Chapter 3

Test-Taking and Study Techniques

In This Chapter

- Choosing your weapon: Paper or computer
- Developing strategies like a general
- Guessing like a psychic
- Studying like you mean it
- Feeling fine on test day

Unless your high-school days were filled with nothing but A's, taking the ASVAB requires some preparation. The best course of action is to study for it, just as you would any test. You need to be mentally (even physically) prepared before you sit down at the testing station.

This chapter includes information on how to prepare for the test — how you study and how and why you should take the practice exams. In addition, we let you in on some inside information like secrets for guessing when you don't know the answer to a question. (Although, if you study for the test, that will never happen, right?) The tips and techniques we provide in this chapter can help you get a jump on the ASVAB and your military career.

Paper versus Computer: Know Your Medium

The ASVAB has several versions: The form 18/19 and the form 20/22. The 18/19 version is also called the Institutional ASVAB. This version comes in paper form only (no computerized version) and is given only in high schools. Scores from the ASVAB 18/19 can be used for military qualification.

The form 20/22, called the Production ASVAB, is used specifically for military recruiting purposes. This version comes in two flavors: paper and computerized.

The ASVAB 18/19 and 20/22 have different questions but cover the same subject matter at the same level of difficulty. Some important differences do exist between the 20/22 paper version and the 20/22 computerized version, and you should know what they are. The "Paper chase: Taking the paper-based ASVAB" and "Computer games: Taking the computer-based ASVAB," sections later in this chapter highlight these differences.

Maybe it's because young people today are more comfortable in front of a computer than with a pencil, but military recruiters have noted that — among applicants who have taken both the paper-based and computerized versions of the ASVAB — recruits tend to score slightly higher on the computerized version of the test. The following sections can help you decide which version of the test is best for you.

Paper chase: Taking the paper-based ASVAB

The paper-based test allows you to skip questions that you don't know the answer to and come back to them later. This option can be a real help when you're racing against the clock and want to get as many answers right as possible. You can change an answer on the subtest you're currently working on, but you can't change an answer on a subtest after the time for that subtest has expired.

You can mark up the examination booklet as much as you want. If you skip a question, you can circle the number of the question in your booklet to remind yourself to go back to it. If you don't know the answer to a question, you can cross off the answers that seem unlikely or wrong to you and then guess based on the remaining answers.

A disadvantage to taking the paper ASVAB is that getting your scores back may take a week or more (sometimes up to a month — remember, we're talking military efficiency here).

Computer games: Taking the computer-based ASVAB

The computerized version of the ASVAB, called Computerized Adaptive Testing, or CAT-ASVAB, tests the same abilities as the paper version, but the questions are different.

You take the computerized version if you take the ASVAB at a Military Entrance Processing center (MEP), which you will probably do if you aren't in high school when you take the test. (In that case, your recruiter helps you arrange to take the test.)

If you have your heart set on taking the paper version of the test but didn't do so in high school, ask your recruiter if your locality has a Mobile Examining Team (MET) site. There are 685 MET sites throughout the United States. Most localities also have scheduled days when the paper version of the Production ASVAB is given (once or twice per month), usually at the local National Guard Armory. If you want to take the paper-based test at an armory or a similar site, a military recruiter must put you on the schedule.

The CAT-ASVAB adapts the questions it offers you based on your level of proficiency (that's why it's called *adaptive*.) Translation: The first test item is of average difficulty. If you answer this question correctly, the next question is more difficult. If you answer it incorrectly, the computer gives you an easier question. (By contrast, on the paper ASVAB, the first item is usually the easiest, and the questions become progressively harder.)

The test items are weighted for level of difficulty, so if you correctly answer more difficult questions than other people taking the exam do, you get a higher score than they do.

Unlike the paper-based version, you can't skip questions or change your answers after you enter them on the CAT-ASVAB. This stipulation can make taking the test harder. Instead of being able to go through and immediately answer all the questions you're sure of and then coming back to the questions that require you to do some head-scratching, you have to answer each question as it comes. This can make it difficult to judge how much time to spend on a difficult question before guessing and moving on. Also, if you have a few minutes at the end of the test, you can't go back and check to make sure you marked the correct answer to each question.

When you take the CAT-ASVAB, the computer automatically adds up and prints your scores for each subtest and your composite scores. (For more on composite scores, see Chapter 2.)

With the computerized version, you usually know if you qualify for military enlistment on the same day you take the test, and if so, which jobs you qualify for.

Multiple-Choice Strategies

Both the paper-based and the computerized ASVAB are multiple-choice tests. You choose the correct (or most correct) answer from among four or five choices. (Four choices for most of the subtests; five choices for the Coding Speed subtest.)

On the math subtests, be especially careful to read the symbols correctly. When you're in a hurry, the + sign and the ÷ sign can look very similar. And blowing right by a negative sign or another symbol is just as easy.

Reading the directions

Although instructing you to read the directions may seem obvious, when you're in a hurry, you can sometimes *misread* the directions, and that won't help you get the right answer. Each subtest has a paragraph or two describing what the subtest covers and instructions on how to answer the questions.

Understanding the questions

Take special care to read the questions correctly. Most questions ask something like, "Which of the following equals 2×3?" But sometimes, a question may ask, "Which of the following does not equal 2×3?" You can easily skip right over the *not* when you're reading, assume that the answer is six, and get the question wrong.

You also have to understand the terms being used. When a math problem asks you to find the *product* of two numbers, be sure you know what *finding the product* means. (It means you have to multiply the two numbers.) If you add the two numbers together, you arrive at the wrong answer.

Reviewing all the answer options

On most of the subtests, you select the correct answer from four possible answer options. On the Coding Speed subtest, you choose from five possible answers.

Often, a person reads a question, decides on the answer, glances at the answer options, chooses the option that agrees with his or her answer, marks it on the answer sheet, and then moves on.

Although this approach usually works, it can sometimes lead you astray. On the ASVAB, you're supposed to choose the answer that is "most correct." (Now and then you do the opposite and choose the answer that is "least correct.") Sometimes several answers are reasonably correct for the question at hand, but only one of them is "most correct." If you don't stop to read and review all the answers, you may not choose the one that is "most correct." Or, if you review all the answer options, you may realize that you hastily decided upon an incorrect answer because you misread it.

Marking the answer carefully

A machine scores the ASVAB paper-based answer sheets. You have to clearly mark the answer so that the machine knows what answer you've selected. This means carefully filling in the space that represents the correct letter answer.

You've done this a million times, we know, but it's worth repeating. Don't use a check mark, don't circle the answer, and don't let your mark wander into the next space. If you must erase, make certain that all evidence of your prior choice is gone; otherwise, the grading machine can get confused and credit you with the wrong choice or, worse, disregard your answer and give you no credit at all.

On the paper version, the very real possibility exists of incorrectly marking the answer sheet — answering Question 11 on the line for Question 12, Question 12 on the line for Question 13, and . . . you get the idea. (Don't laugh — this happens more often than you would guess.) Be especially careful if you skip a question that you're going to return to later.

Incorrectly marking the answers can cause a real headache. If you fail to get a qualifying score, the minimum amount of time you must wait before retaking the ASVAB is 30 days — you have to wait a whole month to do it all over again. Even then, your journey to military glory through ASVAB torment may not be over. Regulations allow the testing-center commander to request *another* retest if a 20-point or greater difference between two test results pops up. So, if you're not careful, you'll be taking *three* ASVABs when all you really needed to take was *one*. Sound fun? Chapter 1 discusses how and when you can re-take the ASVAB.

Here's a word of wisdom about the computerized test: Be especially careful to select the right answer on the keyboard. On most of the subtests, you choose the letter on the keyboard, and then you must press Enter for the computer to register your choice. But on two of the subtests — Numerical Operations and Coding Speed — as soon as you press the letter, the computer registers your answer, and you're on to the next question. So be certain that you select the right answer before touching the key.

Guessing Again

On the ASVAB, guessing is okay. In fact, it's encouraged — except on the Coding Speed subtest, which penalizes you for getting wrong answers. On nine of the ten subtests (11 out 12 on the computerized version), if you choose the correct answer, that's the equivalent of +1. If you don't answer a question, that's the equivalent of zero. If you guess on a question and get the question wrong, that's also the equivalent of zero, not –1. (No penalties here!) But, if you guess, and you guess correctly, that's +1. Because each question usually has four answers, you have a 25 percent chance of guessing correctly, which means that you have more chances to increase your score by guessing than by leaving a question blank.

On the Coding Speed subtest, you *are* penalized for a wrong answer. A wrong answer is worth the equivalent of –1 (not zero). So you're better off skipping a question if you're taking too long to find the answer.

If you guess on more than one question throughout the test, always choosing the same answer for every guess is the smart way to go. For example, all your guesses could be the Answer B. This technique slightly increases your chances of getting more guessed answers correct.

This method doesn't hold true if you can narrow down a guess by eliminating a couple of answer options — what we like to call making an *educated guess.* If you can eliminate Answer B, then, by all means, choose a different answer option as your guess.

In each of the chapters in this book that reviews a particular subtest, we give you hints for making educated guesses that are specific to that topic. But here are some general rules:

- Usually, an answer that has *always, all, everyone, never, none,* or *no one* is incorrect.
- If two choices are very similar in meaning, *neither of them* is probably the correct choice.
- If two answer options contradict each other, *one of them* is usually correct.
- The longer the answer, the more likely that it's the correct answer. The test-makers have to get all those qualifiers in there to make sure that it's the correct answer and you can't find an example to contradict it. If you see phrases like *in many cases* or *frequently,* that's a clue that the test-takers are trying to make the answer "most correct."
- Don't eliminate an answer based on the frequency of that answer coming up. For example, if Choice B has been the correct answer for the last five questions, don't assume that it must be the wrong answer for the question you're on just because that would make it six in a row.
- Don't change an answer after you select it.

By taking the practice tests at the back of the book, you can get a sense of how long it takes you to complete each part of the ASVAB. This little nugget of info can help you know how much time you have to spend on educated guessing.

One last word of guessing advice: If you have to guess, never, ever go back and change the answer, unless you are absolutely, 100-percent, positively convinced that you're changing it to the correct answer *and* you only answered incorrectly because you had sweat in your eyes and didn't read the choices properly. The Air Force Senior NCO Academy conducted an in-depth study of several Air Force multiple-choice-test results, taken over several years, and found that when students changed answers on their answer sheets, they changed from a right to a wrong answer more than 72 percent of the time!

Taking the Practice Tests

The three practice tests at the back of this book are valuable study aids. Before you begin studying, take one of the tests. Try to duplicate the testing environment — take the entire exam at one time, time yourself, and don't allow interruptions. When you complete the first practice test, check your answers to see where you need improvement. But don't forget, not all subtests are equally important. For instance, if you have no interest in pursuing a career in electronics, the Electronics Information subtest is irrelevant to you; so don't spend time studying for it. Instead, devote yourself to other areas that are important to your future career plans.

After you do some additional studying, take the second practice exam. Again, try to duplicate testing conditions. Check your answers. Compare your scores to the scores from your first test. Have you improved? If so, continue studying as you have been. If not, you may need to reconsider how you're studying or if you're setting aside enough time to study. A school counselor or teacher can give you additional study pointers.

Finally, a week or two before the ASVAB, take the third practice test. Think of the third test as a final chance to brush up on any of those nagging areas that still give you fits. It will also help you calm your nerves before taking the ASVAB — how the test works will be fresh in your mind.

Don't waste time memorizing the practice questions in this guide or any other ASVAB study guide. You *will not* see the same questions on the ASVAB test. Use this guide and our sample tests for two purposes:

- **To determine the subject areas in which you need to improve.** Then use our tips and techniques, along with standard study materials (like high-school textbooks), to improve your knowledge of that specific subject.
- **To familiarize yourself with the types of test questions and the way they're presented on the test.** Getting a good idea of what all the subtests look like and ask for will improve your test-taking speed. You won't have to spend time trying to figure out *how* a question works. You can spend your time answering the question.

These are the true secrets to improving your ASVAB test score.

Studying Like You're Taking the Test

When you study for the ASVAB, fall in line with these study habits to make the most of your time:

- **Try to reduce distractions:** Always study in a well-lit, quiet area.
- **Keep study breaks to a minimum:** A few minutes every hour is sufficient.
- **Be a loner:** You may want to study with a partner now and then so that the two of you can brainstorm answers and quiz each other, but most of your studying should be done on your own.
- **Study in long blocks of time:** Studying for an hour or two once or twice a day is much more effective than 15 minutes six times a day.
- **Practice the actual act of test-taking:** Practice marking answers correctly on the answer key and time yourself to see how long it takes you to answer questions.

24 Hours and Counting: Pretest Preparations

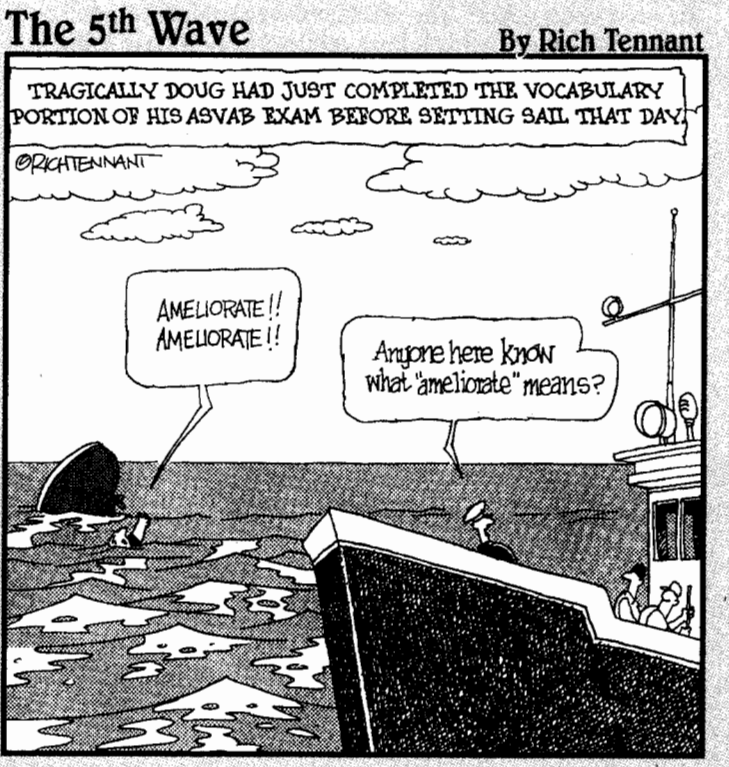
You want some good advice? On the night before the test . . . get some sleep. Give yourself plenty of time to get plenty of rest. Don't drink alcohol the night before — headaches and the ASVAB don't work well together. And don't pull an all-night cram session the night before you're scheduled to take the ASVAB. If you don't know the material by then, it's too late. Staying up all night only guarantees that you'll do poorly on the test. Here are some other suggestions:

- On the morning of the test, eat a light meal — anything too heavy will make you drowsy, but not eating enough will make it hard for you to concentrate.
- Get some exercise the day before and even the morning of the test to help you remain mentally sharp.

- If you're sick, upset, or injured, you may want to reschedule the test.
- Bring any supplies you need: pencils, pens, and erasers. Scratch paper will be provided for you. If you wear eyeglasses, bring them. If you wear contacts, bring your glasses as a backup.
- Bring a watch to help you keep track of time, if you're taking the paper version (the computerized version has a clock on the screen).
- Don't bring calculators, personal CD players, backpacks, or a cooler of munchies to the testing site. You won't be allowed to have them with you.
- Don't drink a lot of liquids just before the test — you don't want to waste valuable test time in the bathroom!
- Make sure you arrive at the test site with plenty of time to spare. In the military, arriving "on time" means that you're five minutes too late.

Part II

Words of Wisdom: Vocabulary and Reading



In this part . . .

Success in the military has a lot to do with how well you can read, understand the material, and react to what you've read. The military loves writing things down. When you set sail for a military career, you'll find all kinds of written instructions to follow. If you don't read and follow instructions accurately, you may guide the sub you're navigating to Alaska instead of Florida.

