Welcome 4-H Leaders!

Welcome to the “Exploring Woodworking” project. There is lots of information, fun facts, and activities. This project covers shop safety, hand tools, and basic finishing techniques. This guide provides you with project meeting plans (Skill Builders) that include a skills list, background information, activity suggestions, and ways to know if your members have learned the skills identified. In short, all the information and tools necessary to make this project a rewarding one for you and your members.

The Leader Guide is written with the expectation that the project leader(s) will have a working knowledge about woodworking. If not, you may need to do some pre-work / research on the activities, or recruit assistance for certain sections.

Be sure to try out activities, demonstrations or hands on work ahead of time to ensure you have an understanding of each Skill Builder. This also allows for any adjustments should an activity not work for you or if any equipment or supplies are unavailable.

The 3D’s of Learning - Each Skill Builder has three sections of learning called “Dream it!” “Do it!” and “Dig it!” Below is a description of each.

**Dream it! Plan for Success** - this gives members a chance to help plan their activities. A skills checklist, background information, important words, and activating questions are included in the Member Manual so they will be able to think about the topic and activity and decide how they will approach it. The Leader Guide contains in depth background information on the topics, material lists, suggestions, time requirements for activities, and activating, acquiring, and applying questions to engage member’s thinking through each step of the learning process.

**Do it! Hands on learning** - this is where members are engaged in the activity planned / discussed in the Dream it! Section. Here members are doing the activities and leaders are observing, recording, and providing feedback on how well they are doing. Allow as much individual practice as required; you are assessing the progress and understanding of individual members.

**Dig it! What did you learn?** - this simply means that members and leaders need to ‘dig into their learning’. For the learning cycle to be completed, both need to reflect on how things went and how well they did. For members, this involves self-assessment, giving feedback, creating meaning from their experiences, and thinking about what they would do differently next time. Once this is done they will be in a good position to apply what they have learned to the next experience.

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- Draft 2010 -
What Skills Will The Member Learn?

Each section, Skill Builder (or Builder) in this project has activities that will help your project group learn to do by doing while learning new skills and having fun!

To complete this project, members must:
- Complete the activities in each Builder OR a similar activity that focuses on the same skills as you and your members may plan other activities
- Plan and complete the Showcase Challenge
- Complete the Portfolio Page
- Participate in your club’s Achievement (See the inside back cover for more information about 4-H Achievements).

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When you successfully complete your builders, you will showcase what you have learned.

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<thead>
<tr>
<th>Showcase &amp; Portfolio</th>
<th>Activities</th>
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<td>• Explain success in using the skills listed above</td>
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Showcase Challenge and My Portfolio Page

At the end of the members’ section are the “Showcase Challenge” and “My 4-H Portfolio Page”. The Showcase Challenge page gets members to think about their accomplishments and explain or demonstrate how they were successful. There are a number of suggestions along with planning information to help them decide how they will best “showcase” their learning to friends, family, community members and/or fellow 4-H members.

Record keeping is an important part of every 4-H project. “My 4-H Portfolio Page” is a graphic organizer used to keep track of members’ 4-H experiences. As each member learns skills, the evidence of learning (through participation and completion of the various activities) is recorded on the page. When the Portfolio Page has been completed and confirmed by the leader, then it becomes a record of the member’s completion of the project and participation in other 4-H activities beyond the project.

4-H leader assessment of members will happen throughout the project as you assess the progress and understanding of individual members. You need to observe the members doing the skill and record what you see and hear. Your feedback should be positive and descriptive (not just “well done”). Share that feedback with members frequently so they can put your suggestions into action. How you choose to observe and record is up to you. Some methods are to create checklists, videos and notes while encouraging discussions, peer observations and questions. Recognize that members may improve over the course of a builder and that records should be updated to reflect when they demonstrated their best learning. You are discussing how well members are meeting the skills checklists that are at the beginning of each of the project books, in each Builder and on the Portfolio Page.

Projects promote technical, communication, meeting management, and leadership skills, as well as community involvement and real-world experiences. In addition to the specific skills members are to learn in each builder, the following general learning goals for members are important: Following instructions - Working with others - Using supplies safely - Using the key words - Improving with practice - Respecting timelines.

4-H Project Series Skill Development Levels

Each project topic series contains three levels of skill development: explore, discover, and master.

Explore - each project series has one project outlining the fundamentals. All members will be expected to complete the Explore level project before moving into the Discover level projects. It introduces the basic skills and terms needed by members for subsequent projects in that series.

Discover - each project series has several project options and members are encouraged to take as many as they would like. At this level, members practice topic specific techniques and gain theme related skills through specialized builders.

Master - multiple project options encourage members to specialize in a topic. They may branch out and take advantage of community options such as cooking for a canteen or participating in a food drive. The leader’s role is to look for opportunities for their members to have more authentic experiences by: working with other mentors, partnering with outside agencies, participating in exchanges, entering competitions, etc. Projects at this level may include the “Partner-a-Project” whereby pre-approved courses will allow members to advance their skills, while applying their learning to the 4-H program.
4-H LEADER TIPS FOR SUCCESS!

♦ To complete, members must complete all the activities referred to on the “Project Completion Requirements” page OR alternate idea for an activity that would teach the same skill or an age appropriate variation. If activity substitutions are used, be sure to have the member make note in their manuals.

♦ Dependent on time available at each meeting, group size and abilities of group members, you may wish to break the Builders into more than one project meeting.

♦ The internet has lots of interesting websites and educational activities. You may choose to use a search engine to explore the options available. We do not endorse any website or the safety or functionality of any products they may sell. Information/products will be used at your own discretion.

♦ Safety is a number one priority. Care has been taken to create safe, age appropriate activities throughout this manual. As leaders, it is important for you to emphasize safety rules and manage or adapt activities in a manner that will safely match your members abilities. Ensure members have a good understanding of safe working and handling practices when using tools, that they use the appropriate safety equipment when necessary, and that appropriate supervision is provided. A quality experience needs to be a safe experience.

♦ The multiple intelligences theory teaches us that people learn in at least 8 different ways. All individuals will be stronger in some ways of “intelligences” and weaker in others. It follows that the more ways we teach, the more members we will reach. Throughout this project, you will find a mix of writing, reading, hands-on work, artwork, self-evaluation, group discussion and performance. Teaching projects using a broad blend will help increase the learning potential of all members.

♦ Projects are designed to teach many skills. However, the 4-H member is always more important than the subject matter. Stress cooperation in the activities where possible to develop teamwork and cooperation skills. These are valuable skills that will assist them in a number of settings. Ensure the work is completed in a manner that members feel good about themselves and their efforts. This can be done by assigning appropriate tasks or roles based on member’s individual abilities. Modelling and expecting supportive behaviour (i.e. no “put-downs”) amongst members, or by other adults, also contributes to a positive experience.

♦ There will be opportunity for experimentation and applying skills that members have learned throughout this project. Experimenting can be frustrating, but learning through trial and error is an important life skill. Explain to members that it is alright to either go onto the next builder or do the builder again if they need the practice. Help the members work through their challenges until they are satisfied with the quality of their work. Creating inventive 4-H members will be very rewarding.

♦ Celebrating success is an important but sometimes overlooked part of our lives. We encourage you to use the final section to empower the members by celebrating all they have learned in a fun manner. Anything that you do to add to the spirit of fun and the sense of accomplishment of each member will likely be remembered as the highlight of their 4-H year.

Have fun and thanks for your belief in young people!
Skill Builder 1: Safety First

Skills Checklist

- Understand how practicing safety can prevent injuries
- Identify the basics of wood processing
- Recognize the fundamental tools

Background for Leaders

Safety is the most important consideration when woodworking. Most of the tools that will be used in this project function by cutting or scratching away at whatever is put in front of them, so adequate supervision is required with beginning members to ensure they are developing safe habits. In order for members to learn safe woodworking habits and techniques, safety must always be contemplated when working with new or unfamiliar tools. The more attention that is paid to safety from the beginning of the project, the safer and more independent members will be in the end.

The first skill builder is dedicated to safety so that the ideas presented may be carried on throughout subsequent skill builders and projects. It is important to lay out your expectations as a leader. Give the members the opportunity to think of safety rules on their own, then have an open discussion in which everyone can add to their own lists. You may want to include rules of your own, but here are some basics that all members should be aware of:

Work Safe

- Put away sharp tools as soon as you are finished with them.
- Never leave tools, wood, or other equipment lying around on tables, chairs, benches or floors where people can trip over them.
- Do not run, jump or throw things around the work area.
- Being tired or frustrated can increase the risk of an accident. Take your time, have shorter sessions, and take a break when someone (big or little) gets frustrated.
- Avoid distractions (TV, visitors) while cutting.
- Know where to find a telephone in case of an emergency.
- Accidents will happen. Keep a first aid kit nearby.

Dress Safe

- Wear sturdy footwear to protect your feet and toes. Wear long pants to protect your legs.
- Button or roll up loose sleeves so they don’t get in your way or become caught in machinery. Tuck in loose clothing for the same reasons.
- Fasten back long hair so it does not obscure your vision or become caught in anything.
- Remove any jewelry, especially long chains. In addition to putting the jewelry at risk, it may catch on equipment and cause you injury.
- Put safety glasses on as soon as you enter the shop and don’t take them off until you leave.
- When working with loud power tools and machinery such as routers, surface planers and joiners, it is wise to wear hearing protection. Being mindful of wearing hearing protection will help to reduce the possibility of long term hearing loss.
- When using power tools it is a good idea to wear a dust mask or respirator as it offers a secure fit around your mouth and face. This is done to keep these fine particles from entering your lungs. When spraying varnish or paint, a respirator is a better choice, to protect you from any harmful effects of using these chemicals.
- When using a lathe, you’ll likely generate a lot of flying chips. In addition to using your safety glasses, a clear full-face shield is a good idea. The shield is comfortable, can be flipped up when not needed, and will keep most of the flying chips away from your face.
Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Personal Protective Equipment (PPE)</th>
<th>Personal protective equipment is used to reduce the risk of injury during use and operation of tools or other products.</th>
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</thead>
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<tr>
<td>Sustainability</td>
<td>Making sure that the rate at which something is being depleted is in balance with the rate in which it is regenerated.</td>
</tr>
<tr>
<td>Softwood</td>
<td>Softwoods are made from coniferous trees, which have thin leaves or needles. Ex. Pine, Fir, Spruce, Cedar.</td>
</tr>
<tr>
<td>Hardwood</td>
<td>Hardwoods come from deciduous trees, which are the trees with big leafy branches that occasionally bear fruit and typically go dormant for the winter. Ex. Birch, Hickory.</td>
</tr>
</tbody>
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Age Considerations

- Ages 8 and up

Dream it!

Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies

Activate members’ prior knowledge by asking the following questions:

- Why is workshop safety so important?
- What are some safety hazards? What would be a way to avoid each hazard?
- What are some fears that members, if any, have regarding safety in the workshop? What could be changed to reduce that fear?
- What are some articles of safety gear, and what do these articles protect against?

Note: Make sure you ask members the activating and applying questions at the end of each activity to get them thinking about the activity and applying the knowledge they have acquired.

Wooden Surroundings

Time Required: 15 minutes

Equipment/Supplies: pen/pencil
Instructions
1. Have the members look around and count the number of things they can see made of wood. They should record this number on the line in their book.
2. Have members complete the diagram in their books about the stages wood goes through to become a finished product. The tree and a house (representing a finished product) are given. You may want to ask them prompting questions along the way. A possible answer is given below.

Hazard Hunt

Time Required: 15 minutes

Equipment/Supplies: pencil/pen, workshop and member manual

Instructions: Have members walk around the workshop checking to make sure that each of the criteria can be given a check mark. If each item is not satisfied, you will want to lead a discussion with the members about how to change the situation. Perhaps you may even want to set up an unsafe situation for the members to find. The items the members need to check are:

- Wood is stored safely.
- Tools are in good condition.
- There is appropriate ventilation.
- Lighting is adequate.
- There are trashcans for disposal.
- Chemicals are stored safely.
- The area is tidy.
- There is a first aid kit.
- Fire extinguisher is nearby.
- The work surface is stable and secure.
- The work surface is smooth and free of snags.
- The work surface does not have nails or metal parts.

Symbol

Time Required: 10 minutes

Equipment/Supplies: Shop supplies, pen/pencil, member manual

Instructions: Have members walk around the shop trying to find supplies that are labelled with the Hazardous Household Product Symbols. When they find an example they can check off the symbol in their book. The Hazardous Household Product Symbols include:

- DANGER
- WARNING
- CAUTION

Poisonous
Flammable
Explosive
Corrosive

Sold in a Store
Made into Something
Saw Mill
Logging Camp
Tree
Home
Tools of the Trade

**Time Required:** 15 minutes

**Equipment/Supplies:** pen/pencil, member manual, exemplars of each tool

**Instructions:** Have the members match the number beside the name of the tool to the picture of the tool. You may want to show a real example of each tool and talk about its purpose.

Logs to Lumber

**Time Required:** Dependent upon where you visit

**Equipment/Supplies:** A place to visit that is involved in processing trees or a computer with internet access to take a virtual tour.

**Instructions:** Have the members record three things they learn about lumber production either from the tour or an online source.

**Resources:** An example of a steam powered saw mill can be found at the following sites -

Tree Types

**Time Required:** 10 minutes

**Equipment/Supplies:** Samples of hard and soft woods, books about different woods or a computer and internet access.

**Instructions:** Discuss the difference between hard and soft wood and if possible, let members try to dent a sample of each. If having the members use the internet to research, this activity could be given as one to do on their own time before the next meeting.

**Background Information:**

- Hardwoods come from deciduous trees, which are the trees with big leafy branches that occasionally bear fruit and typically go dormant for the winter. Birch, oak, hickory or cherry woods are all popular examples of hardwoods.
- Softwoods are made from coniferous trees, which have thin leaves or needles. Cedar, fir, pine and spruce are a few examples of softwoods. Interestingly enough, despite its name, softwoods are quite hard and very durable. The Douglas fir, which is softwood, is actually harder than many hardwoods. Softwoods are less expensive than hardwoods, and most woodworkers start by working with softwoods. Softwoods are still the best option for those just beginning to hone their craft as a woodworker because the resin reserves makes the wood very versatile and easy-to-use. Softwoods also make up the majority of the wood that is used for larger-scale building, from structural framing materials of a house, to the doors and window frames.
• One of the main differences between hard and softwoods is their cellular makeup. Hardwoods have larger cells, some of which make up vessels that allow moisture to travel more efficiently throughout the tree. Softwoods are made up smaller cells that make up fibres. Because of this, softwoods lack the ability to transport water through the tree like hardwood trees do. Instead, softwoods have resin reserves (the syrupy sap) that protect the tree against injury.

Dig it!

Have the members come up with a safety goal that they will follow to keep all their body parts safe. You may wish to create posters of these goals and hang them around the shop to serve as reminders throughout this project.

The Workplace Hazardous Material Information System (WHMIS) symbols are also provided with the suggestion that if members see these they should consult their leader. If there is time, you may want to have sample products with the symbols on them and explain the hazards they present.

What’s next?

Skill Builder 2 introduces the hand saw, coping saw, and brace and bit. Members will gain experience designing patterns and following them. The topic of measurement in both Metric and Imperial Systems is also covered. Tools that can help members measure accurately will be introduced.

Leader’s Notes
In the Member Manual

Skill Builder 1: Safety First

Pip Says....
No matter what project you’re working on, the first thing to think about is safety. This booklet will help you make sure no one gets hurt while using tools and working with wood.

SKILLS CHECKLIST
- Understand how practicing safety can prevent injuries
- Identify the basics of wood processing
- Recognize the fundamental tools

Important words
Watch for these important words throughout this booklet:
Personal Protective Equipment (PPE), Sustainability, Softwood, Hardwood

Dream it!
To begin any project and be successful you need to plan. In Dream it! you will begin thinking about the topic that the builder explores.

Wooden Surroundings
Look around you. Count the number of things you can see made of wood. What steps do the products go through to become what you see around you? Draw pictures between the arrows to show your guesses of what happens between trees and your home.

Do it!
Hazard Hunt
Take a walk around your workspace and check off each item to make sure you will be safe.
- Wood stored safely
- Tools are in good condition
- There is adequate lighting
- There are trashcans for disposal
- Chemicals are stored safely
- The area is tidy
- There is a first aid kit
- Fire extinguisher is nearby
- The work surface is stable and secure
- The work surface is smooth and free of sawdust
- The work surface does not have nails or metal parts

Pip Says....
Try doing your shoes up without your thumbs. Accidents are preventable and by remembering the safety rules, you can make sure you never have to do that again.

Pip Says....
Safety can involve a lot of things in the workshop. Equipment to wear includes: hearing protection, goggles, a shop apron, steel toe boots, rubber or latex gloves (when applying a finish), and a respirator or dust mask. Fortunately, you were born with the best defense against accidents - common sense. So, make sure to use it.

Symbol
To keep people safe while using products in our shops, the International Safety Symbols were created to label products according to their level of threat and type of danger. Take a look around the shop and check off each symbol that you find.

DANGER
- Fire
- Explosives
- Poison
- Electrical Shock

WARNING
- Slippery when wet
- Heavy object
- Sharp object

CAUTION
- Hot surface
- Slippery surface
- Falling object

Tools of the Trade
Match the picture of these common woodworking tools with the number beside the proper name.
1. C-clamp
2. Claw Hammer
3. Coping Saw
4. Electrical Drill
5. Flat-Bladed Screwdriver
6. Hand Drill
7. Handsaw
8. Pencil
9. Phillips Screwdriver
10. Pliers
11. Power Saw
12. Sandpaper Block
13. Tape Measure
14. Try Square
15. Wood Rasp

Logs to Lumber
Visit a place that is involved in turning trees into a finished product. Whether it is a logging camp, a paper mill, or a lumber yard, see what you can learn about the process of changing wood into a useable product. If you are unable to visit in person, try doing some research on the internet. Write three things you learned below.

Woodn’t You Know?
In the Member Manual

Tree Types

Trees are classified depending on their hardness, and are usually labeled as hardwood or softwood. Hardwood comes from deciduous trees (the ones with big bushy leaves that lose their leaves in the fall) like zeb, birch, hickory, oak, maple, poplar, rosewood, and walnut. Softwood comes from coniferous trees (the ones with needles or thin leaves) like cedar, cypress, fir, pine, redwood, and spruce. Softwoods are cheaper than hardwoods and are usually a good choice for a beginner woodworker. To test if a piece of wood is hardwood or softwood, you can push a ballpoint pen into it and see how easily it dents. The easier it dents, the softer the wood. Pick two types of wood to research and fill in the chart below. Ask your local hardware shop about the costs. An example has been done for you.

<table>
<thead>
<tr>
<th>Species</th>
<th>Hardness</th>
<th>Colour</th>
<th>Major Use</th>
<th>Cost($) per Board Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahogany</td>
<td>Hardwood</td>
<td>Reddish</td>
<td>Furniture</td>
<td></td>
</tr>
</tbody>
</table>

**Dig it!**

How can you make sure you stay safe during this project? Make a safety goal to help you keep all ten fingers and all ten toes.

**My Safety Goal:**

Other safety symbols used in the shop are WHMIS (Workplace Hazardous Material Information System). If you see any of these symbols of products you are using, make sure to talk with your leader about extra safety precautions.

**What's next?**

Skill Builder 2 will help you learn to follow a pattern through careful measurement. You will also learn to use the handsaw, coping saw, and brace and bit, as well as make a sign!
Skill Builder 2: Measure Twice, Cut Once

Skills Checklist
- Learn to follow a pattern
- Measure and cut wood
- Understand what units are part of both the metric and imperial systems

Background for Leaders

An accurate diagram or pattern is a great help to woodworkers of any skill level. A good diagram, showing every piece of the project and indicating every necessary measurement, leaves no practical element of the project to the imagination. Misleading diagrams can lead to bad cuts, creating useless and wasted pieces of lumber.

There are two common systems of measurement. Canada uses the Metric System, the units of which will all divide into ten equal parts. Much of the lumber industry still uses the US Imperial system of measurement, which consists of units of measurement including feet and inches. This manual will use a combination of both metric and imperial measurement.

