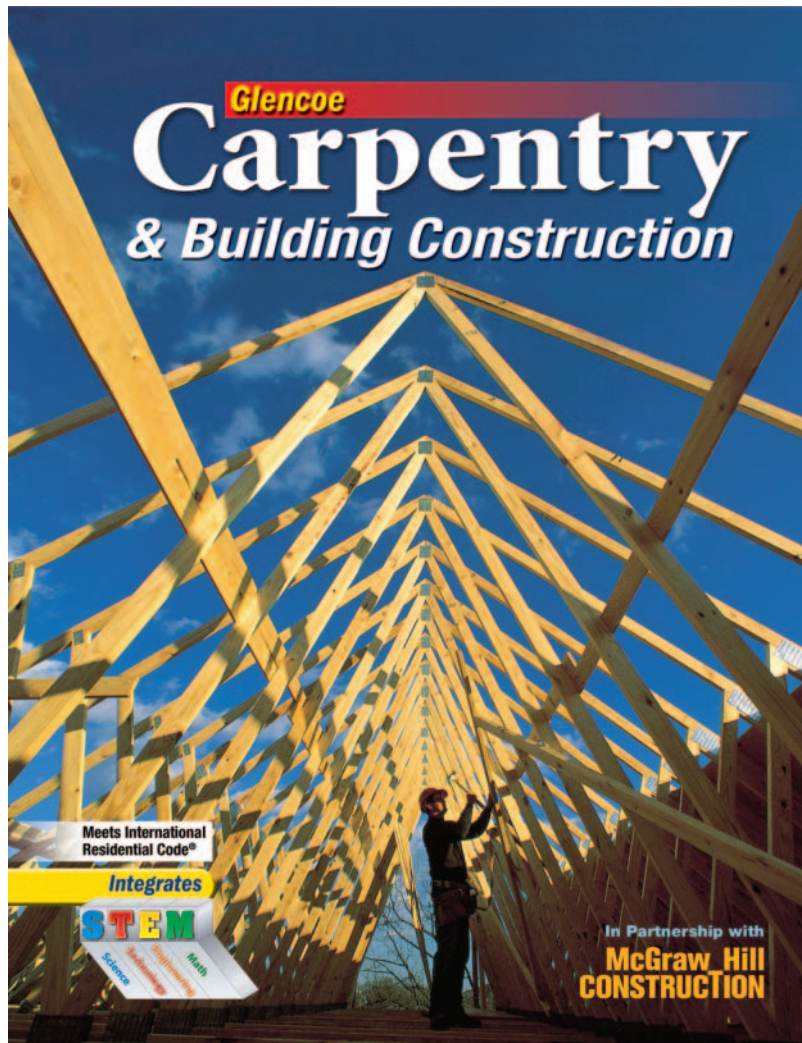


Glencoe
Carpentry
& Building Construction



Mark D. Feirer
John L. Feirer



Glencoe

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To The Student

Learn How Your Book Is Organized

Start with Units: It's All about the Projects

Carpentry & Building Construction is a comprehensive program that covers the entire construction process, from planning and scheduling through painting and flooring. The program focuses on residential construction but also covers some light commercial construction techniques.

As a student, you will be challenged to think critically, use technology and tools effectively and safely, communicate clearly, cooperate within teams, and solve mathematical, logistical, and organizational problems. Accomplishing these goals will help to prepare you for the exciting world of construction, an industry that is expected to be among the nation's largest sources of job growth in the next several years.

Unit Photo Units open with a photo to visually illustrate unit content. The caption is followed by a question designed to help you start thinking about what you will read in the following chapters.

Construction Careers This feature introduces you to a career opportunity in construction. Learn the typical profile for this career, including the academic skills, professional training, and experience you will need to succeed.



Hands-On Math Project Preview This activity will introduce you to the Hands-On Project that concludes each unit. Use the Project Checklist to help you keep track of the skills and concepts you will need to successfully complete the project.

To The Student

Unit Close – The Hands-On Math Project

Each unit concludes with a hands-on project that explores an important aspect of carpentry. To complete each project, you will evaluate and plan your resources, conduct research, complete the project steps as outlined, and present your findings to your teacher or to your class. These projects show you what it is like to be an entrepreneur, organizing a task from start to finish.



Build It Green Challenge your environmental awareness by investigating ways to use eco-friendly materials and approaches to building.

Presentation Checklist Use this checklist to make sure you have completed the project accurately and have met your objectives.

UNIT 1
Hands-On Math Project

Green Construction in the Community

Your Project Assignment
For this project, you will estimate costs for green and standard constructions.

- Find a local organization, such as YouthBuild U.S.A., that builds or renovates homes in your community.
- Build It Green** Research green alternatives to standard home construction methods.
- Prepare the basic activity schedule for a home construction project by your organization.
- Calculate the cost differences in construction labor and materials for using a minimum of three green alternatives.
- Create a three- to five-minute presentation.

Applied Skills
Some skills you might use include:

- List the steps in planning to build a house.
- Research the factors involved in making construction cost estimates.
- Define and select three green alternatives you recommend to build this house. (Tip: Green alternatives can be found at nearly any stage of construction—be creative!)
- Describe the steps you use to make your basic cost estimate. (Tip: Don't forget to include your measurements!)
- Compare the costs for your green and standard construction operations.

NCTM Math Standards
Number and Operations: Compute fluently and make reasonable estimates.
Measurement: Apply appropriate techniques, tools, and formulas to determine measurements.

NCTM National Council of Teachers of Mathematics

The Math Behind the Project
The traditional math skills for this project are estimation and measurement. Remember these key concepts:

Estimation
For quick estimates, round measurements up for lengths and quantities. For example, if you were calculating the area of a concrete slab that was 24' 4" × 15' 9", you could use the numbers 25' × 16' for your estimate.

Percentage
To calculate percentage change in cost for materials, subtract the cost of green products from the cost of the standard product. Divide the difference by the cost of the standard product. For example, if wood studs cost \$123.50 and steel studs cost \$145.87, to find the percentage difference, use the following steps:

1. Subtract the costs.	$\$123.50 - \$145.87 = -\$22.37$
2. Divide the difference by the standard product price.	$\frac{-\$22.37}{\$123.50} = -\$0.181$
3. Convert the decimal number to percentage.	$0.181 \times 100 = 18\%$

This means that the green alternative (steel) costs 18% more than the wood stud construction.

Project Steps

Step 1: Research

- Contact your organization to find out the average cost for their standard home construction project.
- Build It Green** List several green methods that could be used in place of standard construction methods.
- Select a minimum of three green methods you recommend to build.
- Determine the factors that influence price differences between your green methods and the standard ones.
- Confirm the cost and insulation differences between green and standard construction.

