

**Course Title:** Math Applications in Water Distribution

**Course Hours:** 19 (1.9 CEUs)

**Course Description:**

This course focuses on math concepts related to water distribution system operation and maintenance and applies these concepts to work-related math problems. Operators practice solving math problems while getting step-by-step instructions. This course covers topics that operators encounter on the job. It does not attempt to cover the topics of any state certification exam.

**Course Objectives:**

Upon completion of this course, participants will be able to perform math calculations typically used in water distribution systems. Course objectives include:

- Solve problems related to calculating flow rate, dose, and feed rate of chemicals
- Calculate acre-feet as a unit for volume
- Calculate needed doses for algae control
- Calculate the amount of liquid polymer needed to achieve a desired dose

**Course Outline:**

- 1) Basic Math Concepts (250 minutes)
  - a. Numbers and Operations
  - b. Order of Operations
  - c. Basic Algebra
  - d. Percentages
- 2) Intermediate Math Concepts (290 minutes)
  - a. Units
  - b. Area
  - c. Volume
  - d. Mass and Weight
  - e. Density and Specific Weight
  - f. Concentration
  - g. Velocity and Flow Rate
  - h. Force and Pressure
  - i. Work, Head, and Power
  - j. Metric System
- 3) Advanced Math Concepts (320 minutes)
  - a. Pumps
  - b. Evaluating Pump Performance
  - c. Analyzing and Presenting Data
  - d. Describing Data or Results
  - e. Moving Averages
  - f. More Applications of Graphing and Charting
  - g. Regression Analysis (Prediction Equations, Trends, and Correlations)
- 4) Overview of Math Applications in Water Distribution System Operation (5 minutes)
  - a. Introduction
- 5) Basic Calculations in Water Distribution Systems (25 minutes)
  - a. Discussion of flow rate and velocity relationship

- b. Work through example problems 1–3
- c. Estimate concentration (dose)
- 6) Distribution Facilities (50 minutes)
  - a. Discussion of flow rate and velocity relationship in distribution facilities
  - b. Application of Hazen-Williams equation to flow rate and velocity estimations
  - c. System leakage rate estimation
  - d. Work through example problems 1–8
  - e. Gauge pressure and total pressure
  - f. Watch 1 video about uplift force
  - g. Discussion of uplift force exerted by groundwater and estimating uplift force for underground storage tanks
- 7) Distribution Systems Operation and Maintenance (50 minutes)
  - a. Discussion of how total trihalomethanes (TTHM) are formed and estimating TTHM running averages from data
  - b. Discussion of how to determine the accuracy of meters that measure variables such as pressure and temperature
  - c. Calculate the volume of excavation
  - d. Work through example problems 1–9
  - e. Estimate storage tank volume
  - f. Estimate flow rate from a hydrant
- 8) Disinfection (30 minutes)
  - a. Discussion of the relationship between chlorine demand and chlorine residual
  - b. Estimate the mass of chlorine based on the relationship between concentration and volume
  - c. Work through example problems 1–5
  - d. Estimate the volume of hypochlorite solution needed based on the strength of solutions and chlorine dose
- 9) Final Exam (120 minutes)

**Course Format:** This course will be delivered online.

**Assessment Methodology:** Cumulative online assessment (final exam, 120 minutes)

**Prerequisites:** None

**Textbook:** None

**Recommended Reading:** “Water Distribution System Operation and Maintenance,” Seventh Edition. Office of Water Programs, [www.owp.csus.edu](http://www.owp.csus.edu)