Construction activities Introduction to Module 5

The numeracy skills used in construction are extensive. Reading and handling large numbers, measuring accurately and understanding angles (e.g. 90°) are among the more obvious skills. However, competent bricklayers will be able to calculate areas for ordering materials, plan work time to meet the needs of building schedules and calculate the time spent on different parts of the job, in order to receive staged payments if they are self-employed.

This module provides opportunities for learners to practise this range of essential numeracy skills. The skill areas cover:

- determining quantities of material by working out straightforward areas of brick and block work
- calculating areas with windows and doors
- estimating and rounding up quantities of bricks and blocks
- understanding tolerances
- keeping to a schedule
- calculating time and wages.

Needless to say, acquiring competent numeracy skills for the trowel trades is best done practically in the workplace. Additional practice is essential and this module allows for this, in an environment where errors can be made safely. Constantly relating the module's activities to the learners' own workplace will encourage the necessary work-based links to be made.

Skills checklist

As part of the building team, you need to follow instructions and procedures to get a building up and out of the ground. You need to order the correct amount of materials and work out the time it will take to complete each part of the job.

You need the following skills to be confident that you are constructing the building according to the plans and within the timescale. Tick the skills you already have and then look again at the checklist when you have used the materials.

Skills for construction activities	Now	Later
Calculating the area of bricks needed for walls without openings		
Calculating the area of bricks needed for walls with openings and gable ends		
Ordering materials by rounding up the area of bricks calculated, to allow for wastage		
Measuring accurately to within 3 mm		
Understanding and working to agreed tolerances for brick and block work		
Understanding the timed sequence involved in the job		
Calculating and recording the taken time for jobs in hours, days and months		
Calculating your wages		

PAGES 5:1–5:2
Areas (1)

Establishing the amount of materials required to complete a job is essential if the job is to be completed on schedule and within budget (Unit No. VR38, Unit No. VR40). This means calculating the area of a wall from a plan in order to estimate the number of bricks needed to build that wall.

Materials

Calculator

Plans of buildings showing front, rear and side elevations

Learning outcomes

1 To understand that area is a measure of surface (focus page, Task 1)

2 To understand that area is measured in square units, in particular square metres (focus page, Task 1)

3 To understand and use the formula for calculating the area of a rectangle (focus page, Tasks 1 and 2)

4 To understand that is easier to convert dimensions from plans into metres before calculating the area (focus page, Task 3)

Introduction

- Draw different sized rectangles or squares on 1 cm square paper and get learners to count the squares in order to calculate area.
- Write the formula for calculating the area of a rectangle (A = l × w) and ask learners when they would use it (e.g. to find the area of a rectangular floor). Explain that, in the case of a rectangular wall, the word 'height' could replace the word 'width' (w) in the formula to more appropriately describe its properties. Demonstrate this using A4 paper (landscape) marked 'length' and 'width'. Position it on a flat surface to represent a floor. Write the formula A = l × w (Area of a rectangular floor = length × width). Hold the paper at 90° to the surface to represent a wall. Replace the word 'width' with the word 'height'. Write the formula A = l × h (Area of a rectangular wall = length × height). Point out that it is the same two measurements that are multiplied together to give the area.

Focus page

- Ask learners to use the square-counting method to calculate the areas of a number of different sized rectangles. Ask learners to use the formula to find the areas of the same rectangles in order to illustrate that the two methods give the same answer.
- Use a tape measure to illustrate the fact that 1 m is the same as 1000 mm.
- Get learners to convert measurements in millimetres into metres by dividing them by 1000. Use a calculator.
- Ask learners to use both written calculations and calculators to work out the areas of rectangles using the formula.

Curric. refs	NOS/NVQ	Key Skills
MSS1/L1.9	VR38	N1.1c
MSS1/L1.7	VR40	N1.2d
N2/L1.7		

Task 1

Work out the area of a rectangular wall MSS1/L1.9

- Ensure learners understand the task.
- They can find an example of how to complete the task on the focus page.

If the learner has difficulty

- You may need to work through the problem with the learner. (Note: the learner can answer this question by counting or multiplication. Encourage them to count first and confirm using multiplication.) Check the learner's concept of multiplication.
- Give further examples until the learner can move on from counting to multiplication.
- Learners who do not understand the concept of area as a measure will need additional support using the *Skills for Life* materials.

Extension

Move on to the next task.

Task 2

Calculate the area of a rectangular wall using the formula A = l × h

MSS1/L1.9

- Ensure learners know how to complete the task.
- Ensure learners know what each of the letters in the formula represents (illustrated on the focus page).
- Encourage learners to estimate an answer, do the calculations on paper, then check using a calculator.

If the learner has difficulty

- Refer the learner back to Task 1 and explain that the formula is a quicker way of counting the squares.
- Learners may experience difficulty with the calculation and may be unsure of how to handle the 0.5. Review number calculation skills involving decimal place. Refer to *Skills for Life* Numeracy Level 1, Units 2 and 4 if necessary.
- Use the calculator then check using paper and pen.
- Check that dyslexic learners perform the operations in the correct order.

Extension

- Ask learners to calculate the areas of walls shown on different plans.
- Ask learners to measure walls that have already been built and to calculate the area using the formula.

Task 3

Convert dimensions on a plan from millimetres to metres in order to calculate the area of a rectangle

MSS1/L1.7
MSS1/L1.9
N2/L1.7

- Point out to learners that they need to convert the dimensions on the plan from millimetres into metres before they calculate the area.
- Ensure learners know how to convert measurements in millimetres into metres (divide by 1000).
- Remind learners of the formula for calculating the area of a rectangular wall (A = l × h).
- Ensure learners understand what is meant by two decimal places. If necessary, explain and practise this skill (see *Skills for Life* Numeracy Level 1, Unit 2).

If the learner has difficulty

- Make sure the learner understands why conversion is needed (to make the final calculation easier).
- Conversion is also covered in Module 4 (Setting out pages 4:7–4:14) and in *Skills for Life* Numeracy Level 1, Unit 4.
- Check learners are performing operations in the correct order and that they enter numbers into the calculator correctly, particularly the decimal point and zero as a place holder (omitting or misplacing either will make the calculation incorrect). This may be an issue with dyslexic learners.
- Go through the concept of 'correct to two decimal places'.

Extension

- Ask learners to convert other dimensions from millimetres to metres by dividing by 1000.
- Ask learners to calculate the areas of other rectangular walls, windows and doors on plans by converting their dimensions from millimetres to metres first.
- Set further problems involving rounding to one, two and three decimal places.

Theme assessment

- Theme assessment tasks could include:
  - calculating the areas of given rectangles
  - finding the area of a rectangular wall as represented on a plan
  - calculating the area of a wall learners can see going up at work or one they have helped/are helping to build.
- Tasks should involve increasingly complex measures (e.g. mixed units of measure, measures to one, two and three decimal places) and should be performed with and without the use of a calculator.

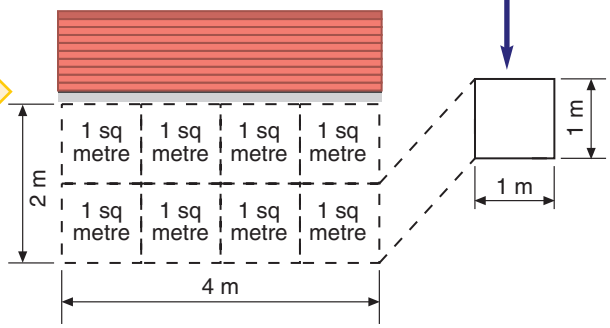
Areas (1)

Focus

Area is the amount of space taken up by a flat surface like a wall. You need to know the areas of walls so you can work out how many bricks and blocks you need for the job.

A 1m by 1m square

The wall of this garage is 4 m long and 2 m high. It has been divided into 1 m by 1 m squares to show you its area. As you can see, there are eight 1 m by 1 m squares. So the area of this wall is 8 square metres.



You don't have to count squares to work out area. A quick way of doing it is to multiply the length of the wall by the height.

length by height

$4\,m \times 2\,m = 8$ square metres

$= 8\,m^2$

= 8 sq metres

These are different ways of writing area. They all mean the same.

The formula for calculating the area of a rectangular wall looks like this:

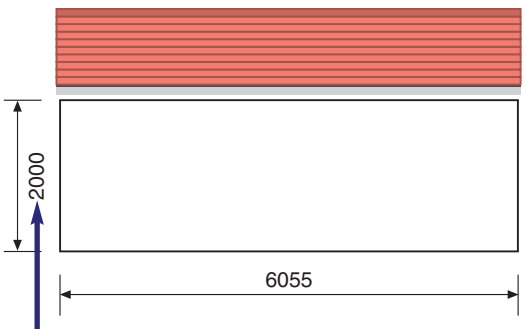
$A = l \times h$

A = area
l = length
h = height

Dimensions on drawings are normally shown in **millimetres** but area needs to be measured in **square metres** (m^2). It is easier to convert the dimensions on the drawing into metres before you calculate the area.

To convert a dimension from **millimetres** to metres you divide it by 1000.

This is because there are 1000 mm in 1 m.



6055 mm = 6.055 m
because 6055 ÷ 1000 = 6.055

So the area of this wall is

$A = l \times h$

$= 6.055\,m \times 2\,m$

$= 12.11\,m^2$

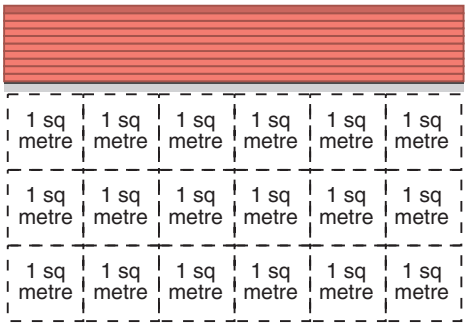
2000 mm = 2 m
because 2000 ÷ 1000 = 2

Areas (1)

Task

Task 1

What is the area of this garage wall?



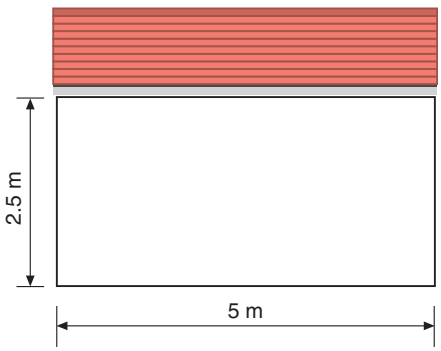
_____ square metres

Task 2

What is the area of this garage wall? Use the formula to help you.

REMEMBER!

Area of a rectangular wall = length × height



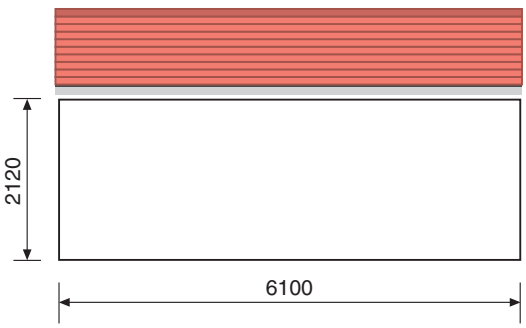
_____ m^2

Task 3

Calculate the area of this garage wall. Give your answer to two decimal places.

Tip

Convert the dimensions on the drawing into metres before you calculate the area.



_____ m^2

PAGES 5:3–5:4

Areas (2)

Establishing the amount of materials required to complete a job is essential if the job is to be completed on schedule and within budget (Unit No. VR38, Unit No. VR40). This theme is about calculating the area of a wall from a plan in order to estimate the number of bricks needed to build that wall.