Step 2: Plan

- Choose the basic design plan for your home.
- Measure the proposed dimensions of your home and calculate the total square footage.
- Determine the basic materials and supplies your organization will use to construct the home.
- List the types of skilled labor this construction will require.

Step 3: Apply

- Use your research to create a cost comparison of the two methods of construction.
- Create a material take-off for green methods and standards and calculate the cost differences.
- Make a CPM flow chart showing the construction process. Use general system terms such as rough plumbing, foundation, and wall framing.

Step 4: Present

Prepare a presentation combining your research and cost calculations using the checklist below.

PRESENTATION CHECKLIST

Did you remember to:

- Organize your research by step and topic?
- Use a calculator or spreadsheet for the cost calculations?
- Create visual aids?
- Create notes you might need for your presentation?
- Focus on your recommendations for green methods?
- Explain the cost differences between green and standard methods?

Step 5: Technical and Academic Evaluation

Assess yourself before and after your presentation.

- Did you plan your steps carefully?
- Is your research thorough?
- Were your cost estimates accurate?
- Were your green method alternatives realistic?
- Was your presentation creative and effective?

Go to glencoe.com for this book's OLC for an evaluation rubric and Academic Assessment.

McGraw-Hill Construction Connection
Learn more about your project by reading a related article from one of the top construction industry information resources in the world, McGraw-Hill Construction.

Go to glencoe.com for this book's OLC to read an article titled "Ola with Jim 'Z' Zardaka" to learn about the ways this contractor supports his community. Write a summary of the article.

102 Unit 1 Preparing to Build



Math Standards Review these important math standards before you tackle the math behind the project.

McGraw-Hill Construction Connection Learn more about your project by reading a related article from one of the top construction industry information resources in the world, McGraw-Hill Construction.

Chapters—Set Your Learning Goals

The chapters of *Carpentry & Building Construction* are organized around the topics and processes that help you discover, learn about, and apply the essential skills of construction. The chapters are divided logically into sections and offer many learning strategies that will help you get the most out of your studies.

Chapter Objectives These objectives will help you preview what you will learn in the chapter.

Reading Guide Each chapter begins with a reading guide to give you a preview of content and academic vocabulary as well as the industry and academic standards you will cover.

Before You Read A pre-reading question or statement will help you connect with what you read in the chapter.



Academic and Industry Standards *Carpentry & Building Construction* helps you gain proficiency in English Language Arts, Mathematics, and Science. The chapter reading guides list the academic standards that the chapter will cover. Industry standards let you know which important national standards are covered in the chapter.

Graphic Organizer A graphic organizer gives you a visual tool to help you organize and remember new content.

In-Chapter Features—Apply Your Carpentry Skills

The features in each chapter help you check your understanding of what you are reading and extend your knowledge of carpentry concepts.

Estimating and Planning

Concrete Foundation Walls

Formwork
Refer to the floor plan below, which measures 40' x 28'.
1. To determine the total foundation wall area, assume that the wall is 8' high. Multiply 8' x 132' (perimeter of the building). The answer is 1,056 sq. ft.
2. Assume the wall thickness is 8". Refer to the table below. Read down the column headed "Wall Thickness" to 8". Then read across to the column titled "Forming." Remember, the wall is to be 8' high. The table shows that the wall will require 7.75 hours per 100 sq. ft. of wall area.

Walls	Material		Forming		Concrete Place
	Per 100 Feet of Wall	Per 100 Square Feet of Wall	0 to 4	4 to 8	
Wall Thickness (inches)	Cubic Feet Required	Cubic Yards Required	Hours per 100 Square Feet of Wall	Hours per 100 Square Feet of Wall	Average 0.25
4	33.3	1.24	4.7	4.8	2.0
6	50.0	1.85	4.7	7.13	2.0
8	66.7	2.47	5.0	7.75	Varies As to Height
10	83.3	3.09	5.0	7.90	
12	100.0	3.70	5.0	7.90	3.0

Estimating and Planning Practice using formulas to prepare material and labor estimates using this feature.

Step-by-Step Application

Laying a Panel Subfloor

The general method for installing a subfloor is the same for Plywood and OSB panels. However, always consult the manufacturer's instructions.

- Step 1** Measure 48" along the side of the foundation from the starting corner and mark this point. Repeat this process on the opposite side of the foundation. Snap a chalk line between these points. This serves as an alignment guide for the sheathing.
- Step 2** Place a full panel even with one of the outside corners of the floor joists. Align the edge with the chalk line. The grain of the plywood should run at right angles to the joists. If the subfloor will be glue-nailed, spread a bead of construction adhesive on the joist joint before installing each sheet.
- Step 3** Drive just enough nails to hold the panel in place.
- Step 4** Place the next full panel in position at the end of the first panel. Be sure the joint is centered over the first, and leave about 1/4" space between panels.

Go to glencoe.com for this book's OLC for additional step-by-step procedures, applications, and certification practice.

Step-by-Step Application Follow the step-by-step instructions to complete specific carpentry and construction tasks.

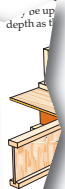
Mathematics and Science Math and science knowledge and application will be critical to your success in carpentry and construction. Work through these quick activities to practice your academic skills.

Measurement

Squaring Floors

Floors need to be "squared up" as they are being constructed. All four angles of a rectangular wall or floor must be right angles. The diagonals running from opposite corners of a rectangular wall must also be equal. It is important to know the length of each of these diagonals. Calculate the length of the diagonals of a floor that measures 24' x 32'.

Starting Hint The Pythagorean Theorem states that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides.
 $(a^2 + b^2 = c^2)$ a = altitude; b = base; c = hypotenuse



Job Safety Make safety a habit and review these job site safety practices carefully.

JOB SAFETY

TREATED WOOD

The chemicals in treated wood can be toxic. Wear gloves to protect your hands when you are handling the material frequently. When sawing or machining, wear a dust mask to prevent nose, throat, and lung irritation. Cut treated lumber outdoors to avoid indoor accumulations of airborne sawdust. Wear eye protection. After handling, wash your hands thoroughly, particularly before eating. Do not burn scraps, as this may result in toxic fumes. Always dispose of treated wood according to local regulations.

Go to glencoe.com for this book's OLC for more on job safety.

Builder's Tip Use this advice to save time or labor without sacrificing safety, accuracy, or quality.

Builder's Tip

SUNLIGHT EXPOSURE

Excessive exposure to direct sunlight can cause the wood in a glulam beam to fade in color. If the beam will be visible in the completed structure, take care to wrap it in an opaque covering prior to installation.

FRP Glulams A new type of glulam beam is being used in light commercial construction. Though it is not yet used in residential

Regional Concerns Building practices can vary due to weather or local codes. This feature highlights some of the different techniques or issues you might come across in various regions around the country.

