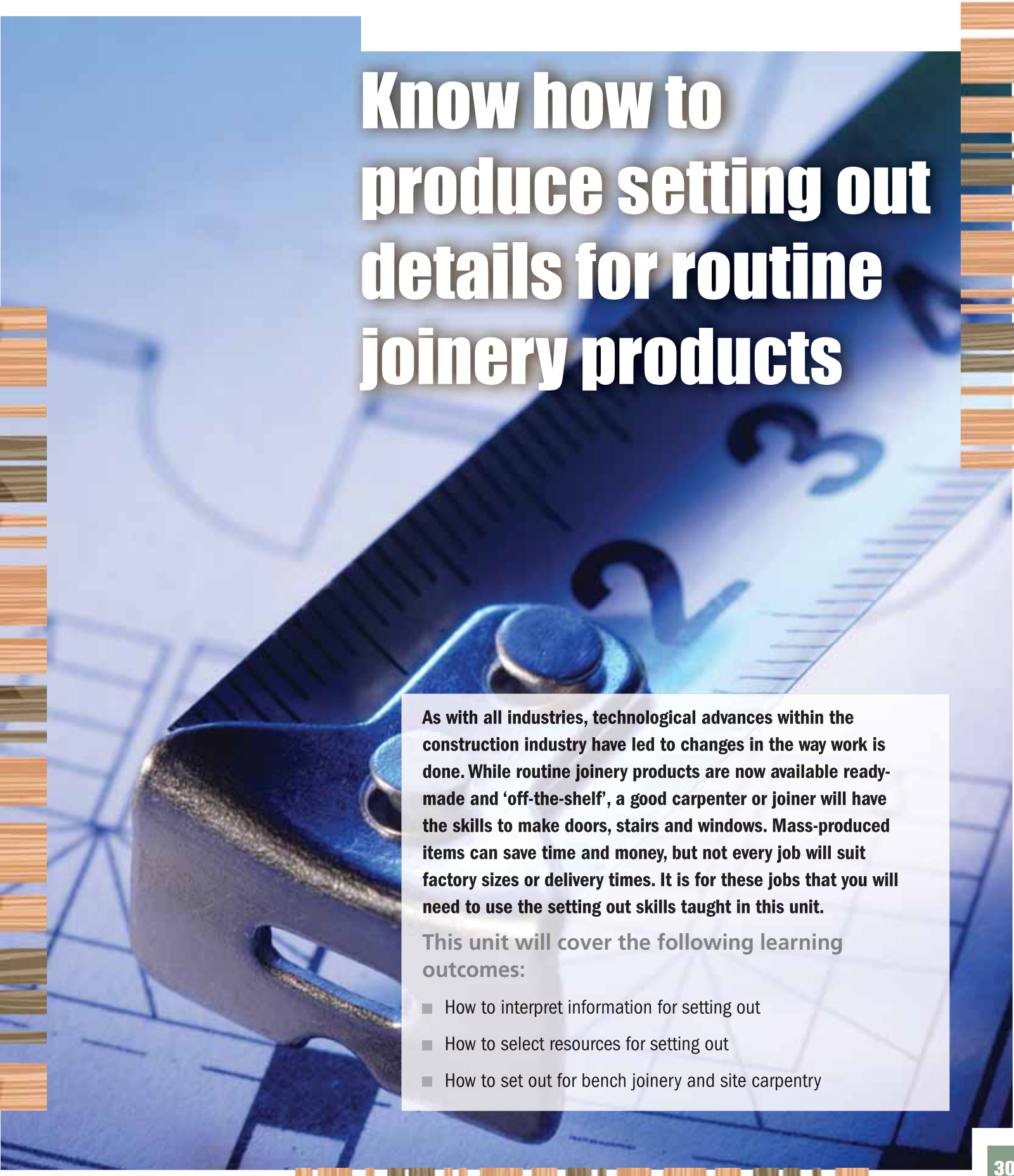
UNIT 2034

Know how to produce setting out details for routine joinery products



As with all industries, technological advances within the construction industry have led to changes in the way work is done. While routine joinery products are now available ready-made and 'off-the-shelf', a good carpenter or joiner will have the skills to make doors, stairs and windows. Mass-produced items can save time and money, but not every job will suit factory sizes or delivery times. It is for these jobs that you will need to use the setting out skills taught in this unit.

This unit will cover the following learning outcomes:

- How to interpret information for setting out
- How to select resources for setting out
- How to set out for bench joinery and site carpentry

K1. Know how to interpret information for setting out

Understanding how to interpret setting out information is a vital tool in a carpenter or joiner's arsenal. A lack of comprehension here will affect your ability to work – if you are not able to take the setting out information and turn it into the expected item built to the right size and using appropriate materials, you will spend a lot of time re-doing work you have already done, wasting your time, the company's time, and, most importantly, the client's time.

Safety tip

When painting rods or anything else, always refer to safety information on the paint tin and follow any guidelines given there

Basic setting out

At the end of this section you will understand:

- the principles of a setting out rod and its uses
- the purpose of a cutting list.

Setting out rod

A setting out rod will usually be a thin piece of plywood, hardboard or medium density fibreborad (MDF), on which can be drawn the full size measurements of the item to be made. It is often painted white to improve the clarity of the drawing.