Materials

Calculator

Plans of buildings showing front, rear and side elevations

Learning outcomes

- To understand that the gable end of a building is usually triangular (focus page)
- To understand how to calculate the area of a triangle using the formula $A = \frac{b \times h}{2}$ (focus page, Tasks 1–3)
- To understand that a wall with a gable end can be split up into a rectangle and a triangle (focus page, Tasks 2 and 3)
- To understand that the total area of a wall with a gable end is equal to the area of the rectangular wall plus the area of the triangular gable (focus page, Task 3)

Introduction

- Draw a diagram of a wall with a triangular gable end and ask learners how many shapes it is made up of. Ask them to highlight and label the different shapes (triangle and rectangle).
- Ask learners to draw a wall with a gable end and cut it up into a triangle and a rectangle.
- Look at a range of plans showing gable-end elevations and mark the triangle and rectangle on each.

Focus page

- Focus particularly on finding the area of the triangle. Show how the formula for a triangle is derived by drawing the corresponding rectangle around it, finding the area of the rectangle and then halving it. Point out to learners that they may also see the formula $A = \frac{b \times h}{2}$ expressed as $\frac{1}{2} \times b \times h$.
- Illustrate both methods with simple figures so that learners can see that the two formulae are the same and will provide the same answer.
- Note: you should choose which of these formulae to use in teaching, but confirm with learners that they both produce an accurate result.

Curric. refs	NOS/NVQ	Key Skills
MSS1/L1.7	VR38	N1.2d
MSS1/L2.7	VR40	N2.2e
MSS1/L2.8		

Task 1

Use a formula to calculate the area of a gable end
MSS1/L1.7
MSS1/L2.7

- Ensure learners know what each of the letters in the formula represents and how to use the formula.
- Ensure learners know how to convert measurements in millimetres into metres.

If the learner has difficulty

- Refer the learner to the worked example on the focus page.
- Identify the measurements required.
- Help the learner to find and extract the information they need from the plan in order to calculate the area of the gable end (the base and height of the gable).

- Help the learner to convert the measurement into metres – remind them how to do this and give further practice using realia if necessary. (Refer learners who struggle with this to *Skills for Life* Numeracy Level 1, Unit 4.)
- Calculate the area of the gable end. Particular help may be needed with understanding the formula. Offer further examples of how this formula is derived. If necessary, offer alternatives such as $b \times h \div 2$, or $\frac{1}{2}$ $b \times h$. Be aware, though, that alternatives can sometimes confuse learners, who may find it difficult to see the connections between formulae.
- Produce memory cards for the formula and procedures. These will reduce memory load and allow the learner to concentrate on understanding each calculation.

Extension

- Ask learners to calculate the areas of other triangles, as found on plans.
- Move on to the next task.

Task 2

Use a formula to calculate the area of a gable end
MSS1/L1.7
MSS1/L2.7

- This is similar to Task 2 but the learner has to extract the relevant information from the plan.
- Ensure learners know what information they need from the plan in order to calculate the area of the gable end (the length of the base and the height of the triangle).
- Ensure learners know what each of the letters in the formula represents and how to use the formula.
- Ensure learners know how to convert measurements in millimetres into metres.

If the learner has difficulty

- Help the learner to extract the information they need from the plan in order to calculate the area of the gable end (the base and the height of the gable).
- See Task 1 for further suggestions.

Extension

- Get the learners to calculate the areas of other gables from plans.
- Move on to the next task.

Task 3

Use formulae to calculate the area of a wall with a gable end
MSS1/L1.7
MSS1/L2.7
MSS1/L2.8

- Ensure learners understand how the wall can be split up into a rectangle and a triangle.
- Ensure learners understand that the total area of the wall is equal to the area of the rectangular wall plus the area of the gable.
- Ensure learners know how to use the formulae for calculating areas of rectangles and triangles and how to find the total.

If the learner has difficulty

- Demonstrate how the wall can be split into a rectangular wall and a triangular gable.
- Refer to the worked example on the focus page.
- You may need to work through the whole problem with the learner. Break it into small steps.
- See Task 1 for further suggestions, including a memory card for the procedure.

Extension

- Ask learners to calculate the areas of other walls with gables from plans.
- Get learners to calculate the areas of walls with gables that are being or have been built where they work.

Theme assessment

- Ask learners to calculate the areas of a range of triangles.
- Ask learners to work out the area of a wall with a gable end shown on a plan.
- Ask learners to calculate the area of a wall (with a gable end) they can see going up at work or one they have helped/are helping to build.

Areas (2)

Focus

Not all walls will be simple rectangles. You will have to work out the areas of walls with gable ends.

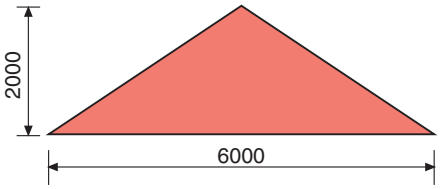
To calculate the area (A) of a triangle

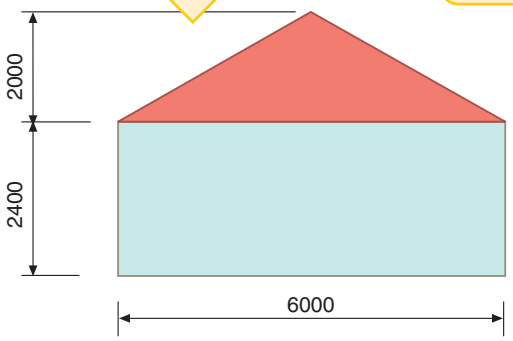
Multiply the base (b) of the triangle by the perpendicular height (h). Divide this by 2. The formula looks like this:

$$A = \frac{b \times h}{2}$$

The gable end of a building is usually a **triangle**. To work out the area of a gable end, you need to know how to find the area of a triangle.

The perpendicular height (h) of this triangle is 2000 mm or 2 m.





The base (b) of this triangle is 6000 mm or 6 m.

So, the area of the gable end is:

$$A = \frac{b \times h}{2}$$

$$= \frac{6\,m \times 2\,m}{2}$$

$$= 6\,m^2$$

Now that you know how to calculate the area of a gable end, you can work out the total area of the wall. The total area of the wall is equal to the area of the **triangle** plus the area of the **rectangle**.

Area of triangle $= \frac{b \times h}{2}$

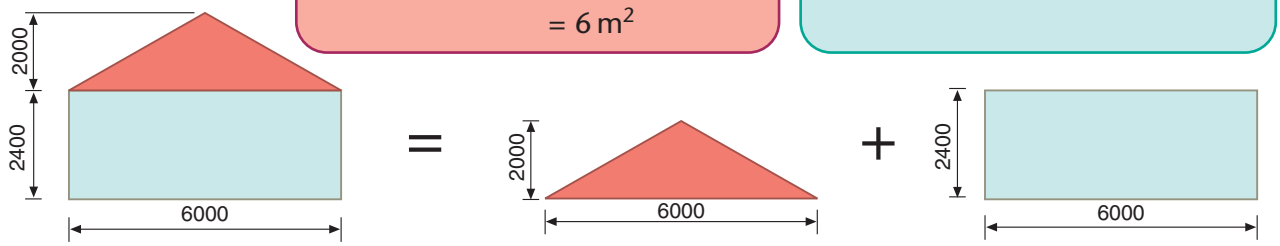
$$= \frac{6\,m \times 2\,m}{2}$$

$$= 6\,m^2$$

Area of rectangle $= l \times h$

$$= 6\,m \times 2.4\,m$$

$$= 14.4\,m^2$$



Total area of wall = Area of triangle + Area of rectangle

$$= 6\,m^2 + 14.4\,m^2$$

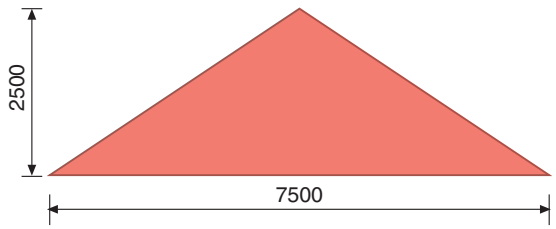
$$= 20.4\,m^2$$

Areas (2)

Task

Task 1

Use the formula for finding the area of a triangle to calculate the area of this gable end.



$$A = \frac{b \times h}{2}$$

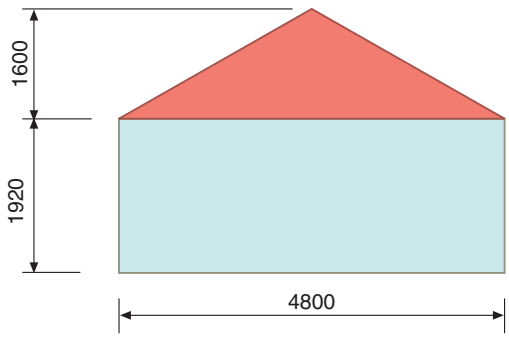
_____ m^2

Tip

Convert the dimensions into metres before you calculate the area.

Task 2

Calculate the area of the gable end on this wall using the formula for finding the area of a triangle.

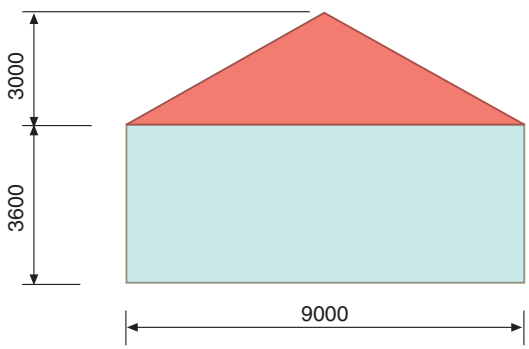


$$A = \frac{b \times h}{2}$$

_____ m^2

Task 3

What is the total area of this wall?



_____ m^2

Tip

The total area of a wall with a gable end is equal to the area of the triangle plus the area of the rectangle.

Convert the dimensions into metres before you calculate the area.

Calculate the area of a triangle.

PAGES 5:5–5:6

Areas (3)

Establishing the amount of materials required to complete a job is essential if the job is to be completed on schedule and within budget (Unit No. VR38, Unit No. VR40). This theme is about calculating the area of a wall from a plan in order to estimate the number of bricks needed to build that wall.

Materials

Calculator

Plans of buildings showing front, rear and side elevations, in particular elevations that include doors and windows

Learning outcomes

1 To understand that bricks do not need to be ordered for the area of the windows and door (focus page)

2 To calculate the area of brickwork with one opening (focus page, Task 1)

3 To calculate the area of brickwork with more than one opening (focus page, Task 2)

Introduction

- Sketch a picture of one rectangle inside another and discuss the strategy for calculating the area of the composite shape (subtract the area of the small rectangle from the area of the large rectangle). Use a wall of the training room to demonstrate.
- Ask the learners when they might use this strategy (when calculating the area of brickwork that contains windows and doors).
- Ask learners to cut windows and doors from a paper plan to demonstrate the reasoning behind the multi-step calculations involved.

Focus page

- Give learners some examples. Remind them to subtract the area of shapes not needed from the area of the whole shape.
- Use the drawing to calculate the area of each wall, with and without door and window spaces.

Curric. refs	NOS/NVQ	Key Skills
MSS1/L1.7	VR38	N1.2
MSS1/L1.9	VR40	N2.2
MSS1/L2.8		

Task 1

Calculate wall area excluding a window
MSS1/L2.8
MSS1/L1.7
MSS1/L1.9

- Ensure learners know how to convert measurements in millimetres into metres.
- Ensure learners know how to calculate the area of a rectangle.
- Ensure learners understand the three steps within the task (i.e. Step 1: Calculate the area of the large rectangle (wall); Step 2: Calculate the area of the smaller rectangle (window); Step 3: Subtract the smaller number from the larger one (window from wall).

