2. Measuring a Garden and Recording the Details

Overview

This Module shows you how to accurately gather information, which then lets you draw the outline of your garden and plot any existing features.

This drawing will form the foundation of your design; so it’s important that you can measure and record the existing state of the garden.

We cover the following topics:
- The maths
- Triangulations
- Chain surveys
- Level surveys

The Maths!

If you’re appalled with areas and horrified by the hypotenuse, fear not. For over the next few pages we hope to dispel the mysteries surrounding the subject.

You’ll find that a few simple techniques will increase your speed and accuracy when it comes to collecting your measurements and plotting them on your plan.

Other than simple multiplication, subtraction, division and addition, you’ll need surprisingly few calculations. These are:
- Areas
- Triangulation
- Chain surveys
AREAS

WHY DO WE NEED TO KNOW THE AREA OF A GARDEN?

There are many reasons, but here are two of the more common ones:

1. You may choose to charge for their design based upon the size of the plot, and so you’ll have to calculate the area in order to price the job.

2. It is a handy tool for giving estimates on the cost of building the garden. A client may want to know roughly how much things cost before they get started.

HOW DO WE CALCULATE THE AREA?

This formula should bring back memories of chalkboards and wooden rulers:

Length $\times$ Width = Area

We abbreviate this to:

Length $\times$ Width = Area

“That’s all very well for gardens that are square or rectangular”, you cry, “but what about those that are ‘funny’ shapes?”

There is a simple way of solving this inevitable problem. First, we need to get to grips with a slight variation of the above formula.

HOW TO FIND THE AREA OF A TRIANGULAR PART OF THE GARDEN

Look at the rectangle in Figure 2.1. We have divided it into two equal parts by drawing a line through it, from corner to corner.
What is the area of one of these new triangles?

![Figure 2.1: A simple rectangle broken into two equally sized triangles](image)

We’ve already established that the rectangle has been divided into two equal halves.

Therefore, the area of the triangle must be half the area covered by the rectangle.

The area of the rectangle is $5 \times 10 = 50 \text{ units}^2$.

So the area of the each triangle is therefore $50$ divided by $2 = 25 \text{ units}^2$.

**Another way of working out area, using right angled triangles**

We can also find the area of the triangles using the following formula:

\[
\text{Area of a right-angled triangle} = \left(\frac{\text{Height}}{2}\right) \times \text{width}.
\]

Working through the above example will demonstrate this.

\[
\begin{align*}
\text{Area of triangle} & = \left(\frac{5}{2}\right) \times 10 \\
& = 2.5 \times 10 \\
& = 25 \text{ units}^2
\end{align*}
\]

Have a go at these to make sure you have got the hang of it. And then we
will discuss how we can apply these techniques.

**EXERCISE 2.1**

We have used metres as a unit of measure. But if you prefer to work in imperial, please feel free to change the units. For example, you can use 34 feet instead of 34 metres.

1. Mr & Mrs Smith have a rectangular garden which measures 34 metres in length by 18 metres in width. What is its area?

2. Mr & Mrs Clark have a rectangular garden which measures 25.5 metres in length by 24 metres in width. What is its area?

3. Mr Jackson has a triangular garden. Assuming that the triangle is a right angled triangle, is 35 metres long and 12 metres wide, what is the area of the triangle?

Use your workbook to do this exercise – it has more space.

Now for the fun part! Figure 2.2 demonstrates how to use these simple shapes to measure even the most complicated of areas. Being faced with this shape to measure would send a shiver down most people's spine.

But now that we have broken the area into simple shapes, the task is much more manageable.
WORKING WITH CURVES

It works with curves too! Figure 2.3 demonstrates that you can be as accurate as you like using this method. But before you get too carried away, remember that we aren’t rocket scientists, and an approximate figure is all we’re ever likely to need.
**TRIANGULATION**

You must be able to identify the position of boundaries and existing features accurately.

Look at Figure 2.4. Where on a plan would you place a tree that’s not lined up with anything in the garden?

Triangulation is one way of achieving this. And there are no extra points for guessing that we will be using triangles to achieve this!

Figure 2.4 demonstrates this technique. By measuring from two known points, you can mark a third point. To pin-point the tree, you take a measurement from two corners of the house.

Our tree is 8m from one corner of the house, and 5m from the other corner. By using a compass on your plan, you could draw two lines (equivalent to 8m and 5m). These two lines meet at the tree.

