How Hot Is It?

Overview	Math Concepts	Materials
Students who are familiar with the two most common standards of measuring temperature learn how to reliably convert from degrees Celsius to degrees Fahrenheit. Students also see how order of operations is crucial in an equation, through discussion and data entry on the calculator.	• approximation • patterns • functions • units of measurement • order of operations	• TI-30XS MultiView™

Activity

Begin with a discussion about the two common systems of measurement for temperatures.

When someone asks you how hot it is outside, how do you answer? If it's summertime and very hot, you may say it's 90°. But do you ever clarify whether you are using Fahrenheit or Celsius?

Discuss what would happen if the students were anywhere other than the United States and they asked a local person the temperature.

Let's imagine you were vacationing in France during the summertime and you asked a shopkeeper in Paris what the temperature was. On a hot day, he or she might answer "about 29°." This would almost certainly leave you confused. How can it be 29° if it's hot outside? Isn't that below freezing?

Introduce the conversion formulas for Fahrenheit to Celsius and vice versa.

If given a temperature in degrees Fahrenheit, you can use the formula to convert to degrees Celsius:

$C = \left(\frac{5}{9}\right)(F - 32)$.

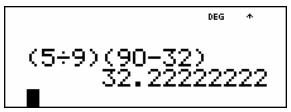
So, given a temperature of 90°F, substitute F = 90:

$C = \left(\frac{5}{9}\right)(90 - 32)$*. You'll see that 90°F is about 32°C.*

Now show how improper entry changes the order of operations and changes the answer.

Follow these steps:

1. Press [(] 5 [÷] 9 [)] [(] 90 [−] 32 [)] to input the entire expression.
2. Press **enter**.
3. The calculator should display:



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What if you enter the expression into the TI-30XS MultiView incorrectly? Without the parentheses, the calculator thinks you want to multiply $\left(\frac{5}{9}\right)$ *by 90 since multiplication comes before subtraction in the order of operations. That gives the incorrect answer of 18. What you really want is to multiply* $\left(\frac{5}{9}\right)$ *by the quantity (90-32).*

Move on to the formula to convert degrees Celsius into degrees Fahrenheit.

Similarly, if given a temperature in degrees Celsius, you can use the formula to convert to degrees Fahrenheit: $F = \left(\frac{9}{5}\right)C + 32$.

Using the example from earlier, if a local citizen in France tells you it's 29°, plug 29 in for C: $F = \left(\frac{9}{5}\right)29 + 32$.

And 29°C is about 84°F, which makes sense for a hot summer day.

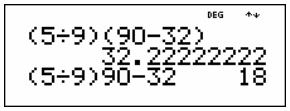
Again, remind your students to be careful with how they input the data, because an incorrect order of operations can and will change the answer.

Now, use the TI-30XS MultiView to show the students how to use the Data Editor to convert between systems by expressing one system as a function of the other. This will allow them to convert multiple values quickly by entering the formula one time.

A quick and efficient way to convert temperatures from one system to another is by inputting the rule into the Data Editor and expressing one list as a function of the other. For instance, let's convert from Celsius to Fahrenheit. If our two initial temperatures are 20°C and 2°C, we'll want to use the formula $F = \left(\frac{9}{5}\right)C + 32$ *for both. We'll do this by using the Data Editor to store the given temperatures in* L_1 *then using the submenus to input the formula to convert to °F.*

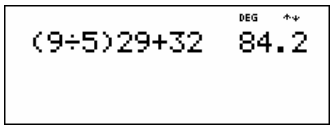
Follow these steps:

1. Press (5 ÷ 9) 90 − 32 to input the expression.
2. Press **enter**.
3. The calculator should display:



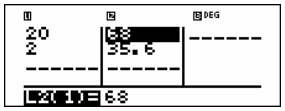
Follow these steps:

1. Press (9 ÷ 5) 29 + 32 to input the expression.
2. Press **enter**.
3. The calculator should display:



Follow these steps:

1. Press **data**.
2. Press 20 ▼ 2 ▼.
3. Press ▶ to move to L_2.
4. Press **data** ▶ for formula menu.
5. Press 1 to add a formula.
6. Press (9 ÷ 5).
7. Press **data** 1 to pull up L_1.
8. Press + 32 **enter**.
9. The screen will display both lists:



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Directions: Use the TI-30XS MultiView™ to convert all temperatures from degrees Fahrenheit into degrees Celsius, or vice versa. Round your answers to the nearest tenth of a degree. Once all temperatures have been converted, circle all the correct answers on the next page to reveal the answer to the riddle. You'll be able to read the answer from left to right.

