

### ACT MATHEMATICS SKILLS EXERCISES

The next few pages contain exercises designed to help you apply the concepts generally tested on the ACT Mathematics Test. Following this section are simulated ACT Mathematics questions, which will allow you to become familiar with the format and types of questions you'll see on your actual ACT test. You might want to get some scratch paper before starting this section.

#### Basic Operations

These questions will test your knowledge of operations using whole numbers, fractions, and decimals.

*Insert the correct operator in the blanks below.*

1.  $108 \_ 9 = 12$

2.  $7 \_ 2 = 3.5$

3.  $\frac{1}{4} \_ \frac{3}{8} = \frac{5}{8}$

*Answer the following questions.*

4. What is the greatest common factor of 48 and 72?

5. What is the lowest common denominator of  $\frac{5}{8}$  and  $\frac{3}{4}$ ?

*Solve the following equations.*

6.  $\frac{(96 - 21)}{15} + 11 = \underline{\hspace{2cm}}$

7.  $3(27 + 2 - 3) = \underline{\hspace{2cm}}$

8.  $\frac{1}{3} + \frac{3}{7} = \underline{\hspace{2cm}}$

9.  $231.2 - 198.7 = \underline{\hspace{2cm}}$

10.  $0.25 \times \frac{1}{5} = \underline{\hspace{2cm}}$

#### Exponents and Square Roots

These questions will test your knowledge of operations using square roots.

*Solve the following problems.*

1.  $5^2 = \underline{\hspace{2cm}}$

2.  $\sqrt{36} \div \sqrt{4} = \underline{\hspace{2cm}}$

3. Express  $3 \times 3$  as a square:  $\underline{\hspace{2cm}}$

4.  $7^2 - 3^2 = \underline{\hspace{2cm}}$

5.  $\sqrt{64} \times 2^2 = \underline{\hspace{2cm}}$

#### Properties of Integer Exponents

These questions will test your knowledge of operations involving integer exponents.

**Solve the following problems.**

1.  $x^3 \times x^6 = \underline{\hspace{2cm}}$
2.  $(3^2)^3 = \underline{\hspace{2cm}}$
3.  $\left(\frac{5}{3}\right)^3 = \underline{\hspace{2cm}}$
4.  $137^0 = \underline{\hspace{2cm}}$
5.  $(y \times z)^2 = \underline{\hspace{2cm}}$

**Fill in the blanks below with the correct number.**

1. 2 raised to the power of  $\underline{\hspace{1cm}}$  = 8.
2.  $3^3 = \underline{\hspace{2cm}}$
3.  $\underline{\hspace{1cm}}^4 = 81$
4.  $125 = 5 \underline{\hspace{1cm}}$
5.  $(2^4)^2 = \underline{\hspace{2cm}}$

**Scientific Notation**

These questions will test your knowledge of operations using scientific notation.

**Fill in the blanks below with the correct number.**

1.  $423,700,000 = 4.237 \times 10$  to the power of  $\underline{\hspace{1cm}}$
2.  $3.76 \times 10^5 = \underline{\hspace{2cm}}$
3.  $(2.50 \times 10^4) \div (1.25 \times 10^3) = \underline{\hspace{2cm}}$
4.  $6.47 \times 10^{-5} = \underline{\hspace{2cm}}$
5.  $(4.2 \times 10^3) \times (1.8 \times 10^{-6}) = \underline{\hspace{2cm}}$

**Ratio, Proportion, and Percent**

These questions will test your knowledge of operations involving ratio, proportion, and percent.

**Answer the following questions.**

1.  $\underline{\hspace{1cm}}$  is 30% of 20.
2.  $\frac{39}{78} = \frac{x}{6}$ . Solve for  $x$ .
3. As an assistant analyst for the Department of Natural Resources, you were asked to analyze samples of river water. A 2-liter sample of water contained about 24 of a particular organism and a 4-liter sample of water contained about 48 such organisms. At this rate, how many of the organisms would you expect to find in a 10-liter sample of water from the same river?  $\underline{\hspace{2cm}}$
4. If 20% of  $x$  equals 16, then  $x = \underline{\hspace{2cm}}$
5. Jim scored 95 points in 5 basketball games for his school. At this rate, how many points will he have scored by the end of the 12-game season?

### Linear Equations with One Variable

These questions will test your knowledge of linear equations involving one variable.

