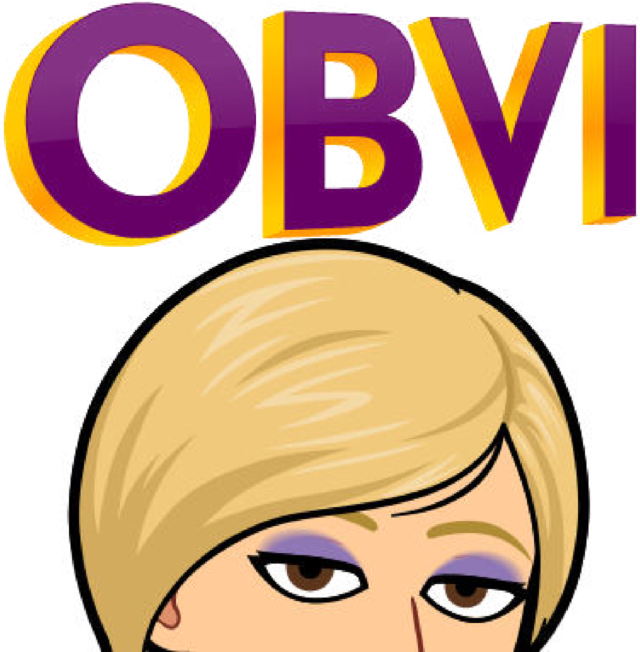
# Today's Materials




- device
- pencil
- notebook

# Today's Goals

- Find the inverse of a linear function by solving an equation for the input variable.
- Interpret an inverse function in terms of the quantities in a situation.

# 16.1: Shopping For Cookbooks

(Page 29)

# Lin is comparing the cost of buying cookbooks at different online stores

**-Store A sells them at $9 each and offers free shipping.**

**-Store B sells them at $9 each and charges $5 for shipping.**

**-Store C sells them at *p* dollars and charges $5 for shipping.**

**-Store D sells them at *p* dollars and charges *of* dollars for shipping**

1. Write an equation to represent the total cost, *T*, in dollars as a function of *n* cookbooks bought at each store.

1. Write an equation to find the number of books, *n*, that Lin could buy if she spent *T* dollars at each store.

# How did it go?

1.

a. Store A: $T = 9n$

b. Store B: $T = 9n + 5$

c. Store C: $T = pn + 5$

d. Store D: $T = pn + f$

2.

a. Store A: $n = \frac{T}{9}$

b. Store B: $n = \frac{T-5}{9}$

c. Store C: $n = \frac{T-5}{p}$

d. Store D: $n = \frac{T-f}{p}$

**What do you notice?**

1.

a. Store A: $T = 9n$

b. Store B: $T = 9n + 5$

c. Store C: $T = pn + 5$

d. Store D: $T = pn + f$

2.

a. Store A: $n = \frac{T}{9}$