If the learner has difficulty

- Refer the learner to the worked example on the focus page.
- Repeat the activity with a paper plan and cut out the opening to demonstrate the logic of the calculations.
- You may need to work through the whole problem with the learner step by step.
- Check the learner understands the principles of the task (i.e. that you are trying to avoid ordering unnecessary bricks and that this means finding a smaller measure of area). Subtraction of one measure from another results in a smaller area.

Extension

Ask learners to calculate the areas of the brickwork on other walls that contain a window or a door.

Task 2

Calculate wall area excluding a window and a door

MSS1/L1.7
MSS1/L1.9
MSS1/L2.8

- This is a similar exercise to Task 1 but with the addition of extra steps to calculate the area of a door and add this to the window area.
- Ensure learners understand each of the steps (i.e. Step 1: Calculate the area of the large rectangle (wall); Step 2: Calculate the area of the window, the area of the door and then the total area of the openings; Step 3: Subtract the total area of the openings from the area of the wall to find the area of the brickwork).

If the learner has difficulty

- Repeat the activity with a paper plan and cut out the openings to demonstrate the logic of the calculations.
- You may need to work through the whole problem with the learner, emphasising the steps that are taken.
- Ask the learner to make a memory card that describes the steps to act as a prompt for future calculations.

Extension

- Get the learners to calculate the area of the brickwork on other walls that contain windows and doors. This could be done in the training room, on site or from plans.
- Extend work on areas to calculating the area of composite shapes.

Theme assessment

- Ask learners to find the areas of walls that contain windows and doors, from measurements they do themselves.
- They can also calculate areas of walls containing windows and doors by interpreting scale drawings from the workplace.
- They should be able to demonstrate the ability to work to at least two decimal places, understand working in mixed units and show rounding skills.

Areas (3)

Focus

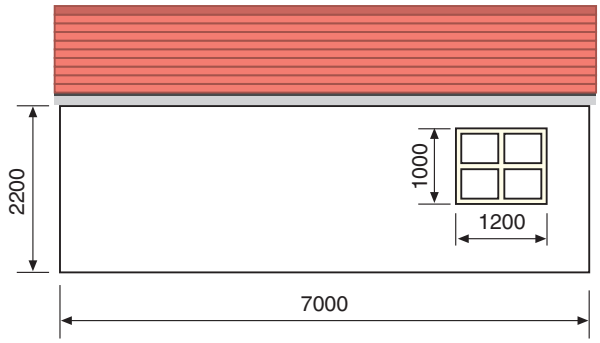
The wall whose area you need to calculate may have openings in it where windows and doors are going to be put in. You don't want to order bricks that aren't going to be used, so you need to take the windows and doors into account when you work out the area of the brickwork.

To find the area of brickwork with openings, follow these steps.

Step 1: Find the area of the whole wall.
Step 2: Find the area of the opening.
Step 3: Subtract the area of the opening from the area of the whole wall to give you the area of the brickwork.

Example

This wall is going to have a window in it. You don't want to order bricks for the space where the window will go.



Step 1: Find the area of the whole wall.

Area of whole wall = length × height
= 7 m × 2.2 m
= 15.4 m^2

Remember to convert the dimensions to metres first.

Step 2: Find the area of the opening.

Area of the opening = length × height
= 1.2 m × 1 m
= 1.2 m^2

Step 3: Subtract the area of the opening from the area of the whole wall to give you the area of the brickwork.

Area of brickwork = 15.4 m^2 – 1.2 m^2
= 14.2 m^2

Areas (3)

Task

Task 1

Use the three steps to work out the area of brickwork on this wall of a garage.

Step 1: The area of the whole wall is:

_____ m × _____ m = _____ m^2

Step 2: The area of the opening is:

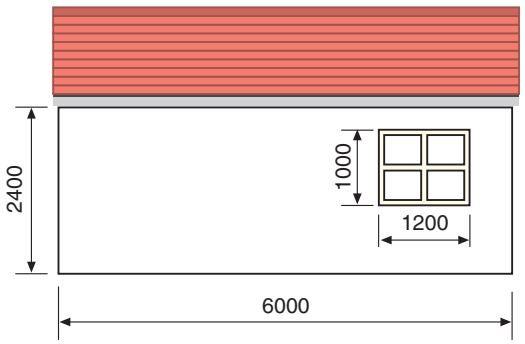
_____ m × _____ m = _____ m^2

Step 3: Take the area of the opening from the area of the wall to find the area of the brickwork:

_____ m^2 – _____ m^2 = _____ m^2

Tip

Convert the dimensions on the drawing into metres first.



Task 2

Use the three steps to work out the area of brickwork on this wall of a garage.

Step 1: The area of the whole wall is:

_____ m × _____ m = _____ m^2

Step 2: Find the area of the openings. This wall has two openings, so you need to find the area of both of them and add them together.

Area of the opening for **window**:

_____ m × _____ m = _____ m^2

Area of the opening for **door**:

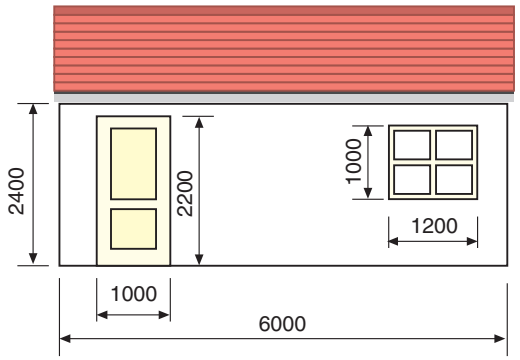
_____ m × _____ m = _____ m^2

Total area of openings:

_____ m^2 + _____ m^2 = _____ m^2

Step 3: Take the total area of the openings from the area of the whole wall to find the area of the brickwork:

_____ m^2 – _____ m^2 = _____ m^2



REMEMBER!

Remember to convert the measurements on the plan to metres before you calculate the area.

Calculate the area of complex shapes.

MSS1/L1.7; MSS1/L1.9; MSS1/L2.8

PAGES 5:7–5:10

Determining quantities

Calculating quantities of material is an important aspect of construction, particularly for self-employed workers. This focus page looks at one method for calculating the number of bricks or blocks. It builds on learners' knowledge of area introduced in the preceding focus pages and leads onto the concept of wastage in Tasks 4 and 5.

Materials

Examples from the workplace of estimating problems

1 m^2 template (card or paper)

Learning outcomes

1 To approximate decimals by rounding up (focus page, Task 5)

2 To use a calculator to calculate efficiently (focus page, Tasks 1–3 and 5)

3 To understand that there are different ways of calculating percentages (Tasks 4 and 5)

4 To calculate percentage parts of amounts (Tasks 4 and 5)

5 To calculate percentage increases (Tasks 4 and 5)

Introduction

- Discuss the concept of setting up a building project from the planning stage to the building stage. Highlight the necessity of ordering sufficient materials.
- Make a 1 m^2 template out of paper or card. Ask learners to estimate how many bricks laid with 10 mm mortar joints will cover an area of 1 m^2. Pose the same question for blocks.
- If necessary, check this by using real bricks or blocks to build a 1 m square.
- Discuss how, by calculating the number of bricks or blocks in 1 m^2 area, the figure can be scaled up to find the number of bricks/blocks in a wall of any size.

Focus page

- Work carefully through all parts of the focus page, ensuring that learners understand the model for calculating the number of bricks per square metre and the number tasks involved in the calculations. You may need to spend some time on each of the three steps to ensure that learners fully understand the process.
- At steps 1 and 2, remind learners that measurements must be in the same unit before they can do these calculations. In the example, 1 m has been converted to 1000 mm (1000 ÷ 225 = 4.444), but it would be equally correct to convert 225 mm into 0.225 m (1 ÷ 0.225 = 4.444). At step 3, discuss why it is best, when calculating amounts of materials, to round up rather than down – it is better to have slightly too many bricks than not enough.

Curric. refs	NOS/NVQ	Key Skills
N2/L1.7	VR40	N1.1e
N2/L1.9		N1.2b
N2/L1.10		N1.2c
N2/L1.11		N1.2d
N2/L1.5		
N2/L1.4		

Task 1

Calculate the number of blocks required to build a wall

N2/L1.7

N2/L1.11

- Ensure learners understand the task. An example of how to complete it is on the focus page.
- Ensure learners know how to round to the nearest whole number and the appropriate stage to round up.

If the learner has difficulty

- Check the learner has added in the mortar bond measurement.
- Learners may be unsure with the calculation. Review calculation skills involving decimal places and zero as a place holder.

- This is a fairly complex multi-stage procedure. Learners, including dyslexic learners, may omit a stage or perform the stages in the wrong order. Check this and work through each stage in turn. Check learners understand what is being done at each stage and why.
  - Divide the length of a standard brick and mortar bond into 1 m (1000 mm) to find out how many laid bricks make a length of 1 m.
  - Divide the width of a standard brick and mortar bond into 1 m (1000 mm) to find out how many laid bricks make a height of 1 m.
  - Multiply the number of bricks that make a length of 1 m by the number of bricks that make a height of 1 m. This gives you the number of bricks that make an area of 1 m^2. Round this up to the next whole brick.
  - Find out the area of the wall to be built in m^2.
  - Multiply the number of bricks in 1 m^2 by the number of m^2 of brickwork you want to build.
- Encourage the learner to prepare a memory card to remind him/her of the stages involved in such a calculation.

Extension

Set further problems based on different areas of wall and involving areas that are a fraction of a square metre (e.g. 19.6 m^2). Include wall areas from the workplace or training room, and working from plans.

Task 2

Calculate the number of blocks required to build a wall

N2/L1.7
N2/L1.11
N2/L1.5

- Ensure learners understand the task. An example of how to complete it is shown on the focus page.
- Ensure learners know how to round up to the nearest whole number and the appropriate stage to round up.

If the learner has difficulty

- Check the learner has added in the mortar bond measurement.
- Learners may be unsure with the calculation. Review calculation skills involving decimal places and zero as a place holder.
- This is a fairly complex multi-stage procedure. Learners, including dyslexic learners, may omit a stage or perform the stages in the wrong order. Check this and work through each stage in turn. Check learners understand what is being done at each stage and why.
  - Find out how many bricks there are in 1 m^2 of brickwork (see Task 1).
  - Work out how many m^2 of brickwork you are going to build. Work this out from the measurements on the drawing.
  - Multiply the number of bricks in 1 m^2 by the number of m^2 of brickwork you want to build.
- Encourage learners to prepare a memory card to remind him/her of the stages involved in such a calculation.

Extension

Set more difficult problems, based on different areas of wall, involving areas that are a fraction of a square metre (e.g. 19.6 m^2), wall areas from the workplace or training room, or working from plans.

Task 3

Calculate the number of bricks required to build a wall

N2/L1.7
N2/L1.11
N2/L1.5

- Ensure learners understand the task. An example of how to complete it is shown on the focus page.
- Ensure learners know how to round up to the nearest whole number and the appropriate stage to round up.

If the learner has difficulty

- Check the learner has added in the mortar bond measurement.
- Learners may be unsure with the calculation. Review calculation skills involving decimal places and zero as a place holder.
- This is a fairly complex multi-stage procedure. Learners, including dyslexic learners, may omit a stage or perform the stages in the wrong order. Check this and work through each stage in turn (see Tasks 1 and 2 and focus page). Check learners understand what is being done at each stage and why.

Extension

- Set more difficult problems, based on different areas of wall, involving areas that are a fraction of a square metre (e.g. 19.6 m^2), wall areas from the workplace or training room, or working from plans.
- It would be useful to apply these skills to a particular workplace task (e.g. estimating the number of blocks/bricks for a particular construction task). This could lead to costing of materials and estimates of staff time.

