Pre-Algebra

The various pre-algebra topics are the most basic on the ACT Math Test. You probably covered much of this material in your middle school math classes. These topics are not conceptually difficult, but they do have some nuances you may have forgotten along the way. Also, since questions covering pre-algebra are often not that hard, you should make sure you review properly to get these questions right.

The topics in this section appear roughly in order of frequency on the Math Test. Number problems are usually the most common pre-algebra questions on the test, while series questions are usually the least common.

1. Number Problems
2. Multiples, Factors, and Primes
3. Divisibility and Remainders
4. Percentages, Fractions, and Decimals
5. Ratios and Proportions
6. Mean, Median, and Mode
7. Probability
8. Absolute Value
9. Exponents and Roots
10. Series

While “Multiples, Factors, and Primes” and “Divisibility and Remainders” do not explicitly appear too frequently on the test, the math behind them will help you answer number problems, so we’ve included them at the top of the list.

We mentioned that the above list is only roughly ordered by decreasing frequency. If it were in an exact order, percentages would share the top billing with number problems; because we wanted to keep related topics close together, we sacrificed a bit of precision.

Number Problems

On the ACT Math Test, number problems are word problems that ask you to manipulate numbers. The math in number problems is usually extremely simple. You are seldom asked to perform operations that are more complicated than basic addition, subtraction, multiplication, and division. Despite the simple operations, number problems can be confusing because of their wording and because of the multiple steps involved in answering them. Here’s an example of a typical number problem on the Math Test:

> Train A travels at 90 miles per hour and covers 360 miles. Train B covers the same distance but travels at 60 miles per hour. How much longer does it take Train B than Train A to cover that distance?

The first step in answering these questions is to read carefully to make sure you know exactly what they are asking. Because of the time pressure of the test, some students feel as if the time they take to understand the question is wasted since they aren’t actually doing any math. But taking a moment to ask yourself what the question is asking is *crucial*. Not only will you be more likely to get the question right if you take a moment to make sure you understand it, but that little bit of invested time will actually *save* you time later, since you will be able to proceed with an understanding of what you need to do.

The question above asks the difference in time it takes the two trains to cover the same distance. Your first step should be to figure out how long each train takes to travel 360 miles. Once you've done that, you can subtract the smaller number from the bigger number to get the difference in time. The question gives you two pieces of information that will help you figure out the trains' times: the speed (miles per hour) and the distance (miles). If you divide the distance by the speed, you will cancel out the miles and end up with the hours:

$$\text{Time (hours)} = \frac{\text{distance (miles)}}{\text{speed (miles/hour)}}$$

Once you've done that, you'll see that Train A travels for 4 hours and Train B for 6 hours:

$$6 \text{ hours} - 4 \text{ hours} = 2 \text{ hours}$$

Multiples, Factors, and Primes

Multiples, factors, and primes appear quite frequently on the ACT Math Test. You will rarely see a non-word problem covering multiples, factors, and primes; this topic almost always appears in word problem form.

While these questions are relatively easy, they can be quite confusing simply because of the terminology they use. Below, we give you the definition for each of these three mathematical concepts.

Multiples

The multiple of a number is the product generated when that number is multiplied by an integer. The first five multiples of 7 are 7, 14, 21, 28, and 35 since $7 \times 1 = 7$, $7 \times 2 = 14$, $7 \times 3 = 21$, $7 \times 4 = 28$, and $7 \times 5 = 35$.

THE LEAST COMMON MULTIPLE

The least common multiple (LCM) is the name given to the lowest multiple that two particular numbers share. For example, the multiples of 6 and 8 are:

- **Multiples of 6:** 6, 12, 18, **24**, 30, 36, 42, **48**, 54, . . .
- **Multiples of 8:** 8, 16, **24**, 32, 40, **48**, 56, 64, 72, . . .

As the two lists show, 6 and 8 both have 24 and 48 as multiples (they also share many other multiples, such as 72, 96, etc.). Because 24 is the lowest in value of these shared multiples, it is the least common multiple of 6 and 8.

Being able to figure out the least common multiple of two numbers can prove quite handy on the ACT, especially for questions in which you have to add or subtract two fractions with unlike denominators (we'll explain when we talk about fractions).