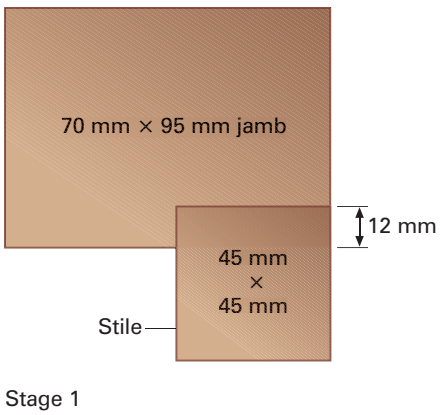


Figure 34.1 White setting out rod for small, four-pane sash

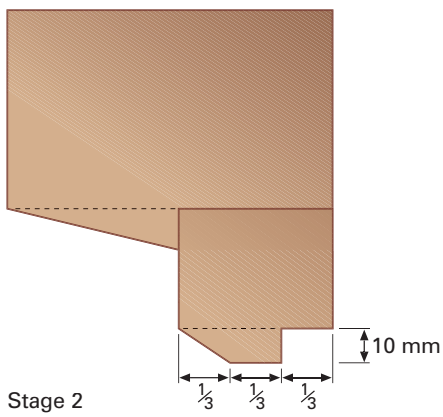


Figure 34.2 Height and width sections

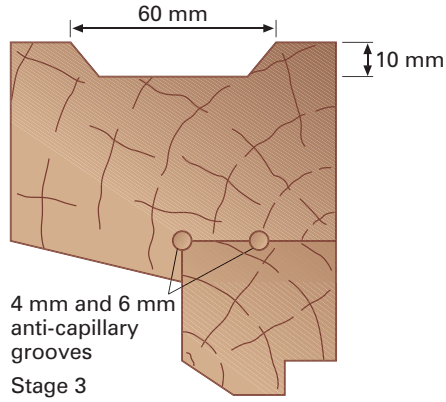


Figure 34.3 Rod with critical dimensions for a single panel glazed door

Rods can be used time and time again, simply by re-painting the surface upon completion of a task. If marked rods are to be kept for re-use they must be referenced and stored safely.

Key term

Setter out – an experienced bench joiner whose job is the setting out of joinery products

Upon receipt of scale drawings, specification and any on site measurements the **setter out** will produce a full size, horizontal and vertical section through the item by drawing it on a setting out rod. See Figure 34.1.

Elevations may also be drawn on setting out rods. This is particularly valuable for shaped or curved work, as the setter out can get a 'true' visual image of a completed joinery item.

Although rods are marked up full size, certain critical dimensions can be added as a check against any errors or damage to the rod. These are usually:

- **sight size** – the size of the innermost edges of the component (usually the height and width of any glazed components and, therefore, sometimes referred to as 'daylight size')
- **shoulder size** – the length of any member between shoulders of tenons
- **overall size** – the extreme length and width of an item.

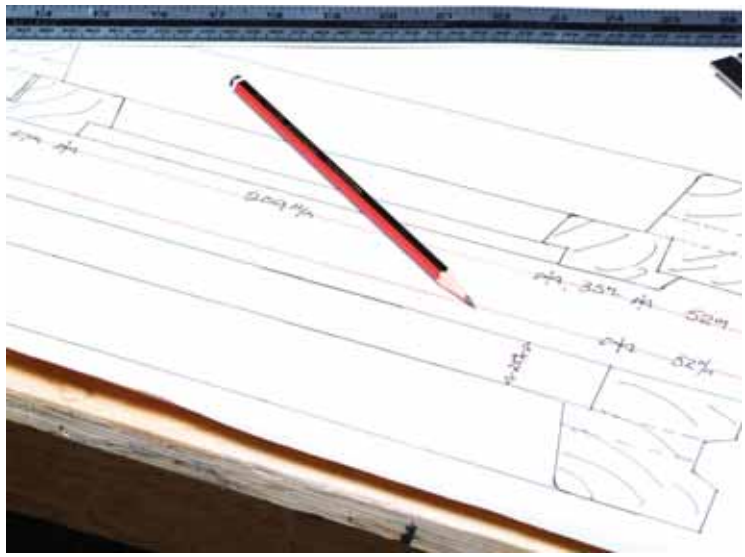


Figure 34.4 Rod marked up for a casement window

Developing drawn components

When producing workshop rods an inexperienced or apprentice joiner can sometimes have problems when building up a detailed section of timber. To overcome this, use the following step-by-step guidelines.

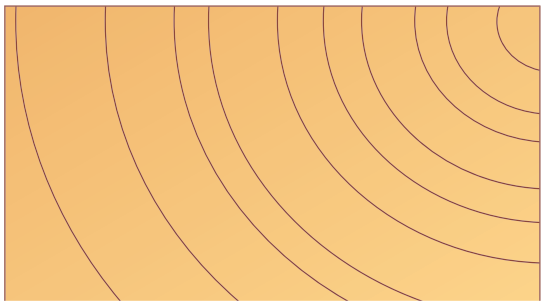


Figure 34.5 Step 1 Draw the components as a rectangular section

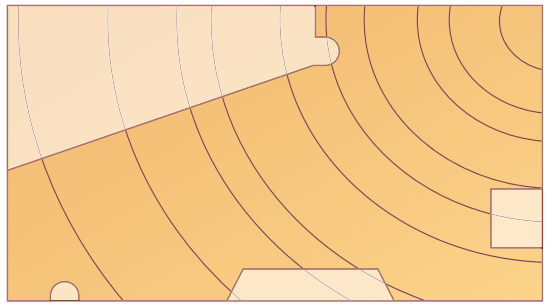


Figure 34.6 Step 2 Add any rebates, grooves and mouldings

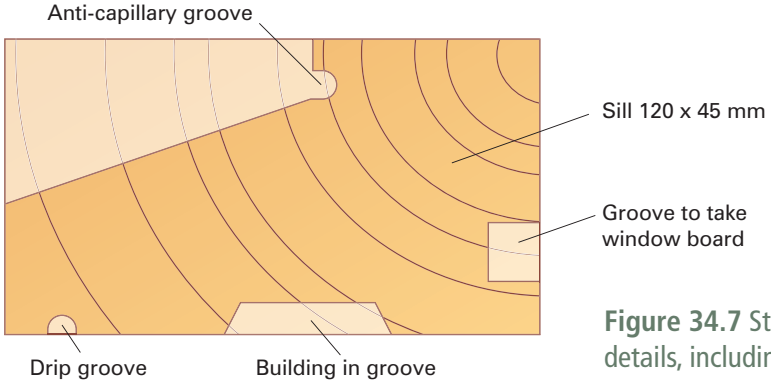


Figure 34.7 Step 3 Add all other details, including any labelling

Cutting lists

Once the setting out rod has been completed the cutting list can be compiled. The cutting list is an accurate, itemised list of all the timber required to complete the job shown on the rod.

The cutting list will need to be referred to throughout the manufacturing process. It is, therefore, good practice to include the cutting list on the actual rod wherever possible.