In this part, we show you why it's important to do well on the ASVAB vocabulary and reading subtests, and we give you the tools to accomplish the mission. We review basic vocabulary and reading information — rock-solid advice like how to find the main idea of a paragraph and quick tips such as ways to understand the definition of a vocabulary word based on context, roots, prefixes, and suffixes.

Chapter 4

Word Knowledge

In This Chapter

- Scoring like a pro on the Word Knowledge subtest
- Building words for fun and profit
- Making a vocabulary list and checking it twice
- Putting your money where your mouth is: Practice questions

Can you spell *boot camp?* To make it there, you have to score well on the Word Knowledge section of the ASVAB. But what if you don't know the difference between a *carbine* and a *carbon?* Never fear — we're here to help you out. In this chapter, we let you know what the Word Knowledge portion of the ASVAB consists of and how to study for it. We even toss some practice questions at you. Don't duck! Answer 'em!

Word Knowledge just means *vocabulary,* which means *hard words no one uses in ordinary conversation.* (Well, not really.) Word knowledge isn't part of the ASVAB just because your high-school English teacher thinks that it ought to be. The test-makers include it because words stand for ideas, and the more words you understand, the more ideas you can understand (and the better you can communicate with others). So society (including people in the military) often equates a large vocabulary with intelligence and success.

Your score on the Word Knowledge subtest (along with the Paragraph Comprehension, Mathematics Knowledge, and Arithmetic Reasoning subtests) determines your eligibility for service. You need to do well on the Word Knowledge subtest in order to qualify for jobs such as air traffic controller, military intelligence, and even fire fighting. See the Appendix A for more information on the scores you need to get the job you want.

Checking Out the Word Knowledge Format

The Word Knowledge (WK) portion of the ASVAB measures your vocabulary knowledge. It consists of 35 questions. In each question, you see an underlined word. Choose the answer closest in meaning to the underlined word. For example:

His house was <u>derelict</u>.

(A) solid

(B) run-down

(C) clean

(D) inexpensive

Closest in meaning doesn't mean *the exact same thing.* You're looking for similar or related words.

In case you're wondering, the answer is Choice B.

You have 11 minutes to answer the 35 questions on this subtest, which means that you have slightly less than 20 seconds to answer each question. (No pressure, right?)

Words Made Fresh Daily!

Many English words are created from building blocks called roots, prefixes, and suffixes. These basic word parts generally have the same meaning in whatever word they're used. For instance, *pro* means something along the lines of *in favor of, forward,* or *positive* whether you use it in the word *pro*ton or the word *pro*ceed.

If you memorize some of these word parts, you'll have a better chance of figuring out the meaning of an unfamiliar word when you see it on the ASVAB. And that's a good thing. Figuring out the meaning of unfamiliar words is how people with large vocabularies make them even larger. (They look up words in the dictionary, too.)

Fixing up your vocabulary: Prefixes and suffixes

Prefixes, roots, and suffixes are the main parts that make up words. Not every word has all three, but many have at least one. *Prefixes* are the parts that come at the front of a word, *suffixes* are the parts that come at the end of a word, and *roots* are the parts that come in the middle of a word. Think of roots as the base of the word and prefixes and suffixes as word parts that are attached to the base. (Check out the "Digging for roots" section later in this chapter for more info on — you guessed it — roots.)

Tables 4-1 and 4-2 list some common prefixes and suffixes. Each list has the word part, its meaning, and one word that uses each word part. Writing down additional words that you know for each word part will help you memorize the list.

Table 4-1 Prefixes

Prefix	*Meaning*	*Sample Word*
a	no, not	atheist
ab *or* abs	away, from	absent
anti	against	antibody
bi	two	bilateral
con *or* contra	against	contradict
de	away from	deny
dec	ten	decade
extra	outside, beyond	extracurricular
fore	in front of	foreman
geo	earth	geology
hyper	excess, over	hyperactive
il	not	illogical
mal *or* male	wrong, bad	malediction
multi	many	multiply

Prefix	*Meaning*	*Sample Word*
nom	name	nominate
omni	all	omnibus
ped	foot	pedestrian
que, quer, *or* ques	ask	question
re	back	return
semi	half	semisweet
super	over, more	superior
tele	far	telephone
trans	across	translate
un	not	uninformed

Table 4-2 Suffixes

Suffix	*Meaning*	*Sample Word*
-able *or* -ible	capable of	agree: agreeable
-age	action, result	break: breakage
-al	characterized by	function: functional
-ance	instance of an action	perform: performance
-ation	action, process	liberate: liberation
-en	made of	silk: silken
-ful	full of	help: helpful
-ic	consisting of	alcohol: alcoholic
-ical	possessing a quality of	statistic: statistical
-ion	result of act or process	legislate: legislation
-ish	relating to	child: childish
-ism	act, practice	Buddha: Buddhism
-ist	characteristic of	elite: elitist
-ity	quality of	specific: specificity
-less	not having	child: childless
-let	small one	book: booklet
-man	relating to humans, manlike	gentle: gentleman
-ment	action, process	establish: establishment
-ness	possessing a quality	good: goodness
-or	one who does a thing	orate: orator
-ous	having	danger: dangerous
-y	quality of	taste: tasty

Digging for roots

Root words are word parts that serve as the base of a word. If you recognize a root, you can generally get an idea of what the word means, even if you're not familiar with it. As Mr. Miyagi said in *Karate Kid,* "Root strong, tree grow strong." All right, Daniel-san, in terms of your vocabulary, think of it this way: If your knowledge of word roots is strong, your vocabulary will be much larger.

In Table 4-3 we list some common roots. Memorize them. When you sit down to take the ASVAB, you'll be glad that you did.

Table 4-3 Roots

Root	*Meaning*	*Sample Word*
anthro *or* anthrop	relating to humans	anthropology
bibli *or* biblio	relating to books	bibliography
brev	short	abbreviate
cede *or* ceed	go, yield	recede
circum	around	circumnavigate
chrom	color	monochrome
cogn *or* cogno	know	cognizant
corp	body	corporate
dic *or* dict	speak	diction
domin	rule	dominate
flu *or* flux	flow	influx
form	shape	formulate
frac *or* frag	break	fragment
graph	writing	biography
junct	join	juncture
liber	free	liberate
lum	light	illuminate
oper	work	co-operate
pat *or* path	suffer	pathology
port	carry	portable
press	squeeze	repress
sens *or* sent	think, feel	sentient
scrib *or* script	write	describe
tract	pull	traction
voc *or* vok	call	revoke

Same or Different? Understanding Synonyms and Antonyms

A *synonym* is a word that has the same meaning as or a very similar meaning to another word. *Smile* and *grin* are synonyms. They may not mean exactly the same thing, but their meanings are very similar. An *antonym* is a word that has an opposite or nearly opposite meaning as another word. *Smile* and *frown* are antonyms.

To keep things straight, think of a "synonym" as the "same" and an "antonym" as the "enemy."

The ASVAB may ask you to find the word "that most nearly means the same" thing as a given word, which is a synonym. Or you may be asked to find the word that "most nearly means the opposite" of a given word, which is an antonym. Most of the questions on the Word Knowledge subtest ask you to find synonyms, although a few may ask you to find antonyms.

How can you find the synonym of a word (or the antonym, for that matter)? A good place to start is the dictionary. Many dictionary entries include the abbreviation *syn,* which means *synonym.* The words that follow this abbreviation are synonyms of the entry word. You may also see the abbreviation *ant* in an entry. This abbreviation stands for *antonym,* and the word or words that follow it mean the opposite of the entry word.

As you study vocabulary words for the Word Knowledge subtest, make a list of synonyms and antonyms of the words you learn. Or, use the root-word list in Table 4-3. Using your dictionary and thesaurus, come up with a list of synonyms and antonyms for each word listed in the "Sample Word" column. (Of course, not every word has synonyms and antonyms, but many do.) Putting some time in with synonyms and antonyms can help you ace the Word Knowledge subtest (and it will also help you improve your overall vocabulary).

Whipping Your Vocabulary into Shape

Having an extensive vocabulary can help you do well on the Word Knowledge subtest. But, even if you don't have a huge vocabulary, the strategies in this section can help you make up for that.

What's black and white and read all over?

To build your vocabulary, you have to read. You have to see the words in print, not just hear someone say them. Besides, people can read and understand many more words than they could ever use in conversation.

That doesn't mean you have to start with *Advanced Astrophysics.* In fact, if you don't read much, you can start with your daily newspaper, a news magazine, or any type of reading material that's just a notch or two above what you ordinarily read.

A word to the wise

A decent vocabulary is essential in the military if you want to get ahead. The military operates on paperwork, and whether you're trying to get more supplies (submit necessary logistical requisitions) or get the assignment you want (application for personnel career-enhancement programs), you need to develop a good vocabulary.

When you encounter a word you don't know, try to understand what it means by the context in which the word is used. For example, if you read, "The scientist *extrapolated* from the data," and you don't know what *extrapolated* means, you can try substituting words you *do* know to see if they would make sense. For example, the scientist probably didn't *hide* from the data. She probably used the data to make some sort of decision, judgment, or guess. To confirm your understanding of the word, check your dictionary.

On the Word Knowledge section of the ASVAB, you often won't be able to guess what a word means from its context (because in many cases, there is no context in the test — the words aren't used in sentences). You also won't be able to look it up in the dictionary (because there are no dictionaries in the test). But considering context and consulting a dictionary are two great ways to *discover* vocabulary words during your test preparation.

Keeping a word list

If your vocabulary needs help, you're going to have to memorize some words. Don't worry, this won't hurt a bit. One way to improve your vocabulary is to keep a word list. When you hear or read a word that you don't understand, jot it down. When you have a chance, look the word up in the dictionary and then write the meaning down on your list. Use the word in a sentence that you make up. (Write the sentence down, too.)

You can arrange your list by related items, so that the words are easier to remember. For example, words having to do with your work go on one page, words related to mechanical knowledge go on another page, and so on.

Go through the following vocabulary list and quiz yourself. Which words do you know? Which are unfamiliar? Remember that a word can have more than one meaning, but instead of worrying about alternate meanings, focus on memorizing the most common one. It's highly unlikely that the folks writing the ASVAB will use the less-common meaning of a word. They're not that evil.

Abstruse: obscure

Admonish: warn

Adulterate: make impure

Belligerent: having an aggressive attitude

Benefactor: patron, one who has given help

Chastise: punish

Coerce: force

Commemorate: keep as a remembrance

Defiant: bold opposition

Deluge: overwhelm with water

Discreet: prudent

Discrete: individual, distinct

Edible: suitable for eating

Efficacy: production of results

Erratic: irregular

Facile: easy

Fallacious: not logical

Garrulous: too talkative

Gregarious: friendly

Humane: compassionate

Hypocrisy: insincerity

Illicit: unlawful

Imminent: coming soon

Inept: unskilled

Jargon: highly technical speech

Judicious: prudent

Kilo: one thousand (precedes meters, liters, and so on)

Legacy: bequest

Lien: legal claim

Meticulous: attentive to detail

Mundane: ordinary

Myriad: great number

Nonchalant: lacking interest

Noxious: harmful

Oblivious: unaware

Obtuse: stupid

Pious: religious

Plea: request

Qualm: momentary feeling of doubt

Reciprocate: mutual give-and-take

Reiterate: repeat

Reverent: showing respect

Severance: separation

Skeptic: one who doubts

Synopsis: summary

Tacit: understood without specifying

Tireless: untiring

Ubiquitous: present everywhere

Valid: based on truth

Volatile: unstable

Wield: control, use

Wrangle: noisy dispute

Zenith: height of greatness

You can find more vocabulary words to memorize by going to `www.freevocabulary.com`. You can also find other sites on the Internet that offer lists of words if you spend a few minutes surfing.

Don't forget that one of the best ways to remember vocabulary words is to use them in everyday conversation. Finding a way to work the word *zenith* into a description of last night's basketball game requires creativity, but you won't forget what the word means.

Short-Term Study: Yikes! One Week until the ASVAB!

"Great," you say. "I can keep a word list to improve my vocabulary in a couple of months, but the ASVAB is next week! Now what?"

As always, we're here to help. Just because you only have a few weeks (or a few days) to study doesn't mean you should give up hope. Instead, focus on some short-term fixes that can help you improve your Word Knowledge score.

You can acquire vocabulary words in the short term as well as over a long period of time. Combining both approaches is best, but if you're pressed for time, focus on short-term memorization and test-taking skills.

Playing detective: Identifying unfamiliar words

When you see an unfamiliar word on the Word Knowledge section, don't panic. You may know the word after all . . . just in a different form. In English, one root word can be changed slightly to perform all sorts of roles — it can act as a noun, a verb, an adjective, or an adverb with just a little modification.

So, if you know what the root word *attach* means, you can figure out what the word *attachment* means. If you know *adherent,* you can deduce what *adherence* means.

You can use root-word clues to identify unfamiliar words on the ASVAB. Say you run across the word *beneficent* on the Word Knowledge portion:

Beneficent most nearly means:

(A) kind

(B) beautiful

(C) unhappy

(D) troubled

You sit there in the school-cafeteria chair and begin to sweat. You've never seen the word before, and it's all over for you, right? Well, maybe not. Take a closer look. What other word starting with the letters *benefi* do you know? How about the word *benefit?* A benefit is something that helps or aids. It would be a good bet that the word *beneficent* is related to helping or aiding. So when you look over the possible choices, you can choose the one that has something to do with helping.

But wait. None of the answers say *help* or *aid.* Now what? Just use the process of elimination. If something is helpful (*beneficent*), it probably isn't troubled or unhappy. It may be beautiful, but more likely, it's kind. So the best answer would be Choice A.

When you see an unfamiliar word, try dropping a couple of letters from the beginning and/or the end of the word to see if you recognize what's left — the root. If so, you can make a good guess as to the meaning of the word. (We turn your attention once again to the "Digging for roots" section earlier in this chapter.)

Sounding off by sounding it out

Sometimes you actually know a word because you've heard it in conversation, but you don't recognize it when you see it written down. For instance, the word *subtle* (which is pronounced "suttle") could confuse anyone encountering it in writing for the first time. A student who had heard the word "placebo" pronounced "plah-see-bow" knew that it meant an inactive substance, like a sugar pill. But, when she came across it in writing, she didn't recognize it. She thought it was a word pronounced "plah-chee-bow," which she had never heard before.

So when you see a word on the ASVAB that you don't recognize, try pronouncing it (not out loud please) a couple of different ways. The following pronunciation rules can help you out:

- Sometimes sounds are silent (like the *b* in *subtle* or the *k* in *knight*). Often, a letter at the end of a word is silent. For instance, *coup* is pronounced "coo."
- Some sounds have unusual pronunciations in certain contexts. Think of the *l* in *colonel,* which is pronounced like *kernel.*

- *C* can sound like *s* or *k* and sometimes like *ch* (especially if two *C*s are in a row).
- The letter *i* after a *t* can form a sound like *she*. Think of *initiate*.
- *X* can be pronounced like *z*, and it's sometimes silent.
- A vowel at the end of a word can change the pronunciation of letters in the word. The word *wag* has a different *g* sound than the word *wage*.
- When several vowels are right next to each other, they can be pronounced many different ways (consider *boo, boa,* and *bout*). Try a couple of different possibilities. For instance, if you see the word *feint,* you may think that it should be pronounced *feent* or *fiynt,* but in fact, it sounds like *faint.* It means fake or pretend.

The guessing game: Narrowing down your choices

On the Word Knowledge portion of the ASVAB, remember that you can (and should) guess if you don't know the answer. A wrong answer has no penalty, and according to the laws of probability, you have a one-in-four chance of getting the right answer — so go ahead and guess.

Keep in mind that although you may know the word in the question, you may not know one or more of the words in the multiple-choice answers. If this is the case, use the process of elimination to help you narrow down your choices. Eliminate the words you know aren't correct, and guess which of the remaining words is most likely correct.

Sample Test Questions

Now you're ready to pit your skills against the Word Knowledge section of the ASVAB. Try these sample questions to see how you do. They're similar to what you'll see on the ASVAB.