REGIONAL CONCERNS

Flood Resistant Foundations

The building code now requires special construction details for foundations built where flooding is likely. Foundations must be designed to resist "flotation, collapse, or permanent lateral movement" due to stresses caused by flood waters.

Go to glencoe.com for this book's OLC for more information about regional concerns.

Assessments—Check Your Understanding

Assessing what you have learned is part of the learning process. Review and check your understanding, apply this new knowledge, and get ready for your tests.

Section Assessments

After You Read Reviewing your reading is a powerful study skill. After You Read will help you organize and process your understanding of what you have read.

standards that a builder must meet to obtain a certain type of mortgage. Builders must be aware of these additional requirements before construction begins. Once financing has been arranged, contracts are signed for the construction. From then on, it is the responsibility of the builder and/or architect to make sure that the building goes as planned. A loan officer at the bank may also require progress reports

to ensure that money loaned by the bank is being used properly. Builders are usually paid a certain portion of the construction costs before work is started. They are then paid additional amounts at certain stages, such as after the roof is installed. Again, these are the draws from the construction loan. Final payment is made after the client and lender have inspected and approved the work.

Section 2.1 Assessment

After You Read: Self-Check

1. What is a building code? What is its purpose?
2. What is a building permit, and what must you provide to apply for one?
3. Describe the document that indicates that a house is ready to live in.
4. What is a mortgage?

Academic Integration: Mathematics

5. **Calculate Area** You have been given the following plan for the foundation of a one-story rectangular house. Calculate the surface area of the floor.

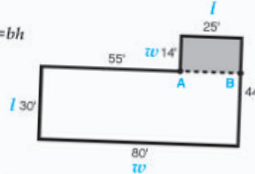
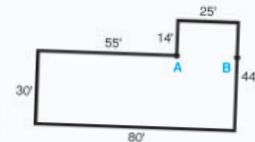
Math Concept Surface area is the sum of all of the areas of the shapes that cover the surface of the object. The area of a flat rectangular surface can be calculated using the following formula: **area = length × width**, or $A = lw$

Area can also be calculated as **area = base × height**, or $A = bh$

Step 1: The foundation is made up of two rectangles. A rectangle is a four-sided figure in which all four of its angles are right angles. This means that the sides opposite one another are of equal length. Draw a dotted line between point A and point B to help you see the two rectangles more clearly.

Step 2: Multiply length by height to calculate the areas of the larger rectangle ($80' \times 30'$) and the smaller rectangle ($14' \times 25'$). Add both areas to find the total area of the foundation.

Go to glencoe.com for this book's OLC to check your answers.



Academic Integration
Academic Integration will connect the section content to academics.

To The Student

Chapter Review and Assessment

Use end-of-chapter activities to assess your learning and reach your goals.

Review Content and Academic Vocabulary Practice your vocabulary by using these words in a sentence or illustrating them in a diagram.

Academic and Workplace Applications Develop your skills for the 21st century by sharpening your workplace skills and focusing on key applications in Science, Technology, Engineering, and Math (STEM).

CHAPTER 9 Review and Assessment

Chapter Summary See the Instructor Manual for answers.

9.1 A house can be positioned or located on a piece of property either by measuring from an established reference line or by using an instrument such as a level or a transit. Most layouts begin at a bench mark. Surveying instruments include levels and transits. The point at which they are set up is called the station mark.

9.2 String stretched between batter boards is used to establish the outline of a house. Once this has been done, the excavation can proceed. The excavation must be wide enough to provide space to work. Soil taken from an excavation is measured in cubic yards.

Review Content Vocabulary and Academic Vocabulary

1. Use each of these content vocabulary and academic vocabulary words in a sentence or diagram.

Content Vocabulary	Academic Vocabulary
<ul style="list-style-type: none">plot plan (p. 236)site layout (p. 236)theodolite (p. 228)bench mark (p. 239)station mark (p. 239)	<ul style="list-style-type: none">batter board (p. 244)differential leveling (p. 240)bearing capacity (p. 247)porosity (p. 248)overdig (p. 248)methods (p. 230)locate (p. 237)visible (p. 240)

Speak Like a Pro

Technical Terms

2. Work with a classmate to define the following terms used in the chapter: *reference line* (p. 236), *leveling rod* (p. 237), *builder's level* (p. 237), *dumpy level* (p. 237), *automatic level* (p. 237), *laser level* (p. 237), *vernier scale* (p. 238), *3-4-5 method* (p. 245), *finish grade* (p. 247), *back slope* (p. 249), *rough-stake* (p. 249).

Review Key Concepts

3. Describe how to work from an existing reference line to establish a simple building layout.

4. Describe the different types of surveying instruments.

5. Demonstrate how to use a builder's level to lay out a right angle.

6. Demonstrate how to set up batter boards.

7. Explain how to use a transit or level to measure a difference in elevation between two points.

8. Explain how to determine the depth of an excavation for a house foundation.

Critical Thinking

9. *infer* How could you best keep the cost of foundations and footings for a building at a minimum?

Academic and Workplace Applications

Mathematics

10. **Problem Solving** A rectangular excavation 5' deep is needed to build a building that is to be 26' by 32'. How many cubic yards of material should be removed if a 2' clearance is needed outside the foundation walls?

Math Concept The formula for finding the volume of a rectangular prism is $V = lwh$. To determine the actual dimensions of the excavation, draw a picture and label the length and width to account for the building and the clearance all around.

Step 1: Draw a picture of the dimensions of the building. Then add the clearance.

Step 2: Multiply the length by the width. Then multiply the result by the depth of the excavation.

Step 3: Use cubic units to express the volume of the material. Convert cubic feet to cubic yards.

Engineering

11. **Measurement Accuracy** A surveyor makes a measurement of 60' using a laser measure. It is accurate to within $\pm \frac{1}{4}$ ". What is the range within which the actual length could fall?

Starting Hint All measurements fall within a range of accuracy depending on the size of the smallest mark on the measuring device used and the quality of the device. Determine the lower end of the range by subtracting the accuracy factor.

21st Century Skills

12. **Lower Skills: Problem Solving** You are a member of a surveying crew that has been hired to survey a building site this Saturday. On Friday evening, the other two members of your crew call to inform you that they will not be able to work on Saturday. The job needs to be completed before Monday. You were planning on working with your crew members and have all of the optical instruments ready to use. Now you will have to determine how you will complete the surveying job alone. Describe what changes you can make in order to complete the job yourself in a one-page summary. Identify the equipment you will need and explain why this equipment will be suitable for the situation.

Standardized TEST Practice

Multiple Choice

Directions: Choose the phrase that best completes the following statements.

