EC-6 Core Subjects: Math
TEXES #291 Review

Domain II-Mathematics

- Approximately 18% of the test
- 60 minutes
- 47 test items
- Averages 77 seconds per question

Math Competencies

- Competency 001 – Mathematics Instruction
- Competency 002 – Number Concepts & Operations
- Competency 003 – Patterns and Algebra
- Competency 004 – Geometry and Measurement
- Competency 005 – Probability and Statistics
- Competency 006 – Mathematical Processes
Competency 001: Mathematics Instruction

The teacher understands how students learn mathematical skills and uses that knowledge to plan, organize and implement instruction and assess learning.

The beginning teacher:

A. Plans appropriate instructional activities for all students by applying research-based theories and principles of learning mathematics.

B. Employs instructional strategies that build on the linguistic, cultural and socioeconomic diversity of students and that relate to students’ lives and communities.

C. Plans and provides developmentally appropriate instruction that establishes transitions between concrete, symbolic and abstract representations of mathematical knowledge and that builds on students’ strengths and addresses their needs.

D. Understands how manipulatives and technological tools can be used appropriately to assist students in developing, comprehending and applying mathematical concepts.

E. Creates a learning environment that motivates all students and actively engages them in the learning process by using a variety of interesting, challenging and worthwhile mathematical tasks in individual, small-group and large-group settings.

F. Uses a variety of tools (e.g., counters, standard and nonstandard units of measure, rulers, protractors, scales, measuring containers, money, calculators, software) to strengthen students’ mathematical understanding.

G. Implements a variety of instructional methods and tasks that promote students’ ability to do the mathematics described in the Texas Essential Knowledge and Skills (TEKS).

H. Develops clear learning goals to plan, deliver, assess and reevaluate instruction based on the mathematics in the Texas Essential Knowledge and Skills (TEKS).

I. Helps students make connections between mathematics and the real world, as well as between mathematics and other disciplines such as art, music, science, social science and business.

J. Uses a variety of questioning strategies to encourage mathematical discourse and to help students analyze and evaluate their mathematical thinking.

K. Uses a variety of formal and informal assessments and scoring procedures to evaluate mathematical understanding, common misconceptions and error patterns.

L. Understands the relationship between assessment and instruction and knows how to evaluate assessment results to design, monitor, and modify instruction to improve mathematical learning for all students, including English-language learners.

M. Understands the purpose, characteristics, and uses of various assessments in mathematics including formative and summative assessments.

N. Understands how mathematics is used in a variety of careers and professions and plans instruction that demonstrates how mathematics is used in the workplace.
Competency 001: Mathematics Instruction
The teacher understands how students learn mathematical skills and uses that knowledge to plan, organize and implement instruction and assess learning.

Problem:
A kindergarten teacher places a bowl of marbles, a melon scooper, and an ice cube tray at a math center. The students are instructed to use the melon scooper to place one marble in a given number of compartments of the ice cube tray. The mathematical concept the teacher is most likely teaching is –

A. Addition
B. Subtraction
C. One to one correspondence
D. Sorting

The teacher understands how students learn mathematical skills and uses that knowledge to plan, organize and implement instruction and assess learning.

Answer:
C is the correct answer.
• The teacher is most likely helping the students develop the concept of one-to-one correspondence by having them place one marble in a compartment for each given number.

Competency 002: Number Concepts & Operations
The beginning teacher:
A. Analyzes, creates, describes, compares and models relationships between number properties, operations and algorithms for the four basic operations involving integers, rational numbers and real numbers, including real-world situations.
B. Demonstrates an understanding of equivalency among different representations of rational numbers and between mathematical expressions.
C. Selects appropriate representations of real numbers (e.g., fractions, decimals, percents) for particular situations.
D. Demonstrates an understanding of ideas from number theory (e.g., prime factorization, greatest common divisor, divisibility rules) as they apply to whole numbers, integers and rational numbers, and uses those ideas in problem situations.
E. Understands the relative magnitude of whole numbers, integers, rational numbers and real numbers including the use of comparative language and sets of objects.
The beginning teacher:
F. Identifies and demonstrates an understanding of and uses of a variety of models and objects for representing numbers (e.g., fraction strips, diagrams, patterns, shaded regions, number lines).
G. Uses a variety of concrete and visual representations to demonstrate the connections between operations and algorithms.
H. Identifies, demonstrates, and applies knowledge of counting techniques, including combinations, to quantify situations and solve math problems (e.g., to include forward, backward, and skip counting, with or without models).
I. Identifies, demonstrates, and applies knowledge of place value (e.g., to compose and decompose numbers), rounding and other number properties to perform mental mathematics and computational estimation with automaticity.
J. Demonstrates a thorough understanding of fractions, including the use of various representations to teach fractions and operations involving fractions.

The teacher understands concepts related to numbers, operations and algorithms and the properties of numbers.

Competency 002: Number Concepts & Operations

The teacher understands concepts related to numbers, operations and algorithms and the properties of numbers.