Although there is no set layout for a cutting list, certain information should be clearly given in all lists. It should include:

- a reference for the setting out rod, i.e. rod number
- the date the list was compiled
- a brief job description
- the quantity of items required
- thecomponent description (e.g. head, sill, stile etc.)
- the component size, both sawn and finished (3mm per face should be allowed for machining purposes)
- any general remarks.

An example cutting list is shown in Figure 34.8.

Timber cutting list

Job description: Two panel door			Date: 8 Sept 2010			
Quantity	Description	Material	Length	Width	Thickness	Remarks
2	Stiles	S wood	1981	95	45	Mortise/groove for panel
1	Mid rail	"	760	195	45	Tenon/groove for panel
1	Btm rail	"	760	195	45	Tenon/groove for panel
1	Top rail	"	760	95	45	Tenon/groove for panel
1	Panel	Plywood	760	590	12	
1	Panel	"	600	590	12	

Figure 34.8 A cutting list

Check work for accuracy

Whatever brief you are given regarding work to be carried out, it is important that it is checked and confirmed to be accurate. Failure to check for accuracy will result in parts of, or whole tasks being done incorrectly. This in turn can lead to the work having to be re-done, which can be very costly in both time and money.

Drawings should match each other, as well as matching the measurements of the area. It is of no use to anyone if the drawing shows a window to be made 2 metres high and the opening is only 1.9 metres high. It is also important to check that all drawings and specification meet the client's requirements. Sometimes drawings may have been changed slightly to meet regulations, and the client must be kept informed. Alternatively, a client might change their mind once they see a drawing, leading to slight alterations or variations.

If you discover any discrepancies it is vital that you inform your supervisor and any people who are associated with the task. If they continue to work to incorrect drawings the work they produce will be wrong and can prove to be costly.

K2. Know how to select resources for setting out

You may be familiar with the expression 'a good carpenter always has the right tools for the job'. What you might not know is that tools means more than just those of the hand and power varieties. Tools used in that context means equipment, and a carpenter and joiner needs to have the right timber, sheet material, or man-made board at his or her disposal. After all, the best equipped toolbox in the world is useless when there is nothing around to work with.

Identification of timber and materials

The identification of timber has been covered in Unit 8, pages 148–151. As you become more skilled, you will find that you are working with a variety of materials, not all of them timber. Sheet materials are often used in joinery work.

The standard size for sheet material is 2400 x 1200 mm, although it is also available in 1800 x 1200 mm, 1800 x 900 mm, and 1200 x 600 mm, going on in increments of 300 mm. The thickness of the sheet varies in multiples of 3 mm, and so goes 3 mm thick, 6 mm thick, 9 mm thick, and so on.

Timber sizes vary greatly with all dimensions and can be made available or machined to any size. Lengths of timber usually start at 1200 mm and rise in increments of 300 mm. The width and thickness of timber are still usually referred to in imperial sizes such as 3" × 2" as opposed to 50 mm x 75 mm. These sizes are numerous by usually go up in 1" or 25 mm increments such as 2" × 1", 2" × 2", 3" × 2".

Whatever the work involved, the quality of the finished product depends upon the skill of the operator in selecting and using the correct tools to cut, shape and assemble the right materials for the task.

K3. Know how to set out for bench joinery and site carpentry

There is a range of skills involved in knowing how to set out for bench joinery and site carpentry and in this section you will find an overview. Once you have selected the appropriate materials for the job, as covered in the previous section, you will need to choose the right tools for the task at hand, know which joints are suitable for the project and how to plan your work so that you complete the job on schedule.

Measuring and marking out tools

Remember

Imperial measurements (e.g. yards, feet, inches) have been replaced by metric (e.g. metres, millimetres), but most older items will have been constructed in imperial

The main tools for measuring and marking out are:

- folding rules
- retractable steel tape measures
- metal steel rules
- pencils
- marking knife
- tri-square
- sliding bevel
- mitre square
- combination square
- gauges (marking, mortise and cutting gauges)
- callipers and dividers.

Figure 34.9 Folding rule

Folding rules

Folding rules are used in the joiner's shop or on site. They are normally one metre long when unfolded and made of wood or plastic. They can show both metric and imperial units.

Retractable steel tape measures

Retractable steel tape measures, often referred to as spring tapes, are available in a variety of lengths. They are useful for setting out large areas or marking long lengths of timber and other materials. They have a hook at right angles at the start of the tape to hold over the edge of the material. On better tapes this should slide, so that it is out of the way when not measuring from an edge.

Figure 34.10 Retractable steel tape measure

Remember

Check the sliding hook regularly for signs of wear

Metal steel rules

Metal steel rules, often referred to as bar rules, are used for fine, accurate measurement work. They are generally 300 mm or 600 mm long and can also serve as a short straight edge for marking out. The rule can also be used on its edge for greater accuracy.

They may become discoloured over time. If so, give them a gentle rub with very fine emery paper and a light oil. If they become too rusty, replace them.

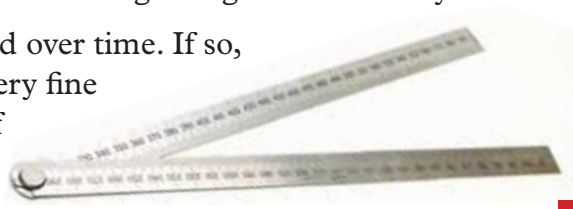


Figure 34.11 600 mm steel rule

Did you know?

The 'lead' in pencils is actually graphite, a naturally occurring form of compressed carbon. If graphite is pressed much harder, it becomes diamond

Pencils

Pencils are an important part of a tool kit. They can be used for marking out exact measurements, both across and along the grain. They must be sharpened regularly, normally to a chisel-shaped point, which can be kept sharp by rubbing on fine emery paper. A chisel edge will draw more accurately along a marking out tool, like a steel rule, than a rounded point.

Pencils are graded by the softness or hardness of the lead. B grades are soft, H grades hard, with HB as the medium grade. Increasing hardness is indicated by a number in front of the H. Harder leads give a finer line, but are often more difficult to rub out. A good compromise for most carpentry work is 2H.

Figure 34.12 A variety of pencils

Marking knife

Marking knives are used for marking across the grain and can be much more accurate than a pencil. They also provide a slight indentation for saw teeth to key into.