**Solve the following equations.**

1.  $3x - 17 = 46$ . Solve for  $x$ .
2.  $\frac{x}{4} = -6$ . Solve for  $x$ .
3. If  $x = 15$ , then  $4x - \underline{\hspace{1cm}} = 42$ .
4. Two trains running on parallel tracks are 600 miles apart. One train is moving east at a speed of 90 mph, while the other is moving west at 75 mph. How long will it take for the two trains to pass each other?
5.  $3(x - 4) = 5x - 20$ . Solve for  $x$ .

### Absolute Value

These questions will test your knowledge of operations involving absolute value.

**Solve the following equations.**

1. If  $x = -8$ , what is the value of  $|x - 6|$ ?
2. Solve  $|4x - 6| = 10$  for  $x$ .
3.  $|-15| \times |6| = \underline{\hspace{1cm}}$
4. Solve  $|6x + 8| = |3x - 7|$  for  $x$ .
5.  $\frac{-32}{|-8|} = \underline{\hspace{1cm}}$

### Simple Probability

These questions will test your knowledge of operations involving simple probability.

**Answer the following questions.**

1. If you roll a single 6-sided die, what is the probability that you will roll an odd number?
2. A company knows that 2.5% of the CD players it makes are defective. If the company produces 300,000 CD players, how many will be defective?
3. When flipping a coin, what is the probability that it will land on tails four times in a row?
4. If the probability that Dave will go to class is 0.7, what is the probability that he will not go to class?
5. There is a bowl with 20 marbles in it (8 blue, 6 red, 3 green, 2 yellow, and 1 orange.) If you reach in and choose one marble at random, what is the probability that it will be red?

### Functions

These questions will test your knowledge of operations involving functions.

**Answer the following questions.**

1. For the function  $f(x) = x^2 - 4x + 8$ , what is the value of  $f(6)$ ?
2. If  $f(x) = x^2$ , find  $f(x + 1)$ .
3. If the function  $f(x) = x + 2$ , and the function  $g(x) = 3x$ , what is the function  $g(f(x))$ ?
4. For the function  $f(x) = x^4 - \frac{3x}{2}$  what is the value of  $f(2)$ ?
5. For the function  $f(x) = x^2 + x$ , what is the value of  $f(-5)$ ?

### Polynomial Operations and Factoring Simple Quadratic Equations

These questions will test your knowledge of operations involving polynomial operations and factoring simple quadratic equations.

**Solve the following equations.**

1. For  $x = 4$ ,  $3x^2 - 5x + 9 = \underline{\hspace{2cm}}$
2.  $(5x^3 + 3x - 12) - (2x^3 - 6x + 17) = \underline{\hspace{2cm}}$
3.  $(4x^2 + 2x)(x - 6) = \underline{\hspace{2cm}}$

**Answer the following questions.**

4. What are the solution sets for  $x^2 + 2x - 48$ ?
5.  $(x - 4)$  and  $(2x + 3)$  are the solution sets for what equation?

### Linear Inequalities with One Variable

These questions will test your knowledge of operations involving linear inequalities with one variable.

**Answer the following questions.**

1. For  $-5 \leq x < 15$ ,  $x = \underline{\hspace{2cm}}$
2. For which values of  $x$  is  $6x - 3 > 4x + 5$ ?
3. If  $x = 7$ , then is  $3x + 7$  greater than or less than  $5x - 6$ ?
4. For which values of  $x$  is  $2x - 5 < -3x + 20$ ?
5. Solve  $-4 \leq x + 3 < 18$  for  $x$ .

### Quadratic Formula

These questions will test your knowledge of operations involving the quadratic formula.

**Answer the following questions.**

1. Use the quadratic formula to solve the equation  $10x^2 + 22x + 12.1 = 0$ .
2. Set up the equation  $4x^2 - 7x + 3 = 10x^2 + x - 11$  so it can be used in the quadratic formula.

- Solve the  $4x^2 + x - 5 = 0$  using the quadratic formula.
- Which values of  $a$ ,  $b$ , and  $c$  will you use in the quadratic formula for the equation  $18x - 117 + 4x^2 = 0$ ? (place an "X" next to the correct answer)
  - 18, -117, 4
  - 117, 4, 18
  - 4, 18, -117
  - 4, 18, 117
- Solve  $(2x + 4)^2 = 0$  using the quadratic formula.