Factors

A factor of a number is an integer that divides evenly into the number. For example, 6, 4, 3, and 2 are all factors of 12 because $12/6 = 2$, $12/4 = 3$, $12/3 = 4$, and $12/2 = 6$. Factors, then, are related to multiples. A given number is a multiple of all of its factors: 2 and 6 are factors of 12, so 12 is a multiple of both 2 and 6.

THE GREATEST COMMON FACTOR

The greatest common factor (GCF) of two numbers is the largest factor that the two numbers share. For example, the GCF of 18 and 24 is 6, since 6 is the largest number that is a factor of both 18 and 24.

FACTORIZATION

To find all the factors of a number, write them down in pairs, beginning with 1 and the number you're factoring. We'll factor 24 for this example. So, 1 and 24 are both factors of 24. Next, try every integer greater than 1 in increasing order. Here are the factor pairs we find for 24: 1 and 24, 2 and 12, 3 and 8, and 4 and 6.

You know you've found all the factors of a number when the increasing integer in each pair exceeds the decreasing integer. For example, after you found that 4 was a factor of 24 and 5 was not, you would see that 6, the next factor of 24, had already been included in a pair of factors. Thus, all the factors have been found.

As you might imagine, factoring a very large number can get pretty involved. But don't worry—that kind of extensive factoring won't be asked of you on the test.

Primes

A prime number is divisible by only 1 and itself (the number 1 itself is not considered prime). For example, 17 is prime because it is divisible by only 1 and 17. The first few primes, in increasing order, are:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, . . .

PRIME FACTORIZATION

Another form of factorization is called prime factorization. Prime factorization expresses an integer as the product of a series of prime numbers.

To find the prime factorization of a number, divide it and all of its factors until every integer remaining is prime. This group of prime numbers is the prime factorization of the original integer. Let's find the prime factorization of 36 as an example:

$$36 = 2 \times 18 = 2 \times 2 \times 9 = 2 \times 2 \times 3 \times 3$$

As you may already have noticed, there is more than one way to find the prime factorization of a number. We could have first resolved 36 into 6×6, for example, and then determined the prime factorization from there. So don't worry—you can't screw up. No matter which path you take, you will always get the same result—that is, as long as you do your arithmetic correctly.

Just for practice, let's find a couple more prime factorizations:

$$45 = 3 \times 15 = 3 \times 3 \times 5$$
$$41 = 1 \times 41$$

Since the only factors of 41 are 1 and 41, it is a prime number. In other words, 41 is its own prime factorization.

RELATIVELY PRIME NUMBERS

Two numbers are called relatively prime if they share no common prime factors (i.e., if their GCF is 1). This doesn't necessarily mean, however, that each number is itself prime. For instance, 8 and 15 are relatively prime, because they have no common primes in their prime factorizations ($8 = 2 \times 2 \times 2$ and $15 = 3 \times 5$), but neither number is prime. It is a good idea just to know the definition of relatively prime numbers, in case the concept pops up on the test somewhere.

Divisibility and Remainders

Divisibility and remainders are also popular subjects for pre-algebraic number problems on the ACT Math Test. As with multiples, factors, and primes, you will probably not see basic problems on divisibility and remainders, but the topic will appear in relatively complicated word problems.
A number (x) is divisible by another number (y) if, when x is divided by y, the answer is a whole number. For example, 6 is divisible by 3 because 6/3 = 2, and 2 is a whole number. However, 6 is not divisible by 4, because 6/4 = $1\,^2/_4$, which is not a whole number. Another way of describing 6/4 is to say that you can make one complete division with a remainder of 2.
To check divisibility, it is always possible to do the division by hand and see whether the result is a whole number. However, if the number we are dividing is large, this becomes very difficult. There are some divisibility rules that make this task much easier—these rules allow us to determine whether a number is divisible by another number without having to carry out the division.

