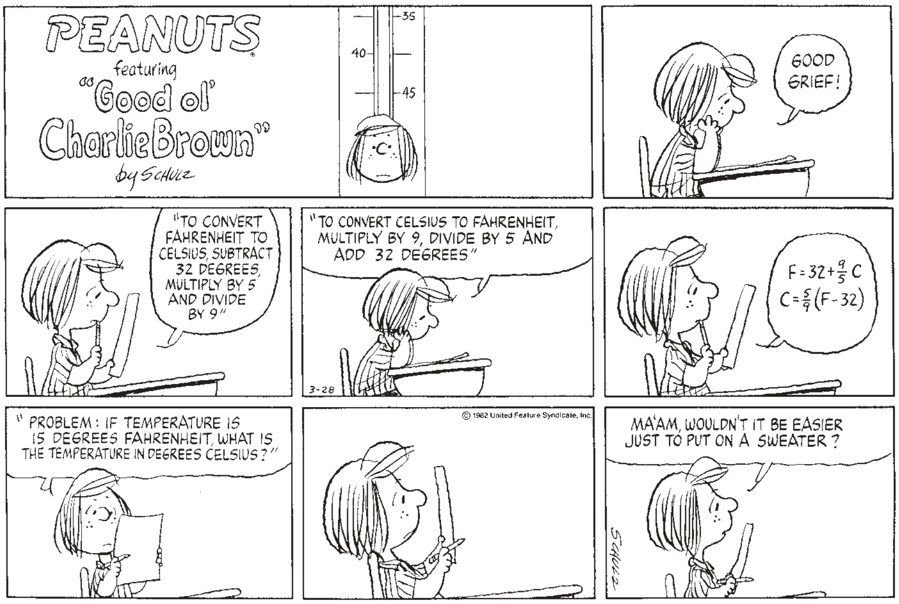
cartoon corner

Name ______________________________

PEANUTS by Charles Schulz



JUST WARMING UP

Our commonly used temperature scales were developed in the 1700s by astronomer Anders Celsius and physicist Daniel Fahrenheit. On the Celsius scale, water freezes at 0° and water boils at 100°; the interval between the two is divided into 100 equal parts called *degrees Celsius* (°C). On the Fahrenheit scale, the freezing point of water is 32° and the boiling point of water is 212°.

1. How many degrees are between the freezing and boiling temperatures on the Fahrenheit scale?

2. Since the temperatures at which water freezes and boils are constants, 0°C = 32°F and 100°C = 212°F. Complete the table at the bottom of the page.

3. Compare the two temperature-scale intervals: A change of 100°C is a change of 180°F. Complete the following:

1°C = _____ °F
1°F = _____ °C

4. a. The difference between the high and low temperatures on one day was 36°F. What is this range in °C?

b. The difference between the high and low temperatures on a different day was 15°C. What is this range in °F?

5. a. At about what Fahrenheit temperature would you want to put on a sweater? What would be the approximate corresponding Celsius temperature?

b. Some U.S. states have recorded temperatures that exceeded 120°F. What would be the approximate corresponding Celsius temperature?

c. Arizona, Kansas, Maryland, and Missouri had record-low temperatures of –40°F. What is the record low in °C for those states?

d. Answer the question in the cartoon: If the temperature is 15°F, what is the Celsius temperature?

CHALLENGE

6. This method allows you to convert a Celsius temperature to Fahrenheit mentally.

Procedure	Example (Start with 25°C)
a. Double the °C b. Subtract 10% c. Add 32°	a. 2(25) = 50 b. 50 – 5 = 45 c. 45 + 32 = 77; 25°C = 77°F

a. Use this method to check the entries in question 2's table.

b. Describe this procedure using algebra, and explain why it works.

Celsius	–20°		–10°	0°	10°	20°	30°		40°	50°	60°		70°	80°	90°	100°
Fahrenheit		0°		32°				100°				150°				212°

from the October 2010 issue of mathematics teaching in the MIDDLE SCHOOL

Edited by **Stephen P. Smith** and **Peggy House**, Northern Michigan University, Marquette. Classroom teachers interested in field-testing or submitting a cartoon should contact **Stephen P. Smith**, stepsmith@nmu.edu. The cartoons must include the date and the newspaper syndicate that holds the copyright.

