ACT® Aspire™

Exemplar Test Items

Mathematics

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ACT Aspire™ Mathematics

Introduction

Mathematics grows in students as they add new topics, make new insights and connections, learn from repeated reasoning. ACT Aspire Mathematics grows with them, capturing what each student can do—across grades—and linking the results to being on track for college and career readiness. Score reports break down results in a myriad of ways to show off student strengths and indicate areas in need of growth, information to illuminate an individualized path for each student.

ACT Aspire Mathematics is rigorous, assessing what students can do with what they've learned, with questions carefully selected from the full range of grade-appropriate content, requiring a variety of cognitive skills that fill depth-of-knowledge categories up through Webb's level 3. Because of the variety in how topics are assessed, ACT Aspire Mathematics also helps identify students headed for STEM levels of achievement.

Modeling in the context of real world applications has long been a strength of ACT's mathematics tests, and this tradition continues with ACT Aspire Mathematics. Students will be able to demonstrate their modeling skills in a multitude of contexts ranging from numbers and operations to number models (including the number line) to geometric shapes to statistical charts, and for higher grades, algebraic expressions, coordinate graphs, functions, and probability.

Technology-enhanced questions (for computer-based testing) constitute an assessment tool that, when used wisely, complements the strengths of traditional assessment formats. This allows a more robust picture of the mathematics students can do, and it also provides new options for engaging students.

ACT Aspire Mathematics features constructed response tasks focusing on Justification & Explanation, for explaining why mathematical results hold. The power of constructed response opens the way for a powerful measure of this important dimension of mathematics.

The following test questions are examples of what students will meet on ACT Aspire Mathematics. Because technology-enhanced questions need an interactive environment, examples are not included here.

The following test questions are organized by grade band and illustrate assessment of a variety of content and a range of cognitive skill. These assess important mathematics in grade-appropriate ways.

We welcome you to this first look.

1. **Juliana divided the part of a number line from 0 to 1 into sections of equal length. She plotted point *M* on the number line, as shown below.**

   One of the following circles is shaded to represent a fraction that is equivalent to the number represented by point *M*. Which one?

A.

B.

C.

D.

*E.

2. **After Cammy gets out of bed in the morning, she completes several activities to get ready for school. The list below shows the numbers of minutes she needs to complete each of these activities.**

   - **30 minutes: brush teeth, shower, and get dressed**
   - **10 minutes: eat breakfast**
   - **30 minutes: car ride to school**

   Cammy must be at school by 8:00 a.m. What is the *latest* time Cammy can get out of bed, complete all her activities, and still get to school on time? Explain why your answer is correct.

* correct answer

3. **Explain what a line of symmetry is.**

Explain why the dashed line drawn in the figure below is NOT a line of symmetry for the figure.

4. **Which of the following amounts of time is the same as 5 3/4 hours?**

A. 5 hours 15 minutes
B. 5 hours 35 minutes
C. 5 hours 40 minutes
***D**. 5 hours 45 minutes
E. 5 hours 75 minutes

5. **Liam is making chocolate chip cookies. The recipe calls for 1 cup of sugar for every 3 cups of flour. Liam has only 2 cups of flour.**

- **How much sugar should Liam use?**

- **Explain why your answer is correct.**

* correct answer

A total of 8 students decorated the front surface of 2 different bulletin boards, 1 in the computer lab and 1 in the library.

The computer lab bulletin board has 4 sides and 4 right angles and is 10 feet long and 9 feet tall.

The library bulletin board is divided into 6 equal parts, as shown below, and is shaded to show the fraction of the front surface the students finished decorating on Tuesday.

6. What is the area, in square feet, of the front surface of the computer lab bulletin board?

A. 19
B. 38
C. 76
***D**. 90
E. 94

7. Each student decorated one or the other of the bulletin boards. More students decorated the computer bulletin board than the library bulletin board. Which of the following numbers could be the fraction of students who decorated the computer lab bulletin board?

A. 1/3
B. 1/5
C. 4/8
D. 4/5
***E**. 5/8

* correct answer

8. Nigel's class placed 10 empty rain gauges on the playground Monday morning. The line plot below shows the number of inches of rainwater in each gauge after it rained Monday afternoon.