Divisibility Rules

1. All whole numbers are divisible by 1.
2. All numbers with a ones digit of 0, 2, 4, 6, and 8 are divisible by 2.
3. A number is divisible by 3 if its digits add up to a number divisible by 3. For example, 6,711 is divisible by 3 because 6 + 7 + 1 + 1 = 15, and 15 is divisible by 3.
4. A number is divisible by 4 if its last two digits are divisible by 4. For example, 78,052 is divisible by 4 because 52 is divisible by 4. But 7,850 is not divisible by 4 because 50 is not divisible by 4.
5. A number is divisible by 5 if it ends in 0 or 5.
6. A number is divisible by 6 if it is even and also divisible by 3.
7. Sorry. There are no rules for 7.
8. A number is divisible by 8 if its last three digits are divisible by 8. For example, 905,256 is divisible by 8 because 256 is divisible by 8. But 74,513 is not divisible by 8 because 513 is not divisible by 8.
9. A number is divisible by 9 if its digits add up to a number divisible by 9. For example, 1,458 is divisible by 9 because 1 + 4 + 5 + 8 = 18 and 18 is divisible by 9.
10. A number is divisible by 10 if it ends in 0.

Two Notes: (1) Because a number divided by itself always yields 1, a number is always divisible by itself. For example, 7 is divisible by 7, and 8,374 is divisible by 8,374. **(2)** No number is divisible by a number greater than itself.

Remainders

A remainder is the number that remains after x has been divided by y. If y divides evenly into x, the remainder of $x \div y$ is zero. A remainder will always be smaller than the number that is doing the dividing. For instance, if you divide 22 by 5, your answer is 4 with a remainder of 2.

Percentages, Fractions, and Decimals

Percentage problems appear frequently on the ACT Math Test. Because percentages are essentially fractions and decimals, our review of percentages will begin with a review of fractions and decimals. While questions dealing specifically with fractions and decimals *per se* are rare on the ACT Math Test, knowing more about them will aid your understanding of the more common questions about percentages.

Fractions

Although you may not see a fraction problem on the Math Test (or, at most, you'll see one or two), you should still review your knowledge of fractions, as they form the basis for percentages, a favorite topic of the ACT.

A fraction describes a part of a whole. The number on the bottom of the fraction is called the denominator, and it denotes how many equal parts the whole is divided into. The number on the top of the fraction is called the numerator, and it denotes how many of the parts we are taking. For example, the fraction $^3/_4$ denotes "three of four equal parts," 3 being the numerator and 4 being the denominator. You can also think of fractions as similar to division. In fact, $^3/_4$ has the same value as $3 \div 4$.

The ACT may indirectly test your ability to add, subtract, multiply, and divide fractions. Questions that deal more directly with fractions will probably test your ability to reduce and compare fractions.

ADDING AND SUBTRACTING FRACTIONS

There are two different types of fractions that you may have to add or subtract: those with the same denominator and those with different denominators.

If fractions have the same denominator, adding them is extremely easy. All you have to do is add up the numerators:

$$\frac{1}{20}+\frac{3}{20}+\frac{13}{20}=\frac{17}{20}$$

Subtraction works similarly. If the denominators of the fractions are equal, then you simply subtract one numerator from the other:

$$\frac{13}{20}-\frac{2}{20}=\frac{11}{20}$$

If the fractions do not have equal denominators, the process is somewhat more involved. The first step is to make the denominators the same. To set the denominators of two fractions as equal, find the least common denominator (LCD), which is simply the Least Common Multiple of the two denominators. For example, 18 is the LCD of $^1/_6$ and $^4/_9$, since 18 is the smallest multiple of both 6 and 9.

Setting the denominators of two fractions equal to one another is a two-step process. First, find the LCD. Second, write each fraction as an equivalent fraction with the LCD as the new denominator, remembering to multiply the numerator by the same multiple as the denominator. For example, if you wanted to add $^5/_{12}$ and $^4/_9$, you would do the following:

First, find the LCD:

1. Factor the denominators: $12 = 2 \times 2 \times 3$ and $9 = 3 \times 3$.
2. Find the LCM of the denominators: $2 \times 2 \times 3 \times 3 = 36$.
3. The LCD is 36.

Once you've found the LCD, write each fraction as an equivalent fraction with the LCD as the new denominator. Multiply the denominator of the first fraction by an integer to get the LCD. Multiply the numerator by the same integer.

$$\text{denominator} = 12 \times 3 = 36$$
$$\text{numerator} = 5 \times 3 = 15$$

The new first fraction is, therefore, $^{15}/_{36}$.

Multiply the denominator and numerator of the second fraction by an integer to get the LCD. Multiply the numerator by the same integer.

$$\text{denominator} = 9 \times 4 = 36$$
$$\text{numerator} = 4 \times 4 = 16$$

The new second fraction is, therefore, $^{16}/_{36}$.
Now that the fractions have the same denominator, you can quickly add the numerators to get the final answer: 15 + 16 = 31, so the answer is $^{31}/_{36}$.