Important Words

Here are some examples of how to use the “important words” to increase the members understanding:
- Ask members to form a mental image of the new word.
- Get members to use a dictionary and show them the range of information it provides.
- Have members describe (rather than define) the new word in terms of their experiences.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
</table>
| Saw        | Hand saws have a metal blade with teeth and a handle made of wood or plastic.  
The teeth cut a path (kerf) through the wood. Saws have set teeth. This means  
that the teeth are bent alternately from side to side, so that the kerf is wider than  
the actual saw. This helps prevent the saw getting stuck when cutting wood. |
| Clamp      | A tool used to keep an object in a fixed position.                           |
| Kerf       | The groove left when cut by a saw blade. Also referred to as the “saw cut”.   |
| Metric     | The decimal measuring system with the metre, litre, and gram as units of length, volume and mass. A user-friendly system in that it works in multiples of 10. |
| Imperial   | Traditional system of weights and measures still used by the United States.  |
| Drill      | A tool used for boring holes into wood.                                     |
| Utility Square | Builders use this square to construct buildings as its greater length makes it more accurate. |
| Try Square | This tool looks like a ruler with a handle attached at a right angle (90 degrees). It is used to test if two surfaces are at 90 degrees or square. |
| Framing Square | Also called a steel utility square.                                       |
| Combination Square | This has several uses: to check if a board is flat, or if it is level, to check angles, to measure depth, to lay out a line parallel to the edge of a board. |
Age Considerations
• Ages 8 and up

Dream it!

Thinking Ahead
• What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success
• Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies

How Do You Measure?

Time Required: 5 minutes

Equipment/Supplies: pen/pencil, piece of lumber

Instructions: Have members circle their answer to the first two questions and then discuss how to measure a piece of wood. All of the answers for number 1 and 2 are possible answers, some are in Metric, others are in Imperial, and some are a better choice than others.
1) What units do you measure your weight in? pounds kilograms ounces grams
2) What units do you measure your height in? feet metres inches centimeters
3) How would you measure a piece of wood?
The answer to this is to measure the thickness of the wood by the width of the board. So a 2” thickness by a 4” width is written as 2" x 4”.

Do it!

Measure Up

Time Required: 5 minutes

Equipment/Supplies: Pen/Pencil, examples of measuring devices.

Instructions: Have members match the letter of the description with the correct picture.

A) A Measuring Tape is a small tool can measure a curved surface in both Metric and Imperial as well as straight surfaces.

B) A Try Square is used to test if two surfaces are at a 90° or right angle. Most projects require pieces to come together at right angles.

C) A Combination Square is used to check is a board is flat or level, to measure depth, to check angles, and to draw a line parallel to the edge of a board.

Many of the activities for this book came out of the National 4-H Woodworking Project Resource published by Agriculture and Agri-Food Canada in 2009. You may want to consult this resource for alternative activities.
Saw It

**Time Required:** 30 minutes

**Equipment/Supplies:** Different types of hand saws including the crosscut (common) saw, coping saw and rip saw, scrap wood.

**Safety Considerations:** Although these saws are not power tools, they are still sharp and can cause considerable damage. Supervision is necessary throughout this activity.

**Background Information:**

Saws are one of the first tools that people associate with woodworking and there are many kinds, each with a specific purpose!

**Hand Saw:** Hand saws have a metal blade with teeth and a handle made of wood or plastic. The teeth cut a path (kerf) through the wood. Saws have set teeth. This means that the teeth are bent alternately from side to side, so that the kerf is wider than the actual saw. This helps prevent the saw getting stuck when cutting wood.

**Common Saw:** The common saw has about eight teeth per inch (2.54 cm.). Use this saw to cut across the grain of a board.

**Rip Saw:** The rip saw has half as many teeth than the common saw. Use the rip saw to cut along the length of a board.

**Backsaw (Mitre Saw):** The backsaw has a rectangular blade with a stiffening metal strip on the top edge. It is used with a mitre box to cut exact angle cuts.

**Frame Saw:** The frame saw is used for making curved cuts. A frame holds the fine blade firmly. The coping saw is the most common type of frame saw.

**Instructions:** Have members practice using the crosscut and coping saw. They should draw a diagram on the wood with rounded edges to cut with the coping saw.

Brace Yourself

**Time Required:** 15 minutes

**Equipment/Supplies:** brace and bits, scrap wood, tape

**Background Information:**

The brace and bit is a very old design that has stood the test of time. It was used to make the ships that brought many of our ancestors to Canada and many of the historic buildings in our country. The brace is the curved metal that has a small knob handle at the end and another longer handle on the bumped out middle section. At the working end there is a chuck, which holds the bits. The bits have three parts - a square or rounded end that fits into the chuck; a spiral shaft, and a screw-tipped end. Bits come in many sizes. Because of its spiral design, the bit actually pulls itself into the wood as you crank the brace! The sharp tip on the bit does its own dimpling of the wood. Hold your brace and bit straight up and down when drilling so the hole will be straight. Put a piece of scrap wood under the project so you do not make a series of holes in the workbench. To remove the bit when the hole is complete, pull it up and out. Sometimes it helps to put your project down on the floor and kneel on it while you are using the brace and bit. It helps to be above it when using it.

**Instructions:** Have the members practice drilling holes into wood properly using the brace and bit.
DeSign It

**Time Required:** 1 hour

**Equipment/Supplies:** wood, brace and bit, paper, pencil, coping saw

**Instructions:**

**Sign Number 1**

1. Sketch the word or name for the sign on a piece of paper the same size as the finished sign will be. Practice two or three times until you are satisfied with how it looks.
2. Square off the ends of the 1×4 at a length that your word will fit on, plus one inch at each end. Sand it carefully.
3. Sketch your word/name onto the wood with a pencil.
4. Put a piece of duct tape at 1/4” on the bit of the drill. This will show you at what depth to stop drilling.
5. Drill holes on the pencil lines of the letters for the name/word.
6. Dust the sign. It might be necessary to vacuum the holes to get all the dust out!

**Sign Number 2**

1. Write your name or message in rounded letters so that letters touch.
2. Cut out the name or message, being careful not to separate them.
3. Smooth with a rasp, if necessary.
4. Sand, then finish.

**Chisels and Rasps**

There was not room for this information in the members’ manual, but the chisel and rasp are involved in some of the building projects. The following is background information that you may wish to share with them. Supervision is necessary with these tools, especially the chisel.

Woodworkers use rasps to shape wood and smooth rough surfaces. Rasps look like a coarse file with a handle on one end. Rasps quickly remove excess wood with their coarse teeth. A rasp only removes wood as it moves forward. Pick it up and lift it back to the start, to take another stroke. Rasping is done before sanding.

Chisels are sharp wood knives that are used to remove unwanted strips of wood. The end of the blade is the sharp part that cuts with a pushing action. The tip of the blade is slanted or beveled. Most chisel work is done with the bevel side down against the wood. Whenever possible, use your chisel with the grain of the wood. To sharpen a chisel, it is whet on an oilstone. Make sure to wear goggles.

1. Apply oil to the stone surface to keep it moist. The oil prevents particles of steel from clogging the pores of the stone. Wipe the stone before putting it away.
2. Hold the chisel or plane iron on the fine grit oilstone with the bevel flat on the surface. Raise the handle slightly (5 degrees or less) so you whet only the forward part of the bevel.
3. Move the chisel or plane in a circular pattern back and forth lengthwise on the stone several times. Working in this way wears the stone evenly so it will last you all your life.
4. After you have sharpened the bevel edge, turn the blade over to remove the little bits that have appeared on the other side. Lay the blade flat on the stone. Move it back and forth a few times to remove those little bits.
5. Inspect the blade edge. Is it completely and evenly sharpened? Are there still some nicks or unsharpened spots? It may be necessary to repeat the whetting process until you have done a complete job. Test your blade on a piece of wood (not your project!).

When you notice the cutting edge is nicked or it is getting harder and harder to use the tool, it is time to grind. The chisel should be ground to a 25 or 30-degree angle. After grinding, finish by whetting.
**Dig it!**

Have the member answer the following questions in their books:
- Do you prefer the Metric (metres, grams, Celsius…) or Imperial (feet, pounds, Fahrenheit) System?
- Which saw do you find easier to use? Why?

You may also want to discuss:
- Why would proper technique and set up be particularly important with the brace and bit?
- For what tasks will you use a saw?
- How are the members doing with their personal safety goal?

**What’s next?**

Skill Builder 3 teaches members how to properly use a hammer to insert and pull a nail. The members will get to use their skills to build a pair of stilts that they can walk around on.

**Leader’s Notes**

Dig it!

Have the member answer the following questions in their books:
- Do you prefer the Metric (metres, grams, Celsius…) or Imperial (feet, pounds, Fahrenheit) System?
- Which saw do you find easier to use? Why?

You may also want to discuss:
- Why would proper technique and set up be particularly important with the brace and bit?
- For what tasks will you use a saw?
- How are the members doing with their personal safety goal?
In the Member Manual

**Saw It**

There are a few types of hand saws you will use throughout this project: the crosscut saw, the rip saw, and the coping saw. The crosscut saw is used to cut across the fibers of wood, whereas the coping saw is used to make clean cuts. The crosscut saw has teeth that are wider than those of a rip saw. When using a coping saw, draw a shape with rounded edges on a piece of wood (perhaps a circle or heart), and try to cut it out as best you can.

**Design It**

Use your brace to drill holes into a piece of wood, but first create a pattern that you can trace onto your piece of wood. You might want to write your name or a favorite word. Show your design below. An example is in the corner.

**From Farming History...**

In order for a team of oxen to plow a field, they needed to be joined by a yoke. This yoke was easily constructed by amateur woodworkers, and most farmers were woodworking of some skill.

**Explore**

1. Back
2. Blade
3. End Pieces
4. Frame
5. Handle
6. Handle
7. Heel
8. Teeth
9. Toe

The kerf is the path the saw cuts through the wood. The teeth of the saw bend from side to side leaving a kerf wider than the saw. To make sure the kerf does not affect your measurement, always saw on the waste side of your marking line.