Task 4

Use mental calculation to work out 5%
N1/L1.4

- Talk about wastage and what this means in practical terms when laying bricks and blocks. The term may be new to some learners.
- You may need to talk through what percent means (i.e. one part out of 100) and that 100% means a whole one. Link this to the notion of 5% wastage allowance (i.e. that you allow five extra bricks in addition to every 100 bricks, in case of damage or the need to cut bricks).
- Ask learners to calculate 10% mentally and to explain what they are doing.
- Check that learners can multiply and divide by 10 and 100. If they can't, refer to *Skills for Life* Numeracy Level 1, Unit 1.
- Work through the worked example on the page, explaining carefully the halving process (10% to 5%).

If the learner has difficulty

- Learners who do not understand the concept of percentage and percentage increase will need further work on this – use *Skills for Life* Numeracy Level 1, Unit 2. Learners may also need to work on the whole concept of fractions.
- Using real materials to demonstrate this may help: set out 100 bricks in 10 piles of 10 bricks (divide by 10 for 10%); take a pile of 10 bricks and make it into two piles (divide by 2 for 5%). You need five bricks extra to allow for wastage. So how many bricks do you need all together? (105)
- Learners may forget the last step of the problem (adding on the extra bricks). *Could you build a wall with six bricks? So how many do you have to order?* Check addition skills – additional support may be required.
- Check that dyslexic learners note down numbers in the correct sequence (e.g. 1302, not 1320) and carry out stages in the correct order.

Extension

Set problems relating to different wastage amounts (e.g. $7\frac{1}{2}$%), for different qualities of bricks or blocks.

Task 5

Calculate percentage increase using a calculator
N2/L1.9
N2/L1.10
N2/L1.11

- The worked example on the page shows how to calculate 5% without using the % function key on the calculator. Work through the method and the explanation. Note that this is the same calculation used in the example for Task 4, so that comparisons can be made.
- Move on to the task – remind learners about rounding up.

If the learner has difficulty

- Dyslexic learners may have problems with the sequence of operations. Ask them to talk through what they are doing to ensure that they are performing operations in the correct sequence.
- Check learners understand the importance of the decimal point and zero as a place holder – omitting either will make the answer wrong.
- The explanation of why multiplying by 1.05 is necessary relies on the learner understanding that 0.05 is 5 hundredths. Learners who do not understand place value will struggle with this and may need support (refer to *Skills for Life*).
- The task involves calculating with decimal place – check the learner keys in the decimal point.
- Check the learner is rounding up at the appropriate point.

Extension

- Demonstrate how to use the % function key on the calculator.
- Note that % function keys work in different ways on different calculators – be sure to use the learner's calculator.
- Ask the learner to experiment with multiplying by 5, 1.5 and 0.05 to see what happens to the number.
- Give additional problems based on workplace examples.

Theme assessment

- The skills for this theme (number calculation skills involving decimals, calculation of percentage, use of a calculator) are best assessed by setting a number of problems, based on learners' experience. These problems could be based on sets of working drawings from the learners' workplace.
- Encourage learners to use estimation alongside this practice (e.g. *How many blocks do you estimate are needed for this job?*), testing their estimates against the actual calculation.

Determining quantities

Focus

Working drawings do not tell you how many bricks and blocks you need to construct a building. You work this out using the dimensions of the bricks or blocks you will be building with and the measurements shown on the drawing.

Length of brick and mortar bond = 215 mm + 10 mm = 225 mm

Height of brick and mortar bond = 65 mm + 10 mm = 75 mm

REMEMBER!
Convert measurements to the same unit before you do your calculation.

To work out how many bricks there are in 1 m² of brickwork you can use this method.

Step 1: Divide the length of a standard brick and mortar bond into 1 m (1000 mm) to find out **how many laid bricks make a length of 1 m.**

1000 ÷ 225 = **4.444** (bricks)

Step 2: Divide the width of a standard brick and mortar bond into 1 m (1000 mm) to find out **how many laid bricks make a height of 1 m.**

1000 ÷ 75 = **13.333** (bricks)

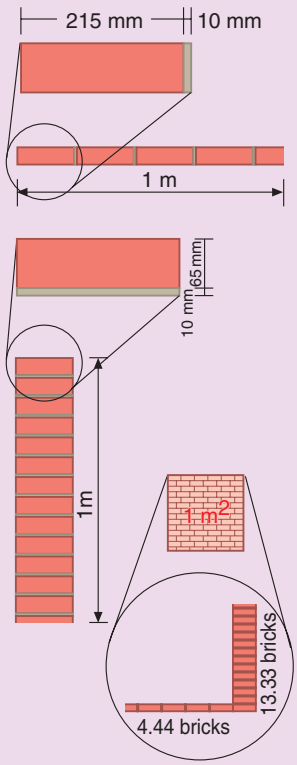
Step 3: Multiply the number of bricks that make a length of 1 m by the number of bricks that make a height of 1 m.

This gives you the number of bricks that make an area of 1 m².

4.444 × 13.333 = 59.252 (bricks)

Round this *up* to the next whole brick.

There are approximately **60 bricks in 1 m² of brickwork.**



Example
Bricks per m²: 60
Area of the wall:
4 m × 2 m = 8 m²
Bricks to build 8 m²:
60 × 8 = 480 bricks.

REMEMBER!
area = length × height

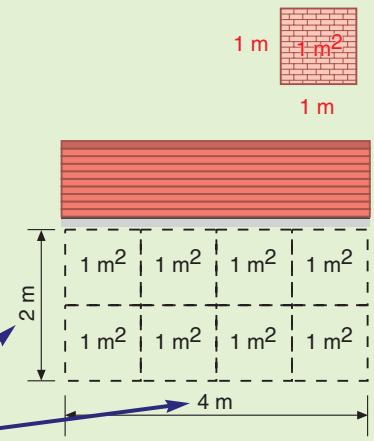
How to do a brick count

To work out how many bricks to order, you need to do the following.

1 Find out how many bricks there are in 1 m² of brickwork. (See the method above.)

2 Work out how many m² of brickwork you are going to build. Work this out from the measurements on the drawing.

3 Multiply the number of bricks in 1 m² by the number of m² of brickwork you want to build.



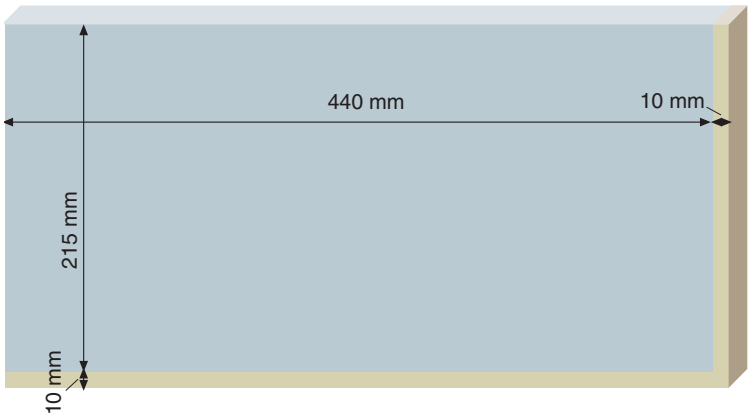
Determining quantities

Task

Task 1

The length of a block is **450 mm** (including a 10 mm mortar bond).
The height of a block is **225 mm** (including a 10 mm mortar bond).

How many **blocks** do you need to build a wall with an area of 8 m^2?



Tip

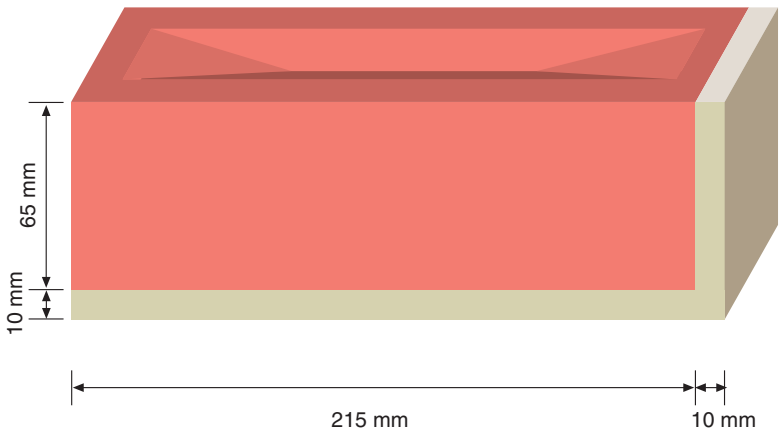
Follow the method on the focus page. Remember to round your answer up to the next whole block or brick.

Task 2

How many **blocks** do you need to build a structure with an area of 50 m^2?

Task 3

How many of these **bricks** do you need to build a structure with an area of 50 m^2?



Determining quantities

Task

Before putting in your order for bricks and blocks, it is good practice to add on an extra amount to allow for **wastage**. The usual allowance for wastage is **5%**. There are several ways to calculate this.

Sometimes bricks and blocks get damaged during delivery or cutting. Damaged bricks and blocks are referred to as **wastage**.

Method A: Do it in your head

Step 1: Find 5%

- Divide the number of blocks or bricks by 10 to get 10%, then divide your answer by 2 to find 5%.

  Example: You need 120 blocks to build a wall.
  10% of 120 = 120 ÷ 10 = 12
  5% is half of **10%**
  Half of 12 is 6

  You need to order 6 extra blocks.

Step 2: Add on the wastage allowance

- Add the amount you will allow for wastage to your original figure to work out how many blocks or bricks to order.
  120 + 6 = 126
  Order 126 blocks.

Task 4

Complete each calculation to allow for 5% wastage.

Plot 15

Blocks

10 per m^2 × 140 m^2	= 1400 blocks
Plus 5% for wastage	= _____ blocks
Order (including wastage allowance)	= _____ blocks

Bricks

60 per m^2 × 140 m^2	= 8400 bricks
Plus 5% for wastage	= _____ bricks
Order (including wastage allowance)	= _____ bricks

Plot 27

Blocks

10 per m^2 × 124 m^2	= 1240 blocks
Plus 5% for wastage	= _____ blocks
Order (including wastage allowance)	= _____ blocks

Bricks

60 per m^2 × 124 m^2	= 7440 bricks
Plus 5% for wastage	= _____ bricks
Order (including wastage allowance)	= _____ bricks

Determining quantities

Task

Method B: Use a calculator

- Multiply the number of blocks or bricks by 1.05 to increase the amount by 5%.

  Example: You need 120 blocks to build a wall. Enter these numbers into your calculator:

The answer comes out as 126.

So you need to order 126 blocks. (This includes 5% wastage.)

Whole units		Tenths	Hundredths
1	.	0	5

***Why** does multiplying by **1.05** increase an amount by **5%**?*

This is how it works:

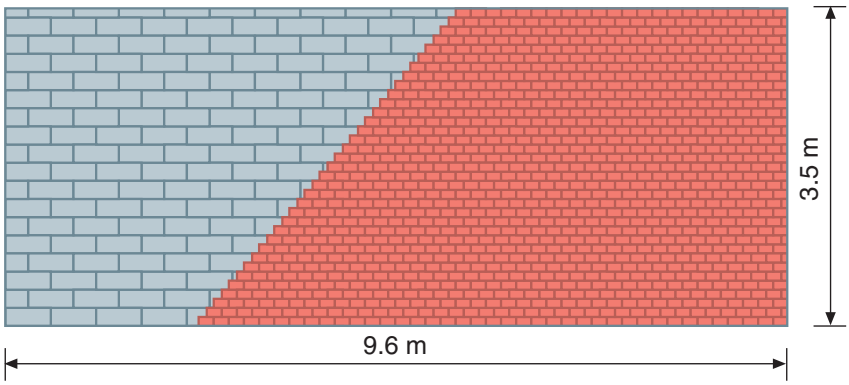
5% is the same as .05 (5 hundredths).

Multiplying a number by .05 gives you 5 hundredths of that number.
Multiplying a number by 1 gives you the original number.
So multiplying a number by 1.05 gives you the original number **plus** 5 hundredths.

