

# Practical Maths for Plumbing & Heating Students and Apprentices

## Unit 9: Transposition of Formulae for Plumbing and Heating Calculations

### Lesson Plan

**Duration:** 3 Hours

**Level:** Level 2 / Level 3

**Delivery Format:** Classroom / Workshop Theory Session

### 1. Learning Objectives

**By the end of this lesson, learners will be able to:**

- Understand the purpose of formula transposition
- Rearrange simple formulas correctly
- Rearrange formulas involving multiplication and division
- Rearrange formulas involving brackets
- Substitute values accurately into formulas
- Apply transposed formulas to plumbing and heating calculations
- Identify and correct common formula transposition mistakes

### 2. Prior Knowledge / Entry Requirements

**Learners should:**

- Understand basic algebra
- Be confident using mathematical operations
- Be able to substitute values into formulas

- Be able to use a calculator
- Have some awareness of formulas used in plumbing and heating work

### **3. Resources Required**

- PowerPoint slides – Unit 9
- Student worksheets – Unit 9
- Answer sheets
- Calculators
- Whiteboard / flipchart
- Course textbook / learner guide
- Formula sheets
- Practical calculation examples

### **4. Lesson Structure**

**Total Duration: 3 Hours**

**Starter Activity (15–20 minutes)**

**Purpose: Assess learner understanding of basic formula manipulation.**

**Example Questions:**

- Rearrange:  $y = x + 5$  to make  $x$  the subject
- Rearrange:  $V = I \times R$  to make  $I$  the subject
- Solve:  $A = l \times w$  for  $w$
- What does “make  $x$  the subject” mean?
- Rearrange:  $C = 45 + 35h$  to make  $h$  the subject

**Teaching Input – Core Concepts (70–80 minutes)**

**Topics Covered:**

- Understanding formulas
- Subject of the formula
- Inverse operations
- Rearranging formulas involving:
  - Addition
  - Subtraction

- Multiplication
- Division
- Rearranging formulas with brackets
- Checking rearranged formulas
- Plumbing and heating applications

### **Worked Example – Plumbing Context**

A heating engineer uses the formula:

$$C = 45 + 35h$$

Where:

C = total cost

h = hours worked

Rearrange to make h the subject.

Step 1:

Subtract 45 from both sides:

$$C - 45 = 35h$$

Step 2:

Divide both sides by 35:

$$h = (C - 45) \div 35$$

**Answer:**

$$h = (C - 45) / 35$$

**Teaching Focus:**

- Using inverse operations correctly
- Working step-by-step
- Maintaining balance in equations
- Applying formulas to real trade situations

**Break: 10–15 minutes**

**Guided Practice (50–60 minutes)**

**Learners complete supported worksheet activities involving:**

- Rearranging formulas
- Solving practical equations
- Formula substitution
- Plumbing and heating application questions

**Independent Practice (40–45 minutes)**

**Learners independently complete:**

- Costing formula rearrangements
- Pipe and flow calculation formulas
- Heating system formula exercises
- Practical plumbing and heating application questions

**Review & Feedback (25–30 minutes)**

Tutor-led review of answers and methods.

**Plenary (10 minutes)**

Quick recap questions and learner reflection.

## **5. Assessment of Learning**

**Assessment will take place through:**

- Starter activity responses
- Ongoing questioning
- Worksheet accuracy
- Learner explanations
- Tutor observation

Homework pack and final assessment are available within the resource pack for assessment purposes.

## 6. Differentiation

### Support:

- Step-by-step demonstrations
- Simpler formulas initially
- Formula guides
- Calculator support
- Worked examples

### Stretch:

- Multi-step rearrangements
- Bracketed formulas
- Realistic plumbing and heating scenarios
- Learner explanations and demonstrations

## 7. English & Maths Integration

### This lesson supports:

- Mathematical vocabulary
- Reading and interpreting formulas
- Verbal explanations
- Trade terminology
- Clear written working

## 8. Behaviour & Engagement Strategy

- Use practical examples throughout
- Encourage learner participation
- Active questioning
- Link formulas to real plumbing and heating calculations
- Reinforce confidence through structured activities

## 9. Homework / Extension

- Complete unfinished worksheet questions
- Practise formula rearrangement
- Revise inverse operations

- Identify formulas used in plumbing and heating work
- Attempt challenge questions from the course textbook

## **10. Tutor Notes**

### **Common Learner Difficulties:**

- Understanding inverse operations
- Moving terms incorrectly
- Rearranging multiplication/division formulas
- Missing brackets
- Calculator mistakes

### **Key Teaching Emphasis:**

- Method before speed
- Logical step-by-step working
- Maintaining equation balance
- Accurate formula manipulation
- Real trade applications

### **Pacing Advice:**

- Spend additional time on inverse operations if learners struggle
- Reinforce formula structure regularly
- Use practical costing and engineering examples where possible