MULTIPLYING FRACTIONS

Multiplying fractions is quite easy. Simply multiply the numerators together and multiply the denominators together, as seen in the example below:

$$\frac{4}{5} \times \frac{2}{7} \times \frac{1}{3} = \frac{4 \times 2 \times 1}{5 \times 7 \times 3} = \frac{8}{105}$$

DIVIDING FRACTIONS

Multiplication and division are inverse operations. It makes sense, then, that to perform division with fractions, all you have to do is invert (flip over) the dividing fraction and then multiply:

$$\frac{1}{4} \div \frac{5}{8} = \frac{1}{4} \times \frac{8}{5} = \frac{8}{20}$$

Note that just as multiplication by a fraction smaller than one results in a *smaller* product, division by a fraction smaller than one results in a *larger* product.

REDUCING FRACTIONS

If you encounter fractions involving large, unwieldy numbers, such as $^{18}/_{102}$, the best move is usually to see if the fraction can be reduced to smaller numbers.
The fastest way to simplify a fraction is to divide both the numerator and denominator by their greatest common factor. In the case of $^{18}/_{102}$, the GCF of 18 and 102 is 6, leaving you with $^{3}/_{17}$. With your knowledge of divisibility rules, you should be able to see that both the numerator and denominator are divisible by 6. Had you not immediately seen that 6 was the greatest common factor, you could have divided both numbers by 2 and gotten $^{9}/_{51}$. From there, it would have been pretty obvious that both the numerator and denominator are also divisible by 3, yielding $^{3}/_{17}$.

The ACT might also present you with variables in fraction form and ask you to reduce them. You can reduce these variable fractions as long as you can find like factors in both the numerator and denominator. For example, to reduce this fraction,

$$\frac{6x^2 + 2}{4x}$$

you merely have to notice that all of the terms in both the numerator and denominator contain 2 as a factor. Dividing 2 out of the fraction, you get:

$$\frac{3x^2 + 1}{2x}$$

COMPARING FRACTIONS

The rare fraction problem you see may ask you to compare two fractions. If either the denominators or the numerators of the two fractions are the same, that comparison is easy. For example, $^{8}/_{9}$ is obviously greater than $^{5}/_{9}$, just as $^{5}/_{9}$ is greater than $^{5}/_{17}$. Just remember, if the numerators are the same, the greater fraction is the one with the smaller denominator.
If the two fractions don't lend themselves to easy comparison, there is still a quick and easy method that will allow you to make the comparison: cross multiplication. To do this, multiply the numerator

of each fraction by the denominator of the other. Write the product of each multiplication next to the numerator you used to calculate it. The greater product will be next to the greater fraction. For example:

$$32 = \frac{4}{7} \times \frac{5}{8} = 35$$

Since 35, the greater product, is written next to $^5/_8$, that is the greater fraction.

Decimals

Decimals are simply another way to express fractions. To get a decimal, divide the numerator of a fraction by the denominator. For example, if you take the fraction $^2/_5$ and divide 2 by 5, you get 0.4. Therefore the decimal 0.4 is equal to $^2/_5$.

Questions testing decimals almost never appear on the ACT. If decimal numbers do appear and you have to add, subtract, multiply, or divide them, the best thing to do is to use a calculator.

Percentages

Percentage problems always make an appearance on the ACT Math Test. You will probably see at least two per test. Percentages are just another way to talk about a specific type of fraction. Percent literally means "of 100." If you have 25% of all the money in the world, that means you have $^{25}/_{100}$ of the world's money.

Let's take the question "4 is what percent of 20?" This question presents you with a whole, 20, and then asks you to determine how much of that whole 4 represents in percentage form, which means "of 100." To come to the answer, you have to set up an equation that sets the fraction 4/20 equal to x/100:

$$\frac{4}{20} = \frac{x}{100}$$

If you then cross multiply to solve for x, you get $20x = 400$, meaning $x = 20$. Therefore, 4 is 20% of 20. You also might realize that instead of working out all this cross multiplication, you could simply do the following:

$$\frac{4}{20} \times 100 = 20$$

IMPORTANT PERCENTAGE TERMS

Percentage terminology can be a little tricky, so here is a short glossary of terms:

- **Percent more**: if one person has 50% more children than a second person, then that first person has the same amount as the second person, plus 50% of the amount the second person has.
- **Percent increase**: percent increase means the same thing as percent more. If the price of some item increases 10%, the new price is the original plus 10% of that original—in other words, 110% of the original.
- **Percent decrease**: the opposite of percent increase. This term means you subtract the specified percent of the original value from that original.