		Degrees Fahrenheit	**Degrees Celsius**
1.	Normal human body temperature	98.6	
2.	A cool fall day	50	
3.	Frozen yogurt		–11.1
4.	A hot July day		37.2
5.	Room temperature on a winter day	70	
6.	Freezing point of water		0
7.	Record low in Chicago in January	–39	
8.	Comfortable temperature for a pool	84	
9.	Median temperature in France in April		23.9
10.	Foods that contain molds must be cooked to this temperature		73.9
11.	Highest temperature on record (Death Valley, California)	134	
12.	Temperature in Nebraska last February		–25.6
13.	Body temperature of an emu		35.8
14.	Estimate of temperature at which someone could freeze to death	0	
15.	Lowest temperature on record (Vostok Station, Antarctica)		–89.2
16.	Temperature at which a butterfly can fly		30
17.	Body temperature of a dolphin	35	

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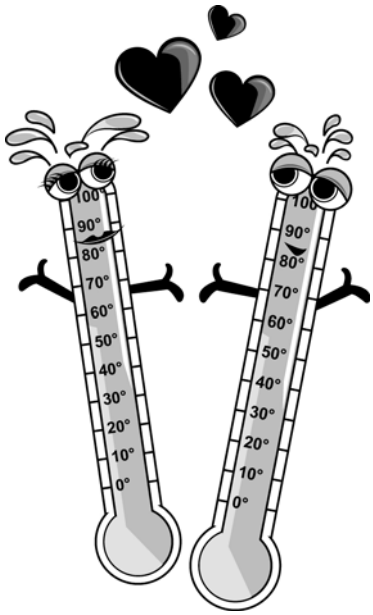
What did one thermometer say to the other thermometer?



–13.4 T	14.7 H	165 Y	–17.8 O	122 S	22.8 E	83.2 T	56.7 U	6.9 I	–12.6 R
12 M	–5.1 E	86 A	197 L	95.6 Y	–32 T	75 K	32 E	11.5 A	76.5 N
75.6 H	–103 U	65.7 C	10 M	123 O	124.6 W	–14.2 R	9.4 T	37 Y	10 E
57.6 A	28.9 T	58 F	37.6 I	–14.1 E	21.1 M	–128.6 P	78.3 S	42.4 W	–43 N
124.2 K	7.3 E	99 R	111.6 V	–25.3 K	22 F	–39.4 I	96.4 S	–4.2 M	1.7 E

Answer: _____

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Answer Key

		Degrees Fahrenheit	Degrees Celsius
1.	Normal human body temperature	98.6	37
2.	A cool fall day	50	10
3.	Frozen yogurt	12	–11.1
4.	A hot July day	99	37.2
5.	Room temperature on a winter day	70	21.1
6.	Freezing point of water	32	0
7.	Record low in Chicago in January	–39	–39.4
8.	Comfortable temperature for a pool	84	28.9
9.	Median temperature in France in April	75	23.9
10.	Foods that contain molds must be cooked to this temperature	165	73.9
11.	Highest temperature on record (Death Valley, California)	134	56.7
12.	Temperature in Nebraska last February	–14.1	–25.6
13.	Body temperature of an emu	96.4	35.8
14.	Estimate of temperature at which someone could freeze to death	0	–17.8
15.	Lowest temperature on record (Vostok Station, Antarctica)	–128.6	–89.2
16.	Temperature at which a butterfly can fly	86	30
17.	Body temperature of a dolphin	35	1.7

What did one thermometer say to the other thermometer?

–13.4 T	14.7 H	165 Y	–17.8 O	122 S	22.8 E	83.2 T	56.7 U	6.9 I	–12.6 R
12 M	–5.1 E	86 A	197 L	95.6 Y	–32 T	75 K	32 E	11.5 A	76.5 N
75.6 H	–103 U	65.7 C	10 M	123 O	124.6 W	–14.2 R	9.4 T	37 Y	10 E
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124.2 K	7.3 E	99 R	111.6 V	–25.3 K	22 F	–39.4 I	96.4 S	–4.2 M	1.7 E

Answer: “You make my temp rise.”