**Fun Facts!**

**Brace Yourself**

Before you can move on to power drills in the Discover level, you need to learn the technique on the ancestor of the power drill - the brace and bit. The brace is the large part that is manually turned to drive the bit into the wood. Bits come in many sizes but they all work in the same way. Hold the brace and bit straight up and down when drilling and make sure to have a piece of scrap wood underneath so that you do not damage your work surface. If you go all the way through, rotate the handle around until the bit is flush as far as you want. You may want to mark on the bit the depth you want to drill so you do not go too far. Once your hole is the correct depth, pull it straight up and out. Practice drilling holes of different depths and widths. You will continue to use the brace and bit to drill pilot holes to help the screws go in easier in Builder 4.

**Dig It!**

Think about the builder and the activities you did...

Do you prefer the Metric (metres, grams, Celsius...) or Imperial (feet, pounds, Fahrenheit) System?

Which saw do you find easier to use? Why?

**Wood'n You Know?**

Countries have been converting to metric since it was invented in France in 1795. Only the U.S., Myanmar (Burma), and Liberia still use Imperial. To learn more about who converted and when, visit: http://ismar.colostate.edu/~hilgert/internet.html

**What's next?**

Hammers and nails are one of the most common tools to put pieces of wood together. You will also build a pair of stilts that you can use to walk around on.
Skill Builder 3: Hammerhead

Skills Checklist

- Understand the measurement system for nails
- Select the correct nail and hammer for the job

Background for Leaders

Hammers are the most common tool and are very useful. Members may even want to purchase their own hammer that they will use for the rest of their life. Of course if members are young, they may grow out of their hammer and have to buy another one later in life. Hammers come in a range of sizes and shapes. Members should choose the weight that feels right for them. Hammers come with wooden, metal or fiberglass handles. The best hammerheads are forged steel. Have the members mark their name and phone number somewhere on their hammer. There are many safety rules that members should follow when using a hammer:

- Make sure the hammerhead is secure.
- Wear eye protection.
- Secure long hair so it does not get caught in the passing hammer.
- Make sure the hammerhead is clean.
- Use your woodworking hammer only for woodworking.
- Hold your hammer at the low end of the handle when using it.
- Watch out for other people when using your hammer.
- When you set your hammer down, make sure the entire hammer is out of the way so that people don’t accidentally knock it off the surface.

Nails come in different sizes and materials. Nails work by pushing wood fibres back against the nail, which keeps the fit snug. A nail driven into the edge or face of a board will hold better than a nail driven into the end of a board. The larger and rougher the surface of a nail, the better it holds the wood.

There are two types of nails that carpenters work with most often. They are:

**Common Nails** - These have a big head and are quite thick.

**Finishing Nails** - These have a smaller head than a common nail and are thinner. Finishing nails are usually set into the wood. The hole is then covered up with putty so that it does not show.

**Important Words:**

Help members define the following words and look for members using this vocabulary in their discussions. A few strategies you can use include:

- Teach synonyms by providing a synonym members know.
- Also, teach antonyms. Not all words have antonyms, but thinking about opposites requires the members to evaluate the critical attributes of the words in question.
- Provide non-examples. Similar to using antonyms, providing non-examples requires students to evaluate a word’s attributes. Invite students to explain why it is not an example.

| **Hammer** | A tool meant to deliver an impact to an object. The most common uses are for driving nails, fitting parts, and breaking up objects. Hammers are often designed for a specific purpose, and vary widely in their shape and structure. |
| **Nail** | A rod shaped piece of metal for hammering into wood to hold separate pieces together. |
Age Considerations
- Ages 8 and up

**Dream it!**

**Thinking Ahead**
- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

**Preparing for Success**
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in these activities might look like, sound like, or feel like.

**Activating Strategies**
You could ask the following questions now and at the end of this Builder:
- What are some things to keep in mind when selecting the right hammer to use?
- What are a few safety tips regarding proper hammering technique?
- What should be done if a nail is bent in the hammering process?
- How many types of nails are there? What are their uses?
- How are nails sized?
- What is a nail set?

**Nail Knowledge**

**Time Required:** 5 minutes

**Equipment/Supplies:** pen/pencil

**Instructions:** Have the members write down what they already know about hammers and nail and what they would like to learn about them. During the Dig It! section of this Builder, they will get to fill out the Learned Column.

**Do it!**

**One a Penny, Two a Penny**

**Time Required:** 20 minutes

**Equipment/Supplies:** nails of various sizes, a nail set

**Instructions:** Have the members try and pick out different sizes of nails and properly label them.

**Background Information:** The sizes of nails are referred to as penny size. The short form for penny is “d”. Nails that are shorter than two inches in length (5 cm) are sized in fractions of an inch as well as the wire gauge size. Wire gauge sizes include #17, 18, 19 and 20. A nail set is used to push the head of a finishing nail further into the wood so that the hole can be covered up with putty. A nail set looks like a fat spike with a flat end. Nail sets come in different sizes, to fit the different sizes of finishing nails.
Nailed It!

**Time Required:** 15 minutes

**Equipment/Supplies:** hammer, nail, scrap wood, pen/pencil

**Background Information:**

The ability to use a hammer and a nail is one of the most important woodworking skills. Hammers come in many different shapes and sizes and you should choose one that doesn’t feel too heavy. It is important to wear eye protection, make sure the hammerhead is securely fastened, and tie long hair back. To hammer:

1) Hold the nail in the desired spot with one hand
2) Swing the hammer from your wrist and tap the nail lightly.
3) Once the nail stays in the wood by itself, remove your holding hand.
4) Hold the hammer at the lower end of the handle and use your whole arm for the most power (this may take time to perfect).
5) Keep the handle of the hammer at a right angle to the nail while driving to make sure you don’t bend the nail.
6) Keep your eyes on the nail and hit it squarely on the head.

**Instructions:**

Have the members practice using a hammer correctly to hit a nail and then remove it. If there is a bent nail, teach the members how to properly straighten it by holding a block of wood against the nail and then tapping the nail repeatedly against the block.

Have the members match the parts of the hammer in the picture with the number beside the correct name.

**Answers:**

![Hammer Parts Diagram]

1. check
2. claw
3. face
4. handle
5. head
6. neck
7. poll

Stilts

**Time Required:** 1 hour

**Materials:**
- 1 scrap 2 x 4, at least 16" long
- 2 scrap 2 x 2s, at least 60" long
- 1 scrap 1 x 2, at least 16” long
- 4 hex bolts, 3/8” x 7”
- 4 3/8” washers
- 4 3/8” wing nuts
- wood glue
- sandpaper, 100 grit

**Tools:**
- square and pencil
- handsaw
- hammer
- protective eye wear
- brace with 3/8” bit

**Cut List:**
- 2, 2x4x6” (steps)
- 2, 2x2x60” (legs)
- 2, 1x2x6 3/4” (braces to keep feet slipping off steps)
Instructions:
1. Measure and mark a square line at 60” on the 2x2 using your marking tools.
2. Clamp this piece to the work bench. Cut on the line. This will be one leg of your stilts. Cut a matching stilt leg, the same length.
3. Clamp a stilt leg to the work bench with a piece of scrap wood under it. Using your tape measure, mark an X at every four inches, starting from one end, until you have marked four Xs.
4. Mark the Xs in the centre of the leg. Use the brace and bit to bore a hole at each X. The scrap wood under the leg protects the work surface when the bit cuts through the leg.
5. Repeat the marking and drilling steps for the other leg.
6. Clamp the 2x4 to the work bench with a C-clamp, with at least 8 inches hanging over the edge.
7. Measure, mark and square the 2x4 at six inches from the end. Clamp and cut it at the six inch line. This will be one step.
8. Repeat to make a matching step.
9. Measure, mark and square a 1x2 piece so it is 6-3/4” long. Clamp and cut it. This piece will keep your foot from sliding off the step.
10. Repeat to make another brace. You will glue a brace to the outside edge of each step.
11. Hammer a finishing nail through the brace and into the step, at either end. Place the nails near the ends so that there will be room to bore holes for the bolts that hold everything together.
12. Repeat step 10 for the other step and brace.
13. Mark where the bolts will go through this way. Place the step/brace piece on the workbench with the brace on the bottom. One edge of the step will face up. Measuring from the end of the step that is even with the brace, mark two marks on the steps edge, at 1” and at 5”.
14. Square across the step’s edge at each mark. Pencil an X at the centre of each line.
15. Clamp one step/brace piece to the work surface, with a piece of scrap wood underneath. Use a brace and 3/8” bit, drill a hole all the way through both X marks. Hold the brace and bit straight up and down so the hole does not come out the side.
16. Repeat step 13 for the other step/brace.
17. Sand all the pieces well, especially the legs where you will be holding on.
18. Assemble your stilts, making sure that the step/brace piece is right side up! Decide what set of holes to use. Push the bolts through the step/brace until they come out the other side of the leg. Put a washer and wing nut on each bolt and tighten.
19. Have the members take a picture of them standing on their stilts to put in their book.

Dig it!

Have the members insert their pictures into their book, filling in the blanks below. You may want to re-ask the questions given under the Activating Strategies section.

What’s next?

Skill Builder 4 looks at using a screwdriver to drill screws into wood. Members will use the brace and bit to drill pilot holes before using the screwdriver. They will also have the opportunity to build a toolbox to carry their tools in.
Skill Builder 3: Hammerhead

Pip Says....

Hammers are one of the oldest tools in the world, dating back to 2,600,000 BC. The modern claw hammer can be used to pound nails in or pull them out using the other side of the head. You should always wear safety glasses when using a hammer!

SKILLS CHECKLIST
- Understand the measurement system for nails
- Select the correct nail and hammer for the job

Dream it!

Nail Knowledge

Fill out the know and want to know boxes about hammers and nails. The learned box will be filled out in the Dig It! section of this builder.

<table>
<thead>
<tr>
<th>Know</th>
<th>Want to Know</th>
<th>Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Do it!

One a Penny, Two a Penny

Nails are measured in a system called penny, represented by the letter “d”. A 1.5 inch long nail is also known as 1.5 d. However, nails that are shorter than 2 inches long are also measured by wire gauge between 17 and 30, with the bigger the number being, the thinner the nail. Two types of nails you will use in your project are the common nail and finishing nail. The common nail has a bigger head than the finishing nail. A nail set is used to push the finishing nail farther into the wood so that the hole can be covered with putty.

Work with your leader to organize nails according to their size and discussing how they are labeled.

Fun Fact!

