IMP 2 September &October: Solve It

IMP 2 November & December: Is There Really a Difference?

Topics to be covered

Interpreting data:

- Constructing and drawing inferences from charts, tables, and graphs, including frequency bar graphs and double-bar graphs
- Determining whether to accept or reject a null hypothesis
- Interpreting a statistical experiment and communicating the outcome
- Making hypotheses about larger populations by looking at sample data
- Understanding the consequences of rejecting a null hypothesis

Related concepts:

- Developing intuition about when differences in samples mean that the larger populations are likely to be different
- Reviewing normal distribution and standard deviation
- Understanding why neither numerical difference nor percentage difference is an adequate tool for measuring "weirdness "of data
- Using simulations to develop intuition and to obtain data about sample fluctuation
- Working with conditional probabilities

Setting up statistical investigations:

- Describing the characteristics of a good sample
- Designing and conducting a statistical experiment
- Distinguishing between data snooping and hypothesis testing
- Making null hypotheses
- Using proportional reasoning to analyze the consequences of a null hypothesis

The chi-square statistic:

- Calculating and interpreting the chi-square statistic in order to compare data from a real-world situation to a theoretical model
- Calculating and interpreting the chi-square statistic in order to compare two populations
- Developing intuition about the meaning of the chi-square statistic
- Interpreting the chi-square distribution curve as a probability chart
- Understanding some limitations in applying the chi-square statistic to a situation
- Using a simulation to estimate the chi-square distribution
- Using the chi-square statistic to make decisions

IMP 2 January & February: Do Bees Build It Best?

Topics to be covered

Area:

- Developing a formula for the area of a regular polygon with a given perimeter in terms of its number of sides
- Discovering formulas for the area of rectangles, triangles, parallelograms, and trapezoids
- Discovering that for a fixed perimeter, the more sides a regular polygon has, the greater its area
- Discovering that the ratio of the areas of similar figures is equal to the square of the ratio of their corresponding linear dimensions
- Establishing standard units for area, especially those based on units of length
- Establishing that a square has the largest area of all rectangles with a fixed perimeter
- Recognizing that the perimeter of a figure does not determine its area
- Understanding the role of units in measuring area

Pythagorean theorem:

- Applying the Pythagorean theorem in a variety of situations
- Discovering the Pythagorean theorem by comparing the areas of the squares constructed on the sides of a right triangle
- Proving the Pythagorean theorem using an area argument

Related concepts:

- Developing the general concept of an inverse function
- Examining the concept of tessellation and discovering which regular polygons tessellate
- Reviewing similarity
- Reviewing the angle-sum property for triangles
- Reviewing the triangle inequality
- Strengthening two- and three-dimensional spatial visualization skills

Surface area and volume:

- Developing principles relating the volume and surface area of a prism to the area and perimeter of its base
- Discovering that the ratio of the surface areas of similar solids is equal to the square of the ratio of their corresponding linear
- Establishing standard units for surface area and volume, especially those based on a unit of length
- Recognizing that the surface area of a solid figure does not determine its volume
- Understanding the role of units in measuring surface area and volume dimensions, and that the ratio of the volumes of similar solids is equal to the cube of the ratio of their corresponding linear dimensions

Trigonometry:

- Finding the ranges of the basic trigonometric functions (for acute angles)
- Reviewing right-triangle trigonometry
- Using the terminology and notation of inverse trigonometric functions

PA STANDARDS: 2.2A8, 2.2B1, 2.2B5, 2.2D, 2.2E, 2.2F, 2.3A1, 2.3A2, 2.4A3, 2.5A1, 2.5A2, 2.5A3, 2.5A4, 2.5B1, 2.5B2, 2.5B3, 2.5B4, 2.5C1, 2.5C2, 2.5C3, 2.5C4, 2.8A4, 2.8D4, 2.8R, 2.9C1, 2.9C2, 2.9D2, 2.9I, 2.10B1, 2.10B2, 2.10B3, 2.10B4, 2.10B5, 2.10B6

IMP 2 March & April: Cookies

Topics to be covered

Creating word problems:

- Creating a problem that can be solved by linear programming methods
- Creating problems that can be solved using two equations in two unknowns

Graphing:

- Finding the equation of a straight line and the inequality for a half plane
- Graphing individual linear inequalities and systems of linear inequalities
- Relating the idea of intersection of graphs to the idea of common solution of equations
- Using graphing calculators to draw feasible regions
- Using graphing calculators to estimate coordinates of points of intersection of graphs

Reasoning based on graphs:

- Combining various concepts and skills listed above to solve linear programming problems with two variables
- Examining how the parameters in a problem affect the solution
- Finding the maximum or minimum of a linear function over a region
- Seeing that setting a linear expression equal to different constants gives a family of parallel lines

Using variables to represent problems:

- Expressing and interpreting constraints using inequalities
- Expressing problem situations using systems of linear equations

Working with variables, equations, and inequalities:

- Developing and using a method for solving systems of two linear equations in two unknowns
- Finding equivalent equations or inequalities
- Recognizing inconsistent and dependent equations
- Solving linear equations for one variable in terms of another

PA STANDARDS: 2.1A7, 2.2A8, 2.2B1, 2.2F, 2.4A3, 2.5A1, 2.5A2, 2.5A3, 2.5A4, 2.5B1, 2.5B2, 2.5B3, 2.5B4, 2.5C1, 2.5C2, 2.5C3, 2.5C4, 2.8D1, 2.8D2, 2.8D3, 2.8D4, 2.8F1, 2.8F2, 2.8G2, 2.8H1, 2.8H2, 2.8H3, 2.8H4, 2.8K1, 2.8K2, 2.8K5, 2.8K6, 2.8L1, 2.8N4, 2.8R

IMP 2 May & June: All About Alice

Topics to be covered

Extending the operation of exponentiation:

- Defining the operation for an exponent of zero
- Defining the operation for fractional exponents
- Defining the operation for negative integer exponents

Graphing:

- Comparing graphs of exponential functions for different bases
- Comparing graphs of logarithmic functions for different bases
- Describing the graphs of exponential functions
- Describing the graphs of logarithmic functions

Laws of exponents:

- Developing the additive law of exponents
- Developing the law of repeated exponentiation

Logarithms:

- Making connections between exponential and logarithmic equations
- Understanding the meaning of logarithms

Scientific notation:

- Converting numbers from ordinary notation to scientific notation, and vice versa
- Developing principles for computation using scientific notation
- Using the concept of order of magnitude in estimation

Number Systems (IM 1) F; Number Systems (IM 2) A, B, D, E, F; Geometry (IM 2) E; Patterns, Algebra & Functions (IM 2) A, D, G, J; Problem Solving & Reasoning (IM 2) A, B, C; Communication (IM 2) A, B, C, D, E

PA STANDARDS: 2.1A3, 2.1A5, 2.1A6, 2.1A10, 2.1A12, 2.2A8, 2.2B1, 2.2B7, 2.2F, 2.4A3, 2.4B1, 2.4B2, 2.4C1, 2.4C2, 2.5A1, 2.5A2, 2.5A3, 2.5A4, 2.5B1, 2.5B2, 2.5B3, 2.5B4, 2.5C1, 2.5C2, 2.5C3, 2.5C4, 2.6C1, 2.8A4, 2.8D4, 2.8R, 2.8S