

# Learning Through Art at the MFAH Middle School

## *MATH TEK Alignment*



### 1. *Evolutionary Balance, 1977*

#### Writing Fractions and Percentages

##### TEKS:

- 6.4 Proportionality.** The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:
- (E) represent ratios and percents with concrete models, fractions, and decimals
  - (G) generate equivalent forms of fractions, decimals, and percents using real-world problems, including problems that involve money
- 6.5 Proportionality.** The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:
- (C) use equivalent fractions, decimals, and percents to show equal parts of the same whole.
- 7.4 Proportionality.** The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to:
- (D) solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems
- 8.2 Number and operations.** The student applies mathematical process standards to represent and use real numbers in a variety of forms. The student is expected to:
- (C) convert between standard decimal notation and scientific notation

### 2. *Portrait of a Boy, c.1758–1760*

#### Writing Equations from Patterns

##### TEKS:

- 6.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (A) apply mathematics to problems arising in everyday life, society, and the workplace;
  - (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
  - (C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;
  - (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
  - (E) create and use representations to organize, record, and communicate mathematical ideas;
  - (F) analyze mathematical relationships to connect and communicate mathematical ideas; and
  - (G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.
- 7.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (A) apply mathematics to problems arising in everyday life, society, and the workplace;
  - (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
  - (C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;
  - (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

- (E) create and use representations to organize, record, and communicate mathematical ideas;
- (F) analyze mathematical relationships to connect and communicate mathematical ideas; and
- (G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

**8.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

- (A) apply mathematics to problems arising in everyday life, society, and the workplace;
- (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
- (C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
- (E) create and use representations to organize, record, and communicate mathematical ideas;
- (F) analyze mathematical relationships to connect and communicate mathematical ideas; and
- (G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

### 3. *Still Life with Golden Bream, 1808–1812*

#### Write Two-Step Equations

TEKS:

**6.10 Expressions, equations, and relationships.** The student applies mathematical process standards to use equations and inequalities to solve problems. The student is expected to:

- (A) model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts; and
- (B) determine if the given value(s) make(s) one-variable, one-step equations or inequalities true.

**7.10 Expressions, equations, and relationships.** The student applies mathematical process standards to use one-variable equations and inequalities to represent situations. The student is expected to:

- (A) write one-variable, two-step equations and inequalities to represent constraints or conditions within problems;
- (B) represent solutions for one-variable, two-step equations and inequalities on number lines; and
- (C) write a corresponding real-world problem given a one-variable, two-step equation or inequality.

### 4. *The Japanese Footbridge, Giverny, c. 1922*

#### Understanding Multiplication and Division

TEKS:

**6.4 Proportionality.** The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:

- (E) represent ratios and percents with concrete models, fractions, and decimals;
- (F) represent benchmark fractions and percents such as 1%, 10%, 25%,  $33\frac{1}{3}\%$ , and multiples of these values using 10 by 10 grids, strip diagrams, number lines, and numbers;
- (G) generate equivalent forms of fractions, decimals, and percents using real-world problems, including problems that involve money

**6.5 Proportionality.** The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:

- (A) represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions;
- (B) solve real-world problems to find the whole given a part and the percent, to find the part given the whole and the percent, and to find the percent given the part and the whole, including the use of concrete and pictorial models; and
- (C) use equivalent fractions, decimals, and percents to show equal parts of the same whole.

**7.4 Proportionality.** The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to:

- (D) solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems

**8.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

- (E) create and use representations to organize, record, and communicate mathematical ideas;
- (F) analyze mathematical relationships to connect and communicate mathematical ideas

## 5. *Necklace, c. 1890*

### Transformational Geometry

#### TEKS:

**6.11 Measurement and data.** The student applies mathematical process standards to use coordinate geometry to identify locations on a plane. The student is expected to graph points in all four quadrants using ordered pairs of rational numbers.

**8.10 Two-dimensional shapes.** The student applies mathematical process standards to develop transformational geometry concepts. The student is expected to:

- (A) generalize the properties of orientation and congruence of rotations, reflections, translations, and dilations of two-dimensional shapes on a coordinate plane;
- (B) differentiate between transformations that preserve congruence and those that do not;
- (C) explain the effect of translations, reflections over the x- or y-axis, and rotations limited to  $90^\circ$ ,  $180^\circ$ ,  $270^\circ$ , and  $360^\circ$  as applied to two-dimensional shapes on a coordinate plane using an algebraic representation

## 6. *The Sorrow of the Nibelungen/Der Nibelungen Leid, 1973*

### Solve Area Formulas

#### TEKS:

**6.8 Expressions, equations, and relationships.** The student applies mathematical process standards to use geometry to represent relationships and solve problems. The student is expected to:

- (A) extend previous knowledge of triangles and their properties to include the sum of angles of a triangle, the relationship between the lengths of sides and measures of angles in a triangle, and determining when three lengths form a triangle;
- (B) model area formulas for parallelograms, trapezoids, and triangles by decomposing and rearranging parts of these shapes;
- (C) write equations that represent problems related to the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers; and
- (D) determine solutions for problems involving the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers.