13. The top edge of a batter board represents the _____.

- depth of the foundation wall
- outside edge of the foundation wall
- height of the foundation wall
- width of the foundation wall

14. A measure of how well the soil can support the weight of a house is called _____.

- a bench mark
- the bearing capacity
- an overdig
- the station mark

15. The purpose of a site layout is to _____.

- position a house correctly on the lot
- determine the depth of an excavation
- locate a bench mark
- maximize solar heat gain

TEST-TAKING TIP

Skip a question when you do not know the answer; you can return to it later. A better strategy is to mark the answer you believe to be correct and come back to the question after you finish the test.

*These questions will help you practice for national certification assessment.

253 Chapter 9 Review and Assessment

Speak Like a Pro Learn the technical language of carpentry and construction by practicing these industry words and phrases with a classmate.

Review Key Concepts Take time to determine how well you have met the chapter objectives by completing the activities outlined here.

Standardized Test Practice These activities give you an opportunity to sharpen your test-taking skills and practice for professional certification in carpentry. The activities also include a valuable Test-Taking Tip.

Standards

Measure Your Progress

What Are Standards?

Being prepared for your career includes developing a wide range of skills that you will need to meet future employers' needs and expectations. Standards are an established and agreed upon set of measures or guidelines for the knowledge, processes, and practices that you as a student should know or be able to do to succeed in your academic and professional career.

Carpentry & Building Construction meets these key academic and professional standards. At the beginning of each chapter in the Reading Guide is a list of the standards that are covered in that chapter. With these standards as your foundation, you will have a better understanding of basic carpentry and construction principles, and you will continue to develop your academic skills, too.

Academic Standards
Take note of the English Language Arts, Mathematics, and Science standards at the beginning of each chapter in the Reading Guide. You will practice these specific academic skills as you move through the chapter.

Industry Standards
The chapter's Reading Guide highlights the sections' content in relation to meeting important professional standards in carpentry. Knowing these standards will help you prepare for professional certification.

Chapter 2 Reading Guide

Before You Read Preview
Building codes and architectural plans guide the construction of a new house. Choose a content vocabulary or academic vocabulary word that is new to you. When you find it in the text, write down the definition.

Content Vocabulary

- building code
- building permit
- stock plan
- floor plan
- mortgage
- architect's scale
- plan view
- elevation
- schedule
- specifications
- bid
- quantity takeoff
- board foot
- indirect cost

Academic Vocabulary
You will find these words in your reading and on your tests. Use the academic vocabulary glossary to look up their definitions if necessary.

- exceeds
- scale
- derived
- allocation

Graphic Organizer
As you read, use a chart like the one shown to organize information about content vocabulary words and their definitions, adding rows as needed.

Content Vocabulary	Definition
building code	Standard set of regulations that govern the procedures and details of construction

Go to glencoe.com for this book's OLC for a downloadable version of this graphic organizer.

Academic Standards

- English Language Arts**
Use different writing process elements to communicate effectively (NCTE 5)
- Mathematics**
Number and Operations: Compute fluently and make reasonable estimates (NCTM)
- Measurement:** Apply appropriate techniques, tools, and formulas to determine measurements (NCTM)
- Geometry:** Use visualization, spatial reasoning, and geometric modeling to solve problems (NCTM)
- Science**
Unifying Concepts and Processes: Constancy, change, and measurement (NSES)
Science in Personal and Social Perspectives: Environmental quality (NSES)
- Industry Standards**
Reading Plans and Blueprints

NCTE National Council of Teachers of English
NCTM National Council of Teachers of Mathematics
NSES National Science Education Standards

Learning for Everyone

What if English is Not Your First Language?

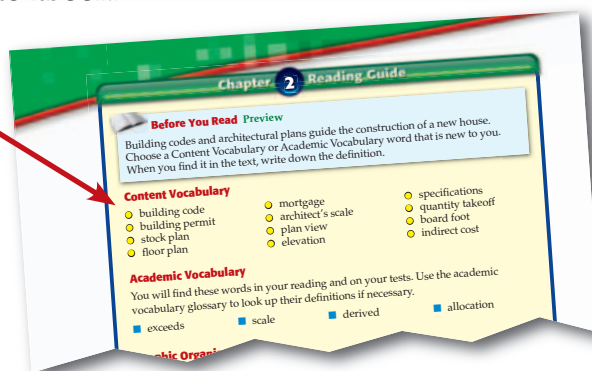
The English Language Learner

Today's diverse classrooms offer wonderful opportunities for you as a student to learn and enhance a variety of skills, including your language skills. You could be a part of a classroom in which ten or more countries are represented. You and your classmates may actually speak different native languages. You can use this multicultural environment to practice your speaking, writing, and listening skills with your teacher and your classmates. Practicing these skills will help you to communicate effectively in your academic and future professional career.

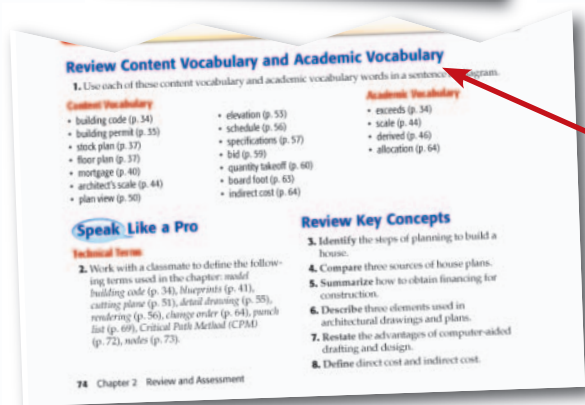
Use these tips as you read and learn from this textbook:

Highlight Vocabulary

Scan the chapter Reading Guide for vocabulary terms that are not familiar to you. Write these words down and look them up in the glossary at the back of the book or in a dictionary.

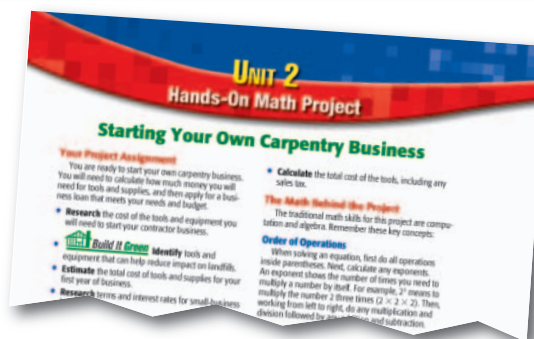


Learn Through Pictures Look at chapter photos and pictures carefully, trying to make a connection between what you have seen in the real world and how it relates to the picture. If something in the picture is not familiar to you, ask your instructor to explain what it is.



Practice Communication Study with a classmate. At the end of each chapter, you can review together what you have learned in that chapter. Start by selecting two vocabulary words from the list. Who can define or describe what they mean?

