Activity 7
Reviewing Multiple Choice Mathematics Items
Grades 3, 4 and 5

Standard: Patterns, Functions, and Algebra

Benchmark: Use variables to create and solve equations representing problem situations.

Indicator: Model problem situations using objects, pictures, tables, numbers, letters and other symbols.

Answer Key: B

Which number goes in A to make the following number sentence true?

$$A + 16 = B$$

A. 16

B. 23

C. 39

Flaws:

Standard: Geometry and Spatial Sense

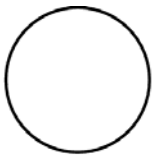
Benchmark: Describe and use the concepts of congruence, similarity and symmetry to solve problems.

Indicator: Describe and use properties of congruent figures to solve problems.

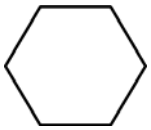
Answer Key: A

Which has the most lines of symmetry?

A.



B.



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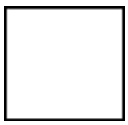

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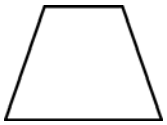


Flaws:

Standard: Patterns, Functions, and Algebra

Benchmark: Use patterns to make predictions, identify relationships, and solve problems.

Indicator: Use patterns to make predictions, identify relationships, and solve problems.

Answer Key: C

Amy created this pattern of figures.

Figure 1	Figure 2	Figure 3	Figure 4
X	XX	XXX	XXXX
	XX	XXX	XXXX
		XXX	XXXX
			XXXX

Which is the next figure in her pattern?

Option A

XXXXX
XXXXX
XXXXX
XXXXX

Option B

XXXX
XXXX
XXXX
XXXX

Option C

X X X X X
X X X X X
X X X X X
X X X X X
X X X X X

Flaws:

Standard: Data Analysis and Probability

Benchmark: Read and interpret tables, charts, graphs (bar, picture, line, line plot), and timelines as sources of information, identify main idea, draw conclusions, and make predictions.

Indicator: Represent and interpret data using tables, bar graphs, line plots and line graphs.

Answer Key: C

The table shows the number of books that students in Mr. Abrigo's class read in one month.

Spelling Scores

Words Correct	Number of Students
8	II
9	~~IIII~~ I
10	III
11	IIII
12	~~IIII~~ IIII
13	I
14	IIII
15	II

How many students read more than 11 books?

Option A

4

Option B

11

Option C

16

Option D

31

Flaws:

Standard: Geometry and Spatial Sense

Benchmark: Use attributes to describe, classify and sketch plane figures and build solid objects.

Indicator: Describe, classify, compare and model two- and three-dimensional objects using their attributes.

Answer Key: B

Which is a true statement about a circle?

Option A

It has two pairs of parallel sides.

Option B

It has a radius.

Option C

It has all sides of equal length.

Option D

It has a right angle.

Flaws:

Standard: Number, Number Sense and Operations

Benchmark: Compare, order and convert among fractions, decimals and percents.

Indicator: Identify and generate equivalent forms of fractions, decimals and percents.

Answer Key: B

Which number is less than 8.75?

Option A

8.09

Option B

8.76

Option C

8.9

Option D

9.05

Flaws:

Activity 7
Reviewing Multiple Choice Mathematics Items
Grades 6, 7 and 8

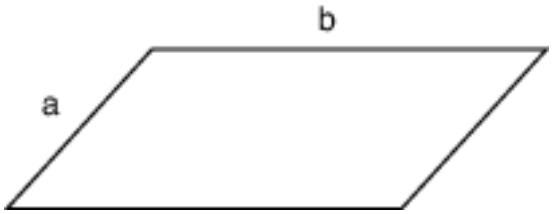
Standard: Measurement

Benchmark: Select a tool and measure accurately to a specified level of precision.

Indicator: Determine which measure (perimeter, area, surface area, volume) matches the context for a problem situation; e.g., perimeter is the context for fencing a garden, surface area is the context for painting a room.

Answer Key: B

The parallelogram has sides a and b. In terms of a and b, its perimeter can be expressed as:



A. P = a x b

B. P = 2a + 2b

C. P = a + b + c + d

D. P = 2a + b

Flaws:

Standard: Measurement

Benchmark: Identify appropriate tools and apply appropriate techniques for measuring angles, perimeter or circumference and area of triangles, quadrilaterals, circles and composite shapes, and surface area and volume of prisms and cylinders.

Indicator: Estimate perimeter or circumference and area for circles, triangles and quadrilaterals, and surface area and volume for prisms and cylinders by: a. estimating lengths using string or links, areas using tiles or grid, and volumes using cubes; b. measuring attributes (diameter, side lengths, or heights) and using established formulas for circles, triangles, rectangles, parallelograms and rectangular prisms.

Answer Key: A

Bernice has a sheet of 84 square stickers which are all the same size. She wants to know the area of one of the stickers but she has no ruler. Then she notices that the sheet of stickers is just slightly smaller than a piece of notebook paper which is 8 $\frac{1}{2}$ inches by 11 inches. Use this to estimate the area of one of the stickers.