1. Community most nearly means:
   (A) society
   (B) money
   (C) date
   (D) bank

   Community means *state* or *commonwealth.* The correct answer is Choice A. Choices B, C, and D are unrelated.

2. She thought that there was a conspiracy against her.
   (A) wall
   (B) plan
   (C) evil deed
   (D) ghost

   Conspiracy means *plot,* so the answer closest in meaning is Choice B. Choices A and D are unrelated. And although a conspiracy may be an evil deed, Choice C isn't as close in meaning as Choice B.

3. Keen most nearly means:

(A) sharp

(B) small

(C) simple

(D) shiny

Keen means *having a fine edge.* Thus, Choice A is closest in meaning. Choices B, C, and D are unrelated.

4. Defer most nearly means:

(A) change

(B) reverse

(C) deny

(D) postpone

Defer means *to put off,* so the correct answer is Choice D. Choices A, B, and C are unrelated.

5. The mother chastised her child.

(A) comforted

(B) carried

(C) lectured

(D) supervised

Chastised means *disciplined* or *punished,* so Choice C is the most correct choice. Choices A, B, and D are unrelated.

Chapter 5

Paragraph Comprehension

In This Chapter

- Knowing what to expect on the Paragraph Comprehension subtest
- Pumping up your comprehension
- Reading like a stock-car driver: Improving your speed
- Making the most of a little bit of time
- Practicing what we preach

Any other organization would call this section of the ASVAB the Reading Comprehension subtest, but the Department of Defense is a stickler for precision. You'll be reading paragraphs, darn it, so you're being tested on paragraph comprehension! Not words, not sentences, not essays, but paragraphs! Glad we got that cleared up.

One thing you'll learn for sure in military boot camp: Comprehending the drill sergeant's orders and the information in your instruction manuals is important. Trust us on this one. The Paragraph Comprehension subtest tests your ability to understand what you read and to draw conclusions from that material. It contains a number of reading passages and questions about those passages.

How Does It Work?

When you get to the Paragraph Comprehension subtest, you have several passages to read. Some passages are only one paragraph long, and others can consist of several paragraphs. Each passage contains between 50 and 200 words. The ASVAB test-makers may ask you to answer only one question about a given reading passage, or they may ask you to answer as many as five questions about one passage. So you want to make sure you understand what you're reading!

This subtest counts toward your AFQT score, which is the composite score that determines whether you're even qualified to enlist. In determining your AFQT score, the Paragraph Comprehension subtest counts for twice as much as the Mathematics Knowledge and Arithmetic Reasoning subtests — the military thinks that your performance on this portion of the ASVAB is very important. (See Chapter 1 for more information on AFQT scores.)

After you enlist, you'll discover that the military runs on paperwork. If you can't read and understand a regulation that's buried within a pile of papers, how are you going to obey it?

Military folks also use the Paragraph Comprehension subtest to determine if you qualify for specific jobs. Certain military jobs require a high score on this test. Turn to Appendix A to learn more about which jobs require a good score on this subtest.

What's the Big Idea? Determining the Main Idea in a Paragraph

Reading comprehension — which is what the Paragraph Comprehension subtest is all about — consists of several abilities:

- Finding the main idea or argument that the author is making
- Remembering specific details about the reading
- Drawing conclusions from what you've read
- Understanding relationships between ideas
- Paraphrasing (or summarizing) what you've read

Questions on the Paragraph Comprehension subtest frequently ask you to identify the main point of a reading passage. How do you get better at identifying main ideas? Practice.

So, what's your point?

The *main idea,* which is the most important point the author is making, is sometimes stated and sometimes implied in a piece of writing. Often, the author begins or ends a paragraph or passage with the main idea, which is located in what is called a *topic sentence.* A topic sentence, reasonably enough, describes the topic that the author is writing about.

So, if you're looking for the main idea, start off by checking the first and last sentence of the passage. (No, this doesn't mean that you should skip the rest of the passage.) For example, suppose you read the following paragraph:

> The local school district is facing a serious budgetary crisis. The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million. Already, 65 teachers have been laid off, and more layoffs are expected.

The main point of this paragraph can be found in the opening sentence, "The local school district is facing a serious budgetary crisis." What follows are details regarding the budget crisis.

Sometimes, a passage builds up to its main idea, and sometimes the main idea is implied, rather than stated. Consider the following paragraph:

> The farmers' market reopened on the second weekend of May. Amid the asparagus and flowers, shoppers chatted about the return of temperatures in the seventies. Across the street, children (and their dogs) were playing Frisbee in the park. Finally, spring has come to town.

In this paragraph, you might think that the farmers' market reopening is the main point, but the other information about the temperature and the kids playing Frisbee tells you that the main idea is something a bit broader than the market opening. The main idea is stated in the last sentence: "Finally, spring has come to town."

In boot camp, your drill instructor may say, "Some of you better check to see that your bunks are properly made." Or he may rip your bunk bed apart and say, "Now make this $%*& bunk the right way, you moron!" Both comments mean the same thing. In the first statement, the drill instructor implies the meaning; the second statement is a bit more direct.

Extra, extra! Identifying subpoints

An author doesn't just make one point in a piece of writing, so you also need to understand the other points the author makes. These details, or *subpoints,* may include facts or statistics, or they may be descriptions that support the main point of the passage. Subpoints help you see what the author is saying.

For instance, look at the first passage again:

> The local school district is facing a serious budgetary crisis. The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million. Already, 65 teachers have been laid off, and more layoffs are expected.

The subpoints help you understand the main point — the school district is facing a severe budgetary crisis. The subpoints help you understand why: "The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million." You can see that the budgetary crisis is part of a larger problem, which is the state suffering a severe revenue shortfall. The subpoints also help you understand what this crisis means: "Already, 65 teachers have been laid off, and more layoffs are expected." By using these facts and figures, the author helps you grasp not just the main point, but the implications of that main point as well.

Everyone's a Critic: Analyzing What You've Read

On the Paragraph Comprehension subtest, the ASVAB may ask you to identify the main point of a passage. It may ask you to remember details and subpoints. Or the ASVAB may ask questions that require you to analyze what you've read. Analysis is more than simply picking out the point of some text. Analyzing a passage requires you to draw conclusions from what you've read and understand relationships between the ideas presented in the text. To analyze a passage, you may need to put it into your own words by paraphrasing it.

I know what it says, but what does it mean?

By drawing conclusions about the meaning of a passage, you reach new ideas that the author implies but doesn't come right out and state. You must analyze the information the author presents in order to make inferences from what you've read.

For instance, look back at the first paragraph again:

> The local school district is facing a serious budgetary crisis. The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million. Already, 65 teachers have been laid off, and more layoffs are expected.

Although the author doesn't say so, you can draw the conclusion that if the state revenue shortfall could somehow be corrected — by increasing state sales tax or income tax, for example — the local school district's budgetary crisis could be resolved. (The $18.7 million cut from the school budget could be restored.)

The author never actually makes this point in the paragraph. But using reason and logic, you can draw this conclusion from the facts presented.

Making inferences and drawing conclusions requires you to use your judgment. You don't want to read too much into a passage. For example, nothing in the above paragraph suggests that electing a new governor is necessary or that increasing federal income taxes would help the problem.

Now look at the second paragraph again:

> The farmers' market reopened on the second weekend of May. Amid the asparagus and flowers, shoppers chatted about the return of temperatures in the seventies. Across the street, children (and their dogs) were playing Frisbee in the park. Finally, spring has come to town.

Suppose you were asked the following question about this paragraph:

It can be inferred from the passage that

(A) Frisbee playing in the park doesn't happen in winter.

(B) the warm weather is unusual for this time of year.

(C) the shoppers were disappointed in the farmers' market produce.

(D) rain is imminent.

Of the answer choices, only Choice A can reasonably be inferred from the passage. If the point of the passage is that spring has come to town, and the author uses Frisbee playing as evidence of the arrival of spring, then it's likely that Frisbee playing doesn't occur in the winter but does begin again in spring.

In my humble opinion: Putting ideas into your own words

One of the best ways to identify the main point of a paragraph is to put the paragraph into your own words (paraphrase it) or to sum up the basic idea of the paragraph (summarize it). By quickly doing this when you take the Paragraph Comprehension portion of the ASVAB, you can be confident that you're answering the question correctly. In other words (to paraphrase), you'll know you know what the paragraph is talking about.

You won't have time to write down the main point or to jot down your paraphrase or summary. Instead, as you're reading, simply try to mentally keep track of what's being said by putting it into your own words.

As you study for the ASVAB, practice paraphrasing reading passages. Get out a pencil and jot down your paraphrases. (Remember, you won't have time to do this on the ASVAB test itself, but the practice will help you mentally paraphrase as you take the test.)

Look at the following paragraph. (This is the last time you'll see this paragraph in this chapter. We promise.)

> The local school district is facing a serious budgetary crisis. The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million. Already, 65 teachers have been laid off, and more layoffs are expected.

Now, close the book and spend a few moments paraphrasing this paragraph. Come on. Pick up that pencil. When you're done, reopen the book and compare your ideas to the passage. If you got something like the following, you're right on track:

> The school district has a budget crunch because the state has a budget crunch. The state cut funding to the school district. Some teachers have been laid off already. More may be laid off soon.

You can practice this technique as you study for the ASVAB. You can paraphrase or summarize any short passage you read — a few sentences or a paragraph or two.

Four Types of Comprehension Questions

The Paragraph Comprehension questions on the ASVAB usually take one of four forms, including

- Finding specific information
- Recognizing the main idea
- Determining word meaning in context
- Drawing an implication from a stated idea

Each type of question asks you to perform a different kind of analysis of the reading passage. If a passage has more than one question associated with it, chances are each question will fall under a different category. The following sections spell out the differences between these four types of questions.

Finding specific information

This type of question asks you to pick out (you guessed it) specific information from a passage. Sounds easy, right? Remember, in the military, the only easy day was yesterday. At times, the information that a question asks about isn't directly stated in the paragraph, but you can infer this information from the text. To see what we're talking about, first take a look at this passage that clearly states the answer to the question that directly follows it:

An industry trade association found that there were more than 13,000 martial-arts schools in the United States, with nearly 6 million active members. Of the 13,000 schools, nearly 7,000 offered Tae Kwon Do lessons.

According to this passage, how many people actively participated in martial arts lessons?

(A) 13,000

(B) 7,000

(C) 6 million

(D) It can't be determined.

Correct answer: C.

Now, consider this question, applied to the same passage:

According to this passage, how many schools didn't teach Tae Kwon Do?

(A) 13,000

(B) more than half

(C) 6 million

(D) 6,000

Correct answer: D. Although the passage doesn't specifically say, "6,000 schools didn't teach Tae Kwon Do," you can infer this information from the fact that 7,000 schools did teach Tae Kwon Do. The remaining schools (of the 13,000 that offered martial arts) must, logically, not have offered Tae Kwon Do.

When questions are phrased in the negative, like the one above, becoming confused about what the question is asking is very easy. (This is especially true when the information being sought is not directly stated in the passage.) Misreading a negative question is also easy. Research has shown that people often skip over a negative when they read. A reader could easily glance at the above question and see "How many schools did teach Tae Kwon Do?" and that mistake would lead to the wrong answer. Be aware that questions on this portion of the ASVAB are frequently stated in the negative. When you see one, an alarm should go off in your head that reminds you to read the question a bit more carefully.

Recognizing the main idea

Sometimes the Paragraph Comprehension questions ask you to identify the main point of a passage. The main point can be directly stated, or it can be implied. Sometimes you can find the main idea in the first sentence of the passage, and sometimes it pops up in the last sentence. So if you're not sure what the main point of a paragraph is, re-read the first sentence and the last sentence. Chances are, one of these two sentences contains the main point. (Flip back to the "What's the Big Idea?" section for more information on identifying main ideas.)

Determining word meaning in context

Sometimes the Paragraph Comprehension subtest asks you to determine the meaning of a word when it is used in a passage. The correct definition that the question is looking for can be the most common meaning of the word, or it can be a less well known meaning of the word.

In either case, you have to read the passage, make sure you understand how the word is being used, and select the answer option that is closest in meaning to the word as it's used in the passage. Consider this example:

In the 18th century, it was common for sailors to be pressed into service in Britain. Young men found near seaports could be kidnapped, drugged, or otherwise hauled aboard a ship and made to work doing menial chores. They were not paid for their service, and they were given just enough food to keep them alive.

In this passage, *pressed* means:

(A) hired

(B) ironed

(C) enticed

(D) forced

Correct answer: D. The descriptions of the conditions these sailors found themselves in should help you decide that they weren't hired or enticed; *ironed* is one meaning of the word "pressed," but isn't correct in this context.

Here's another example:

Since the 1980s, computers have become an indispensable part of American business. There are thousands of applications for which computers can be used, from word processing and running spreadsheets to keeping one's checkbook updated.

In this passage, *applications* means:

(A) functions

(B) sizes

(C) requests

(D) types

Correct answer: A. Try putting the other answer choices in this phrase: "There are thousands of applications for which computers can be used." You can see that *functions* is closest in meaning to *applications,* although in a different context, some of the other answer choices may be correct.

Drawing an implication from a stated idea

The Paragraph Comprehension subtest sometimes asks you to draw an implication from a stated idea. This simply means that you may be asked to draw a conclusion about what you've read. This conclusion should always be based on the reading, not your own particular opinions about a subject.

The *conclusion* — which may be called an *inference* or *implication* — must be reasonably based on what the passage says. You have to use good judgment when deciding what conclusions can be logically drawn from what you've read. Give it a shot:

Twenty-five percent of all automobile thefts occur when the doors of a car are left unlocked. People often forget to lock their doors, find it inconvenient, or tell themselves, "I'll only be a minute." But it only takes a minute for an accomplished car thief to steal a car. And thieves are always alert to the opportunities that distracted or rushed people present them with.

To prevent auto theft, it is a person's responsibility to

(A) leave the doors unlocked.

(B) never be in a rush.

(C) prevent the opportunity.

(D) be willing to perform a citizen's arrest.

Correct answer: C. Although the paragraph doesn't say, "To prevent auto theft, it is a person's responsibility to prevent the opportunity," this idea is certainly implied. There is no implication that people should be willing to (or can) perform a citizen's arrest. Leaving the doors unlocked is the opposite of what one should do, and never being in a rush is probably impossible.

An example of an unreasonable conclusion drawn from the above paragraph would be something like, "If everyone locked their doors, there would be no crime," or "All car thieves should be sentenced to 30 years in prison." Nothing in this particular passage supports such a conclusion.

One way to help determine if you've drawn a reasonable conclusion is to ask yourself, "Based on what I've just read, would the author agree with the conclusion I've reached?" If the answer is yes, your conclusion is probably reasonable. If the answer is no, time to think up a new conclusion.

Try this one on for size:

Boiler technicians operate main and auxiliary boilers. They maintain and repair all parts, including pressure fittings, valves, pumps, and forced-air blowers. Technicians may have to lift or move heavy equipment. They may have to stoop and kneel and work in awkward positions.

According to this job description, a good candidate for this job would be

(A) a person with joint problems.

(B) an individual unaccustomed to heavy lifting.

(C) a person who is not mechanically minded.

(D) a person who is physically fit.

Correct answer: D. Although the passage doesn't say, "This job requires a physically fit person," the duties listed imply that this is so. A person with joint problems may not be able to stoop or kneel or work in awkward positions. A person who is unaccustomed to heavy lifting may not be able to lift or move the heavy equipment as needed. A person who is not mechanically minded may not have the knowledge necessary to maintain and repair boilers and all their parts. This leaves Answer D, and it's true that a person who is physically fit would be a good choice for the job.

Speed Counts: Tips for Slow Readers

You will have 13 minutes to answer 15 questions on this subtest. For many people, 13 minutes is enough time to read the passage, understand the question, and choose the correct answer. But slow readers may have more difficulty getting all the questions answered before time is up. Don't despair: We have some suggestions that can help you build your reading speed. Of course, they require work, but you expected that, right?

Read more, watch less

If you're a slow reader, chances are you don't do a lot of reading. If you have plenty of time before you're due to take the ASVAB, starting to read more — right now — is in your best interest.