To straighten a bent nail, hold a block of wood against the nail and then tap the nail repeatedly against the block. Don’t try to straighten it all in one swing, unless it only has a very small bend. Nails go into dry wood more easily if they have been dipped in a bit of wax. You can drill a small hole in the end of your hammer and hit it with melted paraffin, so the wax is always handy for you!

Hammer Parts

Word Bank
1. check
2. claw
3. face
4. handle
5. head
6. neck
7. poll

Fill in the number of the words with the correct hammer parts.

Skills

Materials:
- 1 scrap 2 x 4, at least 16" long
- 2 scrap 2 x 2, at least 60" long
- 1 scrap 1 x 2, at least 16" long
- 4 hex bolts, 3/8" x 7"
- 4 3/8" washers
- 4 3/8" wing nuts
- wood glue
- sandpaper, 100 grit

Tools:
- square and pencil
- handsaw
- hammer
- protective eye wear
- brace with 3/8" bit

Cut List:
- 2, 2x4x6" (steps)
- 2, 2x2x60" (leg)
- 2, 1x2x6 3/4" (braces to keep feet slipping off steps)

Instructions:
1. Measure and mark a square line at 90° on the 2x2, using your marking tools.
2. Clamp this piece to the work bench. Cut on the line. This will be one leg of your stilts. Cut a matching stil leg, the same length.
3. Clamp a stil leg to the work bench with a piece of scrap wood under it. Using your tape measure, mark an X at every four inches, starting from one end. Until you have marked four Xs.
4. Mark the Xs in the center of the leg. Use the brace and bit to bore a hole at each X. The scrap wood under the leg protects the work surface when the bit cuts through the leg.
5. Repeat the marking and drilling steps for the other leg.
6. Clamp the 2x4 to the work bench with a C-clamp, with at least 8 inches hanging over the edge.
7. Measure, mark and square the 2x4 at six inches from the end. Clamp and cut it at the six inch line. This will be one step.
8. Repeat to make a matching step.
9. Measure, mark and square a 1x2 piece so it is 6 3/4" long. Clamp and cut it. This piece will keep your foot from sliding off the step.
10. Repeat to make another brace. You will glue a brace to the outside edge of each step.
In the Member Manual

11. Hammer a finishing nail through the brace and into the step, at either end. Place the nails near the ends so that there will be room to bore holes for the bolts that hold everything together.

12. Repeat step 10 for the other step and brace.

13. Mark where the bolts will go through this way. Place the step/brace piece on the workbench with the brace on the bottom. One edge of the step will face up. Measuring from the end of the step that is even with the brace, mark two marks on the steps edge. At 1" and at 5".

14. Square across the step's edge at each mark. Pencil an X at the centre of each line.

15. Clamp one step/brace piece to the work surface, with a piece of scrap wood underneath. Use a brace and 3/8" bit, drill a hole all the way through both X marks. Hold the brace and bit straight up and down so the hole does not come out the side.

16. Repeat step 13 for the other step/brace.

17. Sand all the pieces well, especially the legs where you will be holding on.

18. Assemble your stilts, making sure that the step/brace piece is right side up! Decide what set of holes to use. Push the bolts through the step/brace until they come out the other side of the leg. Put a washer and wing nut on each bolt and tighten.

Dig it!

Go back to page 9 and fill in the Learned Column. Attach a picture of you on your stilts below!

In this picture

I want you to notice:

What's next?

If you could twist a nail, you would end up with a screw. The next Builder looks at how to use a screw and screwdriver and how to drill pilot holes so that you don't split your piece of wood. You will also build your own tool box.
Skill Builder 4: No Screws Loose Here

Background for Leaders

The screw is a useful tool when it comes to woodworking as they can be used in both the construction as well as the finishing aspects of a project. However, a screw is used differently than a nail, despite the two looking more or less the same. It is important to recognize the differences between the two items and their individual uses so that an informed decision can be made when having to choose between a screw or nail as a fastener. Screws have three parts – the head, the shank and spiral threads, which end in a sharp point. The spiral threads pull the screw into the wood as you turn the screwdriver. Screws hold pieces of wood together by gripping the wood with the threads. Never hammer screws into wood. Screws differ from nails in that they must be driven into the wood by a screwdriver or a power drill as opposed to a hammer. Screws come in many shapes and sizes. The most common size of screw is the #8. Thickness ranges from #0 to #12, with #0 being the smallest, and #12 the largest. The slot screw features a simple groove cut across its head. Screwdrivers can easily slip from this groove and damage the wood. The Phillips or star head screw is used more often in cars and metal work than in woodwork. The Robertson or square socket screw is favoured for woodworking in Canada. The right-sized screwdriver tip fits snugly in its square head.

Important Words

Help members define the following words and look for members using this vocabulary in their discussions. One strategy to help members learn new vocabulary is to have them paraphrase the definitions. Have members use their own words to increase connection making.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw</td>
<td>Cylinder with a spiral ridge (thread) running round it.</td>
</tr>
<tr>
<td>Screwdriver</td>
<td>A tool with a shaped tip to fit into the head of a screw. The most common screwdrivers in Canada are the slot, the Robertson and the Phillips.</td>
</tr>
<tr>
<td>Pilot Hole</td>
<td>A pilot hole is a smaller hole drilled into a material prior to a larger hole being drilled, widening the hole to the desired width.</td>
</tr>
<tr>
<td>Roundhead</td>
<td>A screw with a half a sphere for a head.</td>
</tr>
<tr>
<td>Flat head</td>
<td>A screw with a flat top.</td>
</tr>
<tr>
<td>Oval</td>
<td>A screw with a spherical head.</td>
</tr>
<tr>
<td>Panhead</td>
<td>A screw with a head that is a low disc with chamfered outer edge.</td>
</tr>
<tr>
<td>Slotted</td>
<td>A type of screw with a groove in the top, or a screwdriver that fits in a slotted screw.</td>
</tr>
<tr>
<td>Phillips</td>
<td>A screwdriver with an x with slightly rounded corners.</td>
</tr>
<tr>
<td>Robertson</td>
<td>A screwdriver with a square end.</td>
</tr>
<tr>
<td>Countersink</td>
<td>To sink a screw-head in so that it lies flush with the surface.</td>
</tr>
</tbody>
</table>
Age Considerations
- Ages 8 and up

Dream it!

Thinking Ahead
- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in their learning in this builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategy: You can ask the following at the beginning and end of this builder:
- What is the difference between a screw and a nail?
- What is the purpose of pilot holes?
- Why would you want to countersink a screw?

Nails with A Twist

Time Required: 5 minutes

Equipment/Supplies: pen/pencil, products that use screws and products that use nails

Instructions: Have members find three products that use screws as fasteners. Encourage them to find a commonality between items that use screws versus items that use nails. The answer should involve strength, as screws will always be stronger than nails.

Do it!

A Few Screws

Time Required: 15 minutes

Equipment/Supplies: different types of screws and screwdrivers, scrap wood

Instructions: Have the members sort screws according to their names (flathead, oval head, round head, Fillister-head) and their sizes. Also let them practice screwing in and taking out a screw.

Pilots in Training

Time Required: 15 minutes

Equipment/Supplies: brace and bit (or power drill if members are older and you have taught proper procedure), screws, screwdrivers, scrap wood

Instructions: Have the members practice drilling proper sized pilot holes to then drill a screw into.
Toolbox Time

**Time Required:** 1 hour

### Materials:
- 1 1” x 8” x 18” (Bottom)
- 2 1” x 4” x 18 (Sides)
- 1 1” x 4” x 10 (Ends)
- 1 1” x 6” x 18” (Handle)
- 4 #8, 1/2 “ flathead wood screws
- 25 #8, 2” flathead wood screws
- fine grit sandpaper

### Tools:
- saws
- screwdriver
- round wood rasp or file
- drill with 1” bit
- pilot hole bits to fit screws and countersink

1. Cut pieces to size (see diagram).
2. Mark and cut the angled cuts on the handle, leaving 1/16” or so for sanding.
3. Mark the handle hole. Bore a 1” hole at each end of the mark and saw out the rest. Use the rasp or file to even and round out the edges. Sand and smooth all sides and edges.
4. On the 8 x 18 bottom piece, draw a centre line lengthwise. Mark and drill countersink holes every three inches on this line. Sand smooth all sides and edges. Screw the bottom to the handle with 2” screws.
5. *Tip: When using slotted screws, line up all the slots the same way. It looks more professional.*
6. In the side pieces, drill the countersink holes 3/8” from the bottom edge. Space the holes as shown on the diagram. Sand smooth all sides and edges. Use 2” screws to fasten both sides to the bottom piece.
7. Add the ends in the same way. Use 1/2” screws at the bottom corners so you do not hit the screws holding the side pieces.
8. For extra strength, drill and countersink the holes in each end piece to hold the handle. Use a 2” screw in each hole.
9. In the last builder, you can paint or stain your tool box to personalize it.

**Dig it!**

Have the members answer the following in their manuals:

What would you tell someone who was going to make the toolbox you just cut and put together?

Why are pilot holes important?

---

**What’s next?**

Skill Builder 5 looks at the power of glue and how to properly use it to attach to pieces of wood. Hinges will be used as well and the members will get to construct a paddle boat.

---

**Leader’s Notes**
In the Member Manual

Skill Builder 4: No Screws Loose Here!

Pip Says....

What's stronger than a nail? A screw! Screws are easily removed from any project. However, screws require a special tool called a screwdriver to insert them into the wood. Screws are measured by length (in inches) and the diameter (a gauge number between 0 and 24).

SKILLS CHECKLIST

- Drill pilot holes
- Use a screw drive
- Select the correct screw and screwdriver for the job

Dream it!

Nails With A Twist

When would you want to use a screw instead of a nail? Look around you and find three places where screws are used instead of nails. What do they all have in common?

1. Found screws: I think screws should be used instead of nails...
   1.
   2.
   3.

Do it!

A Few Screws

The screw is a useful tool as it is used both in construction and finishing. Screws have three parts - the head, the Shank, and the spiral threads. Screws hold the wood together by gripping the wood with the threads. Screws come in many different shapes and sizes. In the diagram on the right, 1) is a flat head, 2) is an oval head, 3) is a round head, and 4) is a Fillister head. Thickness of the screw Shank ranges from #9 to #14, with #8 being the most common. Three common screwdrivers are the slot or flathead screwdriver, the Phillips or star head screwdriver, and the Robertson or square socket screwdriver. Be careful not to let the screwdriver slip out of the screw or it could damage your piece of wood. Your leader will give you a box of screws. Can you sort them according to their names (flathead, oval head, round head, Fillister head)? Also take a look at the different types of screwdrivers and try removing a few screws from a piece of wood as well as putting them back in.