Connect to Your World You will have the chance to show what you have learned by working on projects such as the Unit Hands-On Math Project. When choosing a topic, think of your culture, experiences, and skills and select an idea or activity that is already of interest to you.



Professional Certification

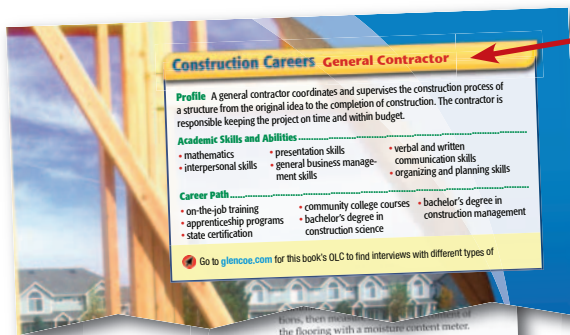
Boost Your Career Potential

What Is Certification?

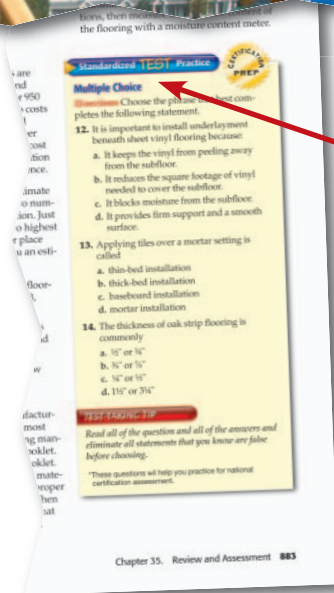
Certain professions require you to become certified in the technical aspects of the job before you can begin to work. Much of a carpenter's knowledge comes from experience on the job, but construction careers often benefit from getting professional certification. Many states require state-level certification.

Union carpenters in the United States are required to pass a skills test to be granted official journey-level status, but uncertified professional carpenters may have journey-level status based on their skill level, years of experience, or simply because they support themselves in the trade. After working at a journey-level status for a specified period, a carpenter may go to study or test as a master carpenter.

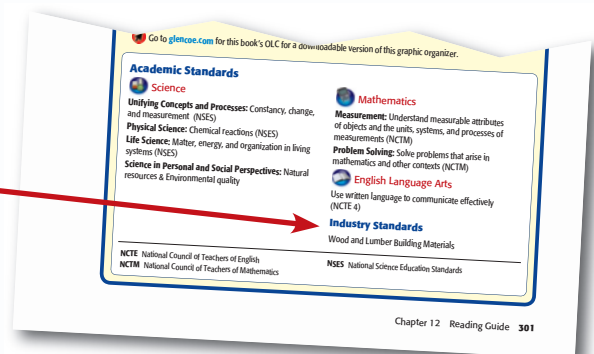
Plan your career path now by knowing what certification might be required of you to succeed in your trade.



Construction Careers Each unit opener highlights a specific construction career profile. Review the career path outlined in this feature and go to glencoe.com for more information about the training and certification requirements for that job.



Prepare for Certification Exams The questions found in the Standardized Test Practice align to the Industry Standards outlined in the front of each chapter. Practice your test-taking abilities and begin to prepare for future certification exams at the same time!



Industry Standards Review the industry standards listed in the Reading Guide at the beginning of each chapter.

Competitive Events

Practice Winning Competitive Events

Carpentry Competitive Events

Have you imagined your future? Competition in the real world is fierce, so you need to be prepared. One of the best ways to gain experience and develop leadership skills is to participate in local, state, and nationwide competitive events. Competitive events for high school students come in all shapes and sizes, but a few of the most notable ones in carpentry and construction are sponsored by SkillsUSA and the National Association of Home Builders (NAHB) Student Chapters.

SkillsUSA

SkillsUSA is a national organization serving teachers and high school and college students, who are preparing for careers in technical, skilled, and service occupations. More than 285,000 students and instructors join SkillsUSA annually. SkillsUSA has served more than 9.3 million members since 1965.

One of the most visible programs of SkillsUSA is the annual SkillsUSA Championships. This competition program serves as a showcase for some of the best career and technical students in the nation. Contests begin locally and continue through the state and national levels.

National Association of Home Builders – Student Chapters

Founded in 1942, The National Association of Home Builders (NAHB) is a federation of more than 800 state and local associations. About one third of NAHB's members are home builders and/or remodelers. The remaining members are associates working in closely related fields within the housing industry.

The NAHB Student Chapters Residential Construction competition was established to offer residential construction students a real-life residential construction experience. Students work on a management proposal for a real project by completing working drawings, labor and materials estimates, and/or a construction schedule.

SkillsUSA Estimating and Planning One competition featured in SkillsUSA involves estimating and planning. Working through the Estimating and Planning features in your chapters can help prepare you for participation in SkillsUSA.

NAHB Student Chapters Competitive events sponsored by NAHB student chapters include estimating and planning projects.

Excavation Volume

Excavation Costs
Multiply the length of the excavation times the width times the depth to determine the volume of the material to be removed.

- For the house shown in the floor plan below, multiply 7' (depth of excavation) times 30' (20' width of house plus 2' clearance of each end, between the excavation and the outside of the foundation wall) times 44' (44' length of house plus 2' clearance of each end). The answer is 9,240 cubic feet.
- There are 27 cubic feet in 1 cubic yard. To convert cubic feet to cubic yards, divide by 27:
 $9,240 \div 27 = 342.2$

Rounded off, approximately 342 cubic yards of material will have to be excavated.

There is another method to determine the cubic yards of material to be removed. It can be used if the excavation depth is a standard one as shown on Table 9-2.

- Refer again to the floor plan. The excavation needed for the house is 30' wide, 44' long, and 7' deep. Multiply the width by the length to find the area of the excavation.
- Refer to Table 9-2. For an excavation 7' deep, 0.229 cubic yards of material are removed for each square foot of area. Multiply the area of the excavation by 0.229 to find how many cubic yards of material will be removed. Round up.

Depth per Square Foot	Cubic Yards Removed	Depth per Square Foot	Cubic Yards Removed
2"	0.006	4"	0.012
4"	0.012	5"	0.015
6"	0.018	6"	0.024
8"	0.024	8"	0.032
10"	0.030	8"	0.041
12"	0.036	7"	0.289
14"	0.042	7"	0.379
16"	0.048	6"	0.311
18"	0.054	6"	0.350
20"	0.060	10"	0.389

Refer to the floor plan to locate the excavation length. The factor is the cubic feet to the yard.