### Radical and Rational Expressions

These questions will test your knowledge of operations involving radical and rational expressions.

**Solve the following problems.**

- $\sqrt{12} \times \sqrt{3} = ?$
- $\sqrt{\frac{2}{5}} = ?$
- $\sqrt[3]{27} = ?$
- $\sqrt{2x^4} \times \sqrt{8y^2} = ?$
- $\sqrt[4]{11^{14}} = ?$

### Inequalities and Absolute Value Equations

These questions will test your knowledge of operations involving inequalities and absolute value equations.

**Answer the following questions.**

- For  $|7x - 13| < 22$ , which one of the following is true? (place an "X" next to the correct answer)
  - $7x - 13 > 22$  OR  $7x - 13 < -22$
  - $7x - 13 < 22$  AND  $7x - 13 > -22$
  - $-7x - 13 < 22$  AND  $-7x - 13 > -22$
  - $7x + 13 > 22$  OR  $7x + 13 < -22$
- If  $|x + 8| > 15$ , what is/are the possible values of  $x$ ?
- If  $|2x + 3| < 21$ , what is/are the possible values of  $x$ ?
- For  $|5x - 6| > 29$ , which one of the following is true? (place an "X" next to the correct answer)
  - $5x - 6 > 29$  OR  $5x - 6 < -29$
  - $5x - 6 < 29$  AND  $5x - 6 > -29$
  - $-5x - 6 < 29$  AND  $-5x - 6 > -29$
  - $5x + 6 > 29$  OR  $5x + 6 < -29$
- If  $|\frac{1}{4}x + 3| > 5$ , what is/are the possible values of  $x$ ?

### Sequences

These questions will test your knowledge of operations involving sequences.

#### Answer the following questions.

- Find the 3rd term of the arithmetic sequence:  $a_n = 3 + (n - 1)(2)$ .
- Write a formula for the  $n$ th term of the arithmetic sequence  $-8, -2, 4, 10, \dots$
- In the geometric sequence:  $\frac{1}{4}, 1, 4, 16, \dots$ , what is the 6th term?
- Which of the following represents the formula to find the 8th term of the arithmetic sequence  $7, 13, 19, 25, \dots$ ? (place an "X" next to the correct answer)
  - $13 + (8 - 1)(19)$
  - $25(7)^{19 - 13}$
  - $7(6)^{8 - 1}$
  - $7 + (8 - 1)(6)$
- Write a formula for the  $n$ th term of the geometric sequence  $25, -5, 1, \frac{1}{5}, \dots$

### Systems of Equations

These questions will test your knowledge of operations involving systems of equations.

#### Solve the following systems of equations.

- $$\begin{cases} x - 2y = 14 \\ x - 4y = -8 \end{cases}$$
- $$\begin{cases} 4x - 2y = 6 \\ -6x + 5y = 7 \end{cases}$$
- $$\begin{cases} 3x - y = 18 \\ 4x = 24 - 6y \end{cases}$$
- $$\begin{cases} 8(y + x) = 12 \\ 4x - 3y = -22 \end{cases}$$
- $$\begin{cases} 4x - y = 63 \\ 3y + x = 6 \end{cases}$$

### Logarithms

These questions will test your knowledge of operations involving logarithms.

**Solve the following problems.**

- What is the value of  $x$  that satisfies  $\log_x 27 = 3$ ?
- If  $\log_x 625 = 4$ , what is the value of  $x$ ? (place an "X" next to the correct answer)
  - 4
  - 5
  - 7
  - 19
- $\log_3 729 = ?$
- If  $\log_x 196 = 2$ , then  $x = \underline{\hspace{1cm}}$ ?
- If  $\log_7 x = 3$ , what is the value of  $x$ ? (place an "X" next to the correct answer)
  - 5
  - 64
  - 216
  - 343

**Roots of Polynomials**

These questions will test your knowledge of operations involving roots of polynomials.

**Answer the following questions.**

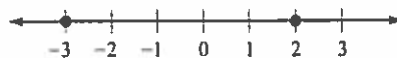
- Find the roots of  $2x^2 + 9x - 35$  by factoring.
- Find the roots of  $x^2 + 2x - 3$  by factoring.
- What polynomial equation has the solutions  $x = 6$  and  $x = -2$ ?
- Solve for  $x$  by factoring the polynomial equation  $x^2 - 8x + 16$ .
- Find the roots of  $-x^2 + 3x + 40$  by factoring.