Problem:
According to the order of operations, what is the first step in simplifying the expression shown below?

\[ 6 + (5 - 3)^2 ÷ 2 \]

A. Divide 2 by 2
B. Square 3
C. Add 6 and 5
D. Subtract 3 from 5

Answer:
D is the correct answer.

Finding the value for the terms inside the parenthesis is the first step. One method teachers sometimes use to help students recall the order of operations is to teach PEMDAS (Parentheses, Exponentiation, Multiplication/Division, Addition/Subtraction). Students recall the acronym by remembering Please Excuse My Dear Aunt Sally.
The beginning teacher:

A. Illustrates relations and functions using concrete models, tables, graphs and symbolic and verbal representations, including real-world applications.
B. Demonstrates an understanding of the concept of linear function using concrete models, tables, graph and symbolic and verbal representations.
C. Understands how to use algebraic concepts and reasoning to investigate patterns, make generalizations, formulate mathematical models, make predictions and validate results.
D. Formulates implicit and explicit rules to describe and construct sequences verbally, numerically, graphically and symbolically.
E. Knows how to identify, extend, and create patterns using concrete models, figures, numbers and algebraic expressions.
F. Uses properties, graphs, linear and nonlinear functions and applications of relations and functions to analyze, model and solve problems in mathematical and real-world situations.

The beginning teacher:

G. Translates problem-solving situations into expressions and equations involving variables and unknowns.
H. Models and solves problems, including those involving proportional reasoning, using concrete, numeric, tabular, graphical and algebraic methods (e.g., using ratios and percents with fractions and decimals).
I. Determines the linear function that best models a set of data. 
J. Understands and describes the concept of and relationships among variables, expressions, equations, inequalities and systems in order to analyze, model and solve problems.
K. Applies algebraic methods to demonstrate an understanding of whole numbers using any of the four basic operations.

A container of Candy Buttons contains 26% green, 24% red, 34% blue and 16% yellow candies. David put 150 of the candies in a container. Which proportion is best for finding y, the total number of yellow candies in the container?

A. \[
\frac{150}{150} = \frac{16}{100}
\]
B. \[
\frac{250}{150} = \frac{16}{100}
\]
C. \[
\frac{150}{250} = \frac{16}{100}
\]
D. \[
\frac{100}{250} = \frac{16}{100}
\]
Competency 003: Patterns & Algebra

The teacher understands concepts related to patterns, relations, functions and algebraic reasoning.

C is the correct answer.
• Sixteen percent, or 16 parts of 100 parts, is equivalent to 40, or 40, parts of 250.

Competency 004: Geometry & Measurement

The beginning teacher:
A. Applies knowledge of spatial concepts such as direction, shape and structure.
B. Identifies, uses, understands and models the development of formulas to find length, perimeter, area and volume of geometric figures.
C. Uses the properties of congruent triangles to explore geometric relationships.
D. Identifies, uses and understands concepts and properties of points, lines, planes, angles, lengths and distances.
E. Analyzes and applies the properties of parallel and perpendicular lines.
F. Uses a variety of representations (e.g., numeric, verbal, graphic, symbolic) to analyze and solve problems involving angles and two- and three-dimensional figures such as circles, triangles, polygons, cylinders, cones and spheres.
G. Uses symmetry to describe tessellations and show how they can be used to illustrate geometric concepts, properties and relationships.
H. Understands measurement concepts and principles, including methods of approximation and estimation, and the effects of error on measurement.
I. Explains, illustrates, selects and uses appropriate units of measurement to quantify and compare time, temperature, mass, weight, area, capacity, volume, percent, speed and degrees of an angle.

The teacher understands concepts and principles of geometry and measurement.

The beginning teacher:
J. Uses translations, rotations and reflections to illustrate similarities, congruencies and symmetries of figures.
K. Develops, justifies and uses conversions within and between measurement systems.
L. Understands logical reasoning, justification and proof in relation to the axiomatic structure of geometry and uses reasoning to develop, generate, justify and prove geometric relationships.
M. Understands attributes of various polygons, including names and how sides and angles of the polygon affect its attributes.
N. Partitions or decomposes polygons to express areas as fractions of a whole or to find areas of non-standard polygons.
O. Demonstrates the value and relationships of United States coins and bills and uses appropriate symbols to name the value of a collection.
P. Identifies, uses and understands the concepts and properties of geometric figures and their relationships.
Q. Describes the key attributes of the coordinate plane and models the process of graphing ordered pairs.
Competency 004: Geometry & Measurement

The teacher understands concepts and principles of geometry and measurement.

Which method could be used to prove that the rectangles are similar?

A. Divide 3 by 2 and 4 by 1.5, check if the quotients are equal.
B. Divide 1.5 by 4 and 2 by 3, check if the quotients are equal.
C. Divide 4 by 1.5 and 2 by 3, check if the quotients are equal.
D. Divide 3 by 1.5 and 4 by 2, check if the quotients are equal.