You don't have to pick up *A Tale of Two Cities* or *War and Peace*. You can start with the newspaper, a biography of a person you admire, or magazines you find at the library. Sorry, but the instruction guide to your favorite video game doesn't count. If you devote at least one hour a day to improving your reading comprehension and speed, you'll see results fast — maybe within a month or so.

Pump up your vocabulary

People sometimes read slowly because they don't have a large vocabulary and don't understand everything they read. If you can identify with this situation, improving your vocabulary is your first step toward increasing your reading comprehension and your reading speed. (Chapter 4 gives you info on building your word knowledge. Check it out.)

Build your confidence

Another reason people read slowly is that they don't have confidence in themselves. They're not convinced that they understand what they're reading, so they read a passage several times, trying to make sure they haven't missed anything. But just like people who check that the front door is locked 15 times before leaving for vacation and still lie awake at night wondering if they locked the door, reading and re-reading a passage doesn't give you confidence that you understand the text. You get confidence from proving that you understand it.

How do you prove to yourself that you understand what you're reading? One way is to get out a textbook or even an encyclopedia (preferably a volume that contains some subject matter that interests you) and read one or two paragraphs straight through without going back and re-reading anything. Then close the book (keeping your place marked) and write, in your own words, a brief description of what you've read. Finally, turn back to the passage and compare your description to the information on the page.

A relatively fun way to build your self-confidence is to play the 20-questions game. Read an article from a magazine, encyclopedia, or textbook. Then ask someone to pick out facts from the article and ask you questions about them.

Is your written version of the article close in meaning to the original? Do you get most of the 20 questions correct? If so, you understand what you're reading, and that should build your confidence. If not, don't toss the book or magazine aside in frustration or go ballistic on your mom for asking you tough questions. Keep working on it — we guarantee your comprehension will improve. Do these confidence-building drills a few times a day until you feel like you can read any paragraph or two and understand it without having to re-read the information.

Help! The ASVAB Is Next Week!

Face it — some old sayings are on the money. Practice makes perfect, and unfortunately, practice takes time. All the study aids that we provide in the preceding sections of this chapter won't help as much as they normally do if the ASVAB is next week and you're a slow reader. But, if you find yourself in this situation, you don't have to just pack it in and forget about the ASVAB and a military career.

The Paragraph Comprehension section tests your ability to understand what you read, not how quickly you can read it. When you sit down to take this subtest, try to go as quickly as you can without sacrificing accuracy. Being methodical in your reading isn't a bad thing, as long as you're getting the answers right. Just try to read a little faster than normal without panicking or missing the point.

Be all that you can be

Today's military is much more complex than attending boot camp, learning how to shoot a gun, and shipping off to war. After boot camp, you'll attend intensive classroom training to learn your military job. If you can't read well, you're going to have a very hard time. But the good news is that it's never too late to work on improving your reading skills.

For short-term preparation, you need to do a hardcore confidence-building workout a few days before the ASVAB. (See the section "Build your confidence," earlier in this chapter, to find out how to do these exercises.)

Take one or two of the practice tests at the back of this book to get a sense of how long it takes you to read and understand the passages and the answer options. The practice tests will give you confidence going into the actual test. You may find that you can do the work in the time allotted.

It's better to read the paragraphs carefully and answer the questions correctly on half the questions, and guess on the other half of the questions than it is to speed through all of the reading and get none of the answers right.

Finally, if ASVAB day is quickly approaching, see the "Practicing Comprehension Skills" and "Test-Taking Tips" sections later in this chapter for more information on how to do well on the Paragraph Comprehension subtest even if you skipped English class your entire senior year.

Test-Taking Tips

Although there are no shortcuts to improving your reading-comprehension skills (besides practice), you can do a few things on test day to make sure that you score as high as possible on the Paragraph Comprehension subtest.

Guessing is always better than not guessing. You have a chance of getting the correct answer if you guess. So, if you're running out of time on the test, or you're not sure if you can identify the main idea of a passage, take a guess. If you think that was a good piece of advice, check out these tried-and-true tactics for test day:

- **Read first, ask questions later:** Read the passage all the way through before glancing at the question and answer options.
- **Take it one question at a time:** Some passages have more than one question associated with them, but look at only one question at a time.
- **Understand each question:** What is the question asking you to do? Are you supposed to find the main point? Draw a conclusion? Find a word that is nearest in meaning? Make sure you know what the question is asking before you choose among the answer options. This tip may seem obvious, but when you're in a hurry, you can make mistakes by misunderstanding the questions.
- **Read each answer option carefully:** Don't just select the first answer that seems right. Remember, on the Paragraph Comprehension subtest, one answer is often "most right" while others are "almost right." You want to choose the "most right" answer, not the "almost right" answer. And to do that, you have to read *all* the answers.
- **Check your feelings at the door:** Answer each question based on the passage, not your own opinions or views on the topic.
- **Don't choose ambiguous-answer options:** They're incorrect 99.99 times out of 100. (Oh heck, call it 100 times out of 100.) If an answer strikes you as not quite true but not totally false, that answer is incorrect. Those nasty ASVAB test-makers have put it there to throw you off. Don't give them the satisfaction of falling for their trap!
- **Never select never:** For the most part, answer options that are absolute are incorrect. *Never, always,* and related words are often a sign that you should select a different answer. Words like *generally* and *usually* are more likely to be correct.

Sample Test Questions

Time for you to put all the great advice we provide in this chapter to good use. (You can see that we're not usually accused of being too modest.) Quiz yourself on the following sample test questions to see if your reading comprehension is up to speed.

Although the average consumer replaces the tires on his or her automobile every 50,000 miles, steel-belted radials can last for more than 60,000 miles. However, they must be properly maintained. The tires must be inflated to the correct air pressure at all times, and tires must be rotated and balanced according to a routine maintenance schedule. The tread should be checked for correct depth regularly.

1. How long can steel-belted radials last?

   (A) 50,000 miles

   (B) 60,000 miles

   (C) No one knows.

   (D) 25,000 miles

Correct answer: B. If you missed this one, you didn't read carefully enough.

2. According to the passage above, proper tire maintenance does not include

   (A) keeping tires properly inflated.

   (B) balancing and rotating tires.

   (C) checking the tread.

   (D) checking the lug nuts.

Correct answer: D. This is a negative question that requires extra care in answering.

Some people argue that baking is an art, but Chef Debra Dearhorn says that baking is a science. She says that if you follow a recipe carefully, assembling the ingredients accurately, cooking at the specified temperature for the specified period of time, your cookies will always turn out right. Chef Dearborn says the best baking is like the best experiment — anyone can duplicate it.

3. In this passage, the word *assembling* most nearly means:

   (A) measuring

   (B) putting together

   (C) buying

   (D) storing

Correct answer: B. Although *measuring* is something you do when baking, it doesn't "most nearly" mean the same thing as *assembling. Putting together* does.

4. According to the above passage, a person who is all thumbs in the kitchen

   (A) should get out of the kitchen.

   (B) is an artist.

   (C) isn't following the recipe carefully.

   (D) is Chef Dearborn.

Correct answer: C. The passage states that if you follow a recipe carefully, your cookies will always turn out right.

The United States Postal Service will deliver a one-pound package overnight for $20, although it does not guarantee on-time arrival. United Parcel Service will deliver the same package for $25 and guarantee the delivery. FedEx will deliver the package for $30 and guarantee the delivery, plus pick up your package for no additional charge.

5. Which service should you use if you must have a delivery guarantee but can't spend more than $25?

(A) United States Postal Service

(B) United Parcel Service

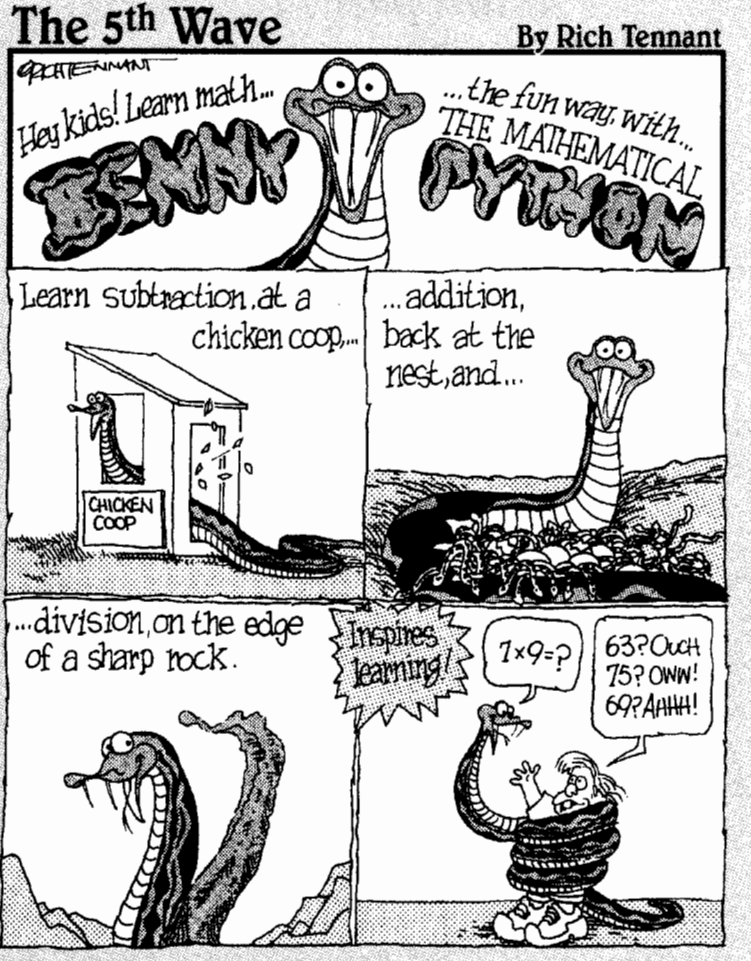
(C) FedEx

(D) None of the services meet the criteria.

Correct answer: B. The passage's second sentence tells you everything you need to know.

Part III

Adding Things Up: Numbers Knowledge



In this part . . .

Many military careers require a solid understanding of math principles. Even though the military will spring for a calculator, you're expected to know how to add and subtract before you hit boot camp.

Part III gives you a chance to brush up on your numbers knowledge. It includes all kinds of information that can help you do well on the four math-related subtests the ASVAB throws at you. We also give you a ton of tips on everything from how to guess if you're running out of time to what to do if you forget the quadratic formula.

Chapter 6

Arithmetic Reasoning

In This Chapter

- Working on word problems
- Reviewing essential basic math
- Thinking like a calculator
- Avoiding common mistakes and traps

Remember the first time your teacher asked you, "If Martha has two bananas and Johnny gives her three bananas, how many bananas does Martha have?" Like many people, you may have wondered why Johnny was giving Martha bananas in the first place — unless Martha was his pet gorilla — but in fact, your teacher was introducing you to the concept of word problems.

Word problems help you apply mathematical principles to the real world (at least the real world according to the people who think up word problems). And the Arithmetic Reasoning subtest tests your ability to do real-life, basic, mathematical calculations derived from simple word problems. If you slept through high-school math, don't worry. We're pretty good at explaining this stuff, if we do say so ourselves.

The Arithmetic Reasoning subtest asks you to read a word problem, determine what the question is asking, and select the correct answer. (Then you have to repeat the process 29 more times.) Most of the problems look like this:

Jane walks five miles to work each morning and five miles home each evening. How many miles does Jane walk in a day?

(A) 6 miles

(B) 8 miles

(C) 7 miles

(D) 10 miles

You have 36 minutes to answer 30 questions, so you have to work quickly to finish, but you're not being tested on speed. The test administrator will supply you with scratch paper so that you can work out some of the problems on paper if needed. Remember, it never hurts to illustrate the problem by drawing graphics — like Martha's two bananas and Johnny's three bananas.

Arithmetic Reasoning is an important part of the overall ASVAB score — otherwise known as the Armed Forces Qualification Test (AFQT) score. (See Chapter 1 for more information.) Also, certain military jobs require that you score well on this subtest. Turn to Appendix A to find out which jobs require what scores on this subtest.

In order to do well on the Arithmetic Reasoning subtest, you have to remember that there are two parts to it: Arithmetic and Reasoning. You usually have to use both of these skills for each problem. The arithmetic part comes in when you have to perform mathematical operations such as addition, subtraction, multiplication, and division. The reasoning comes in

when you figure out what numbers to use in your calculations. In other words, Arithmetic Reasoning tests how you apply your ability to perform calculations to everyday, real-life types of problems.

You're not allowed to use calculators during the ASVAB test, so now is a good time to get into the practice of using scratch paper instead of a calculator.

Wrestling with Word Problems

Test takers often waste a lot of time reading and rereading word problems as if the answer might reveal itself to them by some miracle, which isn't going to happen.

What's the problem? Figuring out what the question is asking

As you read the question, ask yourself what it wants you to do. Maybe the question wants you to find the volume of a cardboard box. Maybe you don't know how to do this. Fine. Don't freak out. Just don't forget to figure out what the question asks. If you waste time panicking and trying to read the problem in such a way that you don't have to find the volume of the cardboard box, you're not doing yourself any favors. Take the philosophical approach and accept what you cannot change.

Suppose you're asked the following question:

How many cubic inches of sand does a cardboard box measuring 12-inches long by 14-inches wide by 10-inches tall contain?

(A) 52 cubic inches

(B) 88 cubic inches

(C) 120 cubic inches

(D) 1,680 cubic inches

What does this question want you to determine? It wants you to figure out how much sand can fit in a box. Would figuring out the perimeter of the box help you with this question? Nope. Would figuring out the area of one side of the box help you? Nope (you're not painting the box, you're filling it). The question wants you to determine the volume of the container. After you know what the question is looking for, you may or may not know how to correctly solve the problem, but at least you know what the problem wants you to find.

Looking for answers in all the right places

One of the best ways to solve a word problem is to write down a formula that will produce the answer to the question and then find the correct facts to plug into the formula. For instance, a question may ask:

Joan just turned 37. She wants to travel to Key West to become a beach bum for a year and then return to her accounting job. To finance this lifelong dream, she needs to save a total of $15,000. How much does Joan need to save each year if she wants to become a beach bum by her 40th birthday?

Write down, in mathematical terms, what the question is asking you to determine. Because the question is asking how much money Joan needs to save per year to reach $15,000, you can say: y (years Joan has to save) times m (money she needs to save each year) equals $15,000. Or to put it more mathematically:

$$ym = \$15{,}000$$

You don't know the value of m (yet) — that's the unknown you're being asked to find. But you can find out the value of y — the number of years Joan has to save. If she's 37 and wants to be a beach bum by the time she's 40, she has 3 years to save. So now the formula looks like this:

$$3m = 15{,}000$$

To isolate the unknown on one side of the equation, you simply divide each side by 3, so that $3m \div 3 = 15{,}000 \div 3$. (If you don't remember how to isolate unknowns, flip on over to Chapter 7.) Thus, your answer is

$$m = 5{,}000$$

Joan needs to save $5,000 each year for 3 years to reach her goal of $15,000 by the time she's 40.

Welcome Back to Basic (Math) Training

Numbers come in several varieties. *Whole* numbers are numbers like 1, 2, 17, and 54. *Fractions, percents,* and *decimals* are numbers used to represent what part of the whole you have. The following sections present some specific strategies you need to remember when you're crunching the numbers to figure out those menacing word problems.

Operating like a mathematical surgeon

When you toss numbers together (mathematically speaking), you perform an *operation.* When you add or multiply, you perform a *basic operation.* But because math, like the universe, functions according to yin-yang-like principles, each of these basic operations also has an opposite operation, called an *inverse operation.* Thus, the inverse of addition is subtraction, and the inverse of multiplication is division. And, of course, the inverse of subtraction is — you got it — addition. The inverse of division (as we're sure that we don't have to tell you) is multiplication.