**Number Line Graphs**

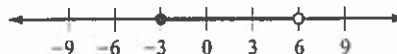
These questions will test your knowledge of operations involving number line graphs.

**Answer the following questions.**

- On a number line, what is the distance between  $-5$  and  $3$ ?
- What is the midpoint of the two points in the below graph?

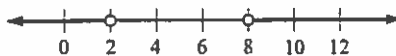


- The below graph represents which values for  $x$ ? (place an "X" next to the correct answer)



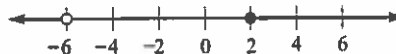
- $x > -3$  AND  $x < 6$   
  $x \geq -3$  AND  $x \leq 6$   
  $x \geq -3$  OR  $x < 6$   
  $x \geq -3$  AND  $x < 6$

4. The below graph represents the solution to which inequality? (place an "X" next to the correct answer)



- $|2x - 10| < 6$   
  $|2x + 10| < 6$   
  $|2x - 10| > 6$   
  $|-2x + 10| > 6$

5. The below graph represents which values for  $x$ ? (place an "X" next to the correct answer)



- $x \geq 2$  OR  $x < -6$   
  $x \geq 2$  AND  $x < -6$   
  $x \geq -6$  OR  $x < 2$   
  $x \geq -6$  AND  $x > 2$

### Equation of a Line and Slope of a Line

These questions will test your knowledge of operations involving the equation of a line and the slope.

**Answer the following questions.**

1. What is the  $y$ -intercept of the line with the equation  $2y = 4x + 12$ ?
2. What is the slope of the line with the equation  $3y = -2x + 5$ ?
3. What is the slope of the line  $x = 4$ ?
4. What is the equation of a line parallel to  $y = 4x - 12$  and crossing the  $y$ -axis at 3?
5. What is the equation of a line perpendicular to  $3x = 2 - y$  with the  $y$ -intercept 8?

### Distance and Midpoint Formulas

These questions will test your knowledge of operations involving distance and midpoint formulas.



**Answer the following questions.**

1. What is the distance between the points  $(3, -4)$  and  $(9, 4)$ ?
2. What is one possible value for  $y$  if the distance between the two points  $(2, 8)$  and  $(-6, y)$  is 17?
3. What is the midpoint between  $(12, 5)$  and  $(10, -7)$ ?
4. Solve for  $x$  if the midpoint between the two points  $(x, 1)$  and  $(-2, -3)$  is  $(5, -1)$ .
5. What is the distance between the points  $(0, 5)$  and  $(5, 0)$ ?

**Properties and Relations of Plane Figures**

These questions will test your knowledge of operations involving plane figures.

**Answer the following questions.**

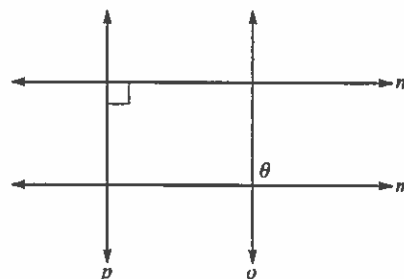
1. What is the hypotenuse of a right triangle with a base of 9 cm and an area of  $54 \text{ cm}^2$ ?
2. What is the area of a circle with a circumference of  $14\pi$  inches?
3. If one of the angles of a parallelogram measures  $35^\circ$ , what is the sum of the remaining angles?
4. A trapezoid has one base of 8 ft, a height of 3 ft, and an area of  $30 \text{ ft}^2$ , what is the length of the other base?
5. A polygon with four sides and four right angles has one side of 6 mm. If the area is  $42 \text{ mm}^2$ , would the polygon be considered a square or a rectangle?

**Angles, Parallel Lines, and Perpendicular Lines**

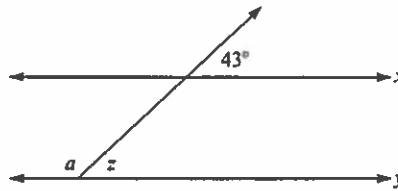
These questions will test your knowledge of operations involving angles, parallel lines, and perpendicular lines.