Pilots In Training

Screwing a screw into a piece of wood can sometimes cause the wood to split. To make sure this doesn’t happen, a pilot hole is drilled first. You can use the brace and bit or a power drill to make a hole for your screw to start going into. The pilot hole should always be smaller than the size of your screw so that the screw has something to hold onto. Practice drilling your own pilot holes and then screwing in different sized screws.

Toolbox Time

Materials:
- 1 1/4" x 3/4" x 18" (Bottom)
- 2 1/4" x 3/4" x 18" (Sides)
- 1 3/4" x 3/4" x 10" (Ends)
- 1 3/4" x 6" x 18" (Handle)
- 4 RB, 1/8" flathead wood screws
- 2S RB, 2" flathead wood screws
- fine grit sandpaper

Tools:
- saws
- screwdriver
- round wood rasp or file
- drill with 1/4" bit
- pilot hole bits to fit screws and countersink

Instructions:
1. Cut pieces to size (see diagram).
2. Mark and cut the angled cuts on the handle, leaving 1/16" or so for sanding.
3. Mark the handle hole. Bore a 1/4" hole at each end of the mark and saw out the rest. Use the rasp or file to even and round out the edges. Sand and smooth all sides and edges.
4. On the 8 x 18 bottom piece, draw a centre line lengthwise. Mark and drill countersink holes every three inches on this line. Sand smooth all sides and edges. Screw the bottom to the handle with 2" screws.
5. Tip: When using slotted screws, line up all slots the same way. It looks more professional.
6. In the side pieces, drill the countersink holes 3/8" from the bottom edge. Space the holes as shown on the diagram. Sand smooth all sides and edges. Use 2" screws to fasten both sides to the bottom piece.
7. Add the ends in the same way. Use 1/2" screws at the bottom corner so you do not hit the screws holding the side pieces.
8. For extra strength, drill and countersink the holes in each end piece to hold the handle. Use a 3/8" screw in each hole.
9. In the last builder, you can paint or stain your tool box to personalize it.

Diagram
In the Member Manual

From Farming History...
Most farmers in the past decades had a woodworking shop as they built almost everything out of wood: their houses, furnishings, wagons, fences, barns, tools, and even machinery like harrows and plows.

Think about this builder and the activities you did...
- Review the skills checklist on page 2. What skills have you developed? Do you need more practice?

Does your piece of wood have a dent? You can actually remove this dent by laying a damp cloth over it and heating it with a hot iron until the cloth dries. The process can be repeated as many times as necessary. The hot water opens up the cells of the wood, allowing it to regain its original form.

Fun Facts!

Dig it!
What would you tell someone who was going to make the toolbox you just cut and put together?

Why are pilot holes important?

What's next?
In the next builder, you will compare the strength of glue with that of a nail. You will also learn how to attach two pieces of wood using a hinge. You will get to build a paddle boat that you can float down a river or stream!
Skill Builder 5: Keep It Together

Skills Checklist

- Fasten pieces of wood using a hinge
- Fasten pieces of wood using glue
- Understand the difference between white and yellow glue

Background for Leaders

The two most common glues used in woodworking are white glue and yellow glue (which is also called carpenter’s glue). White glue is an all-purpose glue that works for most woodworking projects, but carpenters tend to prefer yellow glue. Be sure to instruct members to handle the glue carefully as wood that has glue on it will not accept stain and finish the same way that clean wood will.

It is important to store glue where it will not freeze or be in direct sunlight. Ensure the container is sealed to prevent the entry of air. If the original cap is weak or faulty, try a mariette (which is the screw type cap used to connect electrical wires). The screws in the mariette will dig into the plastic of the spout and block air entry.

Some woodworkers like to store their small bottles of glue upside down so that the glue is ready to go. You can store glue bottles upside down in a coffee can or even build a wooden holder that looks like a giant toothbrush holder.

Important Words

Help members define the following words and look for members using this vocabulary in their discussions. Ask for sentences that "show you know." When members construct novel sentences they confirm their understanding of a new word. Have members use as many terms per sentence to show that connections can be useful. Members can also create impromptu speeches using these terms.

<table>
<thead>
<tr>
<th>Clamp</th>
<th>A tool used to keep an object in a fixed position.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinge</td>
<td>A moveable joint that attaches two pieces of wood.</td>
</tr>
<tr>
<td>Glue</td>
<td>A liquid substance that as it dries, holds two pieces of wood together.</td>
</tr>
</tbody>
</table>

Age Considerations

- Ages 8 and up

Dream it!

Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in their learning in this builder. Discuss what success in these activities might look like, sound like, or feel like.
Activating Strategies
- What are the two most common types of glue for a carpenter to use?
- When is glue an effective fastener? When would it be ineffective?
- What are some tips to keep in mind about the use and storage of glue?

The Power in Glue

Time Required: 10 minutes

Equipment/Supplies: Two pieces of wood glued together, two pieces of wood nailed together.

Instructions: Have the members try and pull apart the two pieces of wood and see what happens when each one comes apart. The nailed pieces should slide apart smoothly but the glued pieces will break.

Do it!

Two Glues

Time Required: 15 minutes

Equipment/Supplies: Glue, scrap pieces of wood, clamps

Instructions: Have the members practice properly gluing two pieces of wood together by following the steps below:
1. Wood must be clean, dry and smooth or it will not glue successfully.
2. Apply a wiggly line of glue to both pieces. Smear the glue around until all the surfaces are covered. If too much glue is used, it will squeeze out, make a mess and go to waste.
3. Put the two glued pieces together and squeeze them. A small amount of glue should squeeze out on the edges. Line them as desired. Clamp them, using wood scraps to prevent dents in the project. Clean up any excess glue.
4. Lightly tighten the clamps at first. Check for positioning.
5. Tighten the clamps further. Leave the clamps on for at least an hour.
6. When the clamps are taken off, leave the project overnight before any more work is done.
7. Clean up.

Clamping My Style

Time Required: 20 minutes

Instructions:
Try this experiment, using white and yellow glue in steps 1-3, to see when glue works best.
1. Glue two dirty or greasy pieces of wood together. Clamp and let dry.
2. Glue two clean pieces of wood together. Clamp and let dry.
4. Compare the strength of the examples at the next meeting. How will these joints stand up over time?
5. Practice gluing pieces of wood together and determining how much glue is enough. Practice cleaning off excess glue with a warm, damp, clean cloth. Maybe later you can practice staining this piece and see how the glue affects the staining process.
6. Compare the types of glues that you have. What differences do you notice in how the glue flows, sticks, smooths out and bonds?

Have the members show the results of their experiment by circling in which situation the glue is stronger and does a better job.

**Hinged Lid**

**Time Required:** 1 hour

Instructions: Have the members design a box that includes a lid with hinges. Have them consider how they will attach the pieces of wood (nails, screws, glue, etc...). They need to draw a diagram, write out their cut list, materials and tools. Before members begin to build, have them show you their pattern. You will want to ask what the purpose of the box will be to make sure that the design will fit the intention.

**Paddle Boat**

**Time Required:** 1 hour

Instructions: Members will follow the design in their book to help them construct a wooden paddle boat.

**Materials:**
- 25mm (1") x 153mm (6") x 305mm (12") wood stock for main deck
- 25mm (1") x 103mm (4") x 126mm (5") wood stock for upper cabin
- 6mm (1/4") x 64mm (2 1/2") x 172mm (6 3/4") wood stock for paddles
- 2-19mm (3/4") wood screws
- Elastic band
- Yellow glue (carpenter’s glue)
- Acrylic paint or varnish

**Tools:**
- Pencil
- Coping saw
- Hand saw
- Rasp
- Chisel
- Sandpaper 80-grit and 220-grit
- Paint brush

Instructions:
1. Trace main deck and upper cabin onto wood stock pieces.
2. With rasp slightly taper underside of main deck bow.
3. Sand main deck and cabin pieces until smooth first with rasp and then sandpaper.
4. Glue cabin to main deck.
5. Cut the two paddle blades to size (diagram 3).
6. Cut out notch (notch should only be as thick as wood used) with coping saw and use chisel to chip out waste wood.
7. Slip one notch into the other to form the paddle.
8. Finish boat with a couple of coats of paint or varnish.
9. Screw in the screws to the stern of the main deck.
10. Place elastic band between the paddle blades.
11. Wind up the paddle blades a few times, let it go in the water and enjoy.
In the Member Manual

Skill Builder 5: Keep It Together

Pip Says....

Yellow glue, also called carpenter’s glue, contains special additives that make it more easily sanded. Yellow glue is especially preferable when working with pine! However, white glue is just as strong as yellow glue.

SKILLS CHECKLIST

- Fasten pieces of wood using a hinge
- Fasten pieces of wood using glue
- Understand the difference between white and yellow glue

Important Words

Watch out for these important words in this builder:

Clamp, Hinge, Glue

Dream it!

The Power in Glue

Your leader will give you two pieces of wood that have been glued together and two pieces that have been nailed together.

I think the __________________ will be stronger. The __________________ was actually stronger. Warm up your muscles and try and pull them apart. Record what you think will be stronger and what actually is.

Do it!

Two Glues

There are two common kinds of glue used in woodworking. White glue is an all-purpose glue used for most woodworking projects where as yellow glue provides a stronger bond. Be sure to store your glue at room temperature and out of direct sunlight. Whichever glue you choose to use, there are certain steps to follow to make sure your wood stays connected.

1. Wood must be clean, dry and smooth or it will not glue successfully.
2. Apply a wiggly line of glue to both pieces. Spread the glue around until all the surfaces are covered. If too much glue is used, it will squeeze out, make a mess and go to waste.
3. Put the two glued pieces together and squeeze them. A small amount of glue should squeeze out on the edges. Line them as desired. Clamp them, using wood scraps to prevent dents in the project. Clean up any excess glue.
4. Lightly tighten the clamps at first. Check for positioning.
5. Tighten the clamps further. Leave the clamps on for at least an hour.
6. When the clamps are taken off, leave the project overnight before any more work is done.