A. 1 in^2

B. 1 in

C. 4 in^2

D. 4 in

Flaws:

Standard: Measurement

Benchmark: Select appropriate units to measure angles, circumference, surface area, mass and volume, using: U.S. customary units; e.g., degrees, square feet, pounds, and other units as appropriate; metric units; e.g., square meters, kilograms and other units as appropriate.

Indicator: Select appropriate units for measuring derived measurements; e.g., miles per hour, revolutions per minute.

Answer Key: C

Orlene wants to determine the speed of the second hand as it rotates on a clock face. She knows the second hand makes one revolution per minute. Orlene finds the speed by calculating the circumference of the clock and dividing by the time.

Which units best represent the speed of the second hand as Orlene calculated it?

A. degrees/second

B. feet/second

C. inches/minute

D. revolutions/minute

Flaws:

Standard: Data Analysis and Probability

Benchmark: Interpret data by looking for patterns and relationships, draw and justify conclusions, and answer related questions.

Indicator: Construct opposing arguments based on analysis of the same data, using different graphical representations.

Answer Key: B

The table below shows the populations and literacy rates in several different countries. (The literacy rate is the percentage of adults who can read.)

Literacy Rates by Country

Country	Population	Literacy Rate
China	1,304,000,000	86%
Egypt	71,900,000	58%
Mexico	103,500,000	92%
New Zealand	3,900,000	100%
Peru	27,200,000	91%
Saudi Arabia	24,300,000	79%

Based on these data, which conclusion is valid?

A. Egypt has fewer literate people than Saudi Arabia.

B. Of the countries shown, New Zealand has the highest literacy rate.

C. The literacy rates in China and Mexico are about the same.

D. Of the countries shown, Peru has the most literate people.

Flaws:

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Standard: Number, Number Sense and Operations

Benchmark: Use and analyze the steps in standard and non-standard algorithms for computing with fractions, decimals and integers.

Indicator: Explain the meaning and effect of adding, subtracting, multiplying and dividing integers; e.g., how adding two integers can result in a lesser value.

Answer Key: C

Rajeev claims that subtracting two integers always results in a difference which is less than both integers.

Which example shows that his claim is not always true?

A. $-3 - 4 = 7$

B. $2.1 - (-1.9) = 4$

C. $8 - (-9) = 17$

D. $-5 - 9 = -14$

Flaws:

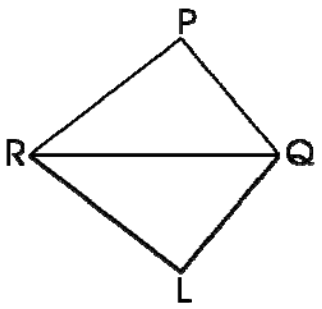
Standard: Geometry and Spatial Sense

Benchmark: Describe and apply the properties of similar and congruent figures; and justify conjectures involving similarity and congruence.)

Indicator: Make and test conjectures about characteristics and properties (e.g., sides, angles, symmetry) of two-dimensional figures and three-dimensional objects.

Answer Key: A

Two congruent triangles are shown.



Triangle PQR is congruent to triangle LQR.

Angle PQR is congruent to

A. Angle LQR

B. Angle QRP

C. None of the above

D. All of the above

Flaws:

Activity 7
Reviewing Multiple Choice Mathematics Items
High School

Standard: Number, Number Sense and Operations

Benchmark: Find the square root of perfect squares, and approximate the square root of non-perfect squares.

Indicator: Recognize and identify perfect squares and their roots.

Answer Key: A

A, B, C and D are integers. A/B = (C/D)^2.

Which statement is true?

A. A and B are both perfect squares.

B. A is a perfect square but B isn't necessarily a perfect square.

C. B is a perfect square but A isn't necessarily a perfect square.

D. Neither A nor B is necessarily a perfect square.

Flaws:

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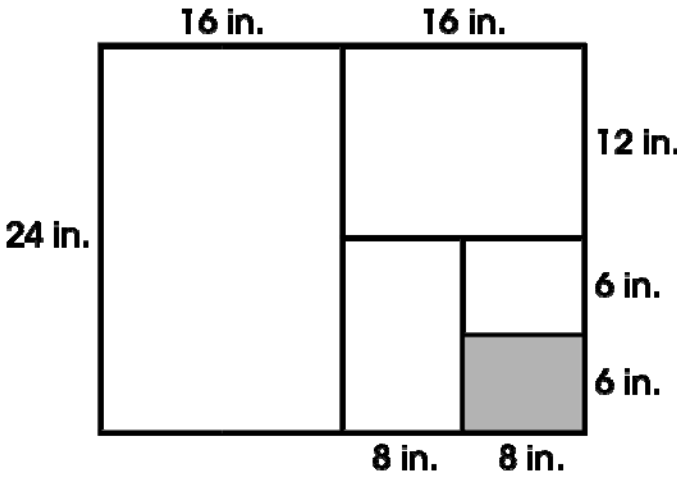
First Standard: Data Analysis and Probability

First Benchmark: Compute probabilities of compound events, independent events, and simple dependent events.

First Indicator: Model problems dealing with uncertainty with area models (geometric probability).