**Answer the following questions.**

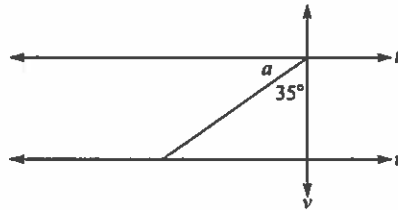
1. What is the measure of the angle that is supplementary to a  $40^\circ$  angle?
2. What is the measure of the angle that is supplementary to a  $25^\circ$  angle?
3. In the figure below, line  $n$  is parallel to line  $m$ , and line  $p$  is parallel to line  $o$ . What is the measure of angle  $\theta$ ?



4. In the figure below, line  $x$  is parallel to line  $y$ . What is the measure of angle  $a$ ?



5. In the figure below, line  $t$  is parallel to line  $u$ , and line  $v$  is perpendicular to line  $u$ . What is the measure of angle  $a$ ?



### Perimeter, Area, and Volume

These questions will test your knowledge of operations involving perimeter, area, and volume.

#### Answer the following questions.

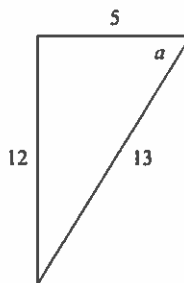
1. You are applying fertilizer to your backyard. The rectangular yard measures 40 feet wide and 70 feet long. You use 6 pounds of fertilizer to treat 700 square feet. The fertilizer comes in 8-pound bags. How many bags of fertilizer will you need to complete the job?
2. John is building a circular fence around his circular pool. The pool is 26 feet in diameter. If John wants to have 4 feet of space between the edge of the pool and the fence, what is the area that will be enclosed by the fence? ( $\pi = 3.14$ )
3. Tiffany inflates a beach ball. If the diameter of the ball is 0.6 m, what is the volume?
4. A cylindrical can of pineapple juice contains  $350 \text{ cm}^3$  of liquid. If the can is  $\frac{14}{\pi}$  cm tall, what is the diameter?
5. A cube has an edge length of 5 in; what is the volume of the cube?

### Trigonometry

These questions will test your knowledge of operations involving trigonometry.

**Answer the following questions.**

1. In the triangle below, what is  $\sin a$ ?



2. If  $\cos a = \frac{4}{5}$ , what is  $\tan a$ ?
3. Convert  $60^\circ$  into radians.
4. Convert  $\frac{3\pi}{4}$  radians into degrees.
5. If  $\sec a = \frac{13}{5}$ , what is  $\sin a$ ?

**Translating Word Problems**

These questions will test your ability to locate relevant mathematical information in word problems.

**Place an "X" next to the correct expression in the questions below.**

1. Tom had 6 books. He gave 2 to his sister and then purchased 3 more at the bookstore. Which of the following mathematical expressions is equivalent to the number of books that Tom has now?
- $6 - 2 + 3$
- $6 + 2 - 3$
- $6(2 + 3)$
- $6(2 - 3)$
2. Juan walked 3 more miles than Rebecca. Rebecca walked 4 times as far as William. William walked 2 miles. Which of the following mathematical expressions is equivalent to the number of miles Juan walked?
- $3 \times 4 \times 2$
- $(2 + 4) \times 3$
- $4(2) + 3$
- $4 + 3 + 2$
3. Tina goes to the store to purchase some CDs and DVDs. CDs cost \$15 and DVDs cost \$18. Which of the following expressions gives the total amount of money, in dollars, Tina will pay for purchasing 2 of the CDs and  $d$  of the DVDs?
- $15 + d$
- $30 + 18d$

\_\_\_  $18 + d + 30$

\_\_\_  $d(18 + 15)$

4. Mark is older than Frank, but younger than David. If  $m$ ,  $f$ , and  $d$  represent the ages, in years, of Mark, Frank, and David, respectively, which of the following is true?

\_\_\_  $d < f < m$

\_\_\_  $f < m < d$

\_\_\_  $d < m < f$

\_\_\_  $f < d < m$

5. Kathy was twice as old as Jim 2 years ago. Today, Jim is  $j$  years old. In terms of  $j$ , how old was Kathy 2 years ago?

\_\_\_  $2(j - 2)$

\_\_\_  $2j - 2$

\_\_\_  $2(j + 2)$

\_\_\_  $j(2 + 2)$