Figure 34.13 Marking knife

Tri-square

Tri-squares are used to mark and test angles at 90° and check that surfaces are at right angles to each other.

Tri-squares should be regularly checke for accuracy. To do this, place the square against any straight-edged spare timber and mark a line at right angles. Turn the square over and draw another line from the same point. If the tool is accurate the two lines should be on top of each other.

Figure 34.14 Tri-square

Figure 34.15 Sliding bevel

Sliding bevel

The sliding bevel is an adjustable tri-square, used for marking and testing angles other than 90°. When in use, the blade is set at the required angle then locked by either a thumbscrew or set screw in the stock.

Remember

Do not over-tighten thumbscrews on a sliding bevel as they may snap

Mitre square

The blade of a mitre square is set into the stock at an angle of 45° and is used for marking out a mitre cut.

Figure 34.16 Mitre square

Remember

All squares should be checked for accuracy on a regular basis

Combination square

A combination square does the job of a tri-square, mitre square and spirit level all in one. It is used for checking right angles, 45° angles and also that items are level.

Figure 34.17 Combination square

Gauges

Gauges are instruments used to check that an item meets standard measurements. They are also used to mark critical dimensions, such as length and thickness.

Figure 34.18 Marking gauge

Marking gauge

A marking gauge is used for marking lines parallel to the edge or end of the wood. The parts of a marking gauge include stem, stock, spur (or point) and thumbscrew. A marking gauge has only one spur or point.

Mortise gauge

A mortise gauge is used for marking the double lines required when setting out mortise and tenon joints, hence the name. It has one fixed and one adjustable spur or point. Figure 34.20 shows setting of the adjustable point to match the width of a chisel.

Figure 34.19 Mortise gauge

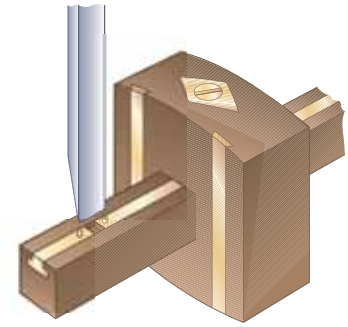


Figure 34.20 Setting mortise gauge to chisel blade width

Cutting gauge

The cutting gauge is very similar to the marking gauge, but has a blade in place of the spur. This is used to cut deep lines in the timber, particularly across the grain, to give a clean, precise cut (e.g. for marking the shoulders of tenons).

Callipers and dividers

Callipers and dividers enable accurate checking of widths and gaps. They can have a simple friction joint or knurled rod and thread. The latter are more accurate for repetitive work, as the width setting can be maintained.

Callipers are designed for either internal and external gaps. Although some come with a graduated scale, it is usually better to check measurements against a steel rule.

Figure 34.21 External and internal callipers

Organising work in sequence

One of the most important things to consider when organising work is the sequence of operations. If you get this wrong it can lead to work having to be re-done. When making windows, for example, you would not fully fit the glass and glazing bead before the window is installed as you may need to fix the window through the rebate where the glass sits. To do this once the window was installed would mean having to remove the glass, fit the window and re-install the glass. This is extra work which is unnecessary and will add time and money.

Experience helps when planning a sequence of operations. There are times when mistakes are made in the sequencing and things have to be re-done, but it is always a good idea to list the sequence of operations before starting the work.

Woodworking joints

At the end of this section you should be able to:

- understand simple jointing methods used on doors and windows
- identify the main joints used in the assembly of units and fitments
- state the correct jointing methods used on a common staircase.

Halving Joints

Halving joints are used where two pieces of timber overlap and can be used for lengthening or on corners. They are relatively simple joints to construct, but variations can make them stronger and more difficult such as dovetail or mitred halving.

Edge joints

Edge joints are where the timber is joined along its edge and is used in lengthening usually in the form of a finger-type joint.

Lengthening

Other edge-type joints are simple butt joints where a decorative piece of timber is placed along the edge of a material, such as plywood to disguise the rougher edge. In some cases the edge joint can take the form of a tongue and groove joint.

Draw boring

To give additional strength to a through mortise and tenon style joint and to pull the joint tight, a timber dowel is fixed through the face of the frame's head and into the tenon. The hole should be previously drilled in the face and then slightly off-centre in the tenon. When the dowel is knocked home the joint is pulled tight. This method is known as draw boring.

Joints used on doors and windows

During the manufacture of doors and windows the mortise and tenon joint is extensively used. The type of mortise and tenon will depend on its location. Examples of this joint are described over the next few pages.

Through mortise and tenon

In a through mortise and tenon joint a single rectangular tenon is slotted into a mortise. See Figure 34.22.

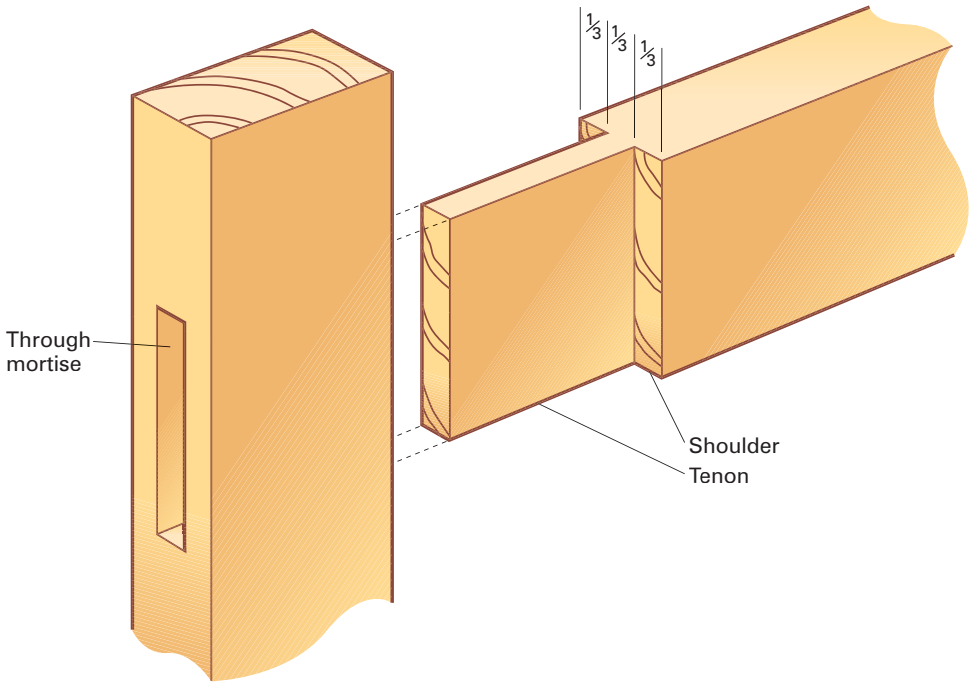


Figure 34.22 Through mortise and tenon

Stub mortise and tenon

In a stub mortise and tenon joint the tenon is stopped short to prevent it protruding through the member. See Figure 34.23.