<table>
<thead>
<tr>
<th><strong>EXERCISE 2.2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Find a point in your garden. Measure its distance from two other points, such as the ends of your house.</td>
</tr>
<tr>
<td>If you can, plot its location on a sheet of graph paper. Use a scale of 1:100 to do this. In other words, 5 metres on the ground will be 5cm on the paper.</td>
</tr>
<tr>
<td>For this exercise, you will need a pair of compasses, which you will find in a stationers like WH Smith.</td>
</tr>
</tbody>
</table>
FIGURE 2.4: USING TRIANGULATION TO LOCATE A POINT

As Figure 2.4 shows, triangulation is simple and accurate. On your plan, you can place the client’s tree exactly where it should be. No guess work!

EXERCISE 2.3

As we are about to see, triangulation is not the only method of accurate measuring. However if triangulation is so quick, easy and accurate, why do we need to know of another way?

See if you can think of a reason. Then look at the end of this module for the answer.

CHAIN SURVEYS

A chain survey. It sounds like something only to be attempted by a surveyor with several letters after their name, or somebody looking into the pros and cons of heavy lifting apparatus!

That isn’t the case. A chain survey is a straightforward and accurate method
of plotting objects. It’s called a chain survey simply because in the good old days chains were used instead of tape measures, and links were used as units.

So a chain survey is only as complicated as laying a few tapes out on the ground from some fixed points. Figure 2.5 demonstrates how to use two tapes to mark the position of a tree.

**THE 3, 4, 5 TRIANGLE**

It’s important that these tapes are perpendicular (at right-angles) to each other and from the point of origin (the house in Figure 2.5.).

You can check this using a large set square, or by measuring out a '3,2,5 triangle'.

This is the last thing on triangles we promise (well in this section, anyway!).

A 3,4,5 triangle is a useful way of checking and setting up right angles. A triangle which measures 3 units along its base, 4 units along its side and 5 units along its hypotenuse will always have a right angle at the point where the base and side meet. Figure 2.6 demonstrates this.
EXERCISE 2.4

Imagine you’re setting up a 3,4,5 triangle, using a tape. You’ll be using 1 metre as your base unit. What would be the measurement on the tape at point A, B and C in Figure 2.7? The tape starts at point A, goes to point B, then to point C and finally back to point A.
WHY CHAIN SURVEYS SOMETIMES BEAT TRIANGULATION

Referring back to Figure 2.5, you can see the advantage of using a chain survey over triangulation.

If we had tried to use triangulation, the shed would have made it impossible to get an accurate measurement from one of the corners of the house. If you are working in a mature garden, there will be many obstacles to measure around: large shrubberies, outbuildings, raised beds, and walls and fences, for instance.

EXERCISE 2.5

Take the same object you measured in Exercise 2.2. Now plot it on a sheet of paper, using a chain survey. You will need a tape measure for this.

RECORDING THE INFORMATION

The way in which you record the information about the garden may vary from one garden to another.

A very simple plot, perhaps that of a newly built house, which has a simple shape, has very little in it, and is level. You would easily record all of the details on one sheet of paper.

But a larger, more complex site, with lots of existing features and different levels, would be more simply read if recorded on two or more sheets.

To measure a garden, you should go armed with the following equipment.

1. 30m (100ft) Tape measure or perhaps 100m (330ft) for larger sites.
2. 3-5m (10-15ft) steel tape.
3. Clipboard
4. A4 pad
5. Pencil and eraser (A pencil will work in the wet)
6. Ruler
7. Sturdy boots or Wellingtons.
8. Durable coat

There are two types of measurement that you can use to record distance. Each has its own merits.

- Absolute
- Relative
**ABSOLUTE MEASUREMENTS**

This is quite simply the distance between two points. It is used for triangulation, and perhaps to confirm a relative measurement.

**RELATIVE MEASUREMENTS**

Of the two measuring techniques, you should use this more often. It’s quicker and more accurate when measuring several items over larger distances. This is the method of measurement associated with chain surveys.

You choose a point as a base mark (0.0m), and take a series of measurements from it. There can be several base marks in one garden.

![Diagram showing absolute and relative measurements](image)

**Figure 2.8**

A demonstration of absolute and relative measurements

- Absolute measurements
- Relative measurements
MEASURING HEIGHTS AND CHANGES IN LEVEL

The following is an introduction into the world of surveying. It’s a whole new specialist topic in itself, and so we won’t go into it in every detail. We’ve chosen some of the more relevant issues for this module.

The techniques described here will suffice for most projects. However, if you have a more complex job to deal with, or you’re not completely confident, you can always hire the services of a professional surveyor to do the job for you.

A NOTE FOR BEGINNERS

If you feel this section is too complicated for you a present, you can skip it, and go straight to Today’s Task.

This course is something you can grow into, and you may be pleased to re-discover it at a later date.

WHY DO WE NEED TO MEASURE THE CHANGES IN LEVEL?

A garden may be naturally sloped in one or more directions, or may have dips and rises in it. Also, previous work may have been done to the land to level it out, using terracing.