Task 5

Calculate the number of **blocks** and **bricks** required to build a wall 3.5 m × 9.6 m in blockwork and facing bricks. Your figure needs to include an allowance of 5% for wastage.

10 blocks = 1 m²
60 bricks = 1 m²



Area of wall = _____ m × _____ m = _____ m²

Number of blocks

10 per m² × _____ m² = _____ blocks

Order (5% extra including wastage allowance) = _____ blocks

Number of bricks

60 per m² × _____ m² = _____ bricks

Order (5% extra including wastage allowance) = _____ bricks

Tip
Use the method described above to calculate wastage. Round your answers up to the nearest whole block or brick at the end of each calculation.

N2/L1.9; N2/L1.10; N2/L1.11

PAGES 5:11–5:12

Checking your brickwork for accuracy

It is essential that every member of the building team contributes to efficient working practices (Unit No. VR40). Working to an acceptable standard requires the bricklayer to lay bricks and blocks accurately. The 'tolerance' can be as little as plus or minus 3 mm.

Materials

Tape measures

Gauge rods

Plumb lines

Spirit levels

Learning outcomes

1 To recognise the plus and minus symbol (±) to denote tolerance (focus page, Tasks 1 and 2)

2 To understand acceptable tolerances for brickwork (focus page, Tasks 1 and 2)

3 To calculate in mm (Tasks 1 and 2)

Introduction

- Write the word 'tolerance' on the board and ask learners what it means to them – anyone who says that it means putting up with things not being quite right/to their liking has the right idea. Put it in the context of construction, stressing that the amount of tolerance allowed is very small – as little as 3 mm. Get learners to look at their tape measures so that they realise how small 3 mm is!
- Draw the symbol for plus or minus (±) next to the word tolerance and ask learners what they think it means.
- Question learners about situations in which tolerances should be checked (mortar joints, 'plumb' walls, etc).

Focus page

- If the tolerance is different to that used, you may amend the Word® version of the focus page.
- Discuss words like 'standard', 'vertical', 'tolerance', 'acceptable'.
- Ask learners why the first set of measurements for vertical joints shown on the page are all considered acceptable. Ask why the second set of measurements for joints are *not* acceptable.
- Ask learners if they have ever used mortar on vertical joints that has been under or over the agreed tolerance of 3 mm. Explain that this is inevitable while learning to lay bricks. Discuss the implications of laying bricks with vertical joints that are often outside the agreed 3 mm tolerance.
- Focus now on the 5 mm tolerance allowed in every 3 m height of wall. Discuss the implications for the whole building if walls are not built within the limits of the agreed tolerance.
- Discuss the word 'gauge'. Look at the example of how four courses of bricks will measure 300 mm, and 40 will measure 3000 mm. Ask learners what height a wall should be at 8, 10, 20 and 30 courses.
- Get learners in pairs to estimate where 3 m is on a wall and then to confirm and compare by measuring. Remind them that this is the height at which a tolerance of only ± 5 mm is allowed. Get learners to look at their tapes to see just how little this is.

Curric. refs	NOS/NVQ	Key Skills
MSS1/L2.3	VR40	N1.1

Task 1

Check the tolerance of 3 m high walls by adding or subtracting 5 mm

MSS1/L2.3

- Ask learners to tell you in their own words what 'built to gauge with regular joint thickness' means.
- Remind them that there are 1000 mm in a metre and therefore they know how many there are in 3 m when checking the walls in the task for acceptable tolerance.

If the learner has difficulty

- If the learner has difficulty dealing with the 5 mm tolerance on a large number like 3000 mm, then offer calculations using 5 mm tolerance based on smaller numbers (e.g. 10, 30, 300).
- If problems persist, the learner needs some additional support for measuring.

Extension

Pose some questions (e.g. What degree of tolerance can you expect to find in a 10 m wall?).

Task 2

Find the acceptable tolerance in a 1 m high wall by simple subtraction
MSS1/L2.3

- Remind learners that they have to bear in mind 3 mm as they look at each size of gap and to ask themselves 'Is it more than 3 mm?'.

If the learner has difficulty

Demonstrate tolerance by asking the learner to give you some simple millimetre measurements (e.g. 25 mm, 9 mm, etc.) Draw these measurements on paper, making some slightly too long and some slightly too short. Measure the lines together to see if they fall within the tolerance of 3 mm. Return to the original task and look at one measurement together.

Extension

Find out about tolerance used elsewhere in the workplace, both for trowel occupations and others. Describe the impact of not meeting tolerance levels.

Theme assessment

- Write some vertical joint measurements on the board and ask learners to decide if they are within the acceptable tolerance.
- Do the same to check gauge – draw examples of different courses of bricks with measurements labelled, some correct for tolerance, others not.
- Go on site and check some vertical joints for the 3 mm tolerance and partly built walls for level and plumb (at 3 m height if possible).

Checking your brickwork for accuracy

Focus

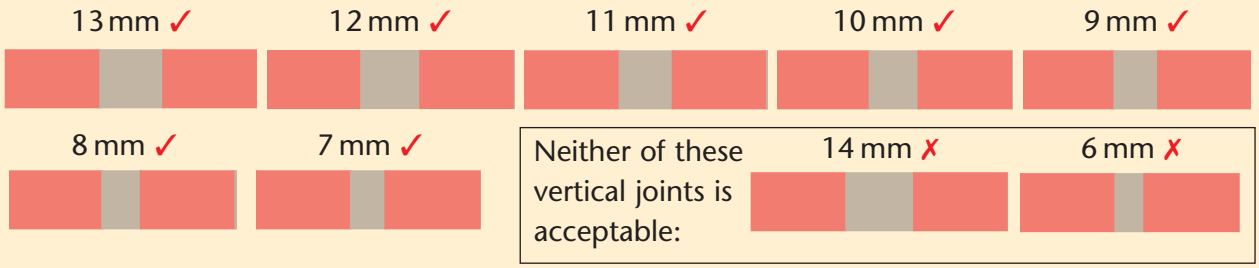
It would be impossible for every single joint in a construction to be the same size and for every single course to be absolutely level and vertical (plumb). However, it is important that all building work is completed to acceptable standards. **Tolerances** tell you what is acceptable and what is not acceptable.

The amount of tolerance that you are allowed is usually very small.

Tolerances are written using the symbol ±, which you say as 'plus or minus'.

The symbol is always followed by a measurement that tells you how accurate your work needs to be. For example, a standard vertical joint is 10 mm thick **with a tolerance of ± 3 mm** ('plus or minus 3 mm'). This means that vertical joints are acceptable as long as they measure **no more than 3 mm wider** or **no more than 3 mm narrower** than 10 mm.

Example: All of these vertical joints are acceptable:



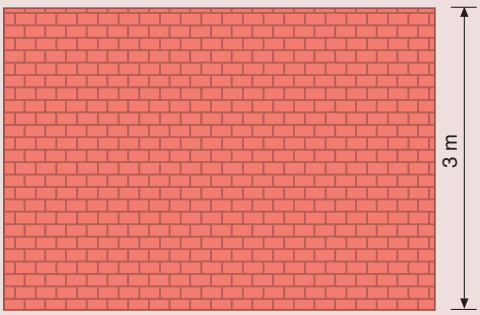
Neither of these vertical joints is acceptable:

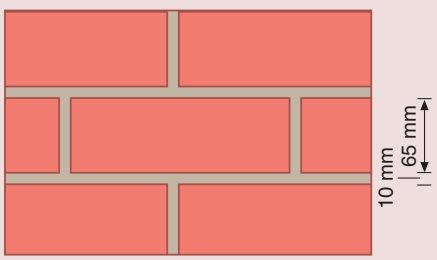
Here is another tolerance. This is a 3 m high wall.

Walls should be built to gauge ± 5 mm in 3 m height and with regular joint thickness.

This means that you must use a gauge rod to check that the joint for each course is a regular thickness. A tolerance is allowed for slight variations in joint thickness.

Your brickwork will be acceptable as long as it measures **no higher than 3005 mm** and **no lower than 2995 mm** after the required number of courses have been laid.





Gauge is the name given to the depth of a brick plus the horizontal joint. In this example, the gauge is **65 mm + 10 mm = 75 mm**.

If built to gauge:
4 courses will measure 300 mm high (4 × 75 mm)
40 courses will measure 3000 mm (or 3 m) high (40 × 75 mm).

Checking your brickwork for accuracy

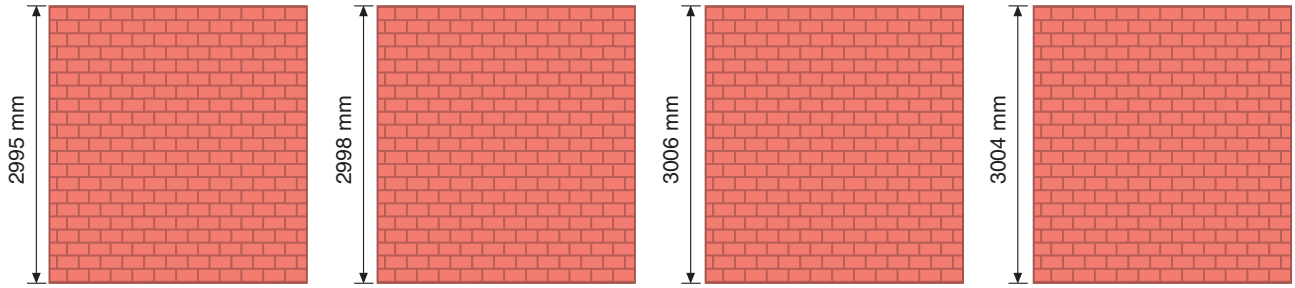
Task

Understanding tolerances is important to your job.
Tolerances tell you how accurate your work needs to be.

Task 1

These walls have been built to gauge with regular joint thickness. The tolerance is ± 5 mm in 3 m height. Which walls meet the required standard? (Tick the boxes.) Which walls do not meet the required standard? (Cross the boxes.)

Tip
1 m = 1000 mm

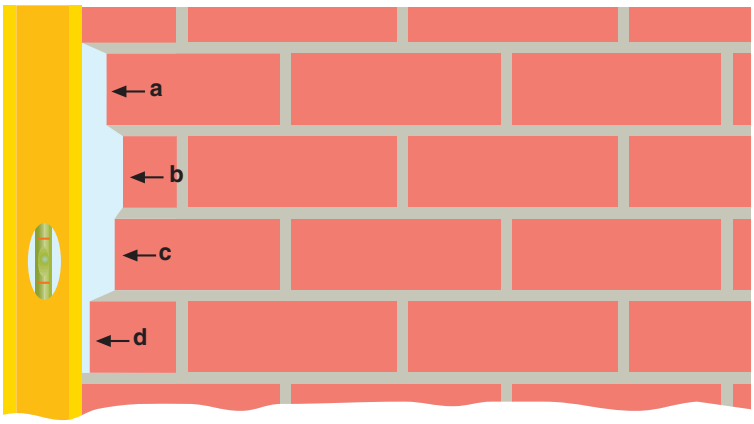


a ☐ b ☐ c ☐ d ☐

Task 2

Here is another tolerance:

When the spirit level is placed vertically against the edge of the brickwork, each brick in a 1 m height must be within 3 mm of the spirit level.



This brickwork has not been built to the acceptable standard. Which of the gaps between the brickwork and the spirit level make it fail the standards? (Cross the boxes.)

Gap **a** measures 3 mm ☐
Gap **b** measures 5 mm ☐
Gap **c** measures 4 mm ☐
Gap **d** measures 1 mm ☐

Tip
Tolerances tell you the **largest** difference from the standard amount that is still acceptable.