250 Chapter 9: Locating the House on the Building Site

Reach for Excellence in Math, Science, and Technology

Welcome to the World of STEM

Science, Technology, Engineering, and Mathematics are the subjects in STEM. STEM is a nationwide initiative directed toward high school students just like you to promote learning in these areas and prepare you to succeed in tomorrow's workforce. STEM applies to virtually every career field today—from aircraft engineers, forensic scientists, and architects to firefighters, game developers, general contractors, and automotive mechanics. That is why even important organizations such as NASA are supporting STEM learning.

STEM in Section Assessments
Jumpstart your STEM know-how in quick Section Assessments.

STEM at the end of the Chapter Practice what you have learned in Science, Technology, Engineering, or Math through a STEM activity at the end of your chapters.

Section 7.1 Assessment

After You Read: Self Check

- Name and describe the two basic types of ladders.
- What should you do if you encounter a ladder that is damaged?
- What two types of planks are most suitable for use as scaffold planks?
- What are the advantages of metal scaffolding over wood scaffolding?

Academic Integration: Mathematics

Height-to-Base Ratio In many codes, the height-to-base ratio for a freestanding (uncured) scaffold support is 3:1. This means that the height of the scaffold should be at least 3 times the length of smallest base dimension. If not, the scaffold will need to be secured. Colin's scaffold has a base of 2×5 . What is the maximum height his scaffold's working platform can be before it has to be secured?

Math Concept A ratio is a comparison of two numbers. Ratios can be expressed with colons (3:1). In the workplace, you may hear the ratio 3:1 expressed as "a three to one ratio."

Starting Hint Multiply the smallest base dimension by 3 to find the maximum height.

Go to glencoe.com for this book's OLC to check your answers.

Section 7.2 Other Support Equipment

Special Supports

What is a pump jack?

It is not always possible or desirable to work from scaffolding and ladders. This is often the case in cramped work areas or when working atop a roof. Other means must then be found for ensuring a safe way to work.

Brackets

Special brackets are available that can be attached to the frame of a structure. Scaffold planks are then laid on the brackets to form a platform. Some brackets are nailed to side-wall studs while others are bolted to them, as in Figure 7-9. Nail-attached wall and corner brackets are secured with 20d nails driven into the stud at an angle through the tapered holes in the bracket. This allows the brackets to be easily removed without pulling the nails. Any nails remaining after the brackets have been removed can be driven flush.

Brackets for working on a roof are attached by nailing through them and into the rafters. They can be removed without pulling the nails. There are several types of roof brackets, as shown in Figure 7-10. One style bolts a 2×4 or 2×6 against the roof. Another style can be adjusted to various roof pitches, from 90° to level.

206 Chapter 7 Ladders, Scaffolds, & Other Support

STEM at the end of the Chapter

Critical Thinking

8. Explain How does laminated-veneer differ from plywood in terms parallel lamination?

Academic and Workplace Applications

Mathematics

9. Estimate Sheathing Engineered panel products are usually purchased in 4×8 panels, but are also available in 4×10 and 4×12 panels. A 4×8 panel covers 32 sq. ft. ($4 \times 8 = 32$ sq. ft.) of space; a 4×10 panel covers 40 sq. ft. A 4×12 panel covers 48 sq. ft. Determine how many 4×8 panels of plywood are actually needed for the walls of a room that measures $10' \times 12'$ and has 8' high ceilings.

Math Concept Estimation

Step 1: Calculate the perimeter of the rectangular room.

Step 2: Multiply the perimeter times the wall height to determine the area of the walls to be covered.

Step 3: Determine the square footage (area) of one panel of plywood.

Step 4: Divide the number of square feet to be covered by the area of one sheet of plywood to determine the actual number of sheets needed.

Science

10. Expansion and Contraction When a floor is framed with conventional lumber, the ends of the floor joists are connected with solid lumber of the same size. This lumber is called a rim joist. Solid lumber rim joists do not work with flooring systems framed with I-joists. This is because the two products expand and shrink differently. Do you know why they expand and shrink differently? Find out more about expansion and contraction of wood products. Then write a few sentences describing why various wood products expand and contract.

Standardized-TEST Practice

Multiple Choice

Directions Choose the term or phrase that best completes the following statements.

12. Which can be used to fasten plywood to other materials?

a. ropes c. screws
b. staples d. stakes

13. Which is the moisture content of laminated-veneer products after they are dried?

a. 20% c. 15%
b. 8% d. 35%

14. Excessive exposure to direct sunlight can cause the wood in a glulam beam to

a. break down. c. shrink
b. fade in color. d. expand.

TEST TAKING TIP

When taking a multiple-choice test, answer all questions without skipping or jumping around. Identify marks in the margin and reread them as time permits.

*These questions will help you practice for national certification assessments.

Chapter 13 Review and Assessment 355

For more information about STEM and exciting STEM-related careers, visit www.stemedcoalition.org.



Reading Skills Handbook

▶ Reading: What's in it for You?

What role does reading play in your life? The possibilities are countless. Are you on a sports team? Perhaps you like to read about the latest news and sports. Are you enrolled in an English class, an algebra class, or a science or technology class? Then your assignments require a lot of reading.

Improving or Fine-Tuning Your Reading Skills Will:

- ◆ Improve your grades
- ◆ Allow you to read faster and more efficiently
- ◆ Improve your study skills
- ◆ Help you remember more information accurately
- ◆ Improve your writing

▶ The Reading Process

Good reading skills build on one another, overlap, and spiral around in much the same way that a winding staircase goes around and around while leading you to a higher place. This handbook is designed to help you find and use the tools you will need **before**, **during**, and **after** reading.

Strategies You Can Use

- ◆ Identify, understand, and learn new words.
- ◆ Understand why you read.
- ◆ Take a quick look at the whole text.
- ◆ Try to predict what you are about to read.
- ◆ Take breaks while you read and ask yourself questions about the text.
- ◆ Take notes.
- ◆ Keep thinking about what will come next.
- ◆ Summarize.

▶ Vocabulary Development

Word identification and vocabulary skills are the building blocks of the reading and the writing process. By learning to use a variety of strategies to build your word skills and vocabulary, you will become a stronger reader.

Use Context to Determine Meaning

The best way to expand and extend your vocabulary is to read widely, listen carefully, and participate in a rich variety of discussions. When reading on your own, though, you can often figure out the meanings of new words by looking at their **context**, the other words and sentences that surround them.



Tips for Using Context

Look for clues such as:

A synonym or an explanation of the unknown word in the sentence:

Elise's shop specialized in millinery, or hats for women.

A reference to what the word is or is not like:

An archaeologist, like a historian, deals with the past.

A general topic associated with the word:

The cooking teacher discussed the best way to braise meat.

A description or action associated with the word:

He used the shovel to dig up the garden.