If you know from the beginning what you will be designing, you many only need a rough idea of the change in levels.

But more often than not, you won’t know how you’re going to tackle the problem. And it’s important to take as much information away with you from that first visit.

A small change in level may seem insignificant at the time. But it may prove critical when you come to draw up the design.

THE IMPORTANCE OF MEASURING THE LEVELS

Having an accurate level survey gives the following benefits:

1. IT LETS YOU FORESEE ANY POTENTIAL DRAINAGE PROBLEMS. Rainwater falling on to hard surfaces such as patios has to go somewhere. Often it can be drained off into a border or lawn area. However if the gradients in the garden don’t allow this, you may have to consider putting in extra
drainage to avoid flooding.

2. **IF THE GARDEN IS TO BE BUILT BY A LANDSCAPER.** They will need to know the height of any retaining walls and also the amount of soil that is going to be moved in and out of the site. If this information is vague then you can expect their quotation to be. If they are unsure as to exactly what is required they will either refuse to quote at all or quote on the high side to cover themselves. Neither of these is very productive for your client.

3. **A STEEPLY SLOPING SITE MAY NEED TERRACING.** To achieve this, you will remove soil from one area and deposit it in another. With a good level survey you can design the space to minimise the amount of soil that will need to be brought in or taken away from the site. This will reduce the cost for your client.

4. **AT DIFFERENT GRADIENTS, PATHWAYS WILL BECOME UNACCEPTABLY STEEP, DEPENDING ON THE AGILITY OF YOUR CLIENT.** You must be able to keep an eye on gradients, and know when to include steps.

5. **WATER FEATURES MAY ALSO BE AFFECTED BY GRADIENTS,** especially if you’re planning a stream.

**CALCULATING CHANGES IN LEVEL**

There are two methods that are effective on simple gradients, although both need two people to carry them out.

1. The tee-staff.
2. Level pegs and string line.

1. **THE TEE-STAFF**

This method involves the use of two 'T' shaped staffs and a measuring rod.

Figure 2.9 shows how the two staffs are driven into the ground, and set level with one another.

Then, by looking across the top and keeping the two in line, you get a level line of site across the garden.

You can then line these up with a third staff and calculate the difference in level at that point.

Another variation is to have someone hold a calibrated staff at the bottom of
the slope, and you can read the measurement straight off of it. We discuss this next.

**USING A CALIBRATED STAFF**

Measure the distance from the ground to the top of the first short staff, A in Figure 2.9. Then subtract that amount from the height of the staff. (B).

That way, you can work out the change in level over that distance. For example:

Distance from top of first staff (A) to the ground = 1 metre

Distance from top of the staff at the bottom of slope (B), to the ground = 1.8 metres

Total fall over that distance (= 1.8 - 1) = 0.8 metres

**FIGURE 2.9**

SIMPLE TECHNIQUE FOR MEASURING CHANGES IN LEVEL

**EXERCISE 2.6**

The distance from the top of the first staff to the ground is 1.2 metres. For the staff at the bottom of the slope, the distance from the top of the staff to the ground is 4 metres. What is the total difference in height?
LEVEL PEGS AND STRING LINE

This method (Figure 2.10) is similar to the previous one. Instead of using staffs, you drive wooden pegs into the ground and use a string line to read off the height on the measuring rod at the bottom of the slope.

When using this method, ensure the string is pulled tight (a string with some elasticity is best) to give a more accurate reading.

FIGURE 2.10. USING PEGS AND STRING

USING SURVEYING EQUIPMENT

Alternatively, you can use more complicated surveying equipment like a dumpy level or laser level (these can be hired from hire centres or bought at a large DIY store).

These work on exactly the same principal as the simple methods. Each device may have its own little quirks when setting it up; but all use the same procedures to take measurements.

STEP 1

Set up the level in an area from which you can see the changes in level you are trying to measure. The level sits on top of a tripod and will have a device
on it to ensure that it is level.

Turn the level to line up the viewfinder with any part of the garden.

**STEP 2**

Take your first reading from a known fixed point that is unlikely to change (this is called a bench mark). Door lintels are good for this, or the damp proof course of the house (DPC).

![Level instrument](image)

**FIGURE 2.11. A TYPICAL LEVEL. IT’S RATHER LIKE A TELESCOPE WITH A LEVEL ON IT, TO ENSURE A TRULY HORIZONTAL LINE OF SIGHT**

To take a reading, hold the measuring staff, which will be supplied with the level, so that the bottom of it is level with your door lintel or DPC. You then take a reading through the viewfinder, and make a note of the measurement.

**STEP 3**

You can now go on to taking measurements of any areas that you feel are necessary.