Too much glue can result in a thick glue line, and therefore a weaker bond than less glue would have. The ideal moisture content for gluing is 6.8% and high moisture will result in wood movement after gluing. Glues do have a shelf life and will go bad, so check the expiry date.

Leader’s Notes

The final Builder will help members finish their projects to preserve the wood for as long as possible. Members will learn how to sand, paint and varnish. They will cut and paint a bird and then finish one of their other creations from this project. The Tree Trial activity requires a bit of pre-painting so that the experiment can be done at your next meeting.

What’s next?

The final Builder will help members finish their projects to preserve the wood for as long as possible. Members will learn how to sand, paint, and varnish. They will cut and paint a bird and then finish one of their other creations from this project. The Tree Trial activity requires a bit of pre-painting so that the experiment can be done at your next meeting.

Dig it!

- Ask the members to answer the following questions in their books:
  - Why do you think this is?
  - What is the best way to attach two pieces of wood - glue, screws, nails...?

You may also want to re-ask the activating questions.
In the Member Manual

Clamping My Style

Try this experiment, using white and yellow glue in steps 1-3, to see when glue works best.

1. Glue two pieces of wood together. Clamp and let dry.
2. Glue two clean pieces of wood together. Clamp and let dry.
4. Compare the strength of the examples at the next meeting.

How will these joints stand up over time?

5. Practice gluing pieces of wood together and determining how much glue is enough. Practice cleaning off excess glue with a warm, damp, clean cloth. Maybe later you can practice staining this piece and see how the glue affects the staining process.

6. Compare the types of glues that you have. What differences do you notice in how the glue flows, sticks, smooths out and bonds?

Circle when glue is strongest:

- a) Dirty Wood
- b) After 24 hours
- c) White Glue
- d) Clean Wood
- e) After 1 month
- f) Yellow Glue
- g) Painted Wood
- h) Yellow Glue

Hinged Lid

In this activity you will design a box of any size and put a lid on it with hinges. Your box can be cubical or a rectangular prism. Before you choose your measurement, consider what you might want to use your box for. How do you want to attach the side and bottom pieces of wood (nails, screws, glue)?

Purpose of My Box:

Materials:

Sketch:

Tools:

Cut List:

Woodn't You Know!

There are many different glues in the stores. To choose the right one for your project visit http://homesremoanrepair.suite101.com/article.cfm/types_of_woodworking_glue or use a search engine with the words "choose a woodworking glue."

Paddle Boat

Materials:

- 25mm (1") x 153mm (6") x 205mm (8") wood stock for main deck
- 25mm (1") x 103mm (4") x 126mm (5") wood stock for upper cabin
- 6mm (1/4") x 64mm (2.1/2") x 172mm (6 3/4") wood stock for paddles
- 2-19mm (3/4") wood screws
- Elastic band
- Yellow glue (carpenter’s glue)
- Acrylic paint or varnish

Instructions:

1. Trace main deck and upper cabin onto wood stock pieces.
2. With rasp slightly taper underside of main deck bow.
3. Sand main deck and cabin pieces until smooth first with rasp and then sandpaper.
4. Glue cabin to main deck.
5. Cut the two paddle blades to size (diagram 3).
6. Cut out notch (notch should only be as thick as wood used) with coping saw and use chisel to chip out waste wood.
7. Slip one notch into the other to form the paddle.
8. Finish boat with a couple of coats of paint or varnish.
9. Screw in the screws to the stern of the main deck.
10. Place elastic band between paddle blades.
11. Wind up the paddle blades a few times, let it go in the water and enjoy.

Dig It?

What is the best way to attach two pieces of wood – glue, screws, nails, …?
Why do you think this is?

What is the best way to avoid leaving clamp marks on a project?

What's next?

The final Builder looks at finishing your projects. Wood products last longer when they have a finish applied to them. This includes sanding it smooth, and applying either coats of varnish or paint. The Tree Trial activity will require some pre-painting.
Background for Leaders

We finish a wood project to protect it and to improve its appearance. The first step is usually sanding it smooth and then applying either a penetrating or surface finish.

**Sanding**

We sand wood to smooth the rough edges and scratches left by cutting it. Sanding also makes a project look and feel to be of better quality. Sandpaper is gritty material glued onto paper. It comes in a range of coarseness. Use coarse sandpaper when starting to sand a project. Use finer sandpaper when you are getting to the final stages of sanding. Sandpaper coarseness is expressed as grit. The lower the number of grit, the coarser the paper. The higher the number, the finer the grit. For example, 80-grit sandpaper is much coarser than 120-grit sandpaper. The grit number is printed on the back of the sandpaper. Many project plans will suggest what grit of sandpaper to use.

Sandpaper comes in standard sheet sizes of 22cm by 28cm. Using an Exacto-Knife, we divide these sheets into four pieces to use with a sanding block. Before you use your sandpaper, roll the paper, grit side out, to break up the glue on the paper a bit and tap the sandpaper on the back to clear dust. Always sand with the grain and wipe your work off with a lint-free cloth.

**Penetrating Finishes (Stains and Preservatives, including Oils)**

Stains soak into the wood fibres so that you can still see the grain and feel the wood. To remove a penetrating finish, you actually need to remove the wood fibres.

**Stain Procedure:**
1. Brush a coat on the surface. Make sure the grain is evenly wet.
2. Rub in the oil. First use a circular motion, and then change it to follow the grain. Let it dry.
3. Lightly sand with the paper or steel wool.
4. Apply more coats, lightly sanding between coats, until you are satisfied with the finish.
5. After the final coat, use a small piece of steel wool to give the surface a fine sheen.
6. Rub briskly with a soft, clean cloth.

**Surface Finishes (Paint, Varnish, Shellac and Lacquer)**

Varnish, shellac, lacquer are clear and allow you to see the grain of the wood and look very natural whereas paint has colour and hides the wood. Paint can cover up flaws in the wood and workmanship, disguise wood filler, match existing furniture, and is washable.

**Varnish Procedure:**
1. Prepare the wood finish. It must be clean and smooth. If necessary, fill any holes and cracks. To clean, wipe with mineral spirits.
2. Brush varnish against the grain. Then, brush diagonally. Then, brush with the grain.
3. When completely dry, use fine silicone-carbide paper to smooth the finish.
4. Repeat with another layer or two of varnish, until you are satisfied with the result.

**Paint Procedure:**
1. Protect your work surface with newspaper.
2. Mix your can of paint. Make sure it is well mixed, right to the bottom of the can.
3. Make sure the object you are painting is clean and free of dirt and grease, or the paint will not stick well. If necessary, clean the surface with mineral spirits.
4. Dip only the tip of the brush into the paint (no more than 1/3 of the brush).
5. Start painting in the corners and work out from there. Paint the flat, easy bits last.
6. Brush the paint with the grain in easy strokes. Keep going until the paint starts to get too thin.
7. Re-dip your brush and continue.
8. Do not put too much on at once. More than one coat is common. If painting two colours next to each other, let the first colour dry completely before starting the second coat.
Important Words

Help members define the following words and look for members using this vocabulary in their discussions.

<table>
<thead>
<tr>
<th>Sanding</th>
<th>Smoothing or polishing wood using a piece of sandpaper.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint</td>
<td>Solid colouring-matter suspended in a liquid.</td>
</tr>
<tr>
<td>Varnish</td>
<td>Resinous matter dissolved in oil used to produce a protective coating.</td>
</tr>
</tbody>
</table>

Age Considerations

- Ages 8 and up

Dream it!

Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies:

- Why is sanding important to a finished piece of woodworking?
- What might happen if something isn't sanded properly, or the wrong grade of sandpaper is used on a project?
- Why is it important to do proper clean up of the dust left from sanding, both in the workshop as well as prior to continuing on with the finishing process?
- Is applying a finish necessary? Why or why not?
- What are important safety tips to keep in mind when applying a finish to a woodworking project?

Final Finish

Time Required: 10 minutes

Instructions: Have the members find the finishing techniques in the word search.

Background Information:

**Splattering** - Load an old toothbrush or small paint brush with paint. Pull the bristles back and let the paint splatter on your project. You can also tap the brush with a small piece of wood.

**Stippling** - With a stippling brush, marine sponge or paper towel, touch your project while the paint is still wet.

**Rag Rolling** - Roll a dry, clean rumpled rag through the paint or dip the rag into paint and then daub it onto a clean, dry surface.

**Dragging** - Drag a comb tool through wet paint and clean off the tool after each pass. This is especially attractive when you use a different color of wet paint over top of dry paint.
Marine Sponge - Dip your sponge into a bit of diluted paint, then wring it almost dry. Touch your project with the sponge, turning it in various ways.

Permanent Markers - Test your markers on a sample of the wood your project is made of, to see if the markers will spread or bleed into the wood. If it does and you do not like that, apply an acrylic sealer to the project first. Markers work best on light coloured woods. The wood grain often shows through markers.

**ANSWER:**

**Do it!**

**Final Touch**

**Time Required:** 15 minutes

**Instructions:** Have the members practice painting and varnishing follow the correct procedure outlined in their manuals.

**Wooden Birds**

**Time Required:** 1 hour

**Instructions:** Have the members choose one of the bird diagrams in their manual to make or have them design their own. The members will cut out the birds and finish them.

**Materials:**
- Scrap pieces of pine or other soft wood (3/4” for the body and 1/2” or thinner for the wings)
- Sandpaper
- Finishing materials of your choice (paint, stain, varnish etc.)
- Cleaning supplies
- Small hook

**Instructions:**
1. Place your pattern pieces on the wood, with the arrow running in the same way as the wood grain.
2. Trace your pattern onto the wood.
3. Cut out the wood pieces.
4. Sand carefully.
5. Glue the wings to the bird. Remove any excess glue so it will not interfere with your painting. Let dry.
6. Paint or finish, as you prefer.
7. Carefully insert the small hook into the top of the bird, so it will hang straight.