Number of Inches of Rainwater

What is the mean amount of rainwater per gauge, in inches, in the 10 rain gauges?

A. 25/80
B. 5/8
***C**. 51/80
D. 37/56
E. 51/8

9. The principal of a school must buy 19 desks for a new classroom. Each desk costs $61. A student calculates the total cost of the desks using the thought process below:

20 desks at $60 each would cost $1,200. So 19 desks at $60 each would cost $1,200 – $60. Because the price of 1 desk is $61 and NOT $60, I must add $1. So the total cost is $1,200 – $60 + $1.

▪ **Identify any mistakes in the student's thought process.**

▪ **Write an expression that represents the total cost of the 19 desks, and explain why it is correct.**

* correct answer

10. Ryan and Tomas walked to school and then to the park, as described below:

Ryan walked 2.3 miles from his home to meet Tomas at school.

Tomas walked 2.7 miles from his home to meet Ryan at school.

Once they were at school, the boys walked *x* miles to the park and then *x* miles back to the school.

The sum of the distance Ryan walked and the distance Tomas walked was at least 15 miles but not more than 21 miles. One of the following is the graph of the possible values of *x*. Which one?

***A.**

B.

C.

D.

E.

11. In square *ACEG* shown below, *B*, *D*, *F*, and *H* are the midpoints of $\overline{AC}$, $\overline{CE}$, $\overline{EG}$, and $\overline{AG}$, respectively.

A student thinks that the area of Δ*DEF*, shown shaded, is 1/4 the area of square *ACEG*. Explain why the student is NOT correct.

* correct answer

12. A pattern exists among the units digits of the powers of 7, as shown below. What is the units digit of 7^{50}?

$7^0 = 1$	$7^3 = 343$	$7^6 = 117{,}649$
$7^1 = 7$	$7^4 = 2{,}401$	$7^7 = 823{,}543$
$7^2 = 49$	$7^5 = 16{,}807$	$7^8 = 5{,}764{,}801$

(Note: The units digit of 2,401 is 1.)

A. 1
B. 3
C. 4
D. 7
***E**. 9

13. Explain why there are no solutions to the system of inequalities given below.

$$\begin{cases} y < -\frac{1}{2}x - 3 \\ y > -\frac{1}{2}x + 2 \end{cases}$$

* correct answer

A map of Nelson County is laid out in the standard (*x,y*) coordinate plane below, where the center of the county is at (0,0). A cell phone tower is at (5,4), and Esteban's house is at (10,–2). Each coordinate unit represents 1 mile. The tower's signal range is 10 miles in all directions.

14. How much land area, to the nearest 10 square miles, does the tower's signal range cover?

A. 80
B. 100
***C**. 310
D. 400
E. 1,260

15. The strength of the tower's signal to Esteban's house depends on the straight-line distance between his house and the tower. What is the straight-line distance, in miles, between Esteban's house and the tower?

A. $\sqrt{11}$

B. $\sqrt{17}$

C. $\sqrt{29}$

D. $\sqrt{41}$

***E.** $\sqrt{61}$

* correct answer

16. **The tower's signal range directly above a point (*a,b*) on the ground extends to an altitude, in miles, given by the function *f*(*a,b*) = $\sqrt{59-a^2+10a-b^2+8b}$. A jet directly above Esteban's house is within the tower's signal range. What is the maximum altitude, in miles, of the jet?**

A. $\sqrt{15}$

B. $\sqrt{19}$

***C.** $\sqrt{39}$

D. $\sqrt{47}$

E. $\sqrt{71}$

17. **Star Wireless will add a new cell phone tower, represented by a point on the same horizontal line and to the right of the existing tower. The signal range from the new tower will be 15 miles in all directions. The signal range from the new tower and the signal range from the existing tower will have an overlap of 1 mile along the line connecting the 2 towers (shown below).**

Identify an equation of the circle whose interior represents the signal range of the new tower, and refer to the towers as you explain the procedure you used to identify the equation.

(Note: In the standard (*x,y*) coordinate plane, a circle with center (*h,k*) and radius *r* is the graph of the equation $(x-h)^2+(y-k)^2=r^2$.)

* correct answer