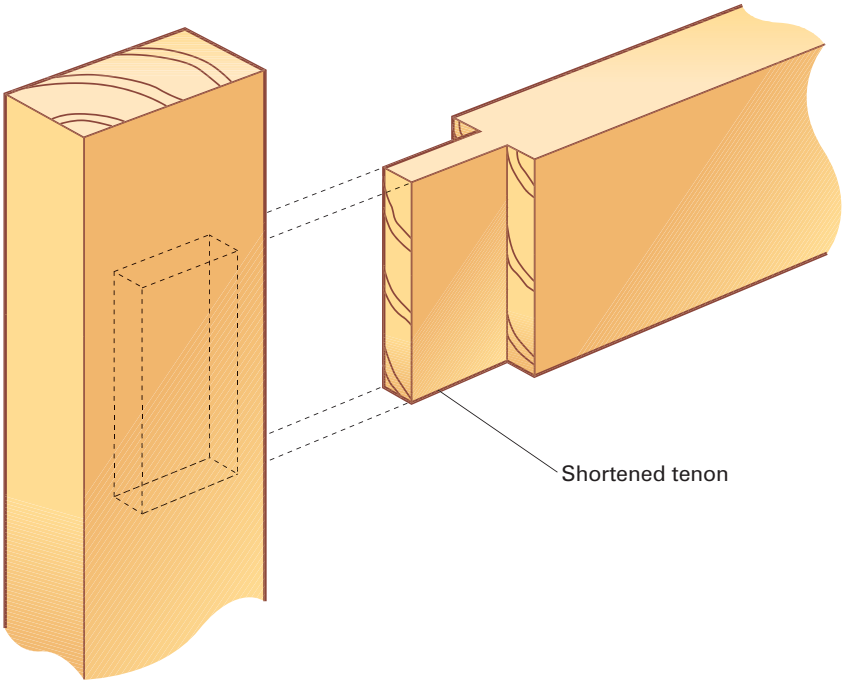


Figure 34.23 Stub mortise and tenon

Haunched mortise and tenon

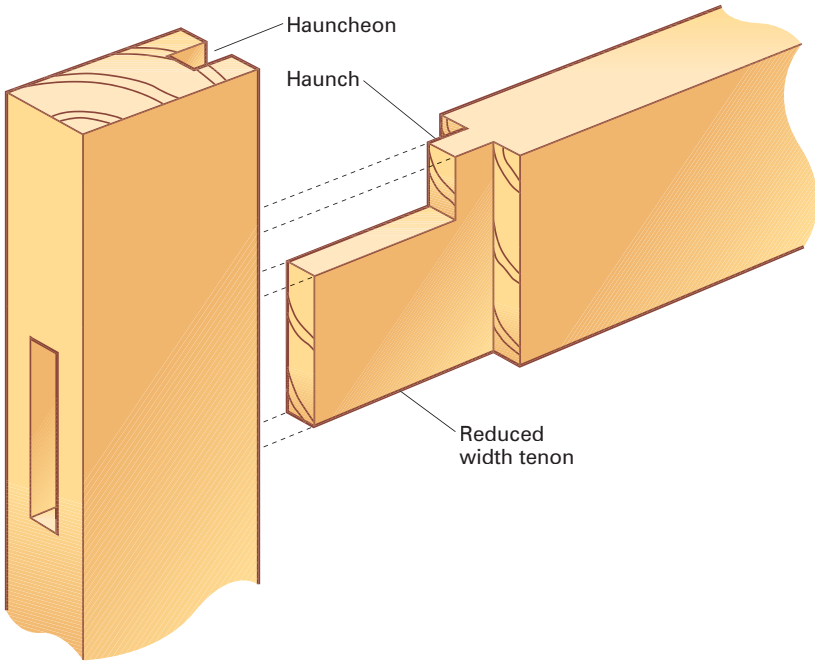


Figure 34.24 Haunched mortise and tenon

In a haunched mortise and tenon joint the tenon is reduced in width, leaving a shortened portion of the tenon protruding which is referred to as a haunch. See Figure 34.24. The purpose of the haunch is to keep the tenon the full width of the timber at the top third of the joint. This will prevent twisting. A haunch at the end of the member will aid the wedging-up process and prevent the tenon becoming **bridled**. For a detailed description of the wedging-up process look at Unit XX Assembling joinery products.

Key term

Bridled – an open mortise and tenon joint. A tenon that has bridled is one that has no resistance and so is not secure

Twin mortise and tenon

In a twin mortise and tenon joint the haunch is formed in the centre of a wide tenon, creating two tenons, one above the other. See Figure 34.25.