Remember to make a note of where you took the measurement. If you’re doing a thorough survey, you might draw a grid over the garden and plot the height every couple of meters. This means marking a grid out in the garden and is quite time consuming. You may only need to measure the extremes of level, and the height of existing features such as walls and patios.
RECORDING THE INFORMATION

The measuring staff is graduated like any other ruler. It starts with zero at the bottom and increases as we move up the staff. You will notice from Figure 2.12 that the higher up the slope we go, the smaller the measurement becomes. This may seem a little back to front, so it is important to write down the information in such a way so as to avoid confusion.

FIGURE 2.12. TAKING A READING FROM LOW ON THE SLOPE AND ANOTHER HIGHER UP
**USING THE FIGURES**

We’ll need a simple table to make sense of these figures. The table below demonstrates this.

Your first measurement from a fixed point (the bench mark) goes in a column all of its own.

After making a note of where you took this reading, write down the other (intermediate) heights you need. Do this in any order you like.

Remember to write down where you took the reading from. This could be a grid co-ordinate, or a description as in the example (below).

This is all you need to do while on the site. The final calculations can be done at home over a cup of tea.

We can now adjust the figures to give them more meaning. For instance, it would be nice to look at the plan and know whether an area or feature is higher or lower than our benchmark.

<table>
<thead>
<tr>
<th>Bench mark</th>
<th>Intermediate</th>
<th>Location</th>
<th>Rise (+)</th>
<th>Fall (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9m</td>
<td>0.2m</td>
<td>Door lintel</td>
<td>0m</td>
<td>0m</td>
</tr>
<tr>
<td></td>
<td>1.6m</td>
<td>Top of slope</td>
<td>1.7m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.0m</td>
<td>Bottom of slope</td>
<td>0.3m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patio</td>
<td></td>
<td>0.1m</td>
</tr>
</tbody>
</table>

To do this, we set the benchmark to zero, and enter it in the ‘Rise’ and ‘Fall’ columns.

Next we work through the list, subtracting the intermediate values in turn from the original value of our benchmark (1.9 in this example). If our answer is a positive number it goes in the 'Rise' column and if it is a negative answer it goes in the 'Fall' column.

These are the figures that we will mark on to the plan, giving us a good picture of the levels that are involved in the garden.

Use the following format to mark the levels on the plan.

+ 1.7  This indicates a rise. (1.7m in this case)

+(0.1) This indicates a fall. (0.1m in this case)
Do not be confused by the '+' symbol. This does not indicate plus. Conventionally this merely shows exactly where the reading was taken from ('X' marks the spot or '+' in our case.).

Positive values (a rise) and negative values (a fall) are indicated by the presence or absence of brackets.

NOW WATCH A VIDEO

How to measure a garden
http://www.youtube.com/watch?v=YmGO6yzM9qo
**EXERCISE 2.7**

Look at the drawing below.

1. What is the area of the existing patio? TIP: as it’s an irregular shape, you’ll have to divide it into more than one piece.

2. Is the garden sloping towards or away from the house? TIP: look at the figures in red.

The red height measurements indicate those which have been arrived at following your calculations at home, and which you would show on your final working drawing.
SUMMARY

1. You understand how to calculate area using the formula: Length \(\times\) Width = Area. You also know how to adapt this formula to suit several shapes that can be used in your garden design.
2. You can use triangulation to identify the position of boundaries and existing features accurately.
3. You recognise that a chain survey can be used to accurately plot objects.
4. You appreciate the importance of measuring levels, and are able to measure levels using several techniques. You also know how to record the information you collect, and are able to use the figures successfully.
**TODAY'S TASK**

Do a rough drawing of your garden. It doesn’t have to be to scale.

Mark major features on it (such as sheds, beds and paths etc).

Describe your garden in writing. Who uses it, and for what purpose?

Does the garden have any disadvantages?

Have you taken any steps to actively ‘design’ it? How might you improve the garden?
Answers to exercises

Exercise 2.1

1. Mr & Mrs Smiths garden measures 612 m².
2. Mr & Mrs Clarks garden measures 612 m².
3. Mr Jackson's garden measures 210 m².

Exercise 2.3

To use the triangulation method it must be possible to run the tape measure in a direct line between the two points. This is not always possible because of obstacles that will get in the way; buildings, shrubs etc.

Exercise 2.4

Point A = 0m and 12m
Point B = 3m
Point C = 7m

Exercise 2.6

The total difference in height is 2.8 metres.

Exercise 2.7

1. The existing patio measures 34.75 m².

2. The garden is sloping towards the house. You might like to note the following: the height at point A is 0.1 metres above the datum and the height at point B is 0.5 metres above the datum indicating that point B is 0.4 metres above point A.