze evidence.
- Put together a report stating a theory of what happened.

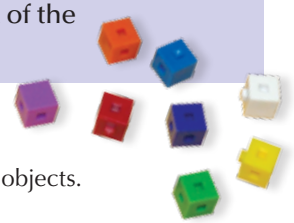
ACTIVITIES

Students complete three performance assessments: 1) Functions and Equations – solve and graph an equation and use the vertical line test to determine if a relation is a function; 2) Slope – determine the slope of a line, explain the slope-intercept formula, and demonstrate its use; and 3) Final Theory – identify excluded suspects and persons of interest and provide evidence to support a theory.

Geometric Packing

OVERVIEW

In *Geometric Packing*, students explore surface areas and volumes of various objects by packing materials. They explore spatial relationships and tessellations by transformations and the use of mathematical software. Students are introduced to the concept of slope, have tactile explorations of spherical packing, and find applications of Pascal's Triangle. They use the Fibonacci sequence to understand the greatest common divisor and the least common multiple. Finally, they explore the Pythagorean Theorem by building a scale replica of the Pyramid of Giza.



STUDENT OBJECTIVES

- Discover surface areas and volumes of three-dimensional objects.
- Create tessellations by the use of rotations, reflections, and translations.
- Investigate spherical packing and the applications of Pascal's Triangle in packing.
- Use the golden ratio, greatest common divisor, and least common multiple to understand architecture and designs.
- Utilize ancient Egyptian mathematics to explore the golden ratio and the Pythagorean Theorem.

ACTIVITIES

Students complete three performance assessments: 1) Surface Areas, Volumes, and Applications – find the surface area and volume of standard objects, recite the Honeycomb Conjecture, and define what a tessellation is; 2) The Fibonacci Sequence and Pascal's Triangle – find Fibonacci sequences, distinguish the greatest common divisor and the greatest common factor, and build Pascal's Triangle; and 3) Rotations, Reflections, Translations, and Dilations – rotate, reflect, and translate a figure, identify the coordinates on a coordinate grid, perform and explain dilations.

Home Makeover

OVERVIEW

DIY has made its way into the classroom. Students in *Home Makeover* put math skills to use as they plan an addition to a home. Students learn the basics involved in financing a home, designing roofs, building trusses, purchasing Sheetrock and floor covering, and calculating the amount of roofing, interior paint, and siding needed for the home.

STUDENT OBJECTIVES

- Explore different types of new homes as well as the costs and financing of a new home.
- Explore different styles of roofs and determine the slope of a roof.
- Explore different truss designs and construct a model truss.
- Determine the amount of roofing to purchase for a sample roof.
- Work with CAD software to design an addition to a home and a deck.
- Determine the amount of floor covering and Sheetrock needed for a room addition.
- Determine the area of the exterior of a house.
- Calculate the number of bags of cement to purchase for deck piers.

ACTIVITIES

Students complete three performance assessments: 1) Roof Trusses – explain how to find slope, explain how to determine brace locations in trusses, and construct a model truss; 2) Floor Plan Revisions – demonstrate and explain how to determine the dimensions of a room based on the floor plan; and 3) Deck Design – design a deck using CAD, evaluate the deck, and explain how a deck extends living area in a home.

Hotel Management

OVERVIEW

In *Hotel Management*, students explore the internal components of operating a hotel. They examine the functions of the five main hotel divisions – sales and marketing, rooms, engineering, housekeeping, and security. Students utilize math skills by calculating occupancy rates, RevPAR, ADR, room rates, and room discounts. Students are also responsible for the designing of a brochure advertising the grand opening of a new hotel.

STUDENT OBJECTIVES

- Examine the classification methods of lodging properties.
- Examine the roles of hotel staff – management, marketing, housekeeping, and security.
- Examine the purpose of a night audit and two statements monitoring financial performance.
- Calculate RevPAR, occupancy rates, room discounts, and room rates.
- Design a brochure advertising the grand opening of a new hotel.
- Explore yield management as it relates to demand and price.
- Complete basic calculations based on housekeeping data.
- Review evacuation and emergency procedures.

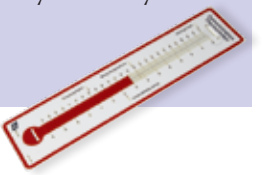
ACTIVITIES

Students complete three performance assessments: 1) RevPAR/Occupancy Rates – list the formulas used for determining occupancy rates and RevPAR and calculate occupancy rates and RevPAR of a given hotel; 2) Forecasting/Room Rates – explain the process used in most hotels for forecasting, give examples of direct and indirect expenses, and calculate a modified room rate; and 3) Hotel Brochure – produce a brochure that includes room rates as well as safety information.

Properties of Math

OVERVIEW

In *Properties of Math*, students use two-color counters, number lines, thermometers, and playing cards to learn the properties of addition, subtraction, multiplication, and division of integers. Students learn the rules for mathematical operations with integers and then apply those rules in engaging – and fun – ways as they solve problems.



