

# MATHEMATICS

Numerical Skills/Pre-Algebra  
Algebra



# Sample Test Questions

*A Guide for Students and Parents*

**ACT**<sup>®</sup> **Compass**<sup>®</sup>

[act.org/compass](https://act.org/compass)

## Note to Students

Welcome to the ACT Compass® Sample Mathematics Test!

You are about to look at some sample test questions as you prepare to take the actual ACT Compass test. The examples in this booklet are similar to the kinds of test questions you are likely to see when you take the actual ACT Compass test. Since this is a practice exercise, you will answer just a few questions and you won't receive a real test score. The answer key follows the sample questions.

Once you are ready to take the actual ACT Compass test, you need to know that the test is computer-delivered and *untimed*—that is, you may work at your own pace. After you complete the test, you can get a score report to help you make good choices when you register for college classes.

We hope you benefit from these sample questions, and we wish you success as you pursue your education and career goals!

## Note to Parents

The test questions in this sample set are similar to the kinds of test questions your son or daughter will encounter when they take the actual ACT Compass test. Since these questions are only for practice, they do not produce a test score; students answer more questions on the actual test. The aim of this booklet is to give a sense of the kinds of questions examinees will face and their level of difficulty. There is an answer key at the end of each subject.

## ACT Compass Mathematics Tests

The ACT Compass Mathematics Tests are organized around five principal content domains: numerical skills/pre-algebra, algebra, college algebra, geometry, and trigonometry. To ensure variety in the content and complexity of items within each domain, ACT Compass includes mathematics items of three general levels of cognitive complexity: basic skills, application, and analysis. A basic skills item can be solved by performing a sequence of basic operations. An application item involves applying sequences of basic operations to novel settings or in complex ways. An analysis item requires students to demonstrate a conceptual understanding of the principles and relationships relevant to particular mathematical operations. Items in each of the content domains sample extensively from these three cognitive levels.

Students are permitted to use calculators on all current versions of ACT Compass Mathematics Tests. Calculators must, however, meet ACT specifications, which are the same for ACT Compass and the ACT® college readiness assessment. These specifications are updated periodically and can be found at <http://actstudent.org/faq/calculator.html>.

## Numerical Skills/Pre-algebra and Algebra Tests

### Numerical Skills/Pre-algebra Placement Test

Questions in the Numerical Skills/Pre-algebra Placement Test range in content from basic arithmetic concepts and skills to the knowledge and skills considered prerequisites for a first algebra course. The Numerical Skills/Pre-algebra Placement Test includes items from more than a dozen content areas; however, a majority of the questions come from the following categories:

1. Operations with Integers
2. Operations with Fractions
3. Operations with Decimals
4. Positive Integer Exponents, Square Roots, and Scientific Notation
5. Ratios and Proportions
6. Percentages
7. Averages (Means, Medians, and Modes)

Sample items for each of these categories are presented later in this section.

### Algebra Placement Test

The Algebra Placement Test is composed of items from three curricular areas: elementary algebra, coordinate geometry, and intermediate algebra. Each of these three areas is further subdivided into a number of more specific content areas. Overall, the Algebra Placement Test includes items from more than 20 content areas; however, the majority of test questions fall within the following eight content areas:

1. Substituting Values into Algebraic Expressions
2. Setting Up Equations for Given Situations
3. Basic Operations with Polynomials
4. Factoring Polynomials
5. Linear Equations in One Variable
6. Exponents and Radicals
7. Rational Expressions
8. Linear Equations in Two Variables

Sample items for each of these categories are presented later in this section.

**Numerical Skills/Pre-algebra**

1.  $54 - 6 \div 2 + 6 = ?$ 
  - A. 6
  - B. 24
  - C. 27
  - D. 30
  - E. 57
  
2. The lowest temperature on a winter morning was  $-8^{\circ}\text{F}$ . Later that same day the temperature reached a high of  $24^{\circ}\text{F}$ . By how many degrees Fahrenheit did the temperature increase?
  - A.  $3^{\circ}$
  - B.  $8^{\circ}$
  - C.  $16^{\circ}$
  - D.  $24^{\circ}$
  - E.  $32^{\circ}$
  
3. If  $\left(\frac{3}{4} - \frac{2}{3}\right) + \left(\frac{1}{2} + \frac{1}{3}\right)$  is calculated and the answer reduced to simplest terms, what is the denominator of the resulting fraction?
  - A. 24
  - B. 12
  - C. 6
  - D. 4
  - E. 3
  
4.  $\frac{1}{2} + \left(\frac{2}{3} \div \frac{3}{4}\right) - \left(\frac{4}{5} \times \frac{5}{6}\right) = ?$ 
  - A.  $\frac{1}{16}$
  - B.  $\frac{17}{27}$
  - C.  $\frac{13}{18}$
  - D.  $\frac{7}{9}$
  - E.  $\frac{5}{6}$

