



## WEST–B: MATHEMATICS

Select any of the test objectives listed below to view

- a set of descriptive statements that further explain each objective, and
- one or more sample test question(s) aligned to each objective.

<b>Test Field</b>	WEST–B: Mathematics
<b>Test Format</b>	Multiple-choice questions
<b>Number of Questions</b>	60
<b>Additional Materials</b>	Mathematical Symbols, Abbreviations, and Formulas (also provided at the test) Glossary

### Objectives:

**0013** Understand and apply concepts and principles of numbers and operations.

*The following are examples of content that may be covered under this objective.*

- Recognize equivalent representations of numbers (e.g., fractions, decimals, percents).
- Apply the principles of integers, fractions, decimals, and percentages.
- Apply understanding of ratios and proportions.
- Demonstrate understanding of the meaning of operations (e.g., addition, subtraction, multiplication, division) and of equality.
- Demonstrate understanding of order of operations.

### Sample Item(s):

**1. A student who is 4 feet tall casts a shadow that is 5 feet long. If a tree casts a shadow that is 65 feet long, how tall is the tree?**

- A. 16 feet
- B. 52 feet
- C. 81 feet
- D. 260 feet

**Correct Response and Explanation**

B. The length of a shadow is proportional to the height of the object casting the shadow. This proportion can be expressed in the following way.  $\frac{\text{height of the student}}{\text{student's shadow}} = \frac{\text{height of the tree}}{\text{tree's shadow}}$ . Since the problem asks for the height of the tree, let  $x = \text{height of the tree}$ . Using  $x$  and the numbers given results in the proportion  $\frac{4}{5} = \frac{x}{65}$ . This proportion can be solved for  $x$  by cross-multiplying.  $(4)(65) = 5x$ , or equivalently  $5x = 260$ , so  $x = \frac{260}{5} = 52$  feet.

**2. Simplify the expression  $44 - 4 \cdot 8 + 4^2 \div 4$ .**

- A. 84
- B. 32
- C. 16
- D. 8

**Correct Response and Explanation**

C. Simplifying the given expression requires correct application of the rules that specify the order in which operations should be performed. The rules specify the following order: parentheses, exponents, multiplication and division, and addition and subtraction. There are no parentheses in the given problem, but there is an exponent. The operation involving the exponent should be performed first:  $44 - 4 \cdot 8 + 4^2 \div 4 = 44 - 4 \cdot 8 + 16 \div 4$ . There is one instance of multiplication ( $4 \cdot 8$ ) and one instance of division ( $16 \div 4$ ) in the problem, and these should be performed next:  $44 - 4 \cdot 8 + 16 \div 4 = 44 - 32 + 4$ . The final step in simplifying the expression is to perform addition and subtraction:  $44 - 32 + 4 = 12 + 4 = 16$ .

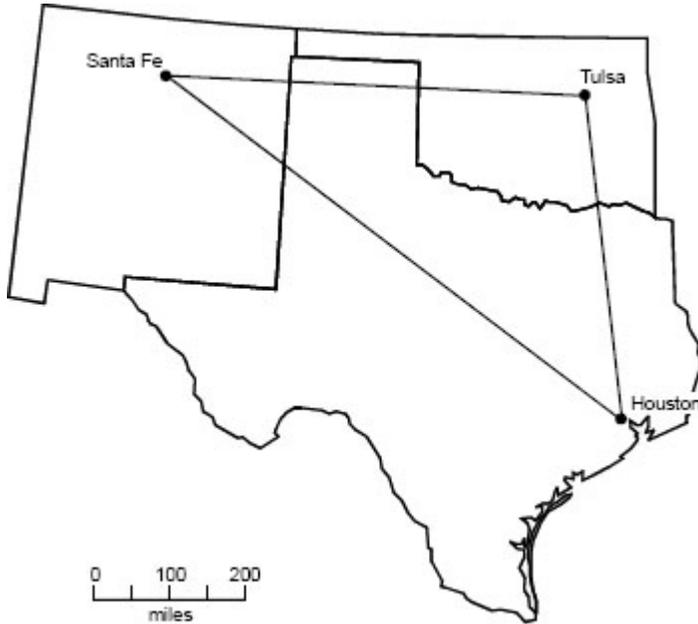
**0014** Understand and apply concepts and procedures of measurement.

*The following are examples of content that may be covered under this objective.*

- Select an appropriate measurement tool or unit for a specified measurement task.
- Solve problems involving the U.S. or metric systems of measurement.
- Solve problems involving scale (e.g., determine the distance between two locations on a map).
- Demonstrate understanding of the concepts of perimeter, area, and volume.
- Calculate derived measurements (e.g., the average speed of a car given how long it takes to travel a specified distance).

**Sample Item(s):**

1. If a pilot flew a plane from Santa Fe to Tulsa to Houston and then back to Santa Fe along the route indicated below, approximately how many miles did the pilot fly?