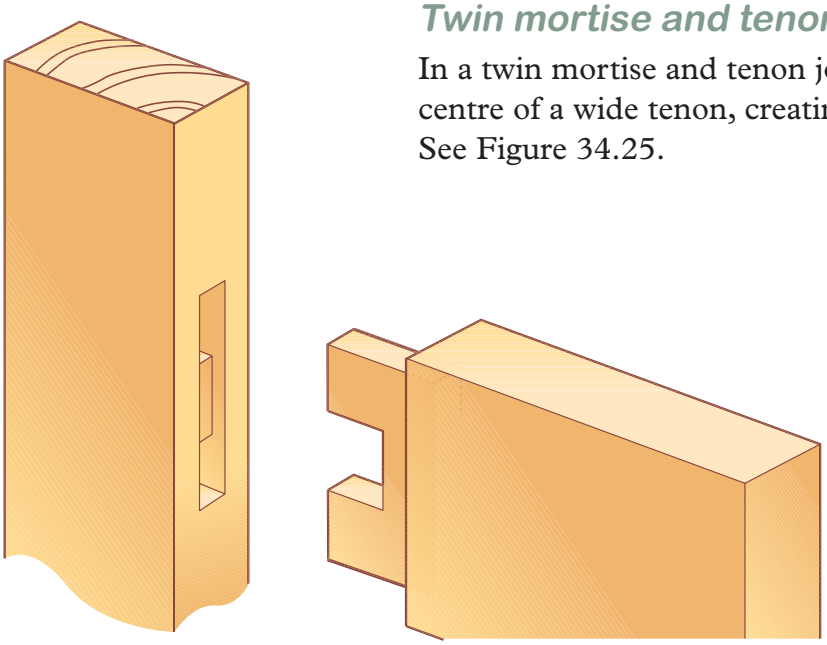


Figure 34.25 Twin mortise and tenon

Double mortise and tenon

For a double mortise and tenon, two tenons are formed within the thickness of the timber. See Figure 34.26.

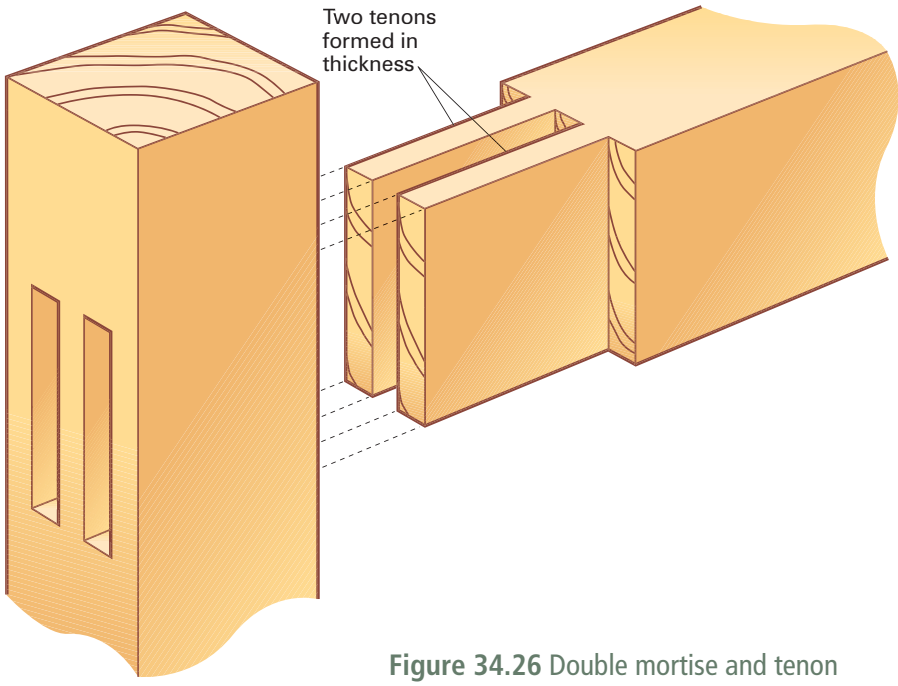


Figure 34.26 Double mortise and tenon

Stepped shoulder joint

Used on frames with rebates, a stepped shoulder joint has a shoulder stepped the depth of the rebate. This joint can also be combined with haunched, twin or stub tenons. See Figure 34.27.

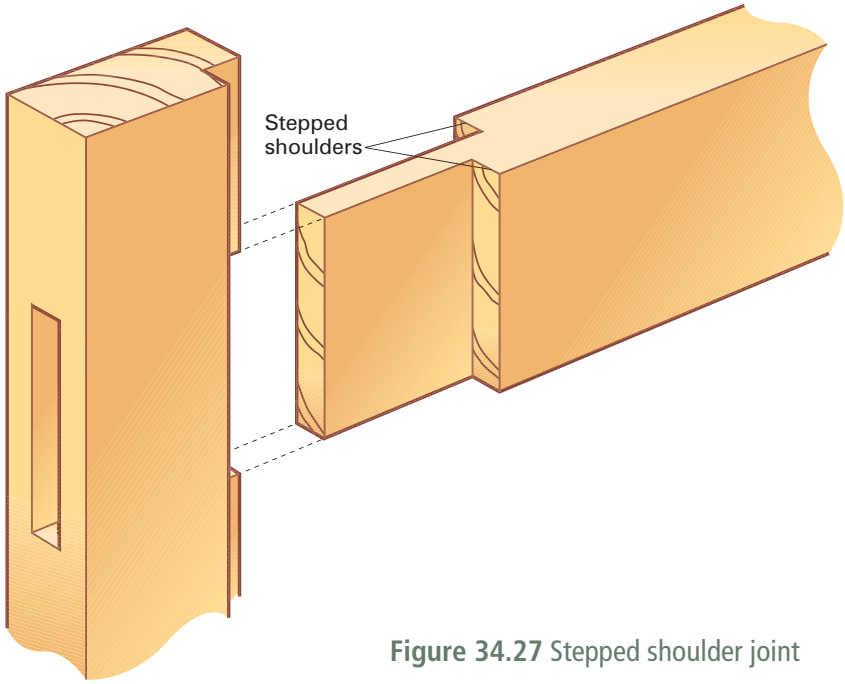


Figure 34.27 Stepped shoulder joint

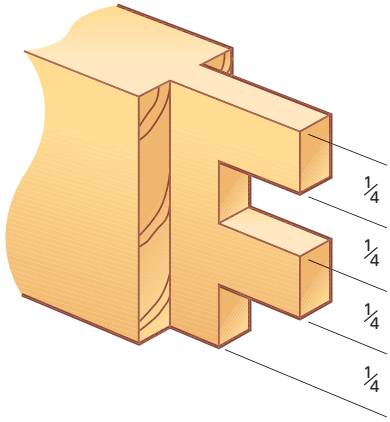


Figure 34.28 Twin tenon with twin haunch

Twin tenon with twin haunch

A twin tenon with twin haunch joint is used on the deep bottom rails of doors. See Figure 34.28.

