Temperature Scales

Teacher Notes & Answers

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Introduction

Why do we have different temperature scales?

Back in history, in the 18th and 19th century, there was a big discussion between scientist about the best way to measure temperature. First of all, which thermometric liquid should be used? Secondly, how to graduate the scale? And thirdly, how to calibrate it?

A lot of experiments were going on and some scientists, often astronomers who had to compensate their measurements for variations in temperature, started to make their own thermometers. Some of them did a good job and succeeded in creating a reliable thermometer. Others failed, and their thermometers quickly went into oblivion.

So, there was and still is historical evolution in using temperature scales. We didn't create just one scale; we created many different scales. Changing from one scale to another takes time, time to convince people to use the other scale. As you know, people always resist change.

Temperature scales, like those created by Newton, Rømer, Réaumur or Delisle, all disappeared and were replaced by the Celsius scale when a lot of countries started to introduce the metric system around 1790.

A few countries maintained the imperial or the customary system and continued to measure temperature in degrees Fahrenheit. Today, these countries are the United States, Liberia, and Myanmar. Some other countries use both Fahrenheit and Celsius.

The Kelvin and Rankine scales are only used for scientific reasons, whereby Kelvin is by far the most used scale and Rankine is only used in a few specific fields of engineering, like thermal power plants.

So, this leaves us with only 3 different scales which are Fahrenheit, Celsius, and Kelvin. Knowing that the Fahrenheit scale is in decay, there may be only two scales in the future. Eventually, perhaps only Kelvin will remain, though it sounds a bit weird to indicate outside temperature with 3 digits.

You can convert quickly and easily between temperature scales using TI Nspire CX.

Author: Bozenna Graham

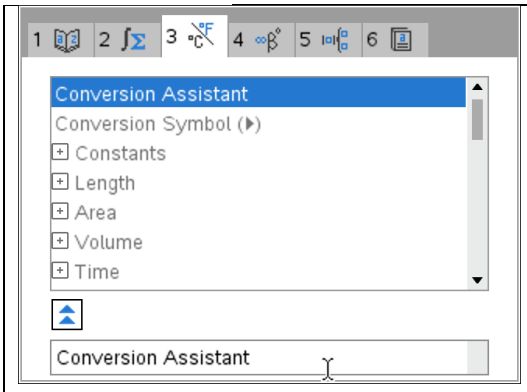
Teacher:

Instructions – Converting temperatures with Conversion Assistant.

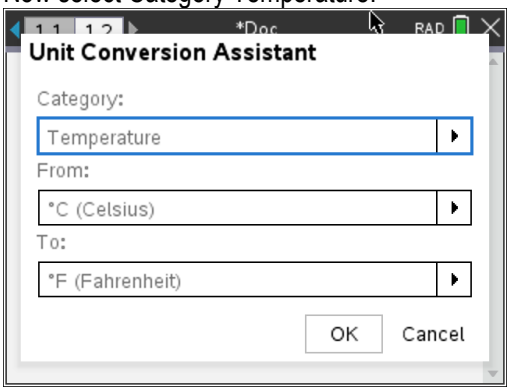
Technology Tip!

Start a new TI-Nspire document and insert a Calculator application.

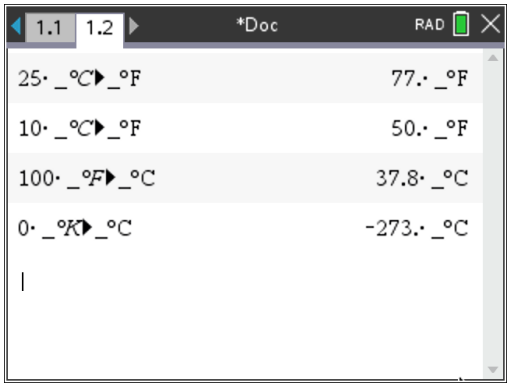
Select Catalogue  (Book) and number 3 Conversion Assistant.



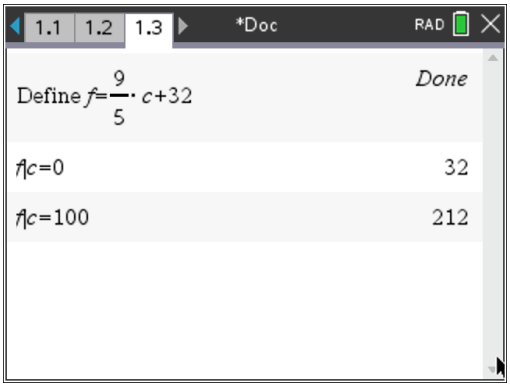
Now select Category Temperature:



Replace Ans with a temperature you wish to convert, select two different scales.



Alternatively use Define and substitution into the formula.



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USE YOUR CAS CALCULATOR TO SOLVE THE FOLLOWING:

Give your answers to **the nearest degree** where applicable.

We measure temperature in degrees Celsius ($°C$), in which water boils at $100°C$ and freezes a $0°C$. We used to measure temperature in the Fahrenheit scale ($°F$); the Americans still do.