5. Mr. Brown went grocery shopping to buy meat for his annual office picnic. He bought  $7\frac{3}{4}$  pounds of hamburger, 17.85 pounds of chicken, and  $6\frac{1}{2}$  pounds of steak. How many pounds of meat did Mr. Brown buy?
- A. 32.10  
 B. 31.31  
 C. 26.25  
 D. 22.10  
 E. 21.10
6. Four students about to purchase concert tickets for \$18.50 for each ticket discover that they may purchase a block of 5 tickets for \$80.00. How much would each of the 4 save if they can get a fifth person to join them and the 5 people equally divide the price of the 5-ticket block?
- A. \$ 1.50  
 B. \$ 2.50  
 C. \$ 3.13  
 D. \$10.00  
 E. \$12.50
7. In scientific notation,  $20,000 + 3,400,000 = ?$
- A.  $3.42 \times 10^6$   
 B.  $3.60 \times 10^6$   
 C.  $3.42 \times 10^7$   
 D.  $3.60 \times 10^7$   
 E.  $3.60 \times 10^{12}$
8. Saying that  $4 < \sqrt{x} < 9$  is equivalent to saying what about  $x$  ?
- A.  $0 < x < 5$   
 B.  $0 < x < 65$   
 C.  $2 < x < 3$   
 D.  $4 < x < 9$   
 E.  $16 < x < 81$

9. What value of  $x$  solves the following proportion?

$$\frac{9}{6} = \frac{x}{8}$$

- A.  $5\frac{1}{3}$   
 B.  $6\frac{3}{4}$   
 C.  $10\frac{1}{2}$   
 D. 11  
 E. 12
10. If the total cost of  $x$  apples is  $b$  cents, what is a general formula for the cost, in cents, of  $y$  apples?
- A.  $\frac{b}{xy}$   
 B.  $\frac{x}{by}$   
 C.  $\frac{xy}{b}$   
 D.  $\frac{by}{x}$   
 E.  $\frac{bx}{y}$
11. On a math test, 12 students earned an A. This number is exactly 25% of the total number of students in the class. How many students are in the class?
- A. 15  
 B. 16  
 C. 21  
 D. 30  
 E. 48
12. This year, 75% of the graduating class of Harriet Tubman High School had taken at least 8 math courses. Of the remaining class members, 60% had taken 6 or 7 math courses. What percent of the graduating class had taken fewer than 6 math courses?
- A. 0%  
 B. 10%  
 C. 15%  
 D. 30%  
 E. 45%

13. Adam tried to compute the average of his 7 test scores. He mistakenly divided the correct sum of all of his test scores by 6, which yielded 84. What is Adam's correct average test score?
- A. 70
  - B. 72
  - C. 84
  - D. 96
  - E. 98
14. A total of 50 juniors and seniors were given a mathematics test. The 35 juniors attained an average score of 80 while the 15 seniors attained an average of 70. What was the average score for all 50 students who took the test?
- A. 73
  - B. 75
  - C. 76
  - D. 77
  - E. 78



**Correct Answers for Sample Numerical Skills/Pre-algebra Questions**

<b>Item Number</b>	<b>Correct Answer</b>	<b>Content Category</b>
1	E	Operations with Integers
2	E	Operations with Integers
3	B	Operations with Fractions
4	C	Operations with Fractions
5	A	Operations with Decimals
6	B	Operations with Decimals
7	A	Exponents
8	E	Exponents
9	E	Ratios and Proportions
10	D	Ratios and Proportions
11	E	Percentages
12	B	Percentages
13	B	Averages
14	D	Averages

## Algebra

1. If  $x = -3$ , what is the value of  $\frac{x^2 - 1}{x + 1}$  ?
- A.  $-4$   
B.  $-2$   
C.  $2$   
D.  $3\frac{2}{3}$   
E.  $5$
2. Doctors use the term *maximum heart rate (MHR)* when referring to the quantity found by starting with 220 beats per minute and subtracting 1 beat per minute for each year of a person's age. Doctors recommend exercising 3 or 4 times each week for at least 20 minutes with your heart rate increased from its *resting heart rate (RHR)* to its *training heart rate (THR)*, where

$$THR = RHR + .65(MHR - RHR)$$

Which of the following is closest to the *THR* of a 43-year-old person whose *RHR* is 54 beats per minute?