Sometimes students see these terms and figure out what the 10% increase or decrease is, but then forget to carry out the necessary addition or subtraction. Here's a sample ACT percentage problem:

A shirt originally cost $20, but during a sale its price was reduced by 15%. What is the current price of the shirt?

A. $3
B. $5
C. $13
D. $17
E. $23

In this question, you are told the whole, $20, and the percentage, 15%, and you need to figure out the part. You can therefore quickly set up the equation (once you are comfortable with percentages you might be able to skip this step of setting up the equation and move straight to solving for *x*):

$$\frac{x}{20} = .15$$

You can find *x* by multiplying 20 by .15 to see what the change in price was:

$$x = 20 \times .15 = 3$$

Once you know the price change, you then need to subtract it from the original price, since the question asks for the reduced price of the shirt.

$$\$20 - \$3 = \$17$$

The answer is **D**. Notice that if you had only finished the first part of this solution and had looked at the answer choices, you might have seen that $3 hanging out at answer A like a big affirmation of correctness and been tempted into choosing it without finishing the question. You could also solve this problem in one step by realizing that if the sale price was 15% lower than the original, it was 85% of the original. Therefore, $0.85($20) = $17.

DOUBLE PERCENTAGES

Some ACT questions will ask you to determine a percent of a percent. Take this question:

The original price of a banana in a store is $2. During a sale, the store reduces the price by 25% and Joe buys the banana. Joe then meets his friend, Sam, who is almost faint with hunger. Seeing an opportunity, Joe raises the price of the banana 10% from the price at which he bought it, and sells it to Sam. How much does Sam pay?

In this question, you are asked to determine the cumulative effect of two percentage changes. The key to solving this type of problem is to realize that each percentage change is dependent on the last. In other words, you have to work out the effect of the first percentage change, come up with a value, and then use that value to determine the effect of the second percentage change.
In the problem asked above, you would first find 25% of the original price.

$$\frac{25}{100} \times \$2 = \frac{50}{100} = \$.50$$

Now subtract that $.50 from the original price.

$$\$2 - \$.5 = \$1.50$$

Then we find 10% of $1.50:

$$\frac{10}{100} \times \$1.50 = \frac{15}{100} = \$.15$$

Therefore, Sam buys the banana at a price of $1.50 + $.15 = $1.65.
When you are working on a percentage problem that involves a series of percentage changes, you should follow the same procedure you would for one single percentage change at each stage of the series. For the first percentage change, figure out what the whole is, calculate the percentage of the

whole, and make sure to perform addition or subtraction, if necessary. Then take the new value and put it through these same steps for the second percentage change.

Ratios and Proportions

On the typical ACT Math Test, you'll see a couple of problems dealing with proportions or ratios.

Ratios

Ratios can look a lot like fractions, and they are related to fractions, but they differ in important ways. Whereas a fraction describes a part out of a whole, a ratio compares two separate parts of the same whole.
A ratio can be written in a variety of ways. Mathematically it can appear as 3/1 or as 3:1. In words, it should be written out as the ratio of three to one. Each of these three forms of this ratio means the same thing: there are three of one thing for every one of another. If you have three red marbles and one blue marble, then the ratio of red marbles to blue marbles is 3:1. For the ACT, you must remember that ratios compare parts to parts, rather than parts to a whole. For example:

> Of every 40 games a baseball team plays, it loses 12 games. What is the ratio of the team's losses to wins?
>
> **A.** 3:10
>
> **B.** 7:10
>
> **C.** 3:7
>
> **D.** 7:3
>
> **E.** 10:3

This ratio question is a little tricky because the information is stated in terms of whole to part, but the question asks for a part to part answer. The problem tells you that the team loses 12 of every 40 games, but it asks you for the ratio of losses to *wins*, not losses to *games*. So the first thing you have to figure out is how many times the team wins in 40 games:

$$40 - 12 = 28$$

The team wins 28 of every 40 games. So for every 12 losses, the team has 28 wins, or 12:28. You can reduce this ratio by dividing both sides by 4, to get 3 losses for every 7 wins, or 3:7. Answer **C** is correct. However, if you didn't realize that losses to games was part to whole, you might have just reduced the ratio 12:40 to 3:10, and then picked choice A.

