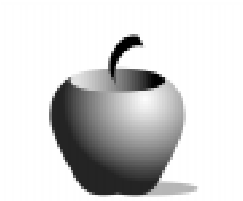
EXPLORATIONS

Activity 6

What's Up?



Teacher Notes

Concept

- Temperature scales
- Formulas

Skill

- Writing keystroke sequences for formulas
- Converting between temperature scales

Applicable Calculator Functions

- [FracMode], [/], [▸D], [▸OP1], [OP1], [▸OP2], [OP2], [STO▸], [RCL]

Materials

- Student Activity Sheets (page 51)
- TI-30X IIS/TI-34 II calculator

Objective

- Students will write keystroke sequences for conversions between temperature scales and use their calculators to convert between the scales

Prerequisites

No prior calculator use is required. Experience with [OP1] and [OP2] or [STO▸] and [RCL] keys would be helpful.

Problem

1. Using your calculator, work with a partner to find the sequence of keystrokes you need to change a temperature given in Fahrenheit to its equivalent in Celsius. Write the steps below.
2. The temperatures listed below use the Fahrenheit scale. First, estimate the corresponding Celsius value, then use the steps you discovered to find the actual value. Finally, record each Celsius value below.
3. Work with a partner to find the sequence of keystrokes you need to change a temperature given in Celsius to its equivalent in Fahrenheit. Write the steps below.
4. Now try changing the temperatures from Celsius to Fahrenheit. First, estimate the corresponding Fahrenheit value, then use the steps above to find the actual value. Finally, record each Fahrenheit value below.

Activity

In an opening discussion, solicit benchmarks for the two temperature scales. Students will often know that the freezing point of water is 0 degrees in Celsius, but 32 degrees in Fahrenheit, and the boiling point is 100 degrees in Celsius, but 212 degrees in Fahrenheit. Then explain that this activity involves two kinds of tasks. The first is to find a correct sequence of keystrokes for a formula using the calculator. The second is to use that formula to estimate, then convert, temperatures from one scale to the other.

If it is appropriate for your students, tell them the Fahrenheit to Celsius formula and have the students rewrite it to solve for Celsius. Rewriting a formula in terms of a different variable is a very valuable skill, but it is also quite difficult for many seventh and eighth graders. If you wish to do this addition to the activity you should do it before you pass out the student activity sheets.

You may want to focus on a comparison of keystrokes for the two formulas, noting the reverse orders and inverse operations they involve.

Some classes may need instruction with using the [STO▸] and [RCL] keys since they are very valuable in producing a sequence of keystrokes for these conversions. Once they have determined a sequence they believe is correct, student pairs should ask other student pairs to try the keystrokes they have listed on the student activity sheet. Again, the students can use the values for freezing and boiling points of water, this time to check whether each proposed sequence works.

Decide whether to encourage mental calculations for the estimates. If so, discuss good "rules of thumb."

All temperatures included in the activity are actual measures. Have kids find other actual temperatures in almanacs, record books, internet, etc., and bring them to class. For example, what is the lowest air temperature recorded on earth? (-128.6 degrees F)

Answers to Student Activity Sheet:

	Reference Point	Degree Fahrenheit	Actual Degree Celsius
A.	Normal human body temperature	98.6°F	37°C
B.	A cool fall day	50°F	10°C
C.	Frozen yogurt	12°F	-11.11°C
D.	A hot day	95°F	35°C
E.	Room temperature on a winter day	68°F	20°C

	Reference Point	Degree Fahrenheit	Actual Degree Celsius
A.	A hot bath	45°C	113°F
B.	Hottest temperature on the moon	102°C	215.6°F
C.	Body temperature of a sparrow	42°C	107.6°F
D.	A broiled steak	60°C	140°F
E.	Temperature on a snowy day	-5°C	23°F
F.	Hottest air temperature recorded on earth	58°C	136.4°F

Wrap-Up

Give students a temperature in Celsius and ask them to estimate it in Fahrenheit. Then have the students find the actual Fahrenheit value and discuss ways to mentally calculate close estimates, using a simplified version of the formula. Repeat the discussion for conversions from Fahrenheit to Celsius.

Assessment

Have students write a short paragraph describing weather conditions on a particular summer, fall, winter, or spring day. Have them include the temperature in Celsius and Fahrenheit. Students could then share those paragraphs, providing the temperature according to one of the scales and have other students estimate the equivalent temperature on the other scale.

Extensions

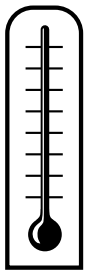
- Have students try this activity with their parents to see how proficient they are at these conversions (or to help them improve!).
- Have students look at the graph for Celsius and Fahrenheit temperatures (X = Celsius and Y = Fahrenheit). Examine the slope (9/5) and intercept (32) and talk about their meanings.

Student Activity

Name _____

Date _____

Activity 6



What's Up?