Basic rules on mortise and tenon joints

The proportions of mortise and tenon joints are very important to their strength. Some basic rules are as follows:

- Tenon width should be no more than five times its thickness. This prevents shrinkage and movement in the joint. If more than five times then a haunch should be introduced.
- The tenon should be one-third of the thickness of the timber. If a chisel is not available to cut a mortise at one-third, the tenon should be adjusted to the nearest chisel size.
- When a haunch is being used to reduce the width of a tenon, then about one-third of the overall width should be removed. The depth of a haunch should be the same as its thickness.
- Although a tenon should be located in the middle third of a member, it can be moved either way slightly to stay in line with a rebate or groove.

Joints used in units and fitments

Key term

Tensile forces – a force that is trying to pull something apart

During the design and setting out of units and fitments the most common joint used is the mortise and tenon, but these are not the best if there are forces likely to try to pull the joint apart. These are called **tensile forces**.

Parts of a unit or fitment subject to such forces must incorporate a joint design that will allow for this. A drawer on a unit is often subject to tensile forces, so a dovetail joint would be used.

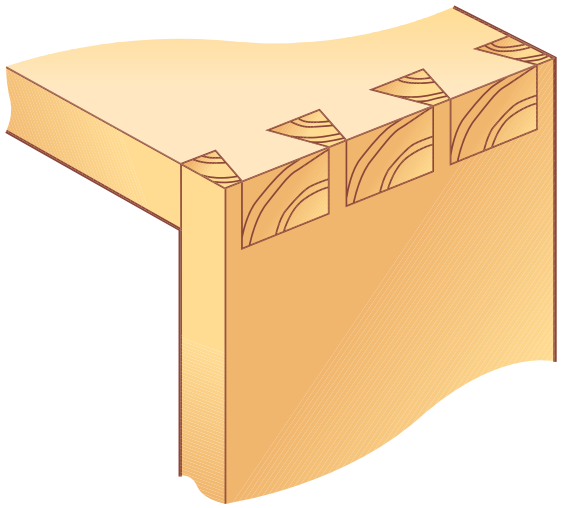


Figure 34.29 Through dovetail joint

Dovetail joints

The two most common types of dovetail joint are through and lapped. A through dovetail joint is shown in Figure 34.29 and a lapped dovetail in Figure 34.30.

Dovetail joints should have a slope (sometimes called the pitch) of 1:6 for softwoods, or 1:8 for hardwoods. If the slope of the dovetail is excessive then the joint will be weak due to short grain. If the slope is insufficient the dovetail will have a tendency to pull apart. The slope (or pitch) is shown in Figure 34.31.

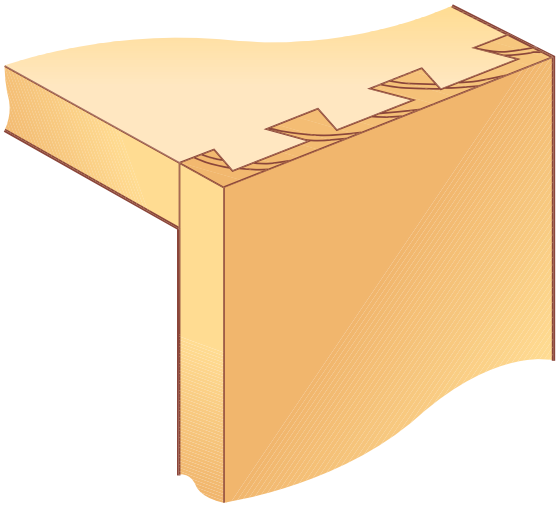


Figure 34.30 Lapped dovetail joint

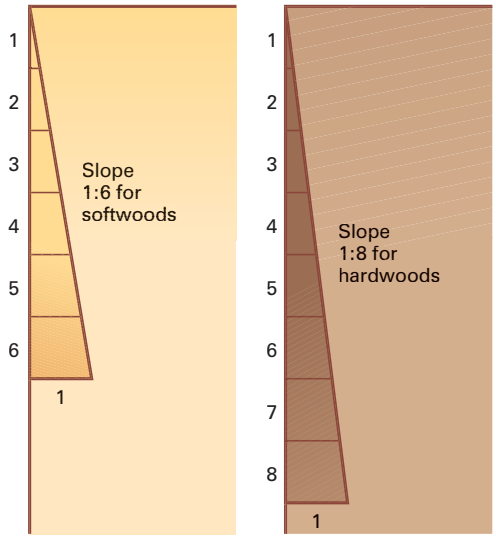


Figure 34.31 Slope of a dovetail joint

Correct jointing methods on staircases

The most common joint used in staircase construction is a **stopped housing joint**. This joint is used to locate or house the tread and riser of a step into the string. It will be stopped at the nosing of the tread. The minimum housing depth is 12 mm. See Figure 34.32.

When the string of a stair meets a newel post, a stubbed and haunched mortise and tenon joint is used, as shown in Figure 34.33. More information on this type of joint can be found earlier in this unit.

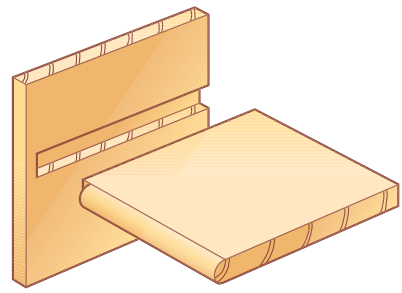


Figure 34.32 Stopped housing joint (staircase)