**7.9 Expressions, equations, and relationships.** The student applies mathematical process standards to solve geometric problems. The student is expected to:

- (C) determine the area of composite figures containing combinations of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles

**8.6 Expressions, equations, and relationships.** The student applies mathematical process standards to develop mathematical relationships and make connections to geometric formulas. The student is expected to:

- (C) use models and diagrams to explain the Pythagorean theorem.

## 7. *Saint Paul Writing His Epistles, c. 1618–1620*

### Shape and Scale

#### TEKS:

**6.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

- (A) apply mathematics to problems arising in everyday life, society, and the workplace;
- (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
- (C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;

- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
- (E) create and use representations to organize, record, and communicate mathematical ideas;
- (F) analyze mathematical relationships to connect and communicate mathematical ideas; and
- (G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

**7.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

- (A) apply mathematics to problems arising in everyday life, society, and the workplace;
- (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
- (C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
- (E) create and use representations to organize, record, and communicate mathematical ideas;
- (F) analyze mathematical relationships to connect and communicate mathematical ideas; and
- (G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

**7.5 Proportionality.** The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships. The student is expected to:

- (C) solve mathematical and real-world problems involving similar shape and scale drawings.

**8.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

- (A) apply mathematics to problems arising in everyday life, society, and the workplace;
- (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
- (C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
- (E) create and use representations to organize, record, and communicate mathematical ideas;
- (F) analyze mathematical relationships to connect and communicate mathematical ideas; and
- (G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

**8.3 Proportionality.** The student applies mathematical process standards to use proportional relationships to describe dilations. The student is expected to:

- (A) generalize that the ratio of corresponding sides of similar shapes are proportional, including a shape and its dilation

**8.12 Personal financial literacy.** The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

- (F) analyze situations to determine if they represent financially responsible decisions and identify the benefits of financial responsibility and the costs of financial irresponsibility

## 8. Tapestry, 2007

### Random Sampling Method

TEKS:

**6.2 Number and operations.** The student applies mathematical process standards to represent and use rational numbers in a variety of forms. The student is expected to:

- (A) classify whole numbers, integers, and rational numbers using a visual representation such as a Venn diagram to describe relationships between sets of numbers

- 7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:
- (F) use data from a random sample to make inferences about a population
- 7.12 Measurement and data.** The student applies mathematical process standards to use statistical representations to analyze data. The student is expected to:
- (B) use data from a random sample to make inferences about a population; and
  - (C) compare two populations based on data in random samples from these populations, including informal comparative inferences about differences between the two populations.
- 8.11 Measurement and data.** The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:
- (C) simulate generating random samples of the same size from a population with known characteristics to develop the notion of a random sample being representative of the population from which it was selected.

## 9. Sketch 160A, 1912

### Mean, Median, Mode and Range

#### TEKS:

- 6.3 Number and operations.** The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions. The student is expected to:
- (D) add, subtract, multiply, and divide integers fluently; and
  - (E) multiply and divide positive rational numbers fluently.
- 6.12 Measurement and data.** The student applies mathematical process standards to use numerical or graphical representations to analyze problems. The student is expected to:
- (D) summarize categorical data with numerical and graphical summaries, including the mode, the percent of values in each category (relative frequency table), and the percent bar graph, and use these summaries to describe the data distribution.
- 7.3 Number and operations.** The student applies mathematical process standards to add, subtract, multiply, and divide while solving problems and justifying solutions. The student is expected to:
- (A) add, subtract, multiply, and divide rational numbers fluently; and
  - (B) apply and extend previous understandings of operations to solve problems using addition, subtraction, multiplication, and division of rational numbers.
- 8.11 Measurement and data.** The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:
- (B) determine the mean absolute deviation and use this quantity as a measure of the average distance data are from the mean using a data set of no more than 10 data points

## 10. The Chicken, c.1926

### Comparing and Contrasting Graphs

#### TEKS:

- 6.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate
- 6.5 Proportionality.** The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:
- (A) represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions
- 6.6 Expressions, equations, and relationships.** The student applies mathematical process standards to use multiple representations to describe algebraic relationships. The student is expected to:
- (A) identify independent and dependent quantities from tables and graphs

- 7.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate
- 7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:
- (G) solve problems using data represented in bar graphs, dot plots, and circle graphs, including part-to-whole and part-to-part comparisons and equivalents
- 8.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate

## 11. from the series 11:02 Nagasaki/Beer Bottle After the Atomic Bomb Explosion, 1961

### Comparing and Contrasting Graphs

#### TEKS:

- 6.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate
- 6.5 Proportionality.** The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:
- (A) represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions
- 6.6 Expressions, equations, and relationships.** The student applies mathematical process standards to use multiple representations to describe algebraic relationships. The student is expected to:
- (A) identify independent and dependent quantities from tables and graphs
- 7.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate
- 7.6 Proportionality.** The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:
- (G) solve problems using data represented in bar graphs, dot plots, and circle graphs, including part-to-whole and part-to-part comparisons and equivalents
- 8.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate

## 12. Abstraction, c. 1914

### Creating Graphs from Data Sets

#### TEKS:

- 6.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (E) create and use representations to organize, record, and communicate mathematical ideas
- 6.3 Number and operations.** The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions. The student is expected to:
- (D) add, subtract, multiply, and divide integers fluently

- 6.12 Measurement and data.** The student applies mathematical process standards to use numerical or graphical representations to analyze problems. The student is expected to:
- (A) represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots;
  - (B) use the graphical representation of numeric data to describe the center, spread, and shape of the data distribution;
  - (C) summarize numeric data with numerical summaries, including the mean and median (measures of center) and the range and interquartile range (IQR) (measures of spread), and use these summaries to describe the center, spread, and shape of the data distribution; and
  - (D) summarize categorical data with numerical and graphical summaries, including the mode, the percent of values in each category (relative frequency table), and the percent bar graph, and use these summaries to describe the data distribution.
- 7.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (E) create and use representations to organize, record, and communicate mathematical ideas
- 7.3 Number and operations.** The student applies mathematical process standards to add, subtract, multiply, and divide while solving problems and justifying solutions. The student is expected to:
- (A) add, subtract, multiply, and divide rational numbers fluently; and
  - (B) apply and extend previous understandings of operations to solve problems using addition, subtraction, multiplication, and division of rational numbers.
- 8.1 Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (E) create and use representations to organize, record, and communicate mathematical ideas

## 13. *Red Hill and White Shell, 1938*

### Golden Ratio

#### TEKS:

- 6.4 Proportionality.** The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:
- (B) apply qualitative and quantitative reasoning to solve prediction and comparison of real-world problems involving ratios and rates;
  - (D) give examples of rates as the comparison by division of two quantities having different attributes, including rates as quotients;
  - (E) represent ratios and percents with concrete models, fractions, and decimals;
  - (G) generate equivalent forms of fractions, decimals, and percents using real-world problems, including problems that involve money
- 6.5 Proportionality.** The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:
- (A) represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions;
  - (B) solve real-world problems to find the whole given a part and the percent, to find the part given the whole and the percent, and to find the percent given the part and the whole, including the use of concrete and pictorial models; and
  - (C) use equivalent fractions, decimals, and percents to show equal parts of the same whole.
- 7.4 Proportionality.** The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to:
- (C) determine the constant of proportionality ( $k = y/x$ ) within mathematical and real-world problems;
  - (D) solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems
- 7.5 Proportionality.** The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships. The student is expected to:
- (A) generalize the critical attributes of similarity, including ratios within and between similar shapes;
  - (B) describe  $\pi$  as the ratio of the circumference of a circle to its diameter; and
  - (C) solve mathematical and real-world problems involving similar shape and scale drawings.
- 8.3 Proportionality.** The student applies mathematical process standards to use proportional relationships to describe dilations. The student is expected to:
- (A) generalize that the ratio of corresponding sides of similar shapes are proportional, including a shape and its dilation

**8.7 Expressions, equations, and relationships.** The student applies mathematical process standards to use geometry to solve problems. The student is expected to:

- (C) use the Pythagorean Theorem and its converse to solve problems

## 14. Woman with a Large Hat, 1962

### Determining the Area of Composite Figures

#### TEKS:

**6.8 Expressions, equations, and relationships.** The student applies mathematical process standards to use geometry to represent relationships and solve problems. The student is expected to:

- (A) extend previous knowledge of triangles and their properties to include the sum of angles of a triangle, the relationship between the lengths of sides and measures of angles in a triangle, and determining when three lengths form a triangle;
- (B) model area formulas for parallelograms, trapezoids, and triangles by decomposing and rearranging parts of these shapes;
- (C) write equations that represent problems related to the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers; and
- (D) determine solutions for problems involving the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers.

**7.9 Expressions, equations, and relationships.** The student applies mathematical process standards to solve geometric problems. The student is expected to:

- (B) determine the circumference and area of circles;
- (C) determine the area of composite figures containing combinations of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles

---

The Learning Through Art program at the Museum of Fine Arts, Houston, receives generous funding from the Kinder Foundation; Mercantil Commercebank; and NORDSTROM.

All Learning and Interpretation programs at the Museum of Fine Arts, Houston, receive endowment income from funds provided by the Louise Jarrett Moran Bequest; Caroline Wiess Law; the William Randolph Hearst Foundation; The National Endowment for the Humanities; the Fondren Foundation; BMC Software, Inc.; the Wallace Foundation; the Neal Myers and Ken Black Children's Art Fund; the Favrot Fund; and Gifts in honor of Beth Schneider.