PAGES 5:13–5:14

Keeping to schedule

Scheduling operations is an important aspect of a construction project, requiring the learner to understand the sequence of operations and how this is logged on a chart or project planner. Learners may be familiar with a range of formats for programmes of work and need to understand the importance of work not falling behind schedule. This focus page looks at how to read and understand a typical programme of work and how to amend it following a change.

Materials

Range of project planners/programmes of work from the workplace

OHT of the chart from the task page

Learning outcomes

1 To understand how to read a project planning chart (focus page, Task 1)

2 To complete a chart for a project (focus page, Task 2)

Introduction

- Look at a range of project planners/programmes of work from the workplace. Have learners seen these before? What are they used for? Who uses them? How do they work?
- Discuss the importance of understanding where your work fits into the overall plan of the construction project.
- Discuss the implications of work being late.

Focus page

- Look at the section from a programme of work. Talk through some of the terms on the page (e.g. 'week commencing', rows, columns). (Note: some learners will have difficulty with the concept of 'week commencing' and the impact this has on date.)
- Work through the example job of 'Roof structure' with learners using the blue arrows on the programme. First, ask learners to find the row for the job 'Roof structure', then to look across the row (using the arrow) until they reach the *start* of a block of colour. Then ask them to go to the top of that column (using the arrow) to the 'week commencing' date to work out the start date of the job (17th May). Point out that this is one day after the 'Brickwork to eaves' is planned to finish.
- Get learners to use the same method to find the planned end date of the 'Roof structure' job (19th May).

Curric. refs	NOS/NVQ	Key Skills
HD1/L1.1 HD1/L1.2	VR02	N1.1

Task 1

Extract information from a programme of work HD1/L1.1

- Ensure learners understand that the information they need is on the chart on the focus page. Confirm learners understand that they are to find information using columns and rows. Make sure they understand the term 'expected to take'. Explain that the time a job is expected to take is from its planned start date to its planned finish date. Point out the tip.

If the learner has difficulty

- Dyslexic learners may have difficulty tracking information across and up/down the page. An 'L' or reversed 'L' shape made from card can help. Otherwise, encourage them to use a ruler or straight edge to help.
- Dyslexic learners may also have difficulty with the orientation of rows and columns – a mnemonic such as 'row across the river and climb up the column' might help.

- Learners may have difficulty understanding the term 'week commencing' and the impact this has on dates. Use a diary or calendar to show how this works. They may need to refer to the diary in order to work out the dates needed, or write all the dates along the top of the form.

Extension

- Set additional questions based on this programme of work.
- Set questions based on programmes of work from the workplace.

Task 2

Amend a programme of work
HD1/L1.2

- Make an OHT of the chart and work through the first example with the group.
- Encourage learners to find the relevant information first (e.g. brickwork to 1st floor), then plot on the chart when this activity actually took place. Make sure learners understand the knock-on effect on subsequent activities.
- Show how to make changes to the chart.

If the learner has difficulty

- Dyslexic learners may struggle with the tracking and orientation aspects of this task. An 'L' shape or ruler may be useful.
- Learners may need support with the term 'week commencing'. Simplify the activity (e.g. if the job should start on Tuesday and is delayed by one day, when will it start?) Move on to two days, three days, etc., then on to dates.

Extension

- Using a blank programme of work, plan the sequence of operations for a simple building project.
- Use an IT project-planning program to plan a straightforward work-based project.

Theme assessment

- Set some more questions based on this chart.
- Check the learner is using programmes of work in the workplace.
- Use a blank chart to plot another construction project, ideally based on a real workplace project.

Keeping to schedule

Focus

Certain construction jobs have to be completed before others can begin. A chart is made that lists all of the jobs that need to be done. It shows the **expected** start and finish dates for each of the jobs. This kind of chart is called a **programme of work**. The programme of work tells you **when** you are needed on site and when different materials and equipment are needed.

The chart can also be used to track progress. There are some empty rows for you to fill in. You record the **actual** start and finish dates for each of the jobs.

Here is a section from a programme of work.

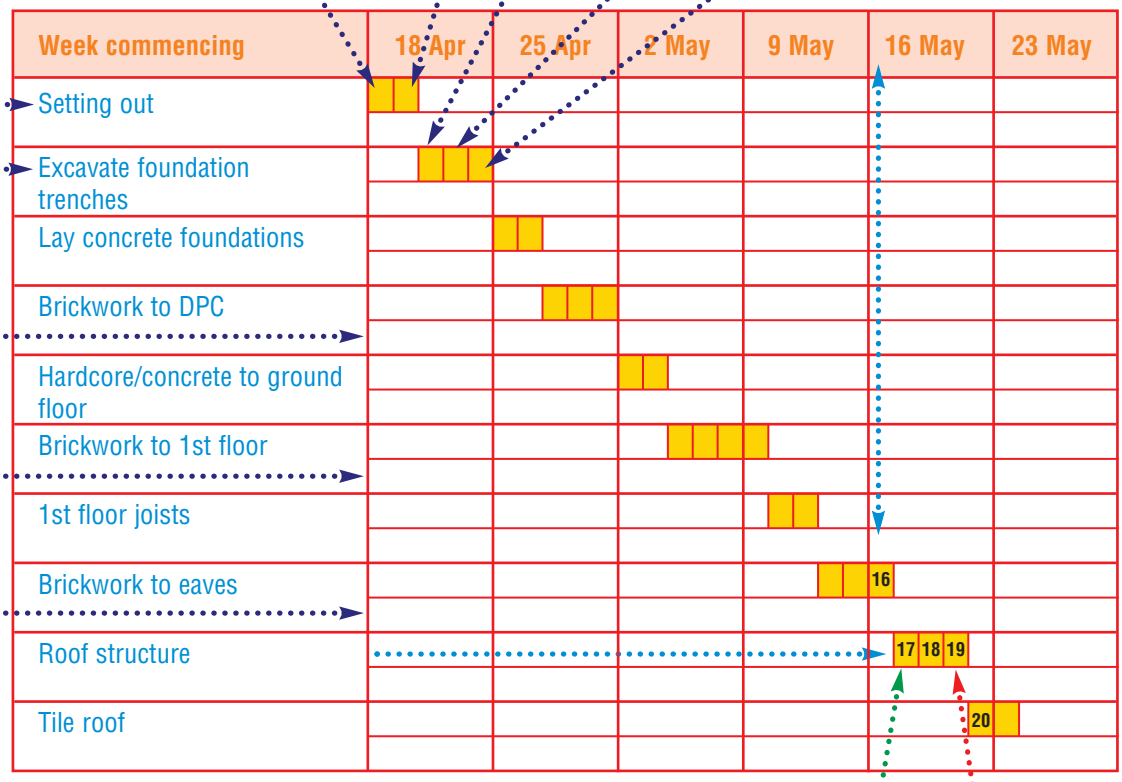
This chart is based on a 5-day working week.

A 'week commencing' date is shown at the top of each column. It tells you the date of the first day of the week. You use it to work out the dates of the other days in that week.

18 April, 19 April, 20 April, 21 April, 22 April

Jobs are listed on separate rows.

You record the **actual** start and finish dates of the jobs in these rows.



Blocks of colour are used to show when jobs are planned to start and finish. The number of coloured blocks tells you the number of days the job is planned for.
Example: Work to the roof structure is planned to take 3 days.

Keeping to schedule

Task

Task 1

Use the chart on the focus page to find the answers to these questions.

1 **a** On what date is work planned to start on brickwork to the DPC?
b How many days is this brickwork expected to take?
c On what date is brickwork to the DPC planned to finish?

2 **a** On what date is work planned to start on brickwork to the 1st floor?
b How many days is this brickwork expected to take?
c On what date is brickwork to the 1st floor planned to finish?

3 **a** On what date is work planned to start on brickwork to the eaves?
b How many days is this brickwork expected to take?
c On what date is brickwork to the eaves planned to finish?

Tip
Each week on the chart represents 5 working days.

Task 2

Despite every effort to keep to a programme of work, jobs don't always run to plan. On this project, rain caused a delay in laying the concrete, causing all the other jobs to start and finish late.

Complete the chart to show:

a That brickwork to the 1st floor started 2 days late and lasted 4 days.
b That brickwork to the eaves started 2 days late and lasted 3 days.

Week commencing	18 Apr	25 Apr	2 May	9 May	16 May	23 May
Setting out						
Excavate foundation trenches						
Lay concrete foundations						
Brickwork to DPC						
Hardcore/concrete to ground floor						
Brickwork to 1st floor						
1st floor joists						
Brickwork to eaves						
Roof structure						
Tile roof						

Use dates to check a building schedule.

PAGES 5:15–5:16

Planning your work; working out wages (1)

Planning and scheduling work is critical in construction, particularly for self-employed workers. This focus page looks at the rounding and estimating skills required to plan work. Although the answers are not exact, rounding and estimating require a good understanding of the underpinning number skills and reasonably accurate calculation skills.

Materials

Examples from the workplace of estimating problems

Learning outcomes

1 To approximate by rounding up or down (focus page, Tasks 1 and 2)

2 To estimate answers to calculations (focus page, Tasks 1 and 2)

Introduction

- Ask learners for their experience of estimating the time needed for tasks. Confirm that this is a critical part of their work, particularly if they are self-employed.
- Ensure that all mathematical vocabulary is fully understood. Discuss the dangers of guessing as opposed to estimating.
- Set some practical questions within the learners' experience, for example: How long does it take to make a mix of concrete? How long does it take to lay a course of bricks 10 m long? How long does it take to make a cup of tea? How long does it take to drive across town? You could set these as a quiz. Discuss how an answer may be reached (e.g. experience, working from a small quantity to a larger one).
- Compare the answers given and make the point that it is easier to estimate if you have accurate knowledge of the task and accurate information about materials and timing.
- It is also useful to make a calculation for a small part of a task (e.g. how long it takes to lay five bricks) then scale this up. Work out examples with learners.
- Ensure that all technical vocabulary is fully understood (e.g. '1st lift of scaffolding').

Focus page

- Work carefully through all parts of the focus page, ensuring that learners understand the model for an experienced bricklayer and the number tasks involved in the calculations. Explain any unfamiliar terms, such as 'per hour'. You may need to spend some time on each of the steps outlined in order to ensure that learners fully understand the process.
- Discuss rounding and when to round up or down.

Curric. refs	NOS/NVQ	Key Skills
N1/L1.8 N1/L1.9	VR02	N1.2

Task 1

Estimate time for a work task

N1/L1.8
N1/L1.9

- Ensure learners understand the task. Work through the example with learners (how many blocks and bricks can be laid per hour).

If the learner has difficulty

- Ensure vocabulary and language is understood.
- Teach estimating time. Allow learners to experience the passage of time using a two-minute silence. Use concrete examples from learners' experience: *How long did it take you to get to work this morning? How long does it take you most mornings? How long do you allow to get to work?*
- Take each part of the solution point by point. Produce a memory card if necessary.

- Ask what calculation is required at each stage; to establish understanding ask why each calculation is required.

Extension

Estimate time using a different area of wall from a real plan.

Task 2

Estimate time for a work task

N1/L1.8

N1/L1.9

- This requires learners to realise that two experienced bricklayers will get a job done in half the time it would take one bricklayer.

If the learner has difficulty

- Point out the note in the worked example at the top of the page (see Task 1).
- Provide further explanation of any points that are not yet understood and if necessary provide further practice for individual needs.

Extension

- Set additional workplace problems.
- Apply to costing work.

Theme assessment

- Set other problems, using different areas of wall.
- Learners could demonstrate their estimation skills by estimating the time required for a job at work.

Planning your work; working out wages (1)

Focus

Whether you are working as an individual or as part of a team, **planning your work** is important.

You will need to be able to work out approximately how long it will take to complete a job or part of a job.

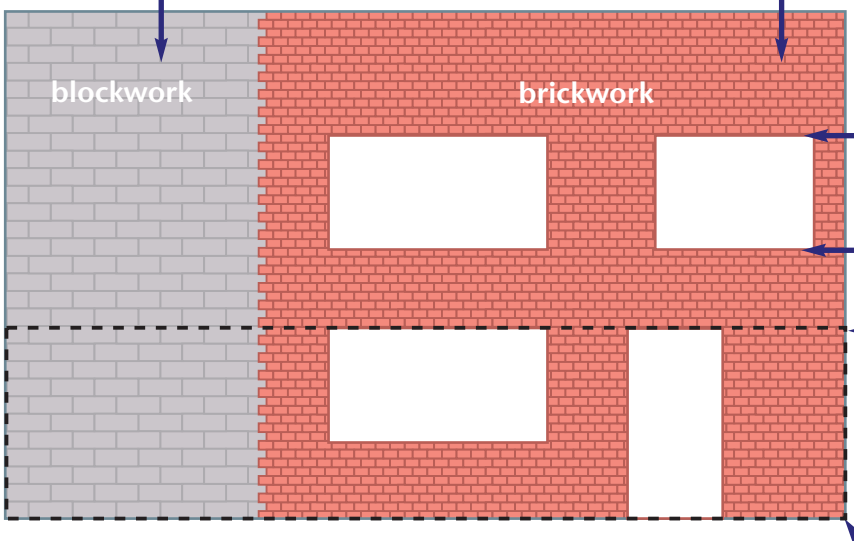
For example: You may need to say when you will be ready for the next lift of scaffolding.

An **experienced bricklayer** can be expected to:

Lay approximately 30 blocks or 3 m^2 of blockwork per hour.

'Approximately' means 'about'.

Lay approximately 50 bricks or 1 m^2 of brickwork per hour.



You are ready for the 3rd lift of scaffolding when construction reaches here.

You are ready for the 2nd lift of scaffolding when construction reaches here.

You are ready for the 1st lift of scaffolding when construction reaches here.

Use the numbers for blocks and bricks you can lay per hour as a guide to help you work out approximately how many days or weeks it will take to do a job.

This is one method:

Step 1: Calculate the area for the job you are doing to the top of the lift.

Step 2: Divide the area by 3 m^2 to find out approximately how many hours it will take to do the blockwork. Divide the area by 1 m^2 to find out approximately how many hours it will take to do the brickwork. Add your answers.

Step 3: Round your answer to the nearest week, day or half day.

Example: You need to calculate the area of all four walls to the top of the ground floor windows to find out how much work is involved to reach the 1st lift.

Note:
A half day's work is approximately 4 hours.
A whole day's work is approximately 8 hours.
A week's work is approximately 40 hours.

Planning your work; working out wages (1)

Task

Example: You need to say when you will be ready for the 1st lift of scaffolding.
The area of walling to the 1st lift is 32 m^2. This is how to do the calculation.

Blockwork:
32 m^2 ÷ 3 m^2 per hour = 10.66 hours
This is approximately 11 hours.

Brickwork.
32 m^2 ÷ 1 m^2 per hour = 32 hours
Note: The number of hours is the same as the number of m^2 in your area calculation.

To lay blocks and brick to 1st lift will take 11 hours + 32 hours = 43 hours or just over 1 week for 1 person.

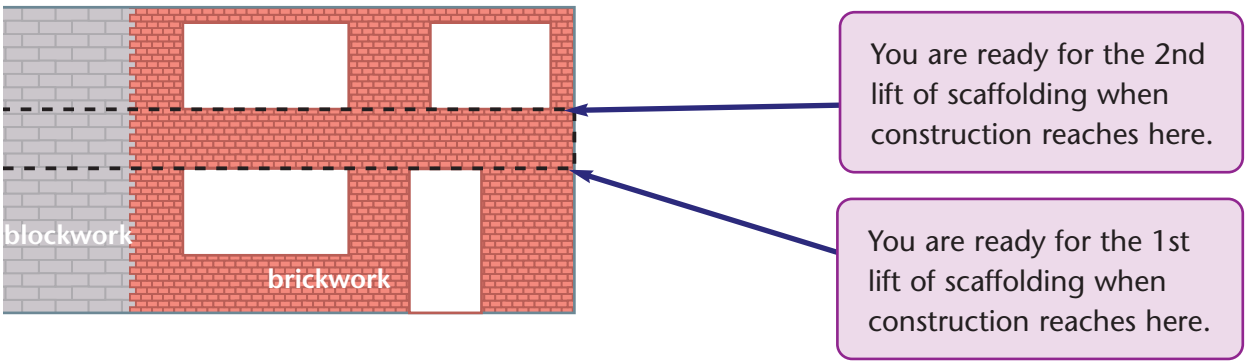
Try this: How long will this job take two people? _____

Task 1

The 1st lift of scaffolding is in place.

You have calculated that the wall area between the 1st and 2nd lift is 41 m^2. How long will it take you to lay 41 m^2 of blockwork and brickwork to the 2nd lift if you work alone?

Approximately _____ days



Task 2

How long will it take to lay 36 m^2 of blockwork and brickwork to the 2nd lift if you work with one other experienced bricklayer?

Approximately _____ days

PAGES 5:17–5:19

Planning your work; working out wages (2)

Many learners will go on to work as part of a sub-contractor team or become self-employed. Working out wages is therefore likely to be an important part of their working lives. This section of work looks at some of the practical money calculation skills required for this aspect of work.

Materials

Calculator

Contract documents from the workplace, showing payments to sub-contractor teams

Blank pay slips

Learning outcomes

To calculate with money (focus pages, Tasks 1 and 2)

Introduction

- Ask for learners' experiences of working as part of a sub-contracting team or in self-employment. How was the money divided? Who gave it out? If learners do not know about this aspect of work in construction, explain how the system operates. Look through examples of payments to sub-contractors and show how this is divided between workers. Compare the pay rates with local conditions.
- This may be a good opportunity to discuss pay slips and deductions (tax, National Insurance contributions, pensions, other deductions) and the rules that apply to people in employment, self-employment and sub-contractors. Use copies of blank pay slips from the workplace for this. Be aware of potential for confusion with the task in hand. Further information can be found in *Skills for Life* Numeracy Entry 3, Unit 2. Information about deductions can be found at www.inlandrevenue.gov.uk.

Focus pages

- Look through the worked example on the first focus page (page 5:17). Encourage learners to use a calculator to check the calculations, in particular to check the order of division (by 8, then by 2 *or* by 2, then by 8). You may need to check that all learners can use a calculator correctly to divide amounts of money. Discuss rounding if it arises and using zero in the pence column as a place holder.
- The second focus page (page 5:18) adds a further variable to the money calculations done on the previous focus page. Work through the example with learners. Do further examples if required. Ensure learners understand the jargon (e.g. compo) and mathematical language).
- This example includes multiplying by 10 – observe methods for doing this and check that learners have the skills to tackle this using mental methods. If necessary, refer to *Skills for Life* Numeracy Entry 3, Unit 2.
- If appropriate, extend the worked examples on the focus pages by using other examples to confirm that learners have understood the processes and have accurate calculation skills.

Curric. refs	NOS/NVQ	Key Skills
N1/E3.9 N2/E3.4	VR02	N1.2

Task 1

Calculate with money, using division
N1/E3.9
N2/E3.4

- It would be useful for learners to do the required calculation on paper first. This will confirm whether they understand the principle of division.
- They should then check their calculation using a calculator.

If the learner has difficulty

- If the learner has difficulty with the principles of division, then further support will be required – try *Skills for Life* Numeracy Level 1, Unit 2. (This material also covers calculator use.)
- Dyslexic learners may have problems with the process of division, particularly long division, where there is a particular sequence of operations in which learners can become lost. A memory card of the sequence of operations may help, as may using a calculator. However, understanding is essential; question learners and ask them to verbalise their actions when performing a calculation (whether on paper or on a calculator).
- Doing a calculation using a calculator involves a sequence of operations (see above). Some learners may not understand this and may get lost in the sequence. A memory card may help. Repeated practice is essential – use *Skills for Life* Numeracy Level 1, Unit 2.
- Ask learners to estimate the likely answer to calculations (i.e. Is a brickie likely to be paid £50, £500 or £5000 per week?) to ensure that they are not over-reliant on the calculator.

Extension

- Use additional examples (of increasing complexity) from the workplace to ensure these skills are firmly in place. Add complexities such as totals that are not whole hundreds or thousands of pounds, that include pence and that include workers on different rates of pay.
- Look at deductions on pay slips. Ask learners to estimate deductions based on National Insurance Contributions of 10% and tax at 20%. Discuss how this is handled when you are self-employed.
- This work could be extended into costing jobs – cost of materials, labour costs (based on estimated time for job) and other costs (e.g. contingency).

Task 2

Calculate with money
N1/E3.9
N2/E3.4

This task is of a similar level of difficulty to Task 1; you may need to remind learners about deducting the labourer's wages before proceeding with the division.

If the learner has difficulty

Take the learner through the logical progression of the calculations. Remind them of the total amount of money for the job. If they take on an extra worker, will the bricklayers have more or less money to share between them? How much less (first calculation). How much is this going to leave them? (second calculation) How much is this each? (third calculation)

Extension

See Task 1.

Theme assessment

- Assess learners' skills in this aspect of work with a range of problems based on sub-contract agreements.
- This skill can also be assessed by checking pay slips and invoices and calculating estimates of worker costs and estimates for jobs.

Planning your work; working out wages (2)

Focus

A lot of building work is done on a **self-employed basis**. When you take on a contract you may want to work out how much pay **your team** can expect to get paid **each week**. You will also have to work out how to divide the money between **members** of your working team.

Example
Contract: £11 200
Team: 2 bricklayers
Duration: 8 weeks

To work out pay per person, divide the total amount of money by the number of people in the team.

11 200 ÷ 2 = 5600

Each person gets **£5600** for working 8 weeks.

To work out pay per person, per week, divide the total amount of money by the number of people in the team and the number of weeks.

11 200 ÷ 2 = 5600
5600 ÷ 8 = £700

Each person gets **£700 each week for 8 weeks.**

Some contractors will pay the team for the work they have done on a weekly basis. A surveyor checks how much work has been completed before the money is paid out.

To work out the team's pay per week, divide the total amount of money by the number of weeks.

11 200 ÷ 8 = 1400

The team gets **£1400** each week for 8 weeks.

REMEMBER!

It doesn't matter if you divide **11200** by **8** and then by **2**. The answer works out the same.

Check it out. 

Planning your work; working out wages (2)

Focus

Employing a labourer

Some teams of bricklayers employ a labourer to help with carrying the bricks and mixing the compo.

Usually the labourer does not receive the same wages as the bricklayers.

Example
Contract: £17 000
Team: 2 bricklayers and 1 labourer
Duration: 10 weeks
Bricklayers will get paid equal shares.
Labourer will get paid £400 per week.

When wages are not paid in equal shares

Step 1: Work out the labourer's share.

Step 1
Labourer's wages = 400 × 10 weeks = **£4000**
The labourer is paid **£4000** for working 10 weeks.

Step 2: Subtract the share you have calculated in step 1 from the whole contract to find out how much money remains for the rest of the team.

Step 2
£17 000 – **£4000** = **£13 000**
£13 000 remains to be shared out between the bricklayers.

Step 3: Share the remainder of the money between the rest of the team.

Step 3
Bricklayers' wages = **£13 000** ÷ **2** = **£6500**
Each bricklayer is paid **£6500** for working 10 weeks.

Planning your work; working out wages (2)

Task

Example
Contract: £11 700
Time: 5 weeks
Team: 3 bricklayers

Task 1

a How much can this team expect to earn each week?

_____

b If they share the money equally, how much will each bricklayer earn for 5 weeks' work?

_____

c If they share the money equally, how much will each bricklayer earn each week?