Don't confuse *opposite* with *inverse.* When you're doing mathematical operations, such as adding and multiplying, the inverse operation *is* the opposite operation (the inverse of addition is subtraction; the inverse of multiplication is division). But (you knew that was coming) when you're talking numbers, opposite and inverse *don't* mean the same thing. The opposite of a positive number is a negative number, so the *opposite* of x is $-x$. But the inverse of a number is that number turned on its head! The *inverse* of x is $\frac{1}{x}$. The inverse of $\frac{1}{5}$ is $\frac{5}{1}$ (or just 5).

The result of each operation goes by a different name. When you add two numbers together, you arrive at a *sum;* when you subtract, all that remains is a *remainder;* when you multiply, you come up with a *product;* and when you divide, you don't conquer, but instead you're left with a *quotient.*

Falling for fractions

If a *whole number* is a pie, a *fraction* is a slice of pie. A fraction also illustrates its relationship to the whole pie. For example, consider the fraction $\frac{3}{5}$. If you accuse your cousin of eating $\frac{3}{5}$ of the pie at Thanksgiving dinner, you're saying that the pie is divided into five equal-sized slices — fifths — and your cousin ate three of those five slices. Can anyone say *pig?*

The number above the fraction bar — the three slices your cousin ate — is called the *numerator.* The number written below the fraction bar — the total number of slices the pie is divided into — is called the *denominator.*

Adding and subtracting fractions

To add and subtract fractions, the fractions must have the same denominator, which is called a *common denominator.* If the fractions don't have a common denominator, you have to find one. Sound fun? Read on.

Finding a common denominator can be easy, or it can be hard. Suppose you want to add $\frac{3}{5}$ and $\frac{3}{10}$. This is an easy one. You can divide one denominator, 10, by the other denominator, 5. The quotient that results is 2. Take the fraction with the smaller denominator ($\frac{3}{5}$) and multiply the denominator by 2, the quotient that resulted when you divided the larger denominator by the smaller. This operation results in a new denominator of 10. Then multiply the numerator by 2 (resulting in a new numerator of 6). Thus, you can also express $\frac{3}{5}$ as $\frac{6}{10}$. (If you cut the pie into 10 slices instead of 5, and your cousin ate 6 slices instead of 3, he would have eaten exactly the same amount of pie.)

You can use this process whenever you can evenly divide one denominator by another.

After you have found a common denominator, you add the two fractions by simply adding the numerators together: $\frac{6}{10} + \frac{3}{10} = \frac{9}{10}$. Think of it this way: If your cousin eats $\frac{6}{10}$ of the pie (which is just another way of saying $\frac{3}{5}$), and your grandpa eats $\frac{3}{10}$ of the pie, together they've eaten $\frac{9}{10}$ of the pie.

But suppose your cousin eats $\frac{3}{5}$ of one pie and your aunt eats $\frac{1}{6}$ of another pie (one that was cut into 6 slices instead of 5), and you want to know how much pie has been eaten. In this case, you need to add $\frac{3}{5}$ and $\frac{1}{6}$.

Adding these fractions is a bit more difficult because you can't divide either denominator by the other. So you have to find a common denominator that both 5 and 6 divide into evenly. The easiest way to find this number is to multiply 5×6 to produce 30. Now you know that you need to convert the fractions so that they both have a common denominator of 30. To get the job done, express each fraction this way: $\frac{3}{5} = \frac{?}{30}$. Because you have to multiply the denominator by 6 to reach 30 ($5 \times 6 = 30$), you also have to multiply the numerator by 6. This time you get 18 ($3 \times 6 = 18$). Your missing numerator is 18, and the fraction $\frac{3}{5}$ can be expressed as $\frac{18}{30}$.

When you're trying to find the common denominator for a fraction, you must always multiply the numerator and the denominator by the same number. Otherwise, you will change the value of the fraction.

With the problem illustrated above, you multiply the numerator and the denominator by 6, discovering that $\frac{3}{5}$ is the same thing as $\frac{18}{30}$. But if you had multiplied only the denominator by 6, you would have a new number. $\frac{3}{5}$ and $\frac{3}{30}$ do not have the same value.

Now express the second fraction the same way: $\frac{1}{6} = \frac{?}{30}$. You multiply the denominator by 5 to reach 30 ($6 \times 5 = 30$), so you have to multiply the numerator by the same number. Perform this little operation ($1 \times 5 = 5$), and you find out that your new numerator is 5. The fraction $\frac{1}{6}$ can be expressed as $\frac{5}{30}$.

After all that work, you can finally add the fractions: $^{18}/_{30} + {}^{5}/_{30} = {}^{23}/_{30}$.

If you have more than two fractions with different denominators, you have to find a common denominator that all the denominators divide into. Suppose you need to add $\frac{1}{2} + \frac{2}{3} + \frac{3}{5}$. A simple way to find a common denominator is to take the largest denominator (in this case 5) and multiply it by whole numbers, starting with 1, 2, 3, 4, and so on until you find a denominator that the other denominators also divide into evenly. If you multiply 5 by 2, you get 10, but 3 doesn't divide evenly into 10. So keep going: $5 \times 3 = 15$, $5 \times 4 = 20$, and so on until you find a number that 2, 3, and 5 can divide into evenly. In this case, 30 is the first number you can find that 2, 3, and 5 can divide into evenly, so 30 is your common denominator.

You can always multiply all the denominators together to find a common denominator, but this process may result in a really big, hard-to-handle denominator.

Multiplying and simplifying fractions

Multiplying fractions is easy. You just multiply the numerators and then multiply the denominators.

Thus, $\frac{1}{2} \times \frac{3}{4} \times \frac{3}{5}$ can be multiplied as $1 \times 3 \times 3 = 9$ (the numerators) and then $2 \times 4 \times 5 = 40$ (the denominators) to result in $\frac{9}{40}$.

Occasionally, when you multiply fractions, you end up with an extremely large fraction that can be *simplified.* To express a fraction in its *lowest terms* means to put it in such a way that you can't divide the numerator and the denominator by the same number (other than 1).

If you have the fraction $\frac{6}{10}$, you can see that both the numerator | 6 | and the denominator |10| can be divided by the same number |2|. A number that you can divide into both the numerator and the denominator is called a *common factor.* In this example, the common factor is 2. If you perform the operations ($6 \div 2 = 3$ and $10 \div 2 = 5$), you see that $\frac{6}{10}$ can be expressed in the simpler terms of $\frac{3}{5}$. You can't reduce (simplify) $\frac{3}{5}$ any further; the only other number that both the numerator and denominator can be divided by is 1, and the result would be the same, $\frac{3}{5}$.

Converting improper fractions to mixed numbers . . . and back again

If you have a fraction with a numerator larger than its denominator, you have an *improper fraction.* For example, $\frac{7}{3}$ is an improper fraction. To put an improper fraction into simpler (proper) terms, you can change $\frac{7}{3}$ into a mixed number (a number that includes a whole number and a fraction). Simply divide the numerator by the denominator. 7 divided by 3 becomes a quotient of 2 with $\frac{1}{3}$ left over. There's something left over because 3 doesn't divide evenly into 7. The number that is left over becomes a numerator over the original denominator. Thus, $\frac{7}{3}$ is the same as $2\frac{1}{3}$.

If you want to multiply or divide a mixed number, you need to convert it into a fraction — an improper fraction. To make the change, you convert the whole number into a fraction and add it to the fraction you already have. So, if you have $7\frac{2}{3}$, you convert 7 to a fraction, which gives you $\frac{21}{3}$, and add that fraction to the fraction that already exists — $\frac{2}{3}$ — to arrive at $\frac{23}{3}$.

How do you know that 7 is the same thing as $\frac{21}{3}$? Well, to convert the whole number into a fraction, multiply the whole number by the denominator of the existing fraction to arrive at a new numerator: $7 \times 3 = 21$. You then place this new numerator over the existing denominator to achieve $\frac{21}{3}$. But you're not done yet. You add that fraction to the remaining fraction to get the final answer: $\frac{21}{3} + \frac{2}{3} = \frac{23}{3}$. (Check out the "Adding and subtracting fractions" section earlier in this chapter for the complete scoop on the adding-fractions thing.) Or, if you want to get technical, you can look at the whole process this way, too:

$$7\frac{2}{3} = \frac{(7 \times 3) + 2}{3} = \frac{23}{3}$$

Dividing fractions

Dividing fractions is simple if you remember this rule: Dividing a fraction by a number (pick a nonzero number) is the same as multiplying it by the *inverse* of that number (remember, the inverse of a number is obtained by reversing the number). That means that if you want to divide a fraction by 5, you simply multiply the fraction by the inverse of 5, which is $\frac{1}{5}$.

This process is more easily illustrated if you remember that 5 is the same thing as $\frac{5}{1}$. In other words, 5 divided by 1 equals 5 ($5 \div 1 = 5$). And the inverse of $\frac{5}{1}$ is $\frac{1}{5}$. To come up with the inverse of a number, simply stand the number on its head.

You can't use this operation on zero. Zero has no inverse. No one knows why — it just is.

So, to divide a fraction, use the inverse of the number that follows the division symbol (÷) and substitute a multiplication symbol (×) for the division symbol. Therefore, $\frac{1}{3} \div 2$ is expressed as $\frac{1}{3} \times \frac{1}{2}$, and you already know how to multiply fractions. (If not, check out the "Multiplying and simplifying fractions" section earlier in the chapter.) $1 \times 1 = 1$ and $3 \times 2 = 6$, so the product of $\frac{1}{3} \times \frac{1}{2}$ is $\frac{1}{6}$. Thus, $\frac{1}{3} \div 2 = \frac{1}{6}$.

Converting fractions to decimals and decimals to percents

A fraction can also be expressed as a decimal and as a percent. To change a fraction into a decimal, divide the numerator (number of slices your cousin ate) by the denominator (number of slices in the whole pie). Given that handy explanation, $\frac{3}{5}$ converted into decimal form is 0.60. To make a decimal into a percent, move the decimal point two spaces to the right and add a percent sign — 0.60 becomes 60.0%. (See the following sections for more thorough discussions of decimals and percents.)

Dealing with decimals

Decimals are just another way of expressing a fraction. The expression 0.1 simply means $\frac{1}{10}$. A decimal expressed as 0.01 is the same as the fraction $\frac{1}{100}$. You can also express these decimals as percents: 0.1 = 10% and 0.01 = 1%.

Adding and subtracting decimals

To add and subtract decimals, put the numbers in a column and line up the decimal points. Then add or subtract as if the decimals were whole numbers, keeping the decimal point in the same position in your answer. Here are two examples:

$$\begin{array}{r} 1.4583 \\ +\ 0.55 \\ \hline 2.0083 \end{array} \qquad \begin{array}{r} 1.4583 \\ -\ 0.55 \\ \hline 0.9083 \end{array}$$

You can add zeroes to the end of a decimal if performing the calculations this way is easier for you. So 0.1 can be 0.100 without changing its value. In the above problems, 0.55 can be 0.5500 to help you do the operation.

Multiplying decimals

Multiplying a decimal is like multiplying a regular, everyday whole number, except that you have to place the decimal point in the right position. To multiply decimals, start off by adding the number of decimal places (from the right of the decimal point) in the numbers being multiplied. If one of the numbers you're multiplying is 0.1, for example, you have one

decimal place. If the other number you're multiplying is 3, you have no decimal places, so the total number of decimal places in your answer is one. In this example, you have to be sure that you have one decimal place in your answer, counting from right to left and putting a decimal point in where you stop. Thus, if you multiply 3×0.1, the product is 0.3.

Or, put another way:

$$3 \times \frac{1}{10} = \frac{3}{1} \times \frac{1}{10} = \frac{3}{10} = 0.3$$

If you're multiplying a number that has only zeroes to the right of the decimal point, then those decimals don't count. For instance, in the above problem, 3 could also be expressed as 3.0, but you wouldn't count the "0" as a decimal place. All of the zeroes to the right of the decimal don't count unless a number other than zero is also to the right of the decimal. 3.000007 has six decimal spaces; 3.0070 has three decimal spaces; and 3.000 has none, at least not for the purpose of multiplying.

If your answer doesn't include enough numbers for the decimal spaces you need, then add as many zeroes as necessary to the left of the answer. Suppose your answer is 50, and you have to move the decimal point over three spaces. There aren't three spaces in 50. So you add a zero to the left, to make 050, and put the decimal point in its proper position: .050 is your answer.

Here's another example: 0.04×0.25. Add the decimal places in the two numbers. (There are four.) Multiply the decimals as if they were whole numbers: $4 \times 25 = 100$. Then put the decimal point in the correct place in the answer. For 100, count from right to left four places, and put the decimal point there: 0.0100. Here's the method behind the madness:

$$\frac{4}{100} \times \frac{25}{100} = \frac{100}{1000} = \frac{1}{10} = 0.01 \text{ (or } 0.0100\text{)}$$

Dividing decimals

Decimals are divided according to slightly different rules depending on whether or not both numbers in the problem are decimals.

Dividing decimals by whole numbers

If you're dividing a decimal by a whole number, perform the operation as if the two numbers were both whole numbers. Move the decimal point over to the right until the decimal is a whole number, counting the number of decimal places. Remember how many places you moved the decimal — you need that info later.

Here's an example: $1.25 \div 4 = ?$. First, change the 1.25 to 125 by moving the decimal two decimal places to the right. Then, perform the division operation on the whole number: $125 \div 4 = 31.25$. No, you're not done yet.

Now move the decimal point two places to the left (to make up for moving it two places to the right when you made 1.25 into a whole number), and your answer is 0.3125.

Dividing decimals by decimals

To divide a decimal by another decimal, make the *divisor* (the decimal going into the other number) a whole number. Move the decimal point all the way to the right, counting (and remembering) the number of places you move it. Then move the decimal in the *dividend* (the number being divided) the same number of decimal places.

So, if you want to divide 0.15 by 0.25, $(0.15 \div 0.25)$ move the decimal point two places to the right in the divisor: 0.25 then becomes 25. Next move the decimal in the dividend the same number of spaces: 0.15 becomes 15. Then, divide 15 by 25. The result is 0.60. You don't need to move any more decimals around — 0.60 is your final answer.

If the dividend is a longer decimal than the divisor, you follow these same steps, but you have to add an extra step at the end. So, if your problem is 0.125 ÷ 0.50, move the decimal point in the divisor (0.50) two places to the right so that you have the whole number 50. Then move the decimal point in the dividend two places, to come up with 12.5. Now the problem looks like this: 12.5 ÷ 50. Now divide following the instructions in the earlier "Dividing decimals by whole numbers" section.

When the divisor is a longer decimal than the dividend, such as 0.5 ÷ 0.125, move the decimal place in the divisor all the way to the right, in this case making 0.125 into 125, counting spaces. Then move the decimal the same number of spaces in the dividend, adding zeroes as needed: 0.5 then becomes 500. 500 ÷ 125 = 4, which is the correct answer (0.50 ÷ 0.125 = 4).

Playing with percents

A *percent* is a fraction based on one hundredths. Five percent (5%) is the same as $\frac{5}{100}$ or 0.05. The ASVAB often asks you to calculate "10% off" or "an increase of 15%" on the Arithmetic Reasoning subtest. You need to be able to convert percents to fractions or decimals to answer these questions correctly.

To add, subtract, multiply, or divide using percents, change the percent to a fraction or a decimal. Remember, a percent is just hundredths, so 3% is $\frac{3}{100}$ or 0.03, 22% is $\frac{22}{100}$ or .22, and 110% is $\frac{110}{100}$ or 1.10. Just drop the percent sign and move the decimal point two places to the left, adding zeros as needed. The decimal point always starts to the right of a whole number, so 60 is the same thing as 60.0. Moving the decimal point two spaces to the left leaves you with 0.60. After you do the conversion, follow the rules we outline in the earlier sections for performing specific operations on fractions or decimals.

Some fractions convert to *repeating decimals* — a decimal in which one digit is repeated infinitely. $\frac{2}{3}$ is the same as 0.66666 (with the sixes never stopping). Repeating decimals are often rounded to the nearest hundredth; therefore, $\frac{2}{3}$ rounds to 0.67. Remember, the first space to the right of the decimal is the *tenth* place, the second space is the *hundredth* place, and the third is the *thousandth* (and so on).