SOLUTIONS

1. a. 180 degrees (212 – 32 = 180)

2. See **table 1** below.

3. 1°C = (9/5)°F; 1°F = (5/9)°C. *Note:* Focus on the relationship that a change of 18°C is 10°F. Ask the students to complete the °C to °F entries in the table by incrementing the Fahrenheit temperatures in steps of 18°. Discuss the fact that the same interval divided into 100°C and 180°F means that 1°C is larger than 1°F, in fact, almost twice as large. This leads to the relationships above.

4. a. 5/9(36) = 20° difference on the Celsius scale.

b. 9/5(15) = 27° difference on the Fahrenheit scale.

5. a. Answers will vary. At 50°F, one might want a sweater, which would be approximately 10°C.

b. 120°F ≈ 48.9°C

c. –40°F= –40°C. (This is a significant benchmark: It is the temperature at which the two scales have the same numerical value.)

d. 15°F ≈ –9.4°C.

6. Algebraically:

$$2C - 0.1\times(2C) + 32 = 1.8C + 32$$
$$= \frac{18}{10}C + 32$$
$$= \frac{9}{5}C + 32$$

Let students practice this method for various temperatures, but emphasize that reasonable approximations are wanted, so they should round to whole numbers. For example, to find the Fahrenheit equivalence of 32°C, calculate 2 • 32 = 64; 64 – 6.4 = 58; and 58 + 32 = 90.

Table 1 The solution to question 2

Celsius	–20°	–17.8°	–10°	0°	10°	20°	30°	37.8°	40°	50°	60°	65.6°	70°	80°	90°	100°
Fahrenheit	–4°	0°	14°	32°	50°	68°	86°	100°	104°	122°	140°	150°	158°	176°	194°	212°

FIELD-TEST COMMENTS

We had just completed our studies of weather in science class when we worked on this lesson. The students liked the cartoon, and it piqued their interest in what we were going to learn. They especially liked being able to discover how the temperature conversions were developed. Converting Fahrenheit to Celsius gave them a better feel for temperatures in their surroundings.

This lesson was also a great review for order of operations. The students enjoyed learning how to convert Celsius to Fahrenheit mentally.

I think that I would introduce this activity *while* we are studying weather so that students can make connections between math and science.

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I teach seventh-grade prealgebra and eighth-grade algebra. When I looked at the real-world situation in the cartoon, I decided to give it to my seventh graders. I felt it would be a good way to introduce linear functions from a practical standpoint.

The activity proved very challenging for nearly all the students. I started by asking them what they thought the temperature was outside. After fielding some estimates (between 45° and 50°), I looked up the temperature on my iPod Touch™ (set to Celsius before the lesson) and showed them that the temperature was 12 degrees. There was an initial gasp until they realized that the screen was showing the temperature in Celsius.

When asked what cued them about this, they responded that they knew the Celsius temperatures used numbers quite a bit smaller than Fahrenheit. I told them the two scales were based on the freezing and boiling points of water. They knew that 0 and 100 degrees mark those points in Celsius, but they were unclear about their Fahrenheit equivalence. They said the numbers were easier to remember in Celsius and that they had been using them in science recently. I asked if they knew how to convert from Fahrenheit to Celsius. They thought that it must be a subtraction of some number.

At that point, I showed them the cartoon. They asked if the formulas they were working with were correct. I replied that they were, but that we would be using the table to determine exactly why.

I asked them to work with a partner and fill out the table as I circulated. They found the table difficult to fill out. The missing points were strategically placed to force them to use a calculator. Even then, they were unclear if their answers were making sense. Many students could not find the ratio for conversion even when reminded that we had studied this topic extensively a month earlier. The standard response was to find the equivalence of 1°C in the Fahrenheit scale and vice versa, instead of finding the conversion ratio. What made this doubly challenging to them was subtracting or adding 32 degrees.

In retrospect, this lesson would have been more effective in my eighth-grade algebra class midyear when they have learned linear functions.

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OTHER IDEAS

We want students to develop temperature sense about Fahrenheit and Celsius, not so much by converting algebraically between the two but by relating both scales to meaningful benchmarks. Ask students to analyze situations, such as those below, in both °F and °C. What would be a reasonable temperature for—

- swimming at the beach?
- wearing a winter coat?
- an air-conditioned classroom?
- setting the oven to bake a pizza?
- a hot cup of cocoa?
- ice cream?