Proportions

If you have a ratio of 3 red marbles to 1 blue marble, that doesn't necessarily mean that you have exactly 3 red marbles and 1 blue one. It could also mean that you have 6 red and 2 blue marbles, or that you have 240 red and 80 blue marbles. In other words, ratios compare only *relative* size. In order to determine how many of each color of marbles you actually have, you need to know how many total marbles you have in addition to knowing the ratio.
The ACT will occasionally ask questions testing your ability to figure out a quantity given the ratio between items and the total number of all the items. For example:

> You have red, blue, and green marbles in the ratio of 5:4:3, and you have a total of 36 marbles. How many blue marbles do you have?

The information given states that for each group of 5 red marbles, you have a corresponding group of 4 blue marbles and a group of 3 green marbles. The ratio therefore tells you that out of every 12

marbles (since 12 = 5 + 4 + 3), 4 of them will be blue. The question also tells you that you have 36 total marbles.
Since we know that the ratio will not change no matter how many marbles you have, we can solve this problem by setting up a proportion, which is an equation that states that two ratios are equal. In this case, we are going to equate 4:12 and *x*:36, with *x* being the number of blue marbles that we would have if we had 36 total marbles. To do math with proportions, it is most useful to set up the proportions in fraction form:

$$\frac{4}{12} = \frac{x}{36}$$

Now you just need to isolate *x* by cross-multiplying:

$$\begin{aligned} 12x &= 4 \times 36 \\ 12x &= 144 \\ x &= 12 \end{aligned}$$

Mean, Median, and Mode

The arithmetic mean, median, and mode are all different ways to describe a group, or set, of numbers. On the ACT, you'll most likely see questions dealing with the arithmetic mean, but you should be prepared for median and mode questions as well.

Arithmetic Mean (a.k.a. Average)

The arithmetic mean, which is also called the average, is the most important and most commonly tested of these three mathematical concepts. The basic rules for finding an average are not very complicated. To find the average of a set of *n* numbers, you need to find the sum of all the numbers and divide that sum by *n*.
For example, the mean of the set 9, 8, 13, 10 is:

$$\frac{9+8+13+10}{4} = \frac{40}{4} = 10$$

Many ACT problems about mean will be straightforward, giving you a bunch of numbers and asking you to find their average. But some problems will be presented in a more roundabout fashion. For instance, the ACT might give you three numbers of a four--number set as well as the average of that set, and ask you to find the fourth number, like so:

If the average of four numbers is 22, and three of the numbers are 7, 11, and 18, then what is the fourth number?

To solve this type of problem, you have to realize that if you know the average of a group, and also know how many numbers are in the group, you can calculate the sum of the numbers in the group. In the question asked above, you know that the average of the numbers is 22 and that there are four numbers. This means that the four numbers, when added together, must equal 4×22, which is 88. Now, from the information given in the problem and our own calculations, we know three of the four numbers in the set and the total sum of the numbers in the set:

$$7 + 11 + 18 + \text{unknown number} = 88$$

Solving for the unknown number is easy: all you have to do is subtract 7, 11, and 18 from 88 to get 52, which is the answer.

Median

The median is the number whose value is in the middle of the numbers in a particular set. Take the set 6, 19, 3, 11, 7. If we arrange the numbers in order of value, we get:

$$3, 6, 7, 11, 19$$

When we list the numbers in this way, it becomes clear that the middle number in this group is 7, making 7 the median.

The set we just looked at contained an odd number of items, but in a set with an even number of items it's impossible to isolate a single number as the median. Let's add one number to the set from the previous example:

$$3, 6, 7, 11, 15, 19$$

In this case, we find the median by taking the two numbers in the middle and finding their average. The two middle numbers in this set are 7 and 11, so the median of the set is (7 + 11)/2 = 9.

Mode

The mode is the number within a set that appears most frequently. In the set 10, 11, 13, 11, 20, the mode is 11 since that number appears twice and all the others appear just once. In a set where all the numbers appear an equal number of times, there is no mode.