To convert between the two, we could use the formula

$$F = \frac{9}{5}C + 32$$

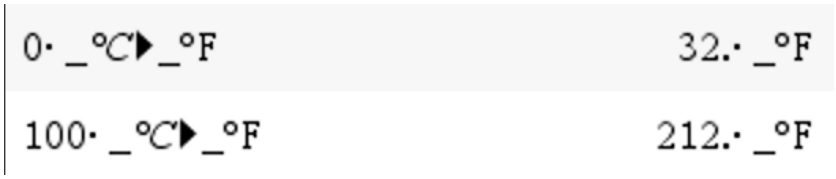
However, your TI Nspire CX CAS calculator has a special feature called **Conversion Assistant.**

Question: 1.

At what temperature in the Fahrenheit scale does water:

a) freeze?
b) boil?

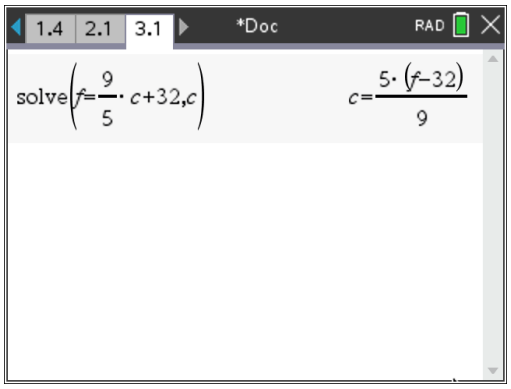
Answer: a) $32°F$ **b)** $212°F$



Question: 2.

Rearrange the equation to make C the subject (express C in terms of F).

Answer: $C = \frac{5(F-32)}{9}$



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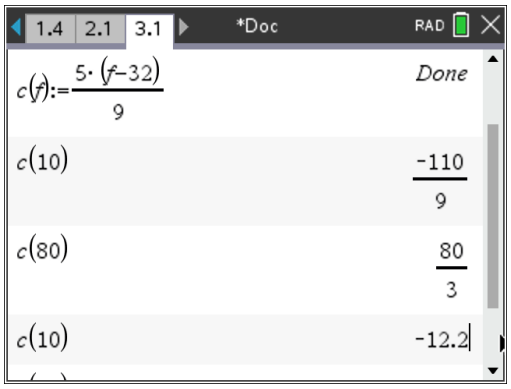
Question: 3.

The oldies talk about hot days when the temperature passes 100 degrees in the old (Fahrenheit) scale. What is this in degrees Celsius?

Find the temperature in degrees C for

a) $10^o F$ b) $80^o F$

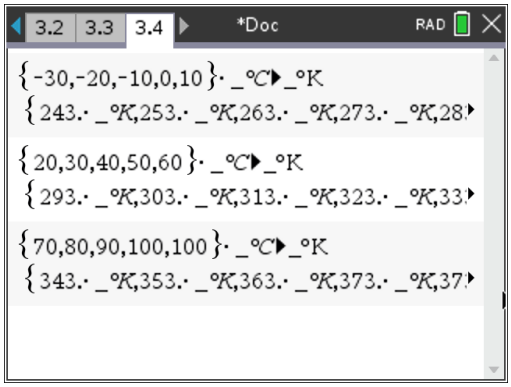
Answer: a) $-\frac{110}{9} = -12^\circ C$ **b)** $\frac{80}{3} = 27^\circ C$

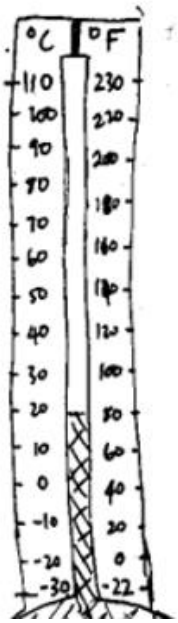


Question: 4.

Draw a thermometer with Celsius scale to the left, and Fahrenheit scale to the right (range $-30°C$ to $110°C$).

Answer:





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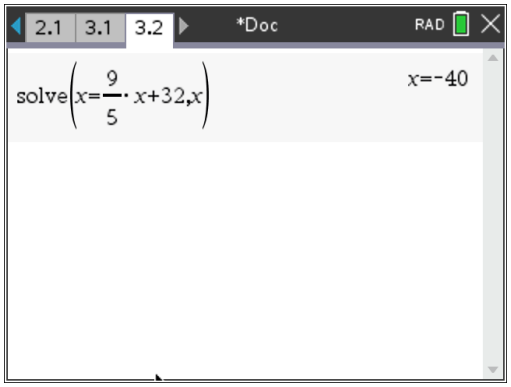
Question: 5.

What temperature is the same in both scales?

Answer: -40°.



In science and engineering, a temperature scale marked in Kelvin is sometimes used. Zero Kelvin ($0K$) is the absolute freezing point called an absolute zero. Nothing can be colder than that. At zero Kelvin, everything is frozen. $\boldsymbol{0K = -273.15°C}$. Since one step on the Kelvin scale ($1K$) is as big as one step on the Celsius scale ($1°C$), water freezes at $273.15K$

Question: 6.

At what Kelvin temperature does water boil?

Answer: $373^{\circ}K$.

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