_____

Tip

- To find pay per week, divide the total figure for the contract by the number of weeks.
- To find pay per person, divide the total figure for the contract by the number of people.
- To find pay per week per person, divide the total figure for the contract by the number of weeks, then the number of people.

Task 2

The team decides to pay a labourer £300 per week for 5 weeks.

a How much will the labourer earn?

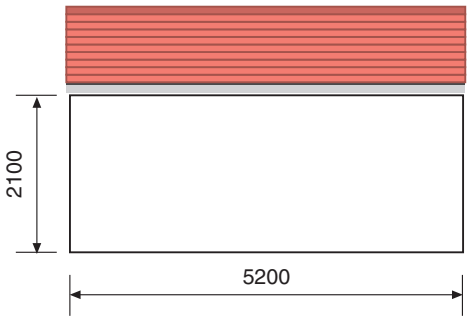
_____

b How much will each bricklayer earn for the 5 weeks' work if they share the remainder of the contract money equally?

_____

Check it

1



What is the area of this garage wall?

A 10.92 m^2

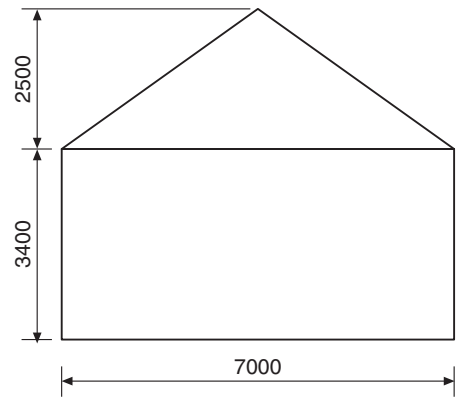
B 10.92 mm^2

C 10.92 m

D 7.3 m^2

MSS1/L1.9

2



This wall has a gable end. What is the total area of the wall and gable end?

A 41.3 m^2

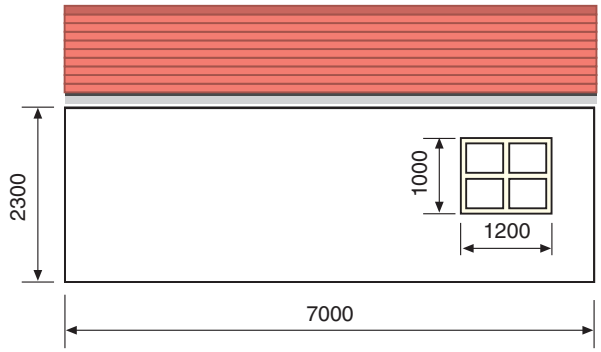
B 32.55 m

C 32.55 m^2

D 44.45 m^2

MSS1/L2.8

3



This garage has a window. What is the area of brickwork on the garage wall?

A 17.3 m^2

B 14.9 m^2

C 16.1 m^2

D 1.2 m^2 **MSS1/L2.8**

4 The length of a block is 450 mm (including a 10 mm mortar bond).

The height of a block is 225 mm (including a 10 mm mortar bond).

How many blocks will you need to build a wall with an area of 12 m^2?
(Do not allow for wastage.)

A 118

B 100

C 50

D 119 **N2/L1.7; N2/L1.11**

5 You have worked out that you need 250 blocks to complete a job.
Allowing 5% for wastage, how many blocks should you order?

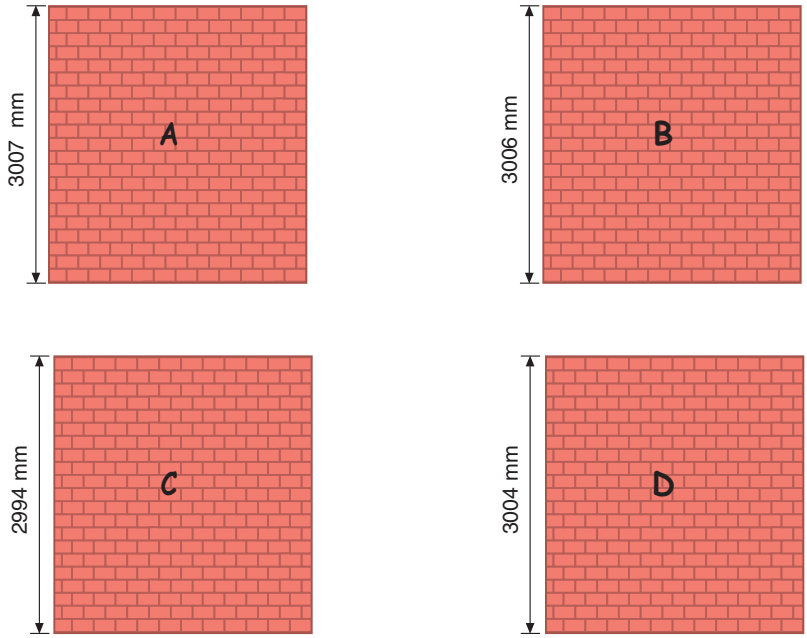
A 262

B 237

C 263

D 238 **N2/L1.9; N2/L1.10; N2/L1.11**

6



These walls have been built to gauge with regular joint thickness.
The tolerance is ±5 mm in 3 m height. Which wall meets the required standard?

A A

B B

C C

D D

MSS1/L1.5

7 **Programme of work**

Week commencing	18 Apr	25 Apr	2 May	9 May	16 May	23 May
Setting out						
Excavate foundation trenches						
Lay concrete foundations						
Brickwork to DPC						
Hardcore/concrete to ground floor						
Brickwork to 1st floor						
1st floor joists						
Brickwork to eaves						
Roof structure						
Tile roof						

Look at the programme of work on the previous page. On what date is work to the 1st floor joists planned to start?

A 9th May

B 10th May

C 11th May

D 12th May **HD1/L1.1**

8 How many days is the work on the 1st floor joists expected to last?

A 1 day

B 2 days

C 3 days

D 4 days **HD1/L1.1**

9 An experienced bricklayer can lay approximately 1 m^2 of brickwork per hour. How long will it take to lay 6 m^2 of brickwork?

A 60 minutes

B 0.17 hours

C 6 hours

D 60 hours **N1/L1.8; N1/L1.9**

10 A gang of three bricklayers is being paid £12 600 for a contract that will last 6 weeks. If they share the money equally, how much will each bricklayer earn each week?

A £2100

B £700

C £1400

D £300 **N1/E3.9; MSS1/L1.1; N2/E3.4**

Answers

PAGES 5:1–5:2

Areas (1)

Task 1

18 square metres

Task 2

12.5 m^2

Task 3

12.93 m^2

PAGES 5:3–5:4

Areas (2)

Task 1

Area = $\frac{7.5\,m \times 2.5\,m}{2}$ = 9.375 m^2

Task 2

Area = $\frac{4.8\,m \times 1.92\,m}{2}$ = 3.84 m^2

Task 3

Area = 9 m × 3.6 m + $\frac{9\,m \times 3\,m}{2}$ = 32.4 m^2 + 13.5 m^2
= 45.90 m^2 or 45.9 m^2

PAGES 5:5–5:6

Areas (3)

Task 1

Step 1: The area of the whole wall is:
6 m × 2.4 m = 14.4 m^2

Step 2: The area of the opening is:
1.2 m × 1 m = 1.2 m^2

Step 3: The area of the brick work is:
14.4 m^2 – 1.2 m^2 = 13.2 m^2

Task 2

Step 1: The area of the whole wall is:
6 m × 2.4 m = 14.4 m^2

Step 2:
Area of the opening for **window:**
1.2 m × 1.0 m = 1.2 m^2

Area of the opening for **door:**
1.0 m × 2.2 m = 2.2 m^2

Total area of openings:
1.2 m^2 + 2.2 m^2 = 3.4 m^2

Step 3: The area of the brick work is:
14.4 m^2 – 3.4 m^2 = 11.0 m^2

PAGES 5:7–5:10

Determining quantities

Note that answers to Tasks 1–3 may differ slightly because of rounding.

Task 1

Blocks to make a length of 1 m = 1 ÷ 0.450 = 2.222
Blocks to make a height of 1 m = 1 ÷ 0.225 = 4.444
Blocks to make an area of 1 m^2 = 2.222 × 4.444
= 9.875
Blocks to make an area of 8 m^2 = 9.875 × 8 = 79,
use 79 blocks

Task 2

Blocks as above.
9.875 × 50 m^2 = 493.75 blocks, **use 494 blocks**

Task 3

Bricks to make a length of 1 m = 1 ÷ 0.225 = 4.444
Bricks to make a height of 1 m = 1 ÷ 0.075 = 13.333
Bricks to make an area of 1 m^2 = 13.333 × 4.444 =
59.252
Bricks to make an area of 50 m^2 = 59.252 × 50 =
2962.6, **use 2963 bricks**

Task 4

Plot 15	
Blocks	
Wastage:	70 blocks
Order:	1470 blocks
Bricks	
Wastage:	420 bricks
Order:	8820 bricks

Plot 27	
Blocks	
Wastage:	62 blocks
Order:	1302 blocks
Bricks	
Wastage:	372 bricks
Order:	7812 bricks

Task 5

Area of wall = 9.6 m × 3.5 m = 33.6 m^2

Number of blocks
10 per m^2 × 33.6 m^2 = 336 blocks
Order (5% extra including wastage allowance) = 353 blocks (336 × 1.05)

Number of bricks
60 per m^2 × 33.6 m^2 = 2016 bricks
Order (5% extra including wastage allowance) = 2117 bricks (2016 × 1.05)

PAGES 5:11–5:12

Checking your brickwork for accuracy

Task 1

Walls **a**, **b** and **d** meet the standard.
Wall **c** does not meet the standard.

Task 2

Gaps **b** and **c** make the brickwork fail the standards.

PAGES 5:13–5:14

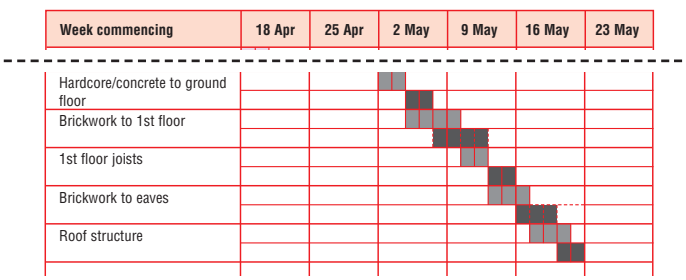
Keeping to schedule

Task 1

1 a 27th April
b 3 days
c 29th April
2 a 4th May
b 4 days
c 9th May
3 a 12th May
b 3 days
c 16th May

Task 2

Note that only the relevant section of the chart is shown here.



PAGES 5:15–5:16

Planning your work; working out wages (1)

Try this: Approximately $2\frac{1}{2}$ days

Task 1

41 m^2 of blockwork will take 41 ÷ 3 hours = 13.7 hours (round up to 14 hours)
41 m^2 of brickwork will take 41 hours
Total = 14 + 41 = 55 hours, which is **approximately 7 days**

Task 2

36 m^2 of blockwork will take 36 ÷ 3 hours = 12 hours.

36 m^2 of brickwork will take 36 hours.

Total time = 12 + 36 = 48 hours.

This is approximately 6 days' work, so two experienced bricklayers working together would take **approximately 3 days**.

PAGES 5:17–5:19

Planning your work; working out wages (2)

Task 1

a £11 700 ÷ 5 weeks = £2340 each week
b £11 700 ÷ 3 bricklayers = £3900 each
c £11 700 ÷ 3 ÷ 5 = £780 per bricklayer per week

Task 2

a £300 × 5 weeks = £1500
b Contract money minus the labourer's share =
£11 700 – £1500 = £10 200
£10 200 ÷ 3 bricklayers = £3400 each

Check it

1 A
2 C
3 B
4 D
5 C
6 D
7 B
8 B
9 C
10 B