Probability

A typical ACT Math Test asks one question on probability. To begin to deal with these questions, you first have to understand what probability is:

$$\frac{\text{chance of a particular outcome}}{\text{total number of possible outcomes}}$$

For example, let's say you're on a game show and are shown three doors. Behind one door there is a prize, while behind the other two doors sit big piles of nothing. The probability that you will choose the door with the prize is $^1/_3$, because out of the total three possibilities there is one chance to pick the lucrative door.

Here's an example of a probability question:

> Joe has 3 green marbles, 2 red marbles, and 5 blue marbles. If all the marbles are dropped into a dark bag, what is the probability that Joe will pick out a green marble?

There are three ways for Joe to pick a green marble (since there are three different green marbles), but there are 10 total possible outcomes (one for each marble in the bag). Therefore, the probability of picking a green marble is:

$$\text{Probability} = \frac{\text{particular outcome}}{\text{total outcomes}} = \frac{\text{green marbles}}{\text{total marbles}} = \frac{3}{10} \text{ or } 33\%$$

When you calculate probability, always be careful to divide by the total number of possible outcomes. In the last example, you may have been tempted to leave out the three chances of picking a green marble from the total possibilities, yielding the equation $P = {}^3/_7$. If you did that, you'd be wrong.

Absolute Value

The absolute value of a number is its magnitude, regardless of sign. Absolute value is indicated by two vertical lines that surround the number: $|5|$and $|-5|$, for example. The absolute value of positive five is equal to five: $|5| = 5$. The absolute value of negative five is also equal to five: $|-5| = 5$. Simply remove the sign before the number to produce its absolute value.

On the ACT, you will generally be asked to do a simple addition, subtraction, multiplication, or division problem using the absolute values of numbers. For example,

$$|-4| + |2| = ?$$

Remember that the vertical lines mean you simply ignore the sign, so the question actually looks like this: 4 + 2 = 6

Exponents and Roots

At most, you'll see one problem on the ACT Math Test dealing with exponents or roots. It's quite likely you won't see any, but you're still doing yourself a favor by preparing for them.

Exponents

Exponents are a shorthand method of describing how many times a particular number is multiplied by itself. To write $3 \times 3 \times 3 \times 3 \times 3$ in exponent form, we would simply count how many threes were being multiplied together (in this case, five), and then write 3^5. In verbal form, 3^5 is stated as "three to the fifth power."

RAISING AN EXPONENT TO AN EXPONENT

Occasionally, a question might ask you to raise a power to a power, in the following format: $(3^2)^4$. In such cases, multiply the exponents:

$$(3^2)^4 = 3^{(2\times 4)} = 3^8$$

If you have an expression involving a variable, like $2a^2$, and you raise it to the third power, then you would write $(2a^2)^3$. To simplify this expression, you would multiply the exponents and raise 2 to the third power; the end result would be $8a^6$. Most basic calculators have an exponent or y^x function key. Be sure to know how to use this function on your calculator before the test.

Square Roots

The square root of a number is the number that, when squared (multiplied by itself), is equal to the given number. For example, the square root of 16 is 4, because $4^2 = 4 \times 4 = 16$. A perfect square is a number whose square root is an integer.

The sign denoting a square root is $\sqrt{\ }$. To use the previous example, $\sqrt{16} = 4$. Again, be sure to find and know how to use the square-root function, or $\sqrt{\ }$ key, on your calculator.

Cube Roots

The cube root of a number is the number that, when cubed (raised to the third power), is equal to the given number. The cube root of 8 is 2, because $2 \times 2 \times 2 = 8$.

The sign denoting a cube root is $\sqrt[3]{\ }$.

Series

Series questions are pretty rare on the ACT. Every once in a while they do pop up, though. A series is a sequence of numbers that proceed one after another, according to some pattern. Usually the ACT will give you a few numbers in a series and ask you to specify what number should come next.

For example,

$$-1, 2, -4, 8, -16$$

is a series in which each number is multiplied by –2 to yield the next number; 32 is the next number in the series. This type of question asks you to be able to recognize patterns and then apply them. There isn't one tried-and-true way to find a pattern. Just think critically, and use your intuition and trial and error.

http://www.sparknotes.com/testprep/books/act/chapter2.rhtml