Predict a Possible Meaning

Another way to find the meaning of a word is to take the word apart. If you understand the meaning of the **base**, or **root**, part of a word, and also know the meanings of key syllables added either to the beginning or end of the base word, then you can usually figure out what the word means.

Word Origins Since Latin, Greek, and Anglo-Saxon roots are the basis for much of our English vocabulary, having some background in languages can be a useful vocabulary tool. For example, *astronomy* comes from the Greek root *astro*, which means "relating to the stars." *Stellar* also refers to stars, but its origin is Latin. Knowing root words in other languages can help you determine meanings, derivations, and spellings in English.

Prefixes and Suffixes A prefix is a word part that can be added to the beginning of a word. For example, the prefix *semi* means "half" or "partial," so *semicircle* means "half a circle." A suffix is a word part added to the end of a word. Adding a suffix can change a word's part of speech.

Using Dictionaries A dictionary provides the meaning or meanings of a word. Look at a dictionary entry to see what other information it provides.

Thesauruses and Specialized Reference Books A thesaurus provides synonyms and often antonyms. A synonym is a word that means the same thing as the word you are using. Check the exact definition of the listed words in a print or online dictionary before you use a thesaurus.

Glossaries Many textbooks contain condensed dictionaries that provide an alphabetical listing of words used in the text and their definitions.

Recognize Word Meanings across Subjects Have you learned a new word in one class, and then noticed it in your reading for other subjects? The word might not mean exactly the same thing in each class, but you can use the meaning you already know to help you understand what it means in another subject area. For example:

Math After multiplying the two numbers, explain how you found the **product**.

Science One **product** of photosynthesis is oxygen.

Economics The Gross National **Product (GNP)** is the total dollar value of goods and services produced by a nation.



Reading Skills Handbook

► Understanding What You Read

Reading comprehension means understanding—deriving meaning from—what you have read. Using a variety of strategies can help you improve your comprehension and make reading more interesting and more fun.

Read for a Reason

To get the greatest benefit from what you read, you should **establish a purpose for reading**. In school, you have many reasons for reading. Some of them are:

- To learn and understand new information
- To find specific information
- To review before a test
- To complete an assignment
- To prepare (research) before you write

As your reading skills improve, you will notice that you apply different strategies to fit the different purposes for reading. For example, if you are reading for entertainment, you might read quickly, but if you read to gather information or follow directions, you might read more slowly, take notes, construct a graphic organizer, or reread sections of text.

Draw on Personal Background

Drawing on personal background may also be called activating prior knowledge. Before you start reading a text, ask yourself questions like these:

- What have I heard or read about this topic?
- Do I have any personal experience relating to this topic?

Using a KWL Chart A KWL chart is a good device for organizing information you gather before, during, and after reading. In the first column, list what you already **know**, then list what you **want** to know in the middle column. Use the third column when you review and you assess what you **learned**. You can also add more columns to record places where you found information and places where you can look for more information.

K (What I already know)	W (What I want to know)	L (What I have learned)

Adjust Your Reading Speed Your reading speed is a key factor in how well you understand what you are reading. You will need to adjust your speed depending on your reading purpose.

Scanning means running your eyes quickly over the material to look for words or phrases. Scan when you need a specific piece of information.



Skimming means reading a passage quickly to find its main idea or to get an overview. Skim a text when you preview to determine what the material is about.

Reading for detail involves careful reading while paying attention to text structure and monitoring your understanding. Read for detail when you are learning concepts, following complicated directions, or preparing to analyze a text.

► Techniques to Understand and Remember What You Read

Preview

Before beginning a selection, it is helpful to **preview** what you are about to read.

Previewing Strategies

- ◆ Read the title, headings, and subheadings of the selection.
- ◆ Look at the illustrations and notice how the text is organized.
- ◆ Skim the selection: Take a glance at the whole thing.
- ◆ Decide what the main idea might be.
- ◆ Predict what a selection will be about.

Predict

Have you ever read a mystery, decided who committed the crime, and then changed your mind as more clues were revealed? You were adjusting your predictions. Did you smile when you found out you guessed the murderer? You were verifying your predictions.

As you read, take educated guesses about story events and outcomes; that is, **make predictions** before and during reading. This will help you focus your attention on the text, and it will improve your understanding.

Determine the Main Idea

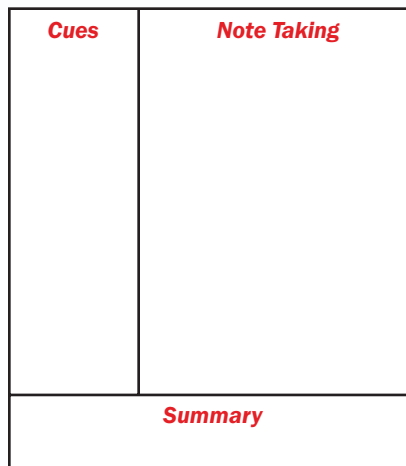
When you look for the **main idea**, you are looking for the most important statement in a text. Depending on what kind of text you are reading, the main idea can be located at the very beginning (news stories in newspaper or a magazine) or at the end (scientific research document). Ask yourself:

- What is each sentence about?
- Is there one sentence that is more important than all the others?
- What idea do details support or point out?



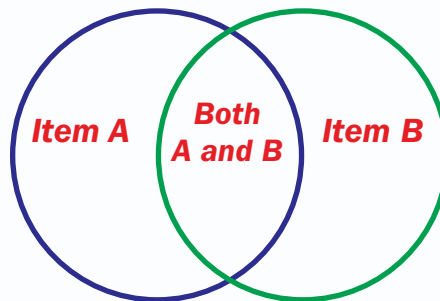
Taking Notes

Cornell Note-Taking System There are many methods for note taking. The **Cornell Note-Taking System** is a well-known method that can help you organize what you read. To the right is a note-taking chart based on the Cornell Note-Taking System.

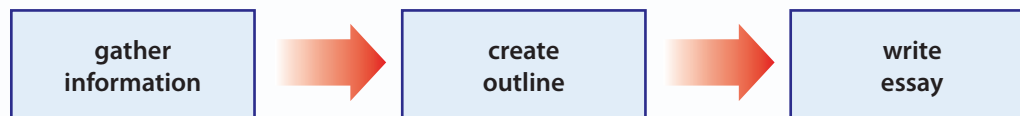


Graphic organizers Using a graphic organizer to retell content in a visual representation will help you remember and retain content. You might make a **chart** or **diagram**, organizing what you have read. Here are some examples of graphic organizers:

Venn diagrams: When mapping out a comparison-and-contrast text structure, you can use a Venn diagram. The outer portions of the circles will show how two characters, ideas, or items contrast, or are different, and the overlapping part will compare two things, or show how they are similar.



