# Part 2 ACT Mathematics Test

The ACT Mathematics Test asks you to answer 60 multiple-choice questions in 60 minutes. The questions are designed to measure your mathematical achievement—the knowledge, skills, and reasoning techniques that are taught in high school mathematics courses and needed for college mathematics courses. Therefore, the questions cover a wide variety of concepts, techniques, and procedures. Naturally, some questions will require computation, but you are allowed to use a calculator on the Mathematics Test. You'll need to understand basic mathematical terminology and to recall some basic mathematical principles and formulas. However, the questions on the test are designed to emphasize your ability to reason mathematically, not to focus on your computation ability or your ability to recall definitions, theorems, or formulas.

## Content of the ACT Mathematics Test

As you saw in the chart on page 23, the questions on the ACT Mathematics Test are drawn from the following six categories, which are explained later in this section. These six content categories represent areas of mathematics commonly taught by the end of grade 11 that are important to success in entry-level college mathematics courses:

- Pre-Algebra
- Elementary Algebra
- Intermediate Algebra
- Coordinate Geometry
- Plane Geometry
- Trigonometry

You will receive a score for all 60 questions, and three subscores: a Pre-Algebra/Elementary Algebra subscore based on 24 questions, an Intermediate Algebra/Coordinate Geometry subscore based on 18 questions, and a Plane Geometry/Trigonometry subscore based on 18 questions.

**Pre-Algebra** questions involve solving problems using the mathematics that you probably learned before you took your first math course in high school—things like operations using whole numbers, fractions, decimals, and integers; numbers raised to positive integer powers and square roots of numbers; ratio, proportion, and percent; multiples and factors of integers; absolute value; ordering numbers from least to greatest or greatest to least; simple linear equations with one variable; simple probability and counting the number of ways something can happen; representing and interpreting data in charts, tables, and graphs; and simple descriptive statistics like mean, median, and mode.

**Elementary Algebra** questions involve topics like using variables to express relationships, substituting the value of a variable in an expression, performing basic operations on polynomials, factoring polynomials, solving simple quadratic equations (the kind that can be solved by factoring), solving linear inequalities with one variable, and applying properties of integer exponents and square roots.

**Intermediate Algebra** questions ask you to apply your knowledge, skills, and reasoning ability to solve problems that involve more advanced topics of algebra like the quadratic formula, radical and rational expressions, inequalities and absolute value equations, sequences, systems of equations, quadratic inequalities, functions, matrices, roots of polynomials, and complex numbers.

**Coordinate Geometry** questions deal with the real number line and the standard $(x,y)$ coordinate plane. They cover number line graphs as well as graphs of points, lines, polynomials, circles, and other curves in the standard $(x,y)$ coordinate plane. They also cover relationships between equations and graphs, slope, parallel and perpendicular lines, distance, midpoints, transformations, and conics.

**Plane Geometry** questions test your grasp of topics that are usually part of high school geometry, though some topics are introduced in earlier coursework. Included are the properties and relations of plane figures (triangles, rectangles, parallelograms, trapezoids, and circles); angles, parallel lines, and perpendicular lines; translations, rotations, and reflections; proof techniques; simple three-dimensional geometry; and measurement concepts like perimeter, area, and volume. Justification, proof, and logical conclusions are a part of this area.

**Trigonometry** questions cover the trigonometric ratios defined for right triangles; the values, properties, and graphs of the trigonometric functions; trigonometric identities; trigonometric equations; and modeling with trigonometric functions.

## Types of Questions on the ACT Mathematics Test

The content of the questions on the ACT Mathematics Test varies; the questions also vary in their complexity and in the amount of thinking you have to do in order to answer them. The rest of this section gives you examples of questions—of various types and complexities—from all six content areas. All of the questions used in the examples are from actual ACT Mathematics Tests that have been taken by students from across the country. A solution strategy is given for each question. As you read and work through each example, please keep in mind that the strategy given is just one way to solve the problem. A variety of other strategies will also work for each question.

### *Basic Math Problems*

The type of question you're probably the most familiar with (and probably find the easiest) is the stripped-down, bare-bones, basic math problem. Problems of this type are simple and straightforward. They test readily identifiable skills in the six content areas, usually have very few words and no extra information, ask the very question you'd expect them to ask, and usually have a numeric answer.