- A. 2000 miles
- B. 1700 miles
- C. 1400 miles
- D. 1100 miles

**Correct Response and Explanation**

**B.** The scale below the map can be used to determine the distance between the three cities on the map. This involves finding the perimeter of the triangle formed by connecting the three cities. A useful tool can be constructed by transferring the scale to a pencil or other writing device and using a thumbnail as a marker. By using this improvised tool as a ruler, it is possible to estimate the distance as follows:

- Distance from Houston to Santa Fe: less than 4 lengths and more than 3 lengths.
- Distance from Santa Fe to Houston: less than 3 lengths and more than 2 lengths.
- Distance from Tulsa to Houston: less than 3 lengths and more than 2 lengths.



Therefore, the distance must be less than 10 units but more than 7 units. Since each unit represents 200 miles, the distance must be less than  $10(200 \text{ miles}) = 2000$  miles and more than  $7(200 \text{ miles}) = 1400$  miles. Of the choices given, only 1700 miles meets these criteria.

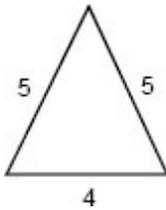
**0015** Understand concepts and principles of geometry and solve related problems.

*The following are examples of content that may be covered under this objective.*

- Demonstrate an understanding of fundamental concepts of geometry (e.g., properties of points, lines, planes, angles).
- Identify types and properties of two- and three-dimensional figures.
- Solve problems involving triangles (e.g., calculate the length of the hypotenuse of a right triangle).
- Analyze figures in terms of symmetry and congruence.
- Describe the locations of points, lines, and objects on coordinate grids.
- Recognize geometric transformations (e.g., slides, flips, turns).

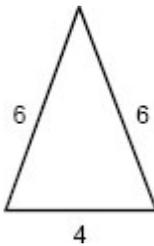
**Sample Item(s):**

1.

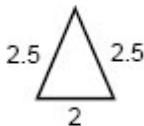


**Which triangle is similar to the triangle shown above?**

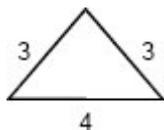
A.



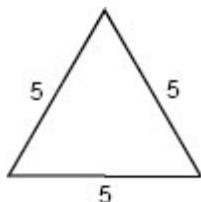
B.



C.



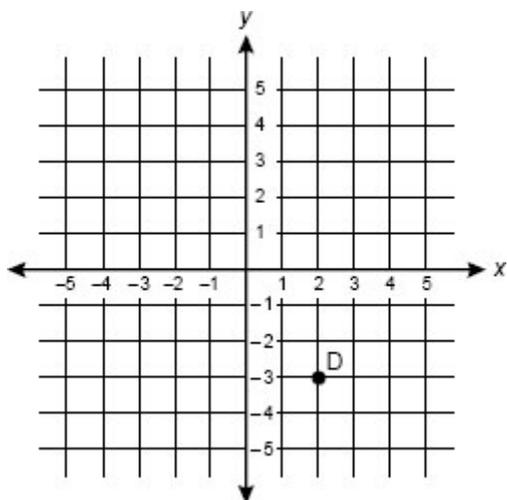
D.



**Correct Response and Explanation**

**B.** Two triangles are similar if they have corresponding sides that are proportional. The triangle shown in the item has sides of length 5 units, 5 units, and 4 units. The triangle shown in Response B is similar to this triangle because each of its sides (2.5 units, 2.5 units, 2 units) is  $\frac{1}{2}$  length of the corresponding side in the given triangle.

**2. What are the coordinates of point D?**



- A. (3, -2)
- B. (-2, 3)
- C. (2, -3)
- D. (-3, 2)

**Correct Response and Explanation**

C. A point on a Cartesian plane can be described by an ordered pair that specifies the point's value on the  $x$ -axis and the point's value on the  $y$ -axis. The value of point D on the  $x$ -axis can be found by noting that the point directly above point D on the  $x$ -axis is labeled 2. Point D's value on the  $y$ -axis can be found by noting that the point directly to the left of point D on the  $y$ -axis is labeled  $-3$ . The ordered pair that describes point D is therefore  $(2, -3)$  (Response C). Response A reverses the positions and the signs of the numbers in the ordered pair. Response B reverses only their signs. Response D reverses only their positions.

**0016** Understand concepts and principles of probability and statistics and solve related problems.

*The following are examples of content that may be covered under this objective.*

- Calculate the probability of a simple event.
- Identify appropriate ways to collect, organize, and display various data.
- Interpret data displayed in various formats (e.g., tables, graphs, scatterplots).
- Demonstrate an understanding of fundamental statistical concepts, such as mean, median, and mode.
- Make predictions based on given data.