Flow charts: To help you track the sequence of events, or cause and effect, use a flow chart. Arrange ideas or events in their logical, sequential order. Then draw arrows between your ideas to indicate how one idea or event flows into another.



Visualize

Try to form a mental picture of scenes, characters, and events as you read. Use the details and descriptions the author gives you. If you can **visualize** what you read, it will be more interesting, and you will remember it better.

Question

Ask yourself questions about the text while you read. Ask yourself about the importance of the sentences, how they relate to one another, if you understand what you just read, and what you think is going to come next.



Clarify

If you feel you do not understand meaning (through questioning), try these techniques:

What to Do When You Do Not Understand

- ◆ Reread confusing parts of the text.
- ◆ Diagram (chart) relationships between chunks of text, ideas, and sentences.
- ◆ Look up unfamiliar words.
- ◆ Talk out the text to yourself.
- ◆ Read the passage once more.

Review

Take time to stop and review what you have read. Use your note-taking tools (graphic organizers or Cornell notes charts). Also, review and consider your KWL chart.

Monitor Your Comprehension

Continue to check your understanding by using the following two strategies:

Summarize Pause and tell yourself the main ideas of the text and the key supporting details. Try to answer the following questions: Who? What? When? Where? Why? How?

Paraphrase Pause, close the book, and try to retell what you have just read in your own words. It might help to pretend you are explaining the text to someone who has not read it and does not know the material.

► Understanding Text Structure

Good writers do not just put together sentences and paragraphs, they organize their writing with a specific purpose in mind. That organization is called “text structure.” When you understand and follow the structure of a text, it is easier to remember the information you are reading. There are many ways text may be structured. Watch for **signal words**. They will help you follow the text’s organization (also, remember to use these techniques when you write).

Compare and Contrast

This structure shows similarities and differences between people, things, and ideas. This is often used to demonstrate that things that seem alike are really different, or vice versa.

Signal words: similarly, more, less, on the one hand / on the other hand, in contrast, but, however



Reading Skills Handbook

Cause and Effect

Writers use the cause-and-effect structure to explore the reasons for something happening and to examine the results or consequences of events.

Signal words: so, because, as a result, therefore, for the following reasons

Problem and Solution

When writers organize text around the question “how?” they state a problem and suggest solutions.

Signal words: how, help, problem, obstruction, overcome, difficulty, need, attempt, have to, must

Sequence

Sequencing tells you the order in which to consider thoughts or facts. Examples of sequencing are:

Chronological order refers to the order in which events take place.

Signal words: first, next, then, finally

Spatial order describes the organization of things in space (to describe a room, for example).

Signal words: above, below, behind, next to

Order of importance lists things or thoughts from the most important to the least important (or the other way around).

Signal words: principal, central, main, important, fundamental

▶ Reading for Meaning

It is important to think about what you are reading to get the most information out of a text, to understand the consequences of what the text says, to remember the content, and to form your own opinion about what the content means.

Interpret

Interpreting is asking yourself, “What is the writer really saying?” and then using what you already know to answer that question.

Infer

Writers do not always state exactly everything they want you to understand. By providing clues and details, they sometimes imply certain information. An **inference** involves using your reason and experience to develop the idea on your own, based on what an author implies or suggests. What is most important when drawing inferences is to be sure that you have accurately based your guesses on supporting details from the text. If you cannot point to a place in the selection to help back up your inference, you may need to rethink your guess.



Draw Conclusions

A conclusion is a general statement you can make and explain with reasoning or with supporting details from a text. If you read a story describing a sport in which five players bounce a ball and throw it through a high hoop, you may conclude that the sport is basketball.

Analyze

To understand persuasive nonfiction (a text that discusses facts and opinions to arrive at a conclusion), you need to analyze statements and examples to see if they support the main idea. To understand an informational text (a text, such as a textbook, that gives you information, not opinions), you need to keep track of how the ideas are organized to find the main points.

Hint: Use your graphic organizers and notes charts.

Distinguish Facts and Opinions

This is one of the most important reading skills you can learn. A fact is a statement that can be proven. An opinion is what the writer believes. A writer may support opinions with facts, but an opinion cannot be proven. For example:

Fact: California produces fruit and other agricultural products.

Opinion: California produces the best fruit and other agricultural products.

Evaluate

Would you take seriously an article on nuclear fission if you knew it was written by a comedic actor? If you need to rely on accurate information, you need to find out who wrote what you are reading and why. Where did the writer get information? Is the information one-sided? Can you verify the information?

▶ Reading for Research

You will need to **read actively** in order to research a topic. You might also need to generate an interesting, relevant, and researchable **question** on your own and locate appropriate print and nonprint information from a wide variety of sources. Then you will need to **categorize** that information, evaluate it, and **organize** it in a new way in order to produce a research project for a specific audience. Finally, **draw conclusions** about your original research question. These conclusions may lead you to other areas for further inquiry.

Online Learning Center

How to Access the Online Learning Center

Follow these steps to access the resources of the *Carpentry & Building Construction* Online Learning Center:



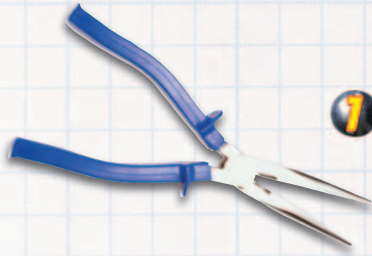
- Step 1** Go to glencoe.com
- Step 2** Enter your state and user type.
- Step 3** Enter "Trade and Technical Education" in the discipline field.
- Step 4** Click ENTER.
- Step 5** Find *Carpentry & Building Construction* ©2010 on the program list. Click the title, and you are there.
- Step 6** Click Student Center for a variety of classroom resources.

Find Your Tools for Success...

Treasure Hunt



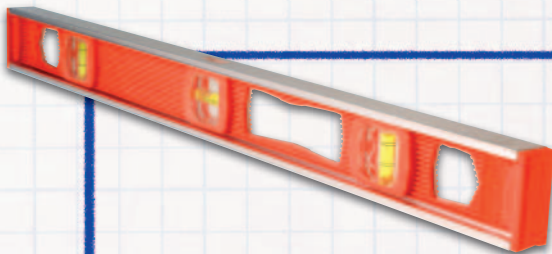
Carpentry & Building Construction contains a wealth of information. The trick is to know where to look to access all the information in the book. If you spend time reviewing this textbook, you get the most out of your reading and study time. Let's begin!



1 How many chapters are in the book? How many units?

2 What part of the textbook will show you specific safety tips?

3 Where do you find the Construction Careers feature?



4 Where can you find specific Science, Technology, Engineering, and Mathematics (STEM) applications?

5 If you need help with one of the math applications, where would you look?

6 Where can you find the definitions of **mastic** and **underlayment**?