Question 1 is a good example of a basic math problem from pre-algebra.

1. What is 4% of 1,100 ?

   A. 4
   B. 4.4
   C. 40
   D. 44
   E. 440

This problem has very few words, asks a direct question, and has a numeric answer. The solution is simple: convert 4% to a decimal and multiply by 1,100 to get (0.04)(1,100) = 44 (D). You probably wouldn't need your calculator on this problem, but remember that you may use it if you wish. If you got answer B or E, you may have used rules about moving decimal points and moved the wrong number of places.

Question 2 is a basic elementary algebra problem.

2. For all $x$, $(x + 4)(x - 5) = ?$

   F. $x^2 - 20$
   G. $x^2 - x - 20$
   H. $2x - 1$
   J. $2x^2 - 1$
   K. $2x^2 - x + 20$

You should know what to do to answer the question the instant you read the problem—use the distributive property (FOIL—Firsts, Outside, Inside, Lasts) and get $x(x - 5) + 4(x - 5) = x^2 - 5x + 4x + 4(-5) = x^2 - x - 20$ (G). On this problem, you probably wouldn't use your calculator. If you got answer F, you probably just multiplied the first terms and the last terms. Check your answer by substituting a number (try 6) into the original expression and into your answer. If the results are not equal, then the expressions cannot be equivalent.

Question 3 is an example of a basic problem from intermediate algebra.

3. If $x + y = 1$, and $x - y = 1$, then $y = ?$

   A. $-1$
   B. $0$
   C. $\frac{1}{2}$
   D. $1$
   E. $2$

This problem gives you a system of linear equations with unknowns $x$ and $y$ and asks for the value of $y$. You might be able to solve this problem intuitively—the only number that can be added to and subtracted from another number and give the same result for the problem ($x + y$ and $x - y$ both give 1) is 0, so $y$ must be 0 (B). Or, you could use algebra and reason that, because $x + y$ and $x - y$ both equal 1, they equal each other, and $x + y = x - y$ gives $2y = 0$, so $y = 0$. Although some calculators have graphing or matrix functions for solving problems of this type, using a calculator on this problem would probably take most students longer than solving it with one of the strategies given here. If you chose answer D, you probably found the value of $x$ rather than the value of $y$.

Question 4 is an example of a basic problem in coordinate geometry.

**4.** What is the slope of the line containing the points (–2,7) and (3,–3) ?

**F.** 4

**G.** $\frac{1}{4}$

**H.** 0

**J.** $-\frac{1}{2}$

**K.** –2

This problem has a few more words than some of the other examples of basic problems you've seen so far, but the most important word is "slope." Seeing that you are given two points, you would probably think of the formula that defines the slope of a line through two points:

$$\frac{y_1 - y_2}{x_1 - x_2}.$$

Applying the formula gives $\frac{7-(-3)}{-2-3}$, or –2 (K). If you chose answer J, you probably got the expression for slope upside down. The change in $y$ goes on top.

There are also some basic plane geometry problems on the ACT Mathematics Test. Question 5 is a good example.

5. If the measure of an angle is $37\frac{1}{2}°$, what is the measure of its supplement, shown in the figure below?


A. $52\frac{1}{2}°$

B. $62\frac{1}{2}°$

C. $127\frac{1}{2}°$

D. $142\frac{1}{2}°$

E. Cannot be determined from the given information

Like many geometry problems, this problem has a figure. The figure tells you what you are given (an angle of $37\frac{1}{2}°$) and what you're asked to find (its supplement, marked by "?"). There really isn't anything you need to mark on the figure because all the important information is already there. If you know that the sum of the measure of an angle and the measure of its supplement equals 180°, a simple subtraction gives the correct answer ($180° - 37\frac{1}{2}° = 142\frac{1}{2}°$), or D. If you answered A, you found the complement, not the supplement.

A word of caution is in order here. You probably noticed that "Cannot be determined from the given information" is one of the options for question 5. Statistics gathered over the years for the ACT Mathematics Test show that "Cannot be determined from the given information" is chosen by many students even when it is not the correct option. You should not think that whenever "Cannot be determined from the given information" is an option, it is automatically the correct answer. It isn't, as question 5 demonstrates. Later in this section, there's a question for which the correct answer is "Cannot be determined from the given information." Be sure to think carefully about problems with this answer choice.