Standards for Mathematics

The National Council of Teachers of Mathematics’ *Principles and Standards for School Mathematics* can guide decisions for mathematics instruction. The outline below illustrates how *Figure This!* challenges support the NCTM Standards. Because many of the challenges incorporate several skills, you will notice that many support more than one standard. Depending on the situation, teachers may choose to emphasize different parts of the challenges. The lists below are only suggestions.

**Number and Operations:**

Instructional programs for middle grades students should enable all students to:

- **Understand numbers, ways of representing numbers, and the relationships among numbers**
  - Combination Locks (22)
  - Pigeonholes (28)
  - Radar Bills (41)
  - Bar Codes (51)
- **work flexibly with fractions, decimals, and percents**
  - Battling Averages (14)
  - Perplexing Percentages (17)
  - Gasoline Tanks (24)
  - Grape Juice Jungle (25)
  - Majority Vote (36)
  - Archeology (71)
- **use ratios and proportions for quantifying relationships**
  - Battling Averages (14)
  - Gasoline Tanks (24)
  - Grape Juice Jungle (25)
  - VCR (47)
  - Tan-Don’t Burn (65)
  - TV Ratings (72)
- **understand and use large numbers**
  - Beating Heart (2)
  - Double or Not (7)
  - Play Ball (11)
  - Tern Turn (18)
- **use factors and primes**
  - Combination Locks (22)
  - Tournaments (31)
  - Monday’s Child (38)
  - Seeing Stars (43)

- **represent and compare quantities with integers.**
  - Which Way? (6)
  - Thirteen! Oh No! (13)
  - Time Zones (46)

- **Understand the meaning of operations**
  - understand the effects of operations with fractions, decimals, and integers
    - Beanie Babies (16)
    - Movie Money (77)

- **Compute fluently and make reasonable estimates**
  - analyze algorithms
    - I Win (26)
    - Monday’s Child (38)
  - estimate reasonableness of answers
    - Big Trees (15)
  - solve problems with proportions
    - Access Ramps (33)
    - VCR (47)
    - Working Hours (48)
    - Glide Ratio (75)
Algebra
Instructional programs for middle grades students should enable all students to:

Understand patterns, relations, and functions
• analyze patterns with tables, graphs, words, and symbols
  Stamps (8)
  Play Ball (11)
  Rose Bowl (42)
  Table for 19 (44)
  Animal Ages (50)
  Gifts Galore (80)
• compare different forms of representations
  Body Mass (21)
  Table for 19 (44)
• identify functions as linear or nonlinear and contrast their properties
  Double or Not (7)
  Stamps (8)

Represent and analyze mathematical situations
• develop conceptual understanding of variables
  Body Mass (21)
• explore relationships between symbols and graphs of a line (slope and intercept)
  Stamps (8)
  Access Ramps (33)
  Glide Ratio (75)
• represent situations in symbols
  Body Mass (21)
  Smiles (30)
  Table for 19 (44)
  Number Tricks (60)
  Movie Money (77)
• generate equivalent forms for algebraic expressions and solve linear equations
  Smiles (30)
  Gone Fishing (58)

Use mathematical models for quantitative relationships
• solve contextualized problems using models
  Line Up! (1)
  Salaries (29)

Analyze change
• use graphs to analyze changes in linearity
  Double or Not (7)
  Salaries (29)

Geometry
Instructional programs for middle grades students should enable all students to:

Analyze two and three-dimensional shapes
  Popcorn (3)
  Don’t Fall In (4)
  Fire Hydrant (35)
  A Shard or Two (73)
• understand relationships among characteristics of similar figures
  Statue of Liberty (61)
• create and criticize arguments
  Don’t Fall In (4)
  Basketball Picks (20)

Apply transformations and use symmetry
• describe positions and orientations under informal transformations
  Envelopes (57)
  Japanese Floors (59)
  Morphing (79)
• examine congruence, similarity, and symmetry under transformations
  Upside Down? (5)
  Mirror, Mirror (9)
  Putt-Putt (40)

Use visualization and spatial reasoning
• represent three dimensional objects with two-dimensional representations
  Mirror, Mirror (9)
  Putt-Putt (40)
  Decorating Boxes (55)
  Visualizing (76)
• use networks to solve problems
  Which Way? (6)
• use geometric models of algebraic relationships
  Fractals (23)
  Three Squares (45)
• apply geometric ideas outside the classroom
  Popcorn (3)
  Don’t Fall In (4)
  Upside Down? (5)
  Map Coloring (37)
  Angolan Sand Pictures (49)
  Cut the Cake (54)
Measurement
Instructional programs for middle grades students should enable all students to:

**Understand measurable attributes of objects**
- understand metric and customary systems
  - Faster? (34)
  - Drip Drops (56)
- understand relationships among units
  - What's My Angle? (10)
  - Faster? (34)
  - Drip Drops (56)
  - Airport Runways (66)
- use appropriate units of measurement to find angles, length, area, volume
  - Popcorn (3)
  - Mirror, Mirror (9)
  - What's My Angle? (10)
  - Big Trees (15)
  - Patios (39)
  - Putt-Putt (40)

**Apply appropriate techniques, tools and formulas**
- use common benchmarks to estimate measurements
  - Line Up! (1)
  - Beating Heart (2)
  - Popcorn (3)
  - What's My Angle? (10)
  - Big Trees (15)
  - Time Zones (46)
  - When in Rome (67)
- use formulas for circumference of circles and area of common shapes
  - Big Trees (15)
  - Fractals (23)
  - Windshield Wipers (32)
  - Patios (39)
- develop strategies to find surface area/volume
  - Popcorn (3)
  - Chocolate (12)
  - Cut the Cake (54)
  - Keeping Cool (62)
- solve problems using scale factors, using ratio and proportion
  - Fractals (23)
  - VCR (47)
  - Statute of Liberty (61)
- solve problems with rates and derived measurements
  - Line Up! (1)
  - Beating Heart (2)
  - Tern Turn (18)
  - Gasoline Tanks (24)
  - The Race (74)

Data Analysis and Probability
Instructional programs for middle grades students should enable all students to:

- formulate questions, collect, organize, and display data to answer them
  - Salaries (29)
  - Capture-Recapture (52)
- Collect data about populations
  - Capture-Recapture (52)
  - Wheel of Fortune (64)
- Create and use graphical representations
  - Basketball Picks (20)
  - Life Expectancy (27)
  - Working Hours (48)
  - Census (53)

**Use appropriate statistical methods to analyze data**
- find and use measures of center and spread
  - Battling Averages (14)
  - Bowl ‘Em Over (78)
- understand correspondence between a data set and its graphs
  - Census (53)
  - Soda (70)

**Develop and evaluate inferences**
- use observations about differences between samples
  - Life Expectancy (27)
  - Salaries (29)
- make conjectures about relationships between two variables
  - Life Expectancy (27)
  - Salaries (29)
  - Bones (68)
  - Archeology (71)

**Understand and apply concepts of probability**
- understand complementary and mutually exclusive events
  - Matching Birthdays (63)
- use probability to make and test conjectures about experiments
  - Wheel of Fortune (64)
- compute probabilities for simple and compound events
  - Two Points (19)
  - I Win (26)
  - Majority Vote (36)
  - Capture-Recapture (52)
  - Misaddressed (69)