Running through ratios

A *ratio* shows a relationship between two things. It expresses a comparison by proportion. If Margaret invested in her tattoo parlor at a 2:1 ratio to her business partner Julie, then Margaret put in two dollars for every one dollar that Julie put in.

Remembering rate

The term *rate* has various meanings. Essentially, a rate is a fixed quantity (a 5% interest rate, for example). It can mean the speed at which one works. (John reads at the rate of one page per minute.) It can also mean an amount of money paid based on another amount. (Life insurance may be purchased at a rate of $1 per $100 of coverage.)

Hitting the scale

Scale, particularly when used on the ASVAB, relates to scale drawings. For example, a map drawn to scale may have a one-inch drawing of a road that represents one mile of physical road in the real world. The Arithmetic Reasoning portion of the ASVAB often asks you to calculate a problem based on scale, which can be represented as a ratio or a fraction.

For example, on a map with a scale of one inch to one mile, the ratio of the scale is represented as 1:1. But questions are never this easy on the ASVAB. You're more likely to see something like, "If a map has a scale of one inch to every four miles. . . ." That scale could be expressed as the ratio 1:4.

Almost every military job makes use of scales, which is why scale-related questions are so common on the ASVAB. No, we're not talking about the scale you climb onto to see if you need to skip lunch. Whether you're reading maps at Mountain Warfare School or organizing trash pickup around the base, you'll need to use and interpret scales frequently.

Uncovering an unusual series of events

The Arithmetic Reasoning subtest often includes questions that test your ability to logically complete a series of numbers. Generally, these problems are the only questions that aren't word problems, but they test your ability to do arithmetic and to reason because you must be able to determine how the numbers are related to each other. And to do this, you must also be able to quickly perform mathematical operations.

Suppose you have a series of numbers that look like this:

1, 4, 7, 10, ?

You can easily see that each number is reached by adding three. 1 + 3 = 4; 4 + 3 = 7; and so on. So the next number in the sequence would be 10 + 3 *or* 13.

But, of course, the questions on the ASVAB aren't quite this simple. More likely, you'll see something like this:

2, 4, 16, 256, ?

In this case, each number is being multiplied by itself, so $2 \times 2 = 4$; $4 \times 4 = 16$; and so on. 256×256 is 65,536, so that's the correct answer.

You may also see sequences like this:

1, 2, 3, 6, ?

In this sequence, the numbers are being added together. 1 + 2 = 3 and 1 + 2 + 3 = 6. So the next number would be 1 + 2 + 3 + 6 *or* 12.

Finding the pattern

To answer sequence questions correctly, you need to figure out the pattern as quickly as possible. Some people, blessed with superior sequencing genes, can figure out patterns instinctively. The rest of us have to rely on more difficult, manual effort.

Finding a pattern in a series of numbers requires you to think about how numbers work. For instance, in the second example in the preceding section, seeing the number 256 should alert you that multiplication is the operation because 256 is so much larger than the other numbers. On the other hand, because the values in the third example don't increase by much, you can guess that the pattern requires addition rather than multiplication.

Dealing with more than one operation in a series

Don't forget that more than one operation can occur in a series. For example, a series may be "add one, subtract one, add two, subtract two." That would look something like this:

2, 3, 2, 4, ?

Because the numbers in the series both increase and decrease as the series continues, you should suspect that something tricky is going on.

Remember that scratch paper? Use it! Jot down notes while you're trying to find the pattern in a series. Writing your work down helps you keep track of what operations you've tried.

Testing 1, 2, 3: Test-Taking Strategies

Guessing in boot camp is a definite no-no, but guessing in many areas of the ASVAB is perfectly fine. On the Arithmetic Reasoning subtest, you aren't penalized for wrong answers, so it makes sense to guess if you don't know the answer. After all, you have a 1 in 4, or 25%, or 0.25, chance to guess the correct answer. That's better than the 0% chance you have of getting a question right if you skip it. Plus, by following the tips in the following sections, you can do a better job of guessing correctly and increase your odds of winning the lottery, er, we mean scoring well on the ASVAB.

Don't spend much more than a minute on any one problem. If you do, you may not have time to finish this subtest. But, before you commit to an answer to a math question, double-check your calculations. One easy way to double-check your work is to plug the answer into the question.

Logical deductions: Eliminating unlikely answers

Check out the sand-in-the-box problem you first encounter in the "What's the problem?" section, earlier in this chapter.

How many cubic inches of sand does a cardboard box measuring 12 inches long by 14 inches wide by 10 inches tall contain?

(A) 52 cubic inches

(B) 88 cubic inches

(C) 120 cubic inches

(D) 1,680 cubic inches

You've already shrewdly determined that the question is asking you to find the volume of the cardboard box. But you don't remember that Volume = length × width × height. In fact, you think that the only time anyone told you about volume was when they said that your stereo was too loud, which is no help to you now.

Still all is not lost. If you use logic, you may be able to eliminate some incorrect or unlikely answers from the choices, which improves your chances of guessing correctly.

Applying other formulas to identify wrong answers

You know that adding the length of each side of the box gives you the perimeter, which isn't the right answer. So, if 12 + 12 + 14 + 14 = the perimeter, or 52 inches, then you know that Answer A is *not* correct.

So you continue thinking about the problem. You know that if you multiply the height of the box by its length, you get the area, not the volume. So solving for area by multiplying length times width and coming up with 120 doesn't solve the problem. Therefore Answer C is also wrong.

At this point, it may occur to you that if you multiply the height of the box by its length and by its width, you get its volume.

Or it may not occur to you. But you do know that the volume measurement is going to be greater than the area measurement. So you can choose an answer that is larger than the area of the cardboard box. Thus, if Answer C, 120, is too small, then Answer B, 88, is also too small — and also wrong. So the correct answer is D, 1680.

Everything doesn't usually work out quite so neatly on the ASVAB, but in general, you can eliminate a few choices through logical reasoning. Then you can choose among the remaining answers. Doing this means you have a greater chance of guessing the right answer.

Avoiding testing traps

Don't forget to solve the entire problem. Sometimes those crafty test-makers set little traps for you to fall into. For instance, suppose you have this question:

John, a roofing contractor, needs to purchase asphalt shingles for a client's roof. How many 4-x-4-inch shingles are needed to cover a roof that measures 12 x 16 feet?

(A) 192

(B) 12

(C) 27,648

(D) 1,728

This question asks you to perform several operations. You must determine the area of the roof, figure out the area each shingle will cover, and then come up with the total number of shingles required to cover the area of the roof.

Many people fail to complete the entire series of calculations because they're sweating the pressure from the clock. They think, "Aha! I know how to answer this one!" They figure out that the area of the roof is 192 square feet (12×16) and choose Answer A as the correct answer. But Choice A isn't the correct answer because coming up with 192 square feet is only a small portion of the problem.

Others folks go further with their calculations and determine that the area of each shingle is 16 inches (4×4) and divide 192 (the area of the roof) by 16 to reach 12 shingles. They choose Answer B, and they're wrong. They're wrong because the roof is measured in feet and the shingles are measured in inches. The measurements must be converted so that the area of the shingles and the area of the roof are both expressed in the same measuring unit.

The easiest way to do this is to multiply both the length and the height of the roof by 12 (because 12 inches are in a foot) and then multiply the height and the length of the roof together to determine the total area of the roof in inches.

Thus, the area of the roof in inches is 27,648. Some people, pleased that they remembered to convert feet into inches, choose Answer C. That's an incorrect answer because the question asks how many shingles are needed to cover the roof. To determine the number of shingles needed, divide 27,648 by 16 (the area in inches of each shingle) to come up with 1,728 shingles (or enough to cause John to go back to the shop for a heavy-duty pickup truck). *Correct answer:* D.

Use your common sense! If an answer doesn't seem reasonable — like a roof requiring only 12 shingles — you've probably made a mistake in your calculations. Go back and try again. Remember, this subtest is testing your ability to make calculations based on real-life problems, and no real-life roof was ever covered with only 12 shingles.

Sample Test Questions

Now that you know what you're up against, give these sample questions a try. They're similar to the ones you'll see on the ASVAB Arithmetic Reasoning subtest.

1. If apples are on sale at 15 for $3, what is the cost of each apple?

   (A) 50 cents

   (B) 25 cents

   (C) 20 cents

   (D) 30 cents

   Correct answer: C. Divide $3 by 15.

2. A noncommissioned officer challenged her platoon of 11 enlisted women to beat her record of performing a 26-mile training run in 4 hours. If all of the enlisted women match her record, how many miles will they have run?

   (A) 71.5 miles

   (B) 6.5 miles

   (C) 286 miles

   (D) 312 miles

   Correct answer: C. Multiply 26×11. The other information in the question is irrelevant — it's there to throw you off.

3. Margaret gets her hair cut and colored at an expensive salon in town. She is expected to leave a 15% tip for services. If a haircut is $45 and a color treatment is $150, how much of a tip should Margaret leave?

   (A) $22.50

   (B) $29.25

   (C) $20.00

   (D) $195.00

   Correct answer: B. Add 45 and 150 and multiply the answer by .15 (15%).

4. A bag of sand holds 1 cubic foot of sand. How many bags of sand are needed to fill a square sandbox measuring 5-feet long and 1-foot high?

   (A) 25 bags

   (B) 5 bags

   (C) 10 bags

   (D) 15 bags

   Correct answer: A. The volume of the sandbox ($l \times w \times h$) is 25 cubic feet, and each bag hold one cubic foot of sand.

5. The day Samantha arrived at boot camp, the temperature reached a high of 90 degrees in the shade and a low of –20 at night in the barracks. What was the average temperature for the day?

   (A) 55 degrees

   (B) 45 degrees

   (C) 70 degrees

   (D) 62 degrees

   Correct answer: A. Divide the temperature range of 110 degrees by 2 to reach the average temperature.

6. Farmer Beth has received an offer to sell her 320-acre farm for $3,000 per acre. She agrees to give the buyer $96,000 worth of land. What fraction of Farmer Beth's land is the buyer getting?

   (A) ¼

   (B) 1/10

   (C) ⅕

   (D) ⅔

   Correct answer: B. $96,000 divided by $3,000 (price per acre) equals 32 acres. 32 acres divided by 320 acres (total of the farm) equals 10% or 1/10 of the land.

7. A map is drawn so that 1 inch equals 3 miles. On the map, the distance from Kansas City to Denver is 192½ inches. How far is the roundtrip from Kansas City to Denver in miles?

   (A) 192½ miles

   (B) 577.5 miles

   (C) 385 miles

   (D) 1,155 miles

   Correct answer: D. Multiply 192.5 × 3 to get the distance in miles and then double the answer to account for both legs of the trip.

8. Margaret and Julie can sell their tattoo parlor for $150,000. They plan to divide the proceeds according to the ratio of the money they each invested in the business. Margaret put in the most money, at a 3:2 ratio to Julie. How much money should Julie get from the sale?

   (A) $50,000

   (B) $30,000

   (C) $60,000

   (D) $90,000

   Correct answer: C. According to the ratio, Margaret should get ⅗ of the money and Julie should get ⅖ of the money. The fractions are calculated by adding both sides of the ratio together (3 + 2 = 5) to determine the denominator. Each side of the ratio then becomes a numerator, so that Margaret's investment can be shown to be ⅗ of the total investment, and Julie's is ⅖ of the total investment. (You can check these fractions by adding ⅗ and ⅖ to get ⅝ or 1, which is all of the money.) Divide $150,000 by 5, then multiply the answer by 2 to determine Julie's share of the money.

9. What is the fifth number in the series 4, 8, 16, 32?

(A) 48

(B) 64

(C) 96

(D) 8

Correct answer: B. The pattern is to double each number: 4 + 4 =8; 8 + 8 =16; 16 + 16 = 32; so 32 + 32 = 64

10. In the military, ¼ of an enlisted person's time is spent sleeping and eating, 1/12 is spent standing at attention, ⅙ is spent staying fit, and ⅖ is spent working. The rest of the time is spent at the enlisted person's own discretion. How many hours per day does this discretionary time amount to?

(A) 6.0 hours

(B) 1.6 hours

(C) 2.4 hours

(D) 3.2 hours

Correct answer: C. Calculate this answer by first assigning a common denominator of 60 to all the fractions and adjusting the numerators accordingly: 15/60, 5/60, 10/60, and 24/60. Add the fractions to find out how much time is allotted to all of these tasks. The total is 54/60, which leaves 6/60 or 1/10 of the day to the enlisted person's discretion. 1/10 of 24 hours is 2.4 hours.

Chapter 7

Mathematics Knowledge

In This Chapter

- Dealing with slightly harder math problems
- Laying down the terms
- Practicing your technique

The Mathematics Knowledge subtest evaluates your understanding of sophisticated mathematical principles and your ability to make correct calculations using those principles.

To qualify for certain jobs in the military, you have to score well on the Mathematics Knowledge subtest. You also have to do well on this subtest (which is part of the Armed Forces Qualifying Test) in order to enlist. Turn to Appendix A to find out more about the subtest scores needed for specific military jobs.

Bringing Up the Background Info

The Mathematics Knowledge subtest consists of 25 questions covering a wide range of mathematical concepts. You have 24 minutes to complete the subtest. You don't necessarily have to rush through each calculation, but the pace you need to set (about a minute per question) doesn't exactly give you time to daydream about what you're having for dinner. You have to focus and concentrate to solve each problem quickly and accurately.

This subtest contains questions expressed in mathematical terms and questions consisting of word problems. But, usually, the Mathematics Knowledge subtest has far fewer word problems than the Arithmetic Reasoning subtest features. (For the straight scoop on the Arithmetic Reasoning subtest, check out Chapter 6.) See, the test-makers do give you a break once in a while.

Determining the general content

Most of the time, the Mathematics Knowledge subtest only contains one or two questions testing each specific mathematical concept. For example, one question may ask you to multiply fractions, the next question may ask you to solve an inequality (a mathematical inequality, not a political or social inequality), and the question after that may ask you to find the value of an exponent. (If we've freaked you out with the last sentence, calm down. We cover inequalities in the "Solving inequalities" section and exponents in the "Minding Your P's and Q's and X's and Y's: Algebra Review" section later in this chapter. Flip back to Chapter 6 for basic information about fractions.)

All this variety forces you to constantly shift your mental gears to quickly deal with different concepts. You can look at this situation from two perspectives. These mental gymnastics can be difficult and frustrating, especially if you know everything about solving for x but nothing about deriving a square root. But variety can also be the spice of life, as your grandma may say. If you don't know how to solve a specific type of problem, this oversight may only cause you to get one question wrong (or maybe two, but think positive). If you use the guessing techniques we describe in the "Guessing your way to better odds" section later in this chapter, your odds of getting the question right are higher, even if you don't know anything about the concept.

Moving uptown with slightly more sophisticated sums

The Mathematics Knowledge subtest requires more extensive mathematical knowledge than the Arithmetic Reasoning subtest. Sorry about that. On the Mathematics Knowledge subtest, the questions relate more to algebra and geometry than to basic mathematical operations like adding and multiplying. Although you do have to add and multiply on this subtest too.

Ordering your operations: Parentheses take precedence

Many of you could become military mathematicians if the ASVAB only contained problems like $3 \times 5 = ?$ and $15 + 19 = ?$. But, instead, it features problems that can be a bit more confusing such as $5 + (16 \times 2) = ?$.

When you see parentheses in a math problem, the calculation in the parentheses should be done first. For example, in $5 + (16 \times 2) = ?$, you first multiply 16 by 2 to arrive at 32, and then you add the 5 to come up with a total of 37. You get a different (and wrong) answer if you simply calculate from left to right: $5 + 16 = 21$. $21 \times 2 = 42$.

To figure out which mathematical operation you should perform first, second, third, and so on, follow these rules, otherwise known as the *order of operations:*

1. **Grouping symbols take precedence.** Do the operation indicated by grouping symbols first. The fraction bar (— or /) is a grouping symbol. So if you have the problem $\frac{1+2}{3} = ?$, you add the numbers above or to the left of the fraction bar and then divide. The answer is $\frac{3}{3} = 1$.