**Sample Item(s):**

**1. A box contains 20 red marbles, 15 blue marbles, 25 yellow marbles, and 2 black marbles. If a person selects a marble at random from the box, what is the probability that the marble will be black?**

- A.  $\frac{1}{62}$
- B.  $\frac{1}{61}$
- C.  $\frac{1}{31}$
- D.  $\frac{1}{30}$

**Correct Response and Explanation**

C. The probability of an event such as the one described in the item can be expressed as a fraction whose numerator is the total number of favorable cases and whose denominator is the total number of possibilities. In the item, the favorable case is the drawing of a black marble. Since there are 2 black marbles, the numerator is 2. The total number of possibilities is the total number of marbles, or 62. The fraction representing the probability of drawing one of the 2 black marbles from the bag of 62 marbles is therefore  $\frac{2}{62}$  or  $\frac{1}{31}$ .

**0017** Understand concepts and principles of algebra and solve related problems.

*The following are examples of content that may be covered under this objective.*

- Recognize and extend arithmetic and geometric patterns and sequences.
- Translate among tabular, symbolic, and graphical representations of relations (e.g., display data from a table as a graph, identify rate of change).
- Identify expressions or equations that represent situations involving variable quantities.
- Simplify expressions and apply formulas.
- Solve linear equations or inequalities involving one variable.
- Demonstrate understanding of the concept of equality.

**Sample Item(s):**

**1. Which equation describes the relationship between the  $x$  and  $y$  values in the table below?**

$x$	$y$
1	3
2	5
3	7
4	9

- A.  $y = 3x$
- B.  $y = x + 2$
- C.  $y = 3x - 1$
- D.  $y = 2x + 1$

**Correct Response and Explanation**

D. To find the correct equation, substitute each  $x$ -value into each equation to determine if the resulting number equals the corresponding  $y$ -value in the table. Start by substituting  $x = 1$  into each equation. Note that for Response C,  $y = 3(1) - 1 = 2 \neq 3$ , so that response can be eliminated. Next, substitute  $x = 2$  into responses A, B, and D. Note that Responses A and B can be eliminated since for A,  $y = 3(2) = 6 \neq 5$ , and for B,  $y = (2) + 2 = 4 \neq 5$ . Response D is the only remaining choice, and it can be further verified by substituting  $x = 3$  and  $x = 4$  into the equation  $y = 2x + 1$  (Response D).

**2. Solve for  $x$ .**

$$2x + 7 > 15$$

- A.  $x > 4$
- B.  $x > 8$
- C.  $x > 11$
- D.  $x > 22$

**Correct Response and Explanation**

A. This inequality can be solved as follows:

First, subtract 7 from each side.

$$2x + 7 > 15$$

$$2x > 15 - 7$$

$$2x > 8$$

Next, divide both sides of the inequality by 2.

$$2x > 8$$

$$x > 4 \text{ (Response A)}$$

**0018** Apply mathematical reasoning, problem-solving, and communication skills.

*The following are examples of content that may be covered under this objective.*

- Identify missing or extraneous information in mathematical problems.
- Identify errors in mathematical explanations.
- Use inductive or deductive reasoning to draw conclusions and make predictions.
- Translate among the various ways of communicating mathematical information (e.g., words, equations, graphs, diagrams).
- Express ideas and situations using appropriate mathematical language and notation.



**Sample Item(s):**

**1. Which piece of information is extraneous for the solution of the problem below?**

A school band is going to a regional competition 85 miles from the school. A total of 80 students and chaperones will be traveling in 2 buses. The transportation cost is \$287.50 per bus. The cost of food for each person is \$18.75.

What is the total cost of the trip?

- A. number of people on the trip
- B. cost of each bus
- C. number of miles the buses will travel
- D. cost of food for each person

**Correct Response and Explanation**

**C.** The total cost for the trip includes both the cost of transportation and the cost of food. The total transportation cost can be calculated by multiplying the cost of each bus (Response B) and the number of buses needed. The cost of food can be calculated by multiplying the number of people on the trip (Response A) and the cost of food per person (Response D). The two products must be added to find the total cost of the trip. Since Responses A, B, and D were all used in the calculation, only Response C is extraneous.

**2. Which pair of numbers provides a counterexample to the statement below?**

The product of two numbers is always greater than either of the two numbers.

- A.  $\frac{1}{2}$  and  $\frac{3}{4}$
- B.  $-4$  and  $-3$
- C. 62 and 43
- D. 3.2 and 2.5



**Correct Response and Explanation**

A. To find a counterexample to the statement, "The product of two numbers is always greater than either of the two numbers," it is necessary to find two numbers with a product that is not greater than either number. Response A provides a counterexample because the product of  $\frac{1}{2}$  and  $\frac{3}{4}$  is  $\frac{3}{8}$ , which is less than either  $\frac{1}{2}$  or  $\frac{3}{4}$ . The other responses are not counterexamples because their products are greater than both of the original numbers.