Objective: *You will explore conversions and comparisons between temperature scales*

Problem: *More and more places are using the Celsius scale to measure and report temperature readings. Do you have a sense of what temperatures in Celsius mean? For example, if you ride by the bank in a car and the temperature displayed is 25° Celsius, will you need a jacket when you get out of the car? Exploring with equivalent temperatures on the Fahrenheit and Celsius scales can help you improve your ability to answer such a question and feel more comfortable with the Celsius scale.*

To change Fahrenheit to Celsius you can use the formula

$$\textbf{Temperature in Celsius} = \frac{5}{9}(\textbf{Fahrenheit} - 32)$$

1. Using your calculator, work with a partner to find the sequence of keystrokes you need to change a temperature given in Fahrenheit to its equivalent in Celsius. Write the steps below.

Compare your results with those of your classmates and revise your steps, if needed.

2. The temperatures listed below use the Fahrenheit scale. First, estimate the corresponding Celsius value, then use the steps you discovered to find the actual value. Finally, record each Celsius value below.

	Reference Point	Degree Fahrenheit	Estimated Degree Celsius	Actual Degree Celsius
A.	Normal human body temperature	98.6°F		
B.	A cool fall day	50°F		
C.	Frozen yogurt	12°F		
D.	A hot day	95°F		
E.	Room temperature on a winter day	68°F		

Now, practice going from a temperature given in Celsius to its equivalent in Fahrenheit.

$$\textbf{Temperature in Celsius} = \frac{\mathbf{5}}{\mathbf{9}}(\textbf{Fahrenheit} - \mathbf{32})$$

3. Work with a partner to find the sequence of keystrokes you need to change a temperature given in Celsius to its equivalent in Fahrenheit. Write the steps below.

Compare your results with those of your classmates and revise your steps, if needed.

	Reference Point	Degrees Celsius	Estimated Degrees Fahrenheit	Actual Degrees Fahrenheit
A.	A hot bath	45°C		
B.	Hottest temperature on the moon	102°C		
C.	Body temperature of a sparrow	42°C		
D.	A broiled steak	60°C		
E.	Temperature on a snowy day	-5°C		
F.	Hottest air temperature recorded on earth	58°C		

What's Up?
Keystrokes for the TI-34 II

Example: *98.6° Fahrenheit to Celsius.*

PRESS	DISPLAY
2nd [▸OP1]	OP1 = (Press CLEAR if needed)
(–) 32 ENTER	OP1 = –32
2nd [▸OP2]	OP2 = (Press CLEAR if needed)
× 5 / 9 ENTER	OP2 = x 5/9
98.6 OP1	98.6 – 32 1 66.6
OP2	66.6 x 5/9 1 37

Example: *45° Celsius to Fahrenheit.*

PRESS	DISPLAY
2nd [▸OP1]	OP1 = (Press CLEAR if needed)
× 9 / 5 ENTER	OP1 = x 9/5

PRESS	DISPLAY
2nd [▸OP2]	OP2 = (Press CLEAR if needed)
+ 32 ENTER	OP2 = + 32
45 OP1	45 x 9/5 1 405/5 N/D → n/d
OP2	405/5 + 32 1 565/5 N/D → n/d
▸D	Ans ▸ D
ENTER	113

Example: *98.6° Fahrenheit to Celsius.*

PRESS	DISPLAY
32 STO▸	A B C D E (use arrow key, if needed to underline A)
ENTER	32 → A 32
98 · 6 − 2nd [RCL]	A B C D E 32
ENTER	98.6 – 32
ENTER	98.6 – 32 66.6

PRESS	DISPLAY
[×] 5 [/] 9	Ans x 5/9
[ENTER]	Ans x 5/9 37

Example: *45° Celsius to Fahrenheit.*

PRESS	DISPLAY
9 [/] 5 [STO▶]	A B C D E (use arrow key, if needed, to underline A)
[ENTER]	9 / 5 → A 9/5
45 [×]	45 x
[2nd] [RCL]	A B C D E 9/5
[ENTER] [ENTER]	45 x 9 / 5 405/5
[▶D]	Ans ▶ D
[ENTER]	Ans ▶ D 81
[+] 32 [ENTER]	Ans + 32 113

What's Up?
Keystrokes for the TI-30X IIS

Example: *98.6° Fahrenheit to Celsius.*

PRESS	DISPLAY
32 [STO▶]	A B C D E (use arrow key, if needed, to underline A)
[ENTER]	32 → A 32
98 [·] 6 [−] [2nd] [RCL]	A B C D E 32
[ENTER]	98.6 – 32
[ENTER]	98.6 – 32 66.6
[×] 5 [Ab/c] 9	Ans * 5⌟9
[ENTER]	Ans * 5⌟9 37

Example: *45° Celsius to Fahrenheit.*

PRESS	DISPLAY
9 [A b/c] 5 [STO▶]	A B C D E (use arrow key, if needed, to underline A)
[ENTER]	9 / 5 → A 1 ⌟ 4/5
45 [×]	45 *
[2nd] [RCL]	A B C D E 1 ⌟ 4/5
[ENTER] [ENTER]	45 * 1 ⌟ 4 ⌟ 5 81
[+] 32 [ENTER]	Ans + 32 113

Example: *45° Celsius to Fahrenheit.*

PRESS	DISPLAY
[2nd] [K]	K = (Press [CLEAR] if needed)
[×] 9 [÷] 5 [+] 32 [ENTER]	K = * 9/5 + 32 DEG K
45 [ENTER]	45 * 9/5 + 32 113 DEG K