- A. 197  
B. 169  
C. 162  
D. 134  
E. 80
3. When getting into shape by exercising, the subject's maximum recommended number of heartbeats per minute ( $h$ ) can be determined by subtracting the subject's age ( $a$ ) from 220 and then taking 75% of that value. This relation is expressed by which of the following formulas?
- A.  $h = .75(220 - a)$   
B.  $h = .75(220) - a$   
C.  $h = 220 - .75a$   
D.  $.75h = 220 - a$   
E.  $220 = .75(h - a)$

4. An airplane flew for 8 hours at an airspeed of  $x$  miles per hour (mph), and for 7 more hours at 325 mph. If the average airspeed for the entire flight was 350 mph, which of the following equations could be used to find  $x$  ?
- A.  $x + 325 = 2(350)$
  - B.  $x + 7(325) = 15(350)$
  - C.  $8x - 7(325) = 350$
  - D.  $8x + 7(325) = 2(350)$
  - E.  $8x + 7(325) = 15(350)$
5. Which of the following is equivalent to  $3a + 4b - (-6a - 3b)$  ?
- A.  $16ab$
  - B.  $-3a + b$
  - C.  $-3a + 7b$
  - D.  $9a + b$
  - E.  $9a + 7b$
6. What is the sum of the polynomials  $3a^2b + 2a^2b^2$  and  $-ab^2 + a^2b^2$  ?
- A.  $3a^2b - ab^2 + 3a^2b^2$
  - B.  $3a^2b - ab^2 + 2a^2b^2$
  - C.  $2a^2b + 3a^2b^2$
  - D.  $2a^2b^3 + 2a^4b^4$
  - E.  $-3a^3b^3 + 2a^4b$
7. Which of the following is a factor of the polynomial  $x^2 - x - 20$  ?
- A.  $x - 5$
  - B.  $x - 4$
  - C.  $x + 2$
  - D.  $x + 5$
  - E.  $x + 10$
8. Which of the following is a factor of  $x^2 - 5x - 6$  ?
- A.  $(x + 2)$
  - B.  $(x - 6)$
  - C.  $(x - 3)$
  - D.  $(x - 2)$
  - E.  $(x - 1)$

9. If  $2(x - 5) = -11$ , then  $x = ?$

- A.  $-\frac{21}{2}$
- B.  $-8$
- C.  $-\frac{11}{2}$
- D.  $-3$
- E.  $-\frac{1}{2}$

10. If  $\frac{4}{5} + \left(-\frac{3}{10}\right) = x + 1\frac{1}{2}$ , then  $x = ?$

- A.  $2$
- B.  $1$
- C.  $-1$
- D.  $-2$
- E.  $-10$

11. For all nonzero  $r$ ,  $t$ , and  $z$  values,  $\frac{16r^3tz^5}{-4rt^3z^2} = ?$

- A.  $-\frac{4z^3}{r^2t^2}$
- B.  $-\frac{4r^2z^3}{t^2}$
- C.  $-\frac{4rz}{t}$
- D.  $-4r^4t^4z^7$
- E.  $-4r^2t^2z^3$

12. For all  $x > 0$  and  $y > 0$ , the radical expression  $\frac{\sqrt{x}}{3\sqrt{x} - \sqrt{y}}$  is equivalent to:

- A.  $\frac{3x - \sqrt{xy}}{9x + y}$
- B.  $\frac{3x - \sqrt{xy}}{3x + y}$
- C.  $\frac{3x + \sqrt{xy}}{9x - y}$
- D.  $\frac{3x + \sqrt{xy}}{3x - y}$
- E.  $\frac{x}{3x - y}$

13. For all  $x \neq -4$ , which of the following is equivalent to the expression below?

$$\frac{x^2 + 12x + 32}{x + 4}$$

- A.  $x + 3$   
B.  $x + 8$   
C.  $x + 11$   
D.  $x + 16$   
E.  $x + 28$
14. Which of the following is a simplified expression equal to  $\frac{9-x^2}{x-3}$  for all  $x < -3$  ?
- A.  $3x$   
B.  $x + 3$   
C.  $x - 3$   
D.  $-x + 3$   
E.  $-x - 3$
15. What is the slope of the line with the equation  $2x + 3y + 6 = 0$  ?
- A.  $-6$   
B.  $-3$   
C.  $-2$   
D.  $-\frac{2}{3}$   
E.  $\frac{2}{3}$
16. Point  $A (-4,1)$  is in the standard  $(x,y)$  coordinate plane. What must be the coordinates of point  $B$  so that the line  $x = 2$  is the perpendicular bisector of  $\overline{AB}$  ?
- A.  $(-6, 1)$   
B.  $(-4, -1)$   
C.  $(-4, 3)$   
D.  $(-2, 1)$   
E.  $(8, 1)$

**Correct Answers for Sample Algebra Questions**

<b>Item Number</b>	<b>Correct Answer</b>	<b>Content Category</b>
1	A	Substituting Values into Algebraic Expressions
2	D	Substituting Values into Algebraic Expressions
3	A	Setting Up Equations for Given Situations
4	E	Setting Up Equations for Given Situations
5	E	Basic Operations with Polynomials
6	A	Basic Operations with Polynomials
7	A	Factoring Polynomials
8	B	Factoring Polynomials
9	E	Linear Equations in One Variable
10	C	Linear Equations in One Variable
11	B	Exponents
12	C	Exponents
13	B	Rational Expressions
14	E	Rational Expressions
15	D	Linear Equations in Two Variables
16	E	Linear Equations in Two Variables