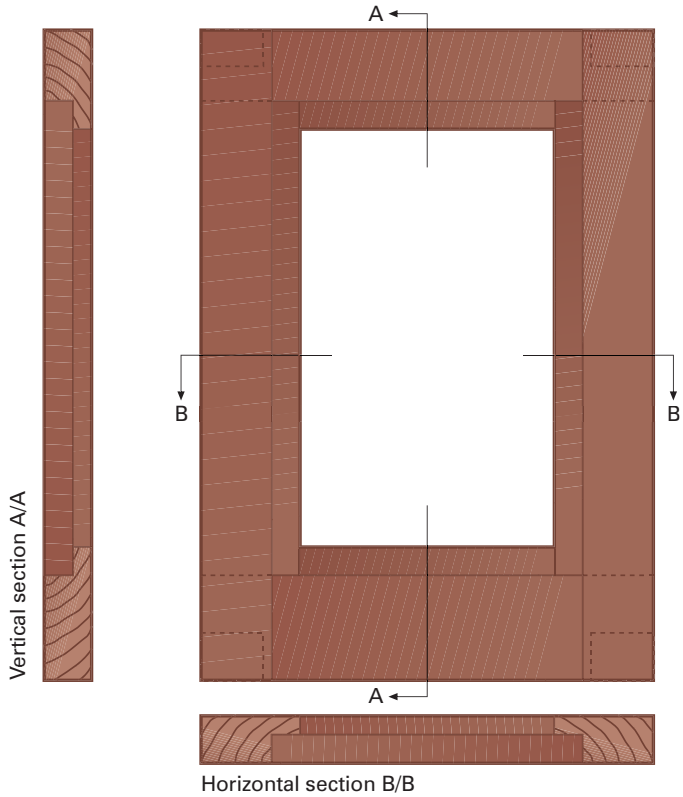


Figure 34.33 Housed string with mortise and tenon

Key term

Stopped housing joint – where a cut does not go completely through the timber

Did you know?

The best way to understand how joints are assembled and used is to get some timber, some tools, get in a workshop and practise, practise, practise!

FAQ

How do I choose between hardwood and softwood for a job?

The type of timber you should use for a job is usually detailed in the specifications. There are several reasons why one type of wood is chosen over another. Hardwood is usually more expensive and longer-lasting than softwood. It is often grown in the hot climates of equatorial countries (e.g. African and South American countries) and is used for jobs where the wood will be visible (i.e. high-class joinery). Softwood is usually grown in countries with cooler climates. It is often cheaper than hardwood and used for jobs where the wood will be concealed (e.g. floorboards and rafters).

Why would you need sawn sizes on a cutting list?

By putting sawn sizes on the cutting list the machinist will quickly be able to determine the most cost-effective sections of stock to use from the timber rack.

Check it out

1. What drawings should setting out rods contain?
2. Why should rods be stored after the component is made?
3. Explain the purpose of face and edge marks.
4. Explain the process of marking out.
5. Describe the purpose of cutting lists.
6. Explain what a haunch is and why is it used.
7. What type of joint is used in door frames?
8. Explain what draw boring is.
9. Show, using sketches, a way in which edge joints can be formed.
10. Show by way of a sketch three different halving joints.
11. Explain the importance of deadlines.
12. Explain the purpose of a sequence of operations.

Getting ready for assessment

The information contained in this unit, as well as continued practical assignments that you will carry out in your college or training centre, will help you with preparing for both your end of unit test and the diploma multiple-choice test. It will also aid you in preparing for the work that is required for the synoptic practical assignments.

The information contained within this unit will aid you in learning how to identify and calculate the materials and equipment required to produce setting out details for routine joinery products.

You will need to be familiar with:

- interpreting information for setting out
- selecting resources for setting out
- setting out for bench joinery and site carpentry

Setting out is a key stage in working in carpentry. Learning outcome three has shown the correct tools that are needed for setting out and explained the uses and proportions of different joints. You will need to use this knowledge to measure and mark out using the correct tools and to specifications. There is a large range of items that need to be set out in carpentry and joinery, such as doors, frames, linings, units, staircases, studwork, floor joists and wall plates.

This unit has also explained the importance of deadlines and organising procedures into the correct sequence. This will be vital for both the practical assignments you will carry out and in your professional life. Meeting deadlines is important for your reputation and procedures will help you to do this without compromising the quality of your final work.

Before you start work on the synoptic practical test it is important that you have had sufficient practice and that you feel that you are capable of passing. It is best to have a plan of action and a work method that will help you. You will also need a copy of the required standards, any associated drawings and sufficient tools and materials. It is also wise to check your work at regular intervals. This will help you to be sure that you are working correctly and help you to avoid problems developing as you work.

Your speed at carrying out these tasks will also help you to prepare for the time limit that the synoptic practical task has. But remember, don't try to rush the job as speed will come with practice and it is important that you get the quality of workmanship right.

Always make sure that you are working safely throughout the test. Make sure you are working to all the safety requirements given throughout the test and wear all appropriate personal protective equipment. When using tools, make sure you are using the correctly and safely.

Good luck!

CHECK YOUR KNOWLEDGE

1 Plans or drawings should be set out, full scale on a:
- **a** marking out rod.
- **b** setting out rod.
- **c** setting out board.
- **d** marking out board.

2 Why are setting out rods often painted white?
- **a** so they can be easily found.
- **b** to conceal any defects in the wood.
- **c** to aid the clarity of drawing.
- **d** to protect the wood.

3 What can also be marked on setting out rods?
- **a** general remarks.
- **b** the date the setting out rod was created.
- **c** rough sketches.
- **d** elevations.

4 Hardwood trees are:
- **a** coniferous.
- **b** evergreen.
- **c** deciduous.
- **d** pine trees.

5 The difference between hardwood and softwood is:
- **a** hardwoods are hard.
- **b** hardwoods are soft.
- **c** there is no difference.
- **d** botanical.

6 A timber that is creamy white with occasional dark streaks, and can be used for building furniture and boats, is:
- **a** pitch pine.
- **b** teak.
- **c** ash.
- **d** western red cedar.

7 A manmade board with compressed wood flakes is called:
- **a** plywood.
- **b** blockboard.
- **c** chipboard.
- **d** fibreboard.

8 Which tool could you use instead of a pencil, when you want to mark measurements very accurately?
- **a** marking gauge.
- **b** tri-square.
- **c** marking knife.
- **d** callipers.

9 What are dividers used for?
- **a** accurate checking of widths and gaps.
- **b** marking out measurements.
- **c** measuring angles.
- **d** marking length and thickness.

10 Which tool is best for marking deep lines?
- **a** mortise gauge.
- **b** marking gauge.
- **c** cutting gauge.
- **d** combination square.