Answer Key: A

At a carnival game, Mark is using the game board shown.



In order to win the game, two disks are needed to land onto the shaded region of the board.

If the disks randomly were to land anywhere on the game board, what is the probability of winning the game?

A. $\frac{1}{256}$

B. $\frac{1}{64}$

C. $\frac{1}{16}$

D. $\frac{1}{4}$

Flaws:

First Standard: Number, Number Sense and Operations

First Benchmark: Apply properties of operations and the real number system, and justify when they hold for a set of numbers.

First Indicator: Explain and use the inverse and identity properties and use inverse relationships (addition/subtraction, multiplication/division, squaring/square roots) in problem solving situations.

Answer Key: A

Kelly is solving the equation shown for *x*.

$$4 = \frac{1}{3}x - 6$$

What is the most appropriate first step?

A. Adding 6 to each side.

B. Subtracting 6 from each side.

C. Multiply each side by $\frac{1}{3}$.

D. Divide each side by $\frac{1}{3}$.

Flaws:

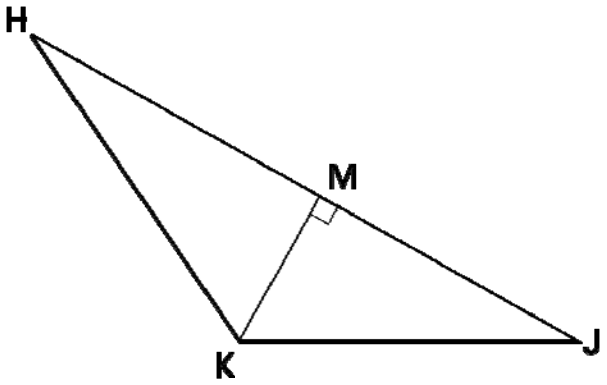
First Standard: Geometry

First Benchmark: Formally define geometric figures.

First Indicator: Formally define and explain key aspects of geometric figures, including: a. interior and exterior angles of polygons; b. segments related to triangles (median, altitude, midsegment); c. points of concurrency related to triangles (centroid, incenter, orthocenter, circumcenter); d. circles (radius, diameter, chord, circumference, major arc, minor arc, sector, segment, inscribed angle).

Answer Key: A

Triangle HJK is shown.



$\overline{KM}$ is:

A. an altitude.

B. an angle bisector.

C. a median.

D. a perpendicular bisector.

Flaws:

First Standard: Data Analysis and Probability

First Benchmark: Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of data collection and analysis.

First Indicator: Describe how the relative size of a sample compared to the target population affects the validity of predictions.

Answer Key: B

One hundred residents of Cleveland were sent a survey about a new library. What can be said about the validity of this sample?

A. Valid but the sample size was too large.

B. Invalid because the sample size was too small

C. Valid but the sample size was too small.

D. Invalid because the sample size was too big.

Flaws:

First Standard: Data Analysis and Probability

First Benchmark: Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of data collection and analysis.

First Indicator: Describe and compare various types of studies (survey, observation, experiment), and identify possible misuses of statistical data.

Answer Key: D

There have been reports of excessive automobile speeding on the road on which a school is located.

Which approach will be best to gather reliable data about this situation?

A. Survey students about speeding cars near the school.

B. Observe the cars driving on the road one morning.

C. Ask the local police how many tickets they have given out on this road.

D. Measure the speed of every tenth car driving on the road for a day.

Flaws:

Activity 8
Revising Multiple Choice Mathematics Items to Correct the Flaws

Stem:

Options:

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D:

Stem:

Options:

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D:

Stem:

Options:

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D:

Stem:

Options:

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D:

Stem:

Options:

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D:

Stem:

Options:

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D:

Stem:

Options:

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D:

Activity 9
Writing Effective Multiple Choice Mathematics Items

Grade 3

Standard: Number Sense

Benchmark: Demonstrate fluency in multiplication facts with factors through 10 and corresponding divisions

Indicator: Demonstrate fluency in multiplication facts with factors through 10 and corresponding division facts.

Grade 4

Standard: Geometry

Benchmark: Identify and draw right, obtuse, acute and straight angles.

Indicator: Identify and define triangles based on angle measures (equiangular, right, acute and obtuse triangles) and side lengths (isosceles, equilateral and scalene triangles).

Grade 6

Standard: Patterns and Algebra

Benchmark: Use rules and variables to describe patterns, functions, and other relationships

Indicator: Represent and analyze patterns, rules and functions, using physical materials, tables, and graphs.

Grade 8

Standard: Measurement

Benchmark: Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.

Indicator: Use appropriate levels of precision when calculating with measurements.

High School

Standard: Data

Benchmark: Use counting techniques, such as permutations and combinations, to determine the total number of options and possible outcomes

Indicator: Calculate the number of possible outcomes for a situation, recognizing and accounting for when items may occur more than or when order is important.

Standard: Number Sense

Benchmark: Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents.

Indicator: Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals.

Stem:

Options

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D:

Stem:

Options

Rationale for Option A:

Rationale for Option B:

Rationale for Option C:

Rationale for Option D: