Math Lab 1 MS 4
Using Formulas to Calculate Temperature

For best results, print this document front-to-back and place it in a three-ring binder.
Corresponding teacher and student pages will appear on each opening.

TEACHING PATH - MATH SKILLS LAB - CLASS M

RESOURCE MATERIALS

Student Text: Math Skills Lab

CLASS GOALS

1. Teach students how to use a formula that converts °F to °C.
2. Teach students how to use a formula that converts °C to °F.

CLASS ACTIVITIES

1. Take five or ten minutes to go through the Student Exercises. Make sure that your students understand the correct answers.
2. Complete the activities. Students already should have read the discussion material and looked at the examples for each activity before coming to class. You should summarize the main points in each activity, work an example or two, and have students complete the Practice Exercises for each activity on their own.
3. Supervise student progress. Help students obtain the correct answers.
4. Before the class ends, tell your students to read Lab 1T1, "Measuring Temperature With Thermometers," as homework.

Math Skills Laboratory

Lab 1 MS 4

MATH ACTIVITY

Using Formulas to Calculate Temperature

MATH SKILLS LAB OBJECTIVES

When you complete this activity, you should be able to do the following:

1. ***Use a formula to calculate the Fahrenheit temperature, given the Celsius temperature.***
2. ***Use a formula to calculate the Celsius temperature, given the Fahrenheit temperature.***

LEARNING PATH

1. ***Read the Math Skills Lab. Give particular attention to the Math Skills Lab Objectives.***
2. ***Study Examples A and B.***
3. ***Work the problems.***

ACTIVITY

Using Formulas to Calculate Temperature

MATERIALS

For this activity, you'll need a hand calculator.

Given any temperature T°C on the Celsius scale, the corresponding temperature T°F on the Fahrenheit scale is found from the formula that follows:

$$T°F = \frac{9}{5}(T°C) + 32° \qquad \textit{Equation 1}$$

Given any temperature T°F on the Fahrenheit scale, the corresponding T°C on the Celsius scale is found from the formula:

$$T°C = \frac{5}{9}(T°F - 32°) \qquad \textit{Equation 2}$$

The examples that follow show how to use the two formulas to convert from Celsius to Fahrenheit and from Fahrenheit to Celsius. Study the examples. Make sure you understand all of the steps in each solution. You may want to check the calculations with your calculator.

Example A: Changing Celsius Temperature to Fahrenheit Temperature

Given: Computer equipment must not become overheated. The temperature of rooms where expensive mainframe computers are used is kept at 20°C.

Find: Fahrenheit temperature equal to 20°C.

Solution: This problem requires that you change from a Celsius temperature (20°C) to a Fahrenheit temperature. Therefore, you use the formula given by Equation 1:

$$T°F = \frac{9}{5}(T°C) + 32°$$

where: T°C = known Celsius temperature
T°F = unknown Fahrenheit temperature to be found

Step 1: Write down the formula as follows:

$$T°F = \frac{9}{5}(T°C) + 32°$$

Step 2: Substitute 20° for T°C in the formula

$$T°F = \frac{9}{5}(20°) + 32°$$

Step 3: Multiply $\frac{9}{5}$ times 20°. (Use your calculator.) You should get 36°. Substitute this in the equation:

$$T°F = 36° + 32°$$

Step 4: Add as indicated. (Use your calculator.) The final answer should be:

$$T°F = 68°F.$$

You have just shown, using a formula, that a temperature of 20°C is equal to a temperature of 68°F.

Example B: Changing Fahrenheit Temperature to Celsius Temperature

Given: Normal body temperature on the Fahrenheit scale is 98.6°F.

Find: Normal body temperature on the Celsius scale.

Solution: This problem requires that you change from a Fahrenheit temperature to a Celsius temperature. Therefore, you use the formula given by the equation:

$$T°C = \frac{5}{9}(T°F - 32°)$$

where: T°F = known Fahrenheit temperature
T°C = unknown Celsius temperature to be found

Step 1: Write down the formula as follows:

$$T°C = \frac{5}{9}(T°F - 32°)$$

Step 2: Substitute 98.6° for T°F in the formula:

$$T°C = \frac{5}{9}(98.6° - 32°)$$

Step 3: Perform the subtraction indicated in the parentheses. Use your calculator. Substitute your result back into the formula. You should get:

$$T°C = \frac{5}{9}(66.6°)$$

Step 4: Use your calculator to determine the value of $T°C = \frac{5}{9}(66.6°)$. You should get 37°.

Step 5: Write down the final answer as:

$$T°C = 37°C.$$

You have just shown, using a formula, that 98.6°F is equal to 37°C.

SOLUTIONS TO PRACTICE EXERCISES

Problem 1:

$$T°C = \frac{5(T°F - 32°)}{9}$$

$$T°C = \frac{5(180 - 32)}{9}$$

$$T°C = 82.2$$

Problem 2:

$$T°F = 1.8\ (T°C) + 32°$$
$$T°F = 1.8\ (36.7) + 32$$
$$T°F = 98.1$$

Problem 3:

$$T°C = \frac{5(T°F - 32°)}{9}$$

$$T°C = \frac{5(5 - 32)}{9}$$

$$T°C = \frac{5(-27)}{9}$$

$$T°C = -15$$

Problem 4:

$$T°F = 1.8\ (T°C) + 32°$$
$$T°F = 1.8\ (694) + 32$$
$$T°F = 1281.2$$

Problem 5:

$$T°C = \frac{5(T°F - 32°)}{9}$$

$$T°C = \frac{5(103 - 32)}{9}$$

$$T°C = 39.4$$

Problem 6:

$$(\Delta T)C° = (\Delta T)F°/(1.8\ F°/C°)$$
$$(\Delta T)C° = 78\ F°/(1.8\ F°/C°)$$

$$(\Delta T)C° = (78\ \cancel{F°}) \times \left(\frac{1}{1.8}\ \ \frac{C°}{\cancel{F°}}\right)$$

$$(\Delta T)C° = 43.3$$

PRACTICE EXERCISES

In the following problems, you'll use Equation 1 or Equation 2. Read each problem carefully. Decide which formula to use. Then solve for the unknown by substituting in the formula.

Problem 1: A thermostat on an automobile engine is calibrated to "open" and allow engine fluid to circulate through the radiator when the fluid temperature reaches 180°F. What is this temperature equal to on the Celsius scale?

Problem 2: The temperature of a hot summer day, in a non-air-conditioned shop, reaches 36.7°C. What is this temperature equal to on the Fahrenheit scale?

Problem 3: A 5W motor oil does not become too viscous (heavy) even at temperatures as low as 5°F. What is this temperature equal to in degrees Celsius (°C)?

Problem 4: A thermocouple that measures the temperature of molten aluminum has a temperature indicator gage that's graduated in a Fahrenheit scale as well as a Celsius scale. The aluminum in the vat is at a temperature of 694°C, as shown by the gage. If the Fahrenheit scale had been read instead, what would the reading be in degrees Fahrenheit (°F)?

Problem 5: A nurse at a hospital emergency room tells Mrs. Nakamura that her baby has a temperature of 103°F. Mrs. Nakamura is a visitor from Japan and only understands the meaning of temperatures expressed in degrees Celsius. What is her baby's temperature in degrees Celsius (°C)?

Problem 6: What is the ***temperature difference*** in Celsius degrees if the temperature difference bewteen two cities is 78 Fahrenheit degrees? (***Note:*** This problem involves a temperature difference, rather than a temperature, so we're working with Fahrenheit degrees (F°) and Celsius degrees (C°) and the relationship 1 C° = $\frac{9}{5}$ F°, or 1 C° = 1.8 F°.)