STUDENT OBJECTIVES

- Locate integers on a number line and a thermometer.
- Identify the absolute value of an integer.
- Name pairs of opposites and order integers from least to greatest.
- Add, subtract, multiply, and divide integers.
- Demonstrate and identify the Commutative and Associative Properties of Addition and Multiplication.
- Demonstrate and identify the identity property of addition and multiplication.
- Demonstrate and identify the Zero Property of Multiplication.
- Simplify expressions using the order of operations.
- Solve equations.

ACTIVITIES

Students complete three performance assessments: 1) Expressions – order numbers on the real number line, define an expression, and find the absolute value of a number; 2) Multiplication and Division – define sets, solve expressions, and explore modular arithmetic; and 3) Prime Factorization – recite the Prime Factorization Theorem, define the greatest common divisor, find the prime factorization of a number, and reduce fractions.

Statistical Analysis

OVERVIEW

While engaged in *Statistical Analysis*, students create and conduct a survey and graph their data. Students explore histograms, box-and-whisker plots, stem-and-leaf plots, bar graphs, circle graphs, and line graphs. Students use data to display statistical information. Students complete probability activities ranging from tossing two-color counters and rolling dice to generating and using Pascal's Triangle to calculate experimental and theoretical probabilities. Students also use their knowledge of probability to create a fair game.

STUDENT OBJECTIVES

- Define terms related to statistics and probability.
- Explore uses and misuses of statistics in everyday situations.
- Complete statistical analyses in music and sports.
- Explore a variety of graphs including box-and-whisker plots and stem-and-leaf plots.
- Conduct a survey and graph data using a histogram and a box-and-whisker plot.
- Calculate experimental and theoretical probabilities.
- Conduct probability experiments using two-color counters and dice.
- Generate Pascal's Triangle and use the pattern to calculate probabilities.
- Create a fair game.

ACTIVITIES

Students complete three performance assessments: 1) Mean, Median, and Mode – define *mean*, *median*, and *mode*; identify uses of statistics; and construct a bar graph of shooting statistics; 2) Survey Statistics – construct a valid and unbiased survey and graph the data using a stem-and-leaf plot, a histogram, and a box-and-whisker plot; and 3) Probability – define *theoretical* and *experimental probability*, define *dependent* and *independent events*, and create a histogram.

Water Management

OVERVIEW

In *Water Management*, students explore the hydrologic cycle, the uses of water, types of water pollution, and the design and function of water treatment plants. They use a River Tank to estimate surface area and volume of water in a water body and to calculate flow rate. They use a watershed model to simulate runoff, groundwater activity, and pollution. They also calculate a water budget for a family, use a variety of graphs, and consider methods of water conservation.

STUDENT OBJECTIVES

- Learn characteristics and uses of water and explore the hydrologic cycle.
- Use 2-D and 3-D figures, including geometric nets, to estimate surface area and volume.
- Measure flow rate in a River Tank and learn how water managers use flow rate.
- Use a watershed model to demonstrate flow of runoff and how pollution travels through an ecosystem.
- Make polluted water and clean it using primary and secondary treatment processes.
- Calculate a family water budget and learn types and effects of water pollution and methods of water conservation.

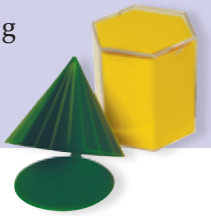
ACTIVITIES

Students complete three performance assessments: 1) Water Area and Volume – know 2-D and 3-D shapes, area equations, volume equations, and the process of estimating surface area and volume using geometric nets; 2) Flow Rate Calculations – explain and demonstrate how to calculate flow rates of running water; and 3) Calculating Water Budgets – explain the uses of graphs and show how to graph the results of a family water budget.

Weights & Measures

OVERVIEW

How many ounces of popcorn are contained in that large tub at the local multiplex? How many ounces of soda in the large cup? These are questions students answer as they learn about *Weights & Measures*. Students also learn to convert from international units to customary units of measurement and temperature using both dimensional analysis and formulas along the way.



STUDENT OBJECTIVES

- Learn about early forms of measurement.
- Identify the basic units of measurement in the Customary System.
- Use the Customary System of measurement to find the length, capacity, and weight of items.
- Convert from one unit to another using dimensional analysis.
- Use metric measurement to measure capacity, volume, and weight.
- Place three-dimensional shapes in order from least to greatest volume.
- Use a thermometer and formulas to convert from Celsius to Fahrenheit and vice versa.

ACTIVITIES

Students complete three performance assessments: 1) Customary Length and Ratios – demonstrate customary and international measurement and write ratios in a over b form; 2) Customary Capacity and Weight – measure ounces of popcorn and fluid ounces in drink containers; and 3) Converting Celsius and Fahrenheit – demonstrate how to convert temperatures using a demonstrational thermometer and formulas.