**Tools:**
- Pencil
- Tracing paper
- Coping saw
- Paint brush
- Hand drill and small bit
Tree Trial

**Time Required:** 1.5 hours (there is wait time in between that the members can use for the other activities in this builder)

**Instructions:**

Cut 5 blocks of wood from a 2 x 4 in the following thicknesses:
- Block #1 – 7/8” thick
- Block #2 – 1/8” thick
- Block #3 – 3/8” thick
- Block #4 – 3/8” thick
- Block #5 – 3/8” thick

Block #1 – Paint it completely and allow it to dry. (It will take a day or two.) Then make a saw cut across the grain as illustrated, but stop short of cutting the block in two.
Block #2 – Paint one side and the ends.
Block #3 – Paint one side and the ends.
Block #4 – Draw a line lengthwise down the center of the block on both sides. Paint half of one side as illustrated. Turn over and paint ends on that half.
Block #5 – Make two saw cuts (but stop short of cutting the finger off) then paint the center finger as illustrated.

1. Place all blocks aside to dry. Let them dry thoroughly.
2. Fill a flat, shallow pan (about 2” deep) half full with water.
3. Place the five blocks in the water and leave for 30 minutes or more.
4. Observe what happens to the different blocks - have the members answer the following:
   - What happens to each block?
   - Which one curved the most? Why?
   - What caused the blocks to curve?
   - Which block increased in length?
   - Are there similarities or differences between block #2 and #3?
5. After you have completed all the steps above and answered the questions, place the blocks in an oven at 225°F (110°C) for at least 30 minutes. Observe and note what happens.

**Dig it!**

Have the members put their new finishing skills to use by finishing a project from one of the other builders. They need to record in their books which one they choose to redo and how they will finish it. If members are interested in learning more advanced finishing techniques, encourage them to take the Discover Level project based on that topic.

**What’s next?**

Congratulations on completing all six Builders! Now the members need to plan for the Showcase Challenge which will help them prepare for 4-H Achievement. The portfolio page also needs to be completed to make sure the Exploring Woodworking Project Skills Chart is complete.
In the Member Manual

Skill Builder 6: A Strong Finish

Pip Says.....
To lengthen your project's life, a finish can be applied. Sanding
smoothes out the wood so that a level coat of paint or varnish can
be put on. Paint and varnish are very flammable so make sure not to
use them near an open flame or you will have a fire!

Skills Checklist

- Finish projects using basic techniques,
  including sanding, painting, and varnishing

Dream it!

Important Words

Look out for these important words in
this builder:
Sanding, Paint, Varnish,
Grit, Grain, Warp

Final Finish

See if you can find the following words which are all types of finishes.

Dragging
Lacquer
Oil
Paint
Permanent Marker
Sand
Shellac
Splattering
Sponge
Striping
Rag Rolling
Varnish

Do it!

Final Touch

Surface finishes include paint, varnish, shellac and lacquer. Paint has color, whereas the other three
are clear and allow the grain to show through. Paint can cover up workmanship errors though.

How to Varnish
1. Prepare the wood finish. It must be clean and smooth. If necessary, fill any holes and
   cracks. To clean, wipe with mineral spirits.
2. Brush varnish against the grain. Then, brush diagonally. Then, brush with the grain.
3. When completely dry, use fine silicone-carbide paper to smooth the finish.

How to Paint
1. Protect your work surface with newspaper and mix your can of paint.
2. Make sure the object you are painting is clean and free of dust and grease.
3. Dip only the tip of the brush into the paint (no more than 1/3 of the brush.)
4. Start painting in the corners and work out from there. Paint the flat, easy bits last.
5. Brush the paint with the grain in easy strokes. Keep going until the paint starts to get too thin.

Both varnish and paint will usually require more than one coat, so don't try and put a thick one on.
In the Member Manual

**Wooden Birds**

**Materials:**
- Scrap pieces of pine or other soft wood (3/4” for the body and 1/2” or thinner for the wings)
- Sandpaper
- Finishing materials of your choice (paint, stain, varnish etc.)
- Cleaning supplies
- Small hook

**Instructions:**
1. Place your pattern pieces on the wood, with the arrow running in the same way as the wood grain.
2. Trace your pattern onto the wood.
3. Cut out the wood pieces.
4. Sand carefully.
5. Glue the wings to the bird. Remove any excess glue so it will not interfere with your painting. Let dry.
6. Paint or finish, as you prefer.
7. Carefully insert the small hook into the top of the bird, so it will hang straight.

**Tools:**
- Pencil
- Tracing paper
- Coping saw
- Paint brush
- Hand drill and small bit

**Pipe Says...**
Sandpaper is measured in grit and the higher the number the finer the grit. You should start with a coarser sandpaper and then finish with a finer grit. Always sand with the grain and never cut sandpaper with scissors or else someone will be angry when their scissors are dull. Use an Exacto-Knife instead.

**Tree Tris!**
Cut 5 blocks of wood from a 2 x 4 in the following thicknesses:
- Block #1 - 7/8" thick
- Block #2 - 1/8" thick
- Block #3 - 3/16" thick
- Block #4 - 3/8" thick
- Block #5 - 3/16" thick

Block #1 - Paint it completely and allow it to dry. (It will take a day or two). Then make a saw cut across the grain as illustrated, but stop short of cutting the block in two.
Block #2 - Paint one side and the ends.
Block #3 - Paint one side and the ends.
Block #4 - Draw a line lengthwise down the center of the block on both sides. Paint half of one side as illustrated. Turn over and paint ends on that half.
Block #5 - Make two saw cuts (but stop short of cutting the finger off) then paint the center finger as illustrated.

1. Place all blocks aside to dry. Let them dry thoroughly.
2. Fill a flat, shallow pan (about 2" deep) half full with water.
3. Place the five blocks in the water and leave for 30 minutes or more.
4. Observe what happens to the different blocks. What happens to each block?

Which one curved the most? Why?
What caused the blocks to curve?
Which block increased in length?
Are there similarities or differences between block #2 and #3?

After you have completed all the steps above and answered the questions, place the blocks in an oven at 225 degrees for at least 30 minutes. Observe and note what happens.

**Dig it!**
Now that you know how to finish a woodworking project, choose one from an earlier builder to refinish. Talk with your leader about what the best option is for a finish (paint, varnish, etc...).

I chose to finish ____________________________

by ____________________________

**Thinking about this builder and the activities you did...**
Review the skills checklist on page 18. What skills have you developed? Do you need more practice? What skills did you use to make this project a success?

**Record it...**
Discuss what you have learned with your leader.

**Apply it...**
How would you explain to others the steps you need to take to have a successful project?

What’s next?
Congratulations on completing all six Builders! Now it is time to think about and plan for the Showcase Challenge on page 21 which will help prepare for your 4-H Achievement. On page 23 is your portfolio page where you can make sure all your Exploring Woodworking Project Skills Chart is complete. There will also be space for you to write down some thoughts and reflections on the project (what you liked, didn't like, etc.).
Showcase Challenge

Have members use their Member Manual to help them in organizing what they have learned. The form of presentation can vary according to the wishes of the leaders and member's ability. Information could be presented in many forms, some of which are: posters, pamphlets, written reports, speeches, computer presentations, displays, etc. Suggestions are listed on the Showcase Challenge page at the back of the member workbook. The best results are almost always obtained when members are allowed to present their information in the style of their choice.
Once members have completed all the builders they will have a lot of information recorded in their manuals. These are products of their learning. As a final project activity, members and leaders will pull together all this learning in completing the My 4-H Portfolio Page in the Member Manual. There is a skills chart that lists the skills members are expected to complete by the end of the project. Leaders must indicate how they know the member was successful at a particular skill. Leaders will find evidence if they think about what they have observed members doing, what discussions they have had with members, and what members have produced. If leaders think that members need to go back and improve on any skill, this chart helps them clarify what needs to be done.
In the Member Manual

**Above and Beyond!**
In addition to project skills, 4-H also increases skills in meeting management, communications, leadership, community involvement through participation in club, area, or provincial 4-H events or activities. List below any activities you participated in this year in 4-H.
(Some examples include Executive Positions Held, Workshops, Communication, Community Service, Rally, Bonspiels, Conferences, Judging, Camps, Trips, Awards, Representation to Area or Provincial Councils, etc)

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**Feel Free to add additional pages that include awards, certificates, new clippings, photos or other items that describe your 4-H involvement.**

**Member Point of Pride!**

What I learned...

What I need to improve on...

What I want others to notice...

Member's Signature: __________________________

**Point of Praise! Another's perspective on your achievements in 4-H.**
(community professionals, 4-H head leaders, friends of 4-H)

I am most impressed by...

I believe that you have learned...

In the future I encourage you to...

Signature: __________________________
4-H Achievement

4-H Achievement is... a 4-H club celebration when members have completed their projects. Achievements are planned by the club to give recognition to members and leaders for their accomplishments in their 4-H projects and club activities.

A 4-H Achievement can take many different formats: from choosing a theme, to member project displays, to members using their new skills for the event (entertainment, food, decorating, photographer, etc.), to members presenting their project to the whole group, the options are endless and open to the creativity of the members and leaders in each club!

Clubs may also plan their Achievement to promote 4-H to the community or to recognize sponsors and others who have helped the club.

Members and leaders - be sure to check your project books for the project completion requirements, so you will be ready for your club's Achievement celebration!

If you have any questions, comments or suggestions for this or other 4-H projects contact:

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This manual is for educational use only and is not intended as professional advice.

For more information about 4-H and the many 4-H opportunities available please visit

http://www.gov.mb.ca/agriculture/4-h/
What is 4-H?

4-H is an international youth organization involving more than 7 million members in 80 countries around the world.

In Canada, 4-H began in 1913 in Roland, Manitoba as a community-based organization dedicated to growth and development of rural youth. Today’s 4-H program reaches both farm and non-farm youth across Canada. The motto of “Learn to Do by Doing” is embodied in the program, as 4-H focuses on skill development as well as personal development of life skills such as communications, leadership and citizenship.

4-H Motto

“Learn To Do by Doing”

4-H Pledge

I pledge,
My HEAD to clearer thinking,
My HEART to greater loyalty,
My HANDS to larger service,
My HEALTH to better living,
For my club, my community, and my country.

4-H Quality Equation Principles

Quality People

- Promote responsibility, respect, trust, honesty, fairness, sportsmanship, citizenship, teamwork and caring.

Quality Experiences

- Provide members with personal development and skill development experiences.

Quality Projects

- Promote and value quality effort.
- Promote high quality, safe food production within industry standards.

Manitoba 4-H project material is developed by
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