Answer:

D is the correct answer.

To prove similarity, divide corresponding sides and compare to see if the quotients are equal. In this example, 3 ÷ 1.5 = 2, and 4 ÷ 2 = 2, as well, so the rectangles are similar.

Competency 005: Probability & Statistics

The beginning teacher:

A. Investigates and answers questions by collecting, organizing and displaying data in a variety of formats as described in the Texas Essential Knowledge and Skills (TEKS) and draws conclusions from any data graph.
B. Demonstrates an understanding of measures of central tendency (e.g., mean, median, mode, and range) and uses those measures to describe a set of data.
C. Explores concepts of probability through data collection, experiments and simulations.
D. Uses the concepts and principles of probability to describe the outcome of simple and compound events.
E. Determines probabilities by constructing sample spaces to model situations.
F. Applies deep knowledge of the use of probability in different scenarios to make observations, draw conclusions and create relationships.
G. Solves a variety of probability problems using combinations and geometric probability (e.g., in the real world).
H. Supports arguments, makes predictions and draws conclusions using summary statistics to analyze and interpret real-world data.
I. Applies knowledge of designing, conducting, analyzing and interpreting statistical experiments to investigate real-world problems.
J. Generates, simulates and uses probability models to represent situations.
K. Uses the graph of the normal distribution as a basis for making inferences about a population.

The teacher understands concepts related to probability and statistics and their applications.
Competency 005: Probability & Statistics

The teacher understands concepts related to probability and statistics and their applications.

A sixth grade teacher is creating memory cues to help her students understand the difference between mean, median, and mode. The best memory cue listed below to help students remember the definition of median is --

A. Most. Median and most both start with “m”.
B. Median. The highway median is in the middle of the road.
C. Mountain range. A mountain range spans from high to low.
D. Measurement. The median is a measurement.

Answer:

B is the correct answer.

Comparing the median of a set of numbers to a highway median will help students remember that the median is the middle value.

Competency 006: Mathematical Processes

The beginning teacher:

A. Understands the role of logical reasoning in mathematics and uses formal and informal reasoning to explore, investigate and justify mathematical ideas.
B. Applies correct mathematical reasoning to derive valid conclusions from a set of premises.
C. Applies principles of inductive reasoning to make conjectures and uses deductive methods to evaluate the validity of conjectures.
D. Evaluates the reasonableness of a solution to a given problem.
E. Understands connections among concepts, procedures and equivalent representations in areas of mathematics (e.g., algebra, geometry).
F. Recognizes that a mathematical problem can be solved in a variety of ways and selects an appropriate strategy for a given problem.
G. Expresses mathematical statements using developmentally appropriate language, standard English, mathematical language and symbolic mathematics.
H. Communicates mathematical ideas using a variety of representations (e.g., numeric, verbal, graphic, pictorial, symbolic, concrete).
I. Demonstrates an understanding of the use of visual media such as graphs, tables, diagrams and animations to communicate mathematical information.
Competency 006: Mathematical Processes

The teacher understands mathematical processes and knows how to reason mathematically, solve mathematical problems and make mathematical connections within and outside of mathematics.

The beginning teacher:

J. Demonstrates an understanding of estimation, including the use of compatible numbers, and evaluates its appropriate uses.

K. Knows how to use mathematical manipulatives and a wide range of appropriate technological tools to develop and explore mathematical concepts and ideas.

L. Demonstrates knowledge of the history and evolution of mathematical concepts, procedures and tools.

M. Recognizes the contributions that different cultures have made to the field of mathematics and the impact of mathematics on society and cultures.

N. Demonstrates knowledge of the history and evolution of mathematical concepts, procedures and ideas.

O. Recognizes the contributions that different cultures have made to the field of mathematics and the impact of mathematics on society and cultures.

P. Knows how to use mathematical manipulatives and a wide range of appropriate technological tools to develop and explore mathematical concepts and ideas.

Q. Demonstrates knowledge of the history and evolution of mathematical concepts, procedures and ideas.

R. Recognizes the contributions that different cultures have made to the field of mathematics and the impact of mathematics on society and cultures.

S. Demonstrates an understanding of estimation, including the use of compatible numbers, and evaluates its appropriate uses.

Problem:

Mr. Gonzalez’s monthly electricity bills for March through June were $97.09, $103.96, $114.73, and $121.82. He estimated that the electricity cost a total of $400.00 over these 4 months. Which best describes his estimate?

A. Less than the actual amount because he rounded to the nearest 100

B. Less than the actual amount because he rounded to the nearest 10

C. More than the actual amount because he rounded to the nearest 100

D. More than the actual amount because he rounded to the nearest 10

Answer:

A is the correct answer.

The estimate is lower than the actual amount because Mr. Gonzalez rounded to the nearest 100. If he had rounded to the nearest 10, he would have arrived at an estimation closer to the actual answer.