   The square root sign ($\sqrt{\ }$) is also a grouping symbol, so you would solve for the square root before doing any other operation in the problem. (For more on fractions, report for duty at the Chapter 6. And to get your fill of square roots, march on over to "Getting to the root, the whole root, and nothing but the root" section later in this chapter.)

2. **Parentheses come next.** Do all the work inside of parentheses after you've finished with the grouping symbols.

3. **Multiplication and division are next.** You always do these operations in left-to-right order (just like you read).

4. **Addition and subtraction are last.** Perform these operations from left to right as well.

Ordering in action

The following example shows you how to perform a problem's operations in order:

$(15 \div 5) \times 3 + (18 - 7) = ?$

Do the work in parenthesis first (because no grouping symbols are used in this problem). The result is

$3 \times 3 + 11 = ?$

Then do division and multiplication (in this problem, only multiplication is needed). You end with

$9 + 11 = ?$

Finally, do the addition and subtraction (in this problem, only addition is needed). Your final answer is 20.

Translating Terminology Tips

In order to understand what each problem on the Mathematical Knowledge subtest asks you to do, you must understand certain mathematical terms, such as the ones we cover in the following sections.

Displaying mathematical reciprocity

A *reciprocal* is the number by which another number can be multiplied to produce 1. For example, the reciprocal of 3 is ⅓. If you multiply 3 times ⅓ you produce 1. The reciprocal of ⅙ is ⁶⁄₁ (which is the same thing as 6). $⅙ \times 6 = 1$. Get the idea?

Hanging out at mathematical bases, not army bases

A *base* is a number that is used as a factor at least two times. For instance, the term 4^3 (which could be written $4 \times 4 \times 4$, and in which 4 is a factor three times) has a base of 4.

Working at the factorial factory

A *factorial* is the product of a whole number and all the whole numbers less than it. So 6 factorial is $6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$. A factorial is represented by an exclamation point! $6! = 720$.

A factorial helps you determine *permutations* — all the different possible ways an event might turn out. For example, if you want to know how many different ways six runners could finish a race (permutation), you would solve for 6.

Rounding the bend

Rounding a number means limiting a number to a few (or no) decimal places. For example, if you have a $1.97 in change in your pocket, you may say, "I have about two dollars." The rounding process simplifies mathematical operations.

Often, numbers are rounded to the nearest tenth. The ASVAB may ask you to do this. For any number 5 and over, round up; for any number under 5, round down. Thus, 1.55 can be rounded up to 1.6, and 1.34 can be rounded down to 1.3.

Discovering roots you never knew you had

The *square root* of a number is the number, which, when multiplied by itself *(squared),* equals the original number. For example, the square root of 36 is 6. If you square 6, or multiply it by itself, you produce 36. (We provide more on square roots in the "Getting to the root, the whole root, and nothing but the root" section later in this chapter.)

Minding Your P's and Q's and X's and Y's: Algebra Review

Remember sitting in high-school algebra class and saying, "I'll never use this in real life"? Well, the ASVAB disagrees. (And, if you never took algebra in school, the ASVAB doesn't care.) It extensively tests your algebra skills. But stick with us and you'll be fine.

Algebra is a way to put problems into mathematical language using the simplest mathematical terms possible.

In algebra, you often hear about "solving for x" or "solving for the unknown," but what's the unknown? That's an easy one. The *unknown* is simply the answer you want find. Check out this example:

If you want to go to the stockcar races in your hometown, and one ticket costs $35, how much will it cost to buy tickets for a family of 4?

You can express this problem in terms of x, with x being how much it will cost to buy tickets for the whole family: x equals 4 (the number of people in the family) times $35 (the ticket price). Written a bit more formally, the equation looks like this: $x = 4 \times 35$ *or* $4 \times 35 = x$.

What if you don't know how much the stockcar tickets cost? You can express this missing piece of information in an equation as well: x (how much it will cost to buy tickets for the whole family) equals 4 (the number of people in the family) times p (the price of one ticket to the race). Once again, written a bit more formally, the equation looks like this: $x = 4 \times p$.

You can remove the multiplication symbol in algebraic expressions when using a combination of letters and numbers. Therefore, the equation $x = 4 \times p$ can also be written $x = 4p$. The multiplication symbol is implied.

The letters in an algebra problem are commonly called *variables,* meaning that the number they stand for *varies,* or changes.

Talking like a math professor: Terminology you need to know

Special algebra terms are used to describe how numbers function and how they relate to each other. Knowing what these terms mean is important to your ASVAB success.

- **Prime number:** A whole number that can be divided evenly by itself and by 1 but not by any other number, which means that it has exactly two *factors*. (Check out the definition of *factor* a bit later in this list.) Examples of prime numbers are 2, 5, and 11.
- **Composite number:** A whole number that can be divided evenly by itself and by 1, as well as by one or more other whole numbers, which means that it has more than two factors. Examples of composite numbers are 6, 8, and 9.
- **Factors:** Numbers that can divide into a composite number. To *factor* a composite number, you simply determine the numbers that you can divide into it. For example, 8 can be divided by the numbers 2 and 4 (in addition to 1 and 8), so 2 and 4 are factors of 8.
- **Exponents:** You can think of exponents as a shorthand method of indicating multiplication. For example, 15×15 can also be expressed as 15^2, which is also known as "15 squared" or "15 to the second power." The small number (^{2}) written slightly above and to the right of a number is called the *exponent*. An exponent indicates the number of times you multiply the number it accompanies by itself — 15^2 (15×15) is *not* the same as 15×2.

  To express $15 \times 15 \times 15$ using this shorthand method, simply write it as 15^3, which is also called "15 cubed" or "15 to the third power." Again, 15^3 isn't the same as 15×3.

Solving for x: The algebra equation

Algebra problems are equations, which means that the quantities on both sides of the equal sign are equal — they're the same. We can say that $2 = 2$. We can say that $1 + 1 = 2$. And we can say that $3 - 1 = 2$. In all these cases, the quantities are the same on both sides of the equal sign. So, if $x = 2$, then x *is* 2 because the equal sign says so. And, like your mother, you should always listen to the equal sign.

Solving one-step equations involving addition and subtraction

If $x + 1 = 2$, then x must be 1, because only 1 added to 1 results in 2. So far, so simple, so good. But what if the equation is a little more complicated:

$$x + 47{,}432 = 50{,}000$$

To find out what x equals, which solves the problem, you need to isolate x on one side of the equal sign. To get that job done, you have to move any other numbers on the x side of the equal sign to the other side of the equal sign.

By looking at the x side of the equation, you can see that it's an addition problem. To move the number on the x side to the opposite side, you have to perform the inverse operation. The inverse operation of addition is subtraction. (For a full rundown on inverse operations, check out Chapter 6.) So, to move the 47,432 from the x side to the non-x side of the equation, simply subtract it from both sides:

$$x + 47{,}432 - 47{,}432 = 50{,}000 - 47{,}432$$

Performing these operations removes the 47,432 from the x side of the equation ($47{,}432 - 47{,}432 = 0$, so that side of the equation is $x + 0$ or simply x) and gives you 2,568 on the non-x side of the equation ($50{,}000 - 47{,}432 = 2{,}568$). You're left with the final answer:

$$x = 2{,}568$$

To double-check that this answer is correct, plug your answer into the original problem:

$x + 47{,}432 = 50{,}000$

$2{,}568 + 47{,}432 = 50{,}000$

If you plug the answer in and it doesn't work, you've made an error in your calculations. Start again; remember that you're trying to isolate x on one side of the equation.

You can perform any calculation on either side of an equation as long as you do it to both sides of the equation. That keeps the equation *equal.*

Multiplying and dividing using integers

An *integer* is any positive or negative whole number or zero. The ASVAB often requires you to work with integers, as in $-6x = 36$. (Don't forget, $6x$ is the same thing as $6 \times x$.) In multiplication and division, if the signs of the two terms being operated on are both plus (positive numbers) or both minus (negative numbers), the answer is a positive number. If one number is negative and the other is positive, the answer is negative.

To solve this problem, $-6x = 36$, you need to isolate x, so perform an inverse operation (remember, the inverse operation of multiplication is division):

$-6x \div -6 = 36 \div -6$

$x = -6$

The answer is a negative number because the two terms, 36 and –6, have different signs.

In an algebra equation, if the same letter is used more than once, it stands for the same number. Thus, in $3x + 2x = 10$, the first x will never ever be a different number from the second x. In this case, $x = 2$ (both times).

You can only combine like terms when operating on algebraic expressions: $3x + 3x = 6x$, but $3x + 3y$ does *not* equal $6xy$, nor does $x^2 + x^3 = x^5$.

Watching the x files: Multistep equations

Not all algebra problems have one-step solutions. (That would be too easy, and you wouldn't sweat nearly as much. The ASVAB test-makers can't have that, can they?) Solving algebra problems on the ASVAB often requires you to perform several steps.

An example of a multistep equation is when x shows up on both sides of the equal sign. Then you have to get rid of x from one side of the equation by moving an x from one side to the other. You do this by performing the inverse operation.

Suppose you want to solve this equation:

$3x + 3 = 9 + x$

To remove the x from one side of the equation, perform the inverse operation:

$3x + 3 - x = 9 + x - x$

This equation can also be stated as

$3x + 3 - 1x = 9 + 0$

Doing the subtraction results in

$2x + 3 = 9$

To finish solving the problem, subtract 3 from each side of the equation:

$$2x + 3 - 3 = 9 - 3$$

$$2x = 6$$

Then divide both sides by 2:

$$2x \div 2 = 6 \div 2$$

$$x = 3$$

When you have a variable by itself, such as x, it's always equal to 1 times that variable (or one of that variable), like $1x$, even if the 1 isn't written out. In fact, any number is equal to 1 times itself, so you could also say $2 = 2 \times 1$. Sometimes this comes in handy when you're solving those algebra problems.

Getting to the root, the whole root, and nothing but the root

A *square root* is the factor (see the "Talking like a math professor: Terminology you need to know" section earlier in this chapter) of a number that, when multiplied by itself, produces the number. Take the number 36, for example. One of the factors of 36 is 6. If you multiply 6 by itself (6×6), you come up with 36, so 6 is the square root of 36. 36 has other factors such as 18. But, if you multiply 18 by itself (18×18), you get 324, not 36. So 18 is *not* the square root of 36. Any number can only have one square root.

Rooting out the details

Only a few numbers, called *perfect squares,* have exact square roots. All the rest have square roots that include decimals that go on forever and have no pattern that repeats (nonrepeating, nonterminating decimals), so they're called *irrational numbers.*

The sign for a square root is called the *radical sign.* It looks like this: $\sqrt{\ }$. Here's how you use it: $\sqrt{36}$ means "the square root of 36" — in other words, 6. We know, we know — simply saying "6" is easier, but we're not mathematical geniuses.

Finding square roots

To find the square root of a number, make an educated guess and then verify your results. If you have to find the square root of a number that isn't a perfect square, the ASVAB usually asks you to find the square root to the nearest tenth.

To use the educated-guess method, you have to know the square roots of a few perfect squares. For example, you should know that the square root of 25 is 5 ($5 \times 5 = 25$) and that the square root of 49 is 7 ($7 \times 7 = 49$). One good way to do this is to learn the squares of the square roots 1 through 12. 1 is the square root of 1; 2 is the square root of 4, 3 is the square root of 9, and so on.

Suppose you run across this problem on the ASVAB: $\sqrt{54}$. You know that the square root of 49 is 7, and 54 is slightly greater than 49. You also know that the square root of 64 is 8, and 54 is slightly less than 64. So, if the number 54 is somewhere between 49 and 64, the square root of 54 is somewhere between 7 and 8.

Because 54 is closer to 49 than to 64, the square root will be closer to 7 than to 8, so you can try 7.3 as the square root of 54. Multiply 7.3 by itself. $7.3 \times 7.3 = 53.29$, which is very close to 54. Then try multiplying 7.4 by itself to see if it's any closer to 54. $7.4 \times 7.4 = 54.76$, which isn't as close to 54 as 53.29. So 7.3 is the square root of 54 to the nearest tenth.

However, the wonderful world of math is also home to concepts like *cube roots, fourth roots,* and so on. These roots are a factor of a number, which, when *cubed* (multiplied by itself three times), taken to the *fourth power* (multiplied by itself four times), and so on, produce the original number. A few examples seem to be in order: The cube root of 27 is 3. If you cube 3 (also known as raising it to the *third power* or multiplying $3 \times 3 \times 3$), the product is 27. The fourth root of 16 is that number which, when multiplied by itself four times, equals 16. Any guesses? Drumroll, please: 2 is the fourth root of 16 because $2 \times 2 \times 2 \times 2 = 16$. You may be asked to multiply exponents to the fifth power, the sixth power, and so on.

Covering All the Angles: Geometry Review

Geometry is the branch of mathematics that makes grown adults cry — end of discussion. What? You want a more specific explanation of geometry than that? Okay, here goes. Geometry is the branch of mathematics concerned with measuring things and defining the properties of and relationships between and among shapes, lines, points, angles, and other such objects. Hey, don't blame us; you asked for it.

Measuring by degrees and minutes

Arcs, circles, triangles, and angles are measured in degrees and (not very often) in minutes (which are smaller than degrees). A circle has 360 degrees (360°); so does a *quadrilateral* (shapes with four sides like a square or rectangle). Therefore, any arc or angle that isn't a complete circle or quadrilateral measures less than 360°.

Outlining angles

Angles are formed when two lines intersect at a point. Angles are measured in degrees. The greater the number of degrees, the wider the angle is. Thus, a *straight line* is 180°. A *right angle* is exactly 90°. (The symbol for a right angle on a drawing is a "half-box" with a vertical line and a horizontal line connecting; see Figure 7-1 for an example.) An *acute angle* is more than 0° and less than 90°. An *obtuse angle* is more than 90° but less than 180°. *Complementary angles* are two angles that equal 90° when added together. *Supplementary angles* are two angles that equal 180° when added together. (You can take a look at the different types of angles in Figure 7-1.)

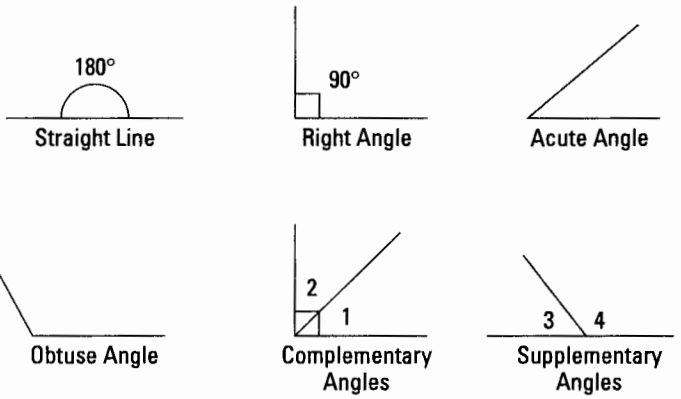


Figure 7-1: Different types of angles.

Pointing out triangle types

A *triangle* consists of three straight lines whose three angles always add up to 180°. The sides of a triangle are called *legs*. Triangles can be classified according to the relationship between their angles or the relationship between their sides, or some combination of these relationships. Check out Figure 7-2 to see what these triangles look like.

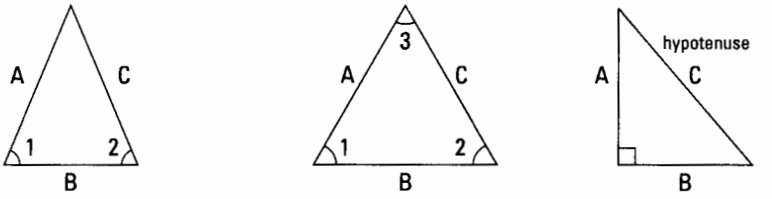


Figure 7-2: Different types of triangles.

Isosceles Triangle	Equilateral Triangle	Right Triangle
If sides A and C are equal,	Sides A, B, C are equal.	$A^2 + B^2 = C^2$

- **Isosceles:** Has two equal sides. The angles opposite the equal sides are also equal.
- **Equilateral:** Has three equal sides. All the angles measure 60°.
- **Right:** Has one right angle (90°). Therefore, the remaining two angles are complementary (add up to 90°). The side opposite the right angle is called the *hypotenuse*, which is the longest side of a right triangle.

You can find the *perimeter* — the distance around a shape — of a triangle by adding together the length of the three sides.

The *area* — the space within a shape — of a triangle is one-half the product of the base (the bottom or the length) and the height (the tallest point of the triangle), or $\frac{1}{2}bh$.

Walking around the quad

Quadrilaterals — shapes with four sides — all contain angles totaling 360°. Many different types of quadrilaterals exist: *Squares* have four sides of equal length, and all the angles are right angles; *rectangles* have all right angles; *rhombuses* have four sides of equal length, but the angles don't have to be right angles; *trapezoids* have at least two sides that are parallel; and *parallelograms* have opposite sides that are parallel, and their opposite sides and angles are equal. (Figure 7-3 illustrates these quadrilaterals.)

Figure 7-3: Different types of quadrilaterals.

To determine the *perimeter* of a quadrilateral, simply add the length of all the sides.

The *area* of a rectangle (including squares) can be determined by multiplying the length times the width.

Circling the wagons

A *circle* is formed when the points of a closed line are all located equal distances from its center. A circle always has 360°. The closed line of a circle is called its perimeter or *circumference*. The *radius* of a circle is the measurement from the center of the circle to any point on the circumference of the circle. The *diameter* of the circle is measured as a line passing through the center of the circle, from a point on one side of the circle all the way to a point on the other side of the circle. The diameter of a circle is always twice as long as the radius of a circle, or $d = 2r$. (See Figure 7-4, which shows you the parts of a circle.)

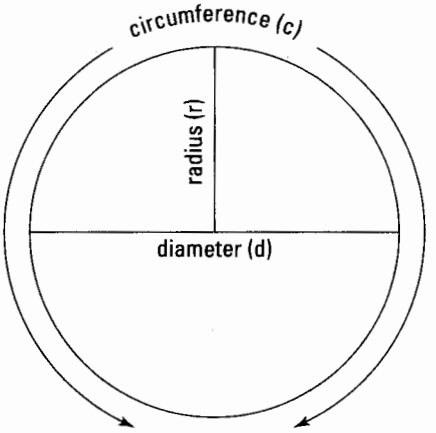


Figure 7-4: The parts of a circle.

Navigating the circumference of a circle

To measure the *circumference* of a circle (its perimeter), use the number pi (π). Although π is a lengthy number, when used in geometry, it's generally rounded to 3.14 or $\frac{22}{7}$. Because π is rounded to 3.14 or $\frac{22}{7}$, when you solve a problem using π, the equal sign isn't used because the answer is not exactly equal to the equation (due to the rounding). A symbol called the *approximation symbol* ($\approx$) is used.

In this formula:

Circumference = $\pi \times$ diameter

or

$C = \pi d$

Because the *radius* of a circle is half its diameter, you can also use the radius to determine the circumference of a circle. Here's the formula:

$C = 2\pi r$

Suppose that you know that the pie you just baked has a diameter of 9 inches. You can determine its circumference using the circumference formula:

$C = \pi d$

$C \approx 3.14 \times 9$

$C \approx 28.26$ inches

Mapping out the area of a circle

Determining the area of a circle also requires the use of π.

Area = $\pi \times$ the square of the circle's radius

or

$A = \pi r^2$

Thus, to determine the area of a 9-inch-diameter pie, multiply π by the square of 4.5. Why 4.5 and not 9? Remember, the radius is always half the diameter, and the diameter is 9 inches.

$A = \pi r^2$

$A \approx 3.14 \times 4.5^2$

$A \approx 3.14 \times 4.5 \times 4.5$

$A \approx 3.14 \times 20.25$

$A \approx 63.585$ inches

Filling 'er up: Calculating volume

Volume is the space a solid (three-dimensional) shape takes up. You can think of volume as how much a shape would hold if you poured water into it. Volume is measured in cubic units.

The formula for finding volume depends on the object. For rectangular objects, you multiply length times width (depth) times height. This is possible because the length, width, and height of a rectangle are consistent throughout the whole shape. Thus, $V = lwh$.

For a box that measures 5-feet long, 6-feet deep and 2-feet tall, you simply multiply $5 \times 6 \times 2$ to arrive at a volume of 60 cubic feet.

For a cylinder, which has two circles for its bases, the calculation is $V = \pi r^2 h$ or, in good-old-fashioned plain English, volume equals pi times the radius squared times height.

For a cylinder that has a radius of 2 inches and a height of 10 inches, here's the deal: Multiply the value of pi (3.14) times 4 (which is the radius squared) times 10, or $3.14 \times 4 \times 10 = 125.6$ cubic inches.

Finding Calculation Clues like Starsky and Hutch

In this section, we bring you up to speed on how to solve problems that the Mathematics Knowledge subtest commonly throws at its victims.

Factoring factors into the equation

Now and then, the ASVAB gives you a *product* (the answer to a multiplication problem), and you have to find the original numbers that were multiplied together to produce that product. This process is called *factoring*. Take, for example, this product:

$4xy + 2x^2$

To factor this number, you first find the *highest common factor* — the highest number that evenly divides all the terms in the expression. In this case, the highest number that divides into both terms is 2.

But wait. You have to figure out the common factors for the variables too. In this case, the highest variable that divides into both xy and x^2 is x.

Okay. Take what you know to this point, and you can see that the highest common factor is $2x$. So far, so good. Now divide $2x$ into both terms in the expression; doing so produces the factors of $2x(2y + x)$.

You use factors when you combine like terms and add fractions.

Making alphabet soup: When x = 1, yru confused?

Algebra questions often ask you to solve for x or solve for an unknown. These questions can be expressed as, for example, $x = 2 + 3$. You simply isolate the unknown on one side of the equation and solve the other side to learn what x equals. In this case, x equals 5. We cover the topic of solving for unknowns in more depth in the section, "Minding Your P's and Q's and X's and Y's: Algebra Review," earlier in this chapter.

But now we come to the dreaded quadratic equation, which the Mathematical Knowledge subtest may ask you to solve. What's a *quadratic equation?* It's an equation that includes the square of an unknown. The exponent in these equations is never higher than 2 (because it would then no longer be the *square* of an unknown, but a *cube* or something else). Here are some examples of quadratic equations:

$$x^2 - 4x = -4$$

$$2x^2 = x + 6$$

$$x^2 = 36$$

With most algebra problems, you try to isolate the unknown to solve the problem. Well, not here. When you're solving a quadratic equation, you put all the terms on one side of the equal sign, making the equation equal zero. In other words, get the quadratic equation into this form: $ax^2 + bx + c = 0$.

Look at this equation again:

$$x^2 - 4x = -4$$

To move all the terms to one side, simply add 4 to both sides of the equation:

$$x^2 - 4x + 4 = -4 + 4$$

or

$$x^2 - 4x + 4 = 0$$

Then, use the quadratic formula to solve for x.

To solve a quadratic equation, you use the quadratic formula. The quadratic formula is

$$\frac{x = -b^{\pm}\sqrt{b^2 - 4ac}}{2a}$$

To solve our problem, now you have to plug and chug.

$$x = \frac{4 \pm \sqrt{-4^2 - 4(1)(4)}}{2(1)}$$

$$x = \frac{4 \pm \sqrt{16 - 16}}{2}$$

$$x = \frac{4 \pm 0 = 2}{2}$$

For the ASVAB, the fastest and easiest way to solve a quadratic equation is to use the trial and error method of substituting each of the four possible answers into the equation that the problem asks you to solve to see which answer is correct.

Solving inequalities

We're talking mathematical inequalities here. Some algebra problems state that two numbers aren't equal to each other (thus they're inequalities). In an inequality, the first number is either greater than or less than the second.

Reviewing rules you need to know

Short and sweet, here they are:

- *Negative numbers* are less than zero and less than positive numbers.
- *Zero* is less than positive numbers but greater than negative numbers.
- *Positive numbers* are greater than negative numbers and greater than zero.

Reviewing symbols you need to know

Certain symbols are used to express inequalities:

- $\neq$ means *does not equal* in the way that 3 *does not equal* 4, or $3 \neq 4$.
- $>$ means *greater than* in the way that 4 *is greater than* 3, or $4 > 3$.
- $<$ means *less than* in the way the 3 *is less than* 4, or $3 < 4$.
- $\leq$ means *less than or equal to* in the way that x may be *less than or equal to* 4, or $x \leq 4$.
- $\geq$ means *greater than or equal to* in the way that x may be *greater than or equal to* 3, or $x \geq 3$.

Getting down business

To solve an inequality, you follow the same rules as you would for solving any other equation. For example, check out this inequality:

$$3 + x \geq 4$$

To solve it, simply isolate the x by subtracting 3 from both sides of the equation:

$$3 + x - 3 \geq 4 - 3$$

or

$$x \geq 1$$

The only exception to this rule is when you multiply or divide both sides of the inequality by a negative number. In that case, the inequality sign is reversed. So, if you multiply both sides of the inequality $3 < 4$ by -4, your answer is $-12 > -16$.

Taking In Some Test-Taking Techniques

As with most of the other subtests on the ASVAB, guessing on the Mathematical Knowledge subtest doesn't count against you. So scribble in an answer, any answer, on your answer sheet because, if you don't, your chances of getting that answer right are 0. But, if you take a shot at it, your chances increase to 25%, or 1 in 4. In the following sections, we lay out some tips that can help you improve those odds, even when you don't know how to solve the problem.

Knowing what the question asks

This subtest presents most of the questions as straightforward math problems, not word problems, so knowing what the question is asking you to do is easier. However, reading each question carefully, paying particular attention to plus and minus signs (which can really change the answer to a question), is still important. Finally, make sure you do *all* of the calculations needed to produce the correct answer. Check out this example:

Find the value of $\sqrt{81^2}$.

(A) 9

(B) 18

(C) 81

(D) 6,561

Correct answer: C. If you're in a hurry, you may put 9 down as an answer because you remember that the square root of 81 is 9. Or, in a rush, you could multiply 9 (the square root of 81) by 2 instead of squaring it, as the exponent indicates you should. Or, you might just multiply 81×81 to get 6,561 without remembering that you also need to find the square root. So make sure you perform all the operations needed (and that you perform the *correct* operations) to find the right answer.

Double-checking on the double

Although you don't have a ton of time to complete the Mathematical Knowledge subtest, you do have about a minute per problem. Although a minute doesn't allow for a lot of head scratching, it's more time than you think. So double-check your answers before putting your pencil down (or before going on to the next problem on the computer).

You can go over your calculations again to make sure that you didn't make an error. You can also plug your answer into the original equation to make sure that it's the correct answer. Then move along, private!

Keep in mind that the questions towards the end of this subtest are harder, so move faster on the early questions to allow for a little more head-scratching time when the ASVAB sends out its big guns.

Guessing your way to better odds

Because the Mathematical Knowledge subtest doesn't penalize you for guessing, mark the answer sheet even if you're clueless. You can even make a pretty design on your answer sheet and still have a one-in-four chance of getting each answer right.

Figuring out what you're solving for

Even though getting artistic with your answer sheet can be fun, we have some techniques that you can try first to improve your chances of guessing the right answer. Right out of the gate, read the question carefully. Some questions can seem out of your league at first glance, but if you look at them again, a light may go on in your brain. Suppose you get this question:

s number of students are in a classroom. $\frac{2}{5}$ of the students are enlisted personnel. $\frac{1}{2}$ of the enlisted personnel are privates. How many privates are in the audience?

(A) $2\frac{1}{2}s$

(B) $2s$

(C) $\frac{1}{5}s$

(D) $\frac{1}{10}s$

At first glance, you may think, "Oh, no! Solve for an unknown, *s*. I don't remember how to do that!" But, if you look at the question again, you may see that you're not solving for *s* at all. You're simply multiplying a fraction. So you take $\frac{2}{5}$ times $\frac{1}{2}$ and arrive at $\frac{1}{5}$. *Correct answer:* C. (See Chapter 6 for a refresher on multiplying fractions.)

Solving what you can and guessing the rest

Sometimes a problem requires multiple operations for you to arrive at the correct answer. If you don't know how to do all of the operations, don't give up. You can still narrow your guess down by doing what you can. Suppose this question confronts you:

What is the value of $(0.03)^3$?

(A) 0.0027

(B) 0.06

(C) 0.000027

(D) 0.0009

Say you don't remember how to multiply decimals. All is not lost! If you remember how to use exponents, you'll remember that you have to multiply $0.03 \times 0.03 \times 0.03$. So, if you simplify the problem and just multiply $3 \times 3 \times 3$, without worrying about those pesky zeroes, you'll know that your answer will have a *27* in it. With this pearl of wisdom in mind, you can see that Answer B, which is arrived at by adding 0.03 to 0.03, is wrong. It also means that Answer D, which is reached by multiplying 0.03×0.03, is wrong. Now you have two possible answers, and you've improved your chances of guessing the right one to 50 percent! *Correct answer:* C.

Don't forget to use that scratch paper! Suppose you run across this question: "A child is building a tower of blocks. Each block is a cube. Some blocks are white, and some blocks are red. Red blocks surround each white block. How many red blocks surround each white block?" This problem may be difficult to figure out, until you sketch a six-sided block (a cube) on your scratch paper and realize that the block must be surrounded by six other blocks.

Using the answers to find the answer

Say the following problem is staring you right in the eyes:

Solve for x: $x - 5 = 32$.

(A) $x = 5$

(B) $x = 32$

(C) $x = -32$

(D) $x = 37$

You're not sure what to do. If you're totally stumped and can't think of any possible way of approaching this problem, simply plugging in each of the four answers to see which one is correct is your best bet.

- **Answer A:** $5 - 5 = 32$, which you know is wrong.
- **Answer B:** $32 - 5 = 32$, which is wrong.
- **Answer C:** $-32 - 5 = 32$, which is wrong.
- **Answer D:** $37 - 5 = 32$, which is correct.

Don't forget that plugging in all the answers is time consuming, so save this procedure until you've answered all the problems you can answer. If you're taking the computer version, you can't skip a question, so remember to budget your time wisely. If you don't have much time, just make a guess and move on. You may be able to solve the next question easily.

Sample Questions

Now that you've honed your mathematical skills, take them out for a test drive with these questions.

1. Which of the following fractions is the largest?

(A) $\frac{2}{3}$

(B) $\frac{5}{8}$

(C) $1\frac{1}{16}$

(D) $\frac{3}{4}$

Correct answer: D. To arrive at this answer, find a common denominator that all the denominators divide evenly into. In this case, the common denominator is 48 (discovered by multiplying 16×3). Next, convert all fractions to 48ths. In the case of Choice A, multiply $\frac{2}{3} \times \frac{16}{16}$ to reach $\frac{32}{48}$. Perform the same type of calculation for all the other fractions and then compare numerators. The largest numerator is the largest fraction.

2. What is the product of $\sqrt{36}$ and $\sqrt{49}$?

(A) 1,764

(B) 42

(C) 13

(D) 6

Correct answer: B. The square root of 36 is 6 and the square root of 49 is 7. The product of those two numbers (6×7) is 42.

3. Solve for x: $2x - 3 = x + 7$.

(A) 10

(B) 6

(C) 21

(D) −10

Correct answer: A. Isolate the x's on one side of the equation by subtracting x from both sides: $2x - 3 - x = x + 7 - x$, or $x - 3 = 7$. Continue to perform operations to isolate x. Add 3 to both sides of the equation: $x - 3 + 3 = 7 + 3$, or $x = 10$.

4. A circle has a radius of 15 feet. What is most nearly its circumference?

(A) 30 feet

(B) 225 feet

(C) 94 feet

(D) 150 feet

Correct answer: C. The circumference of a circle is pi × diameter; the diameter equals two times the radius. Therefore $30 \times 3.14 = 94$.

5. At 3:00 p.m., the angle between the hands of the clock is:

(A) 90 degrees

(B) 180 degrees

(C) 120 degrees

(D) 360 degrees

Correct answer: A. At 3 p.m., one hand is on the 12, and the other is on the 3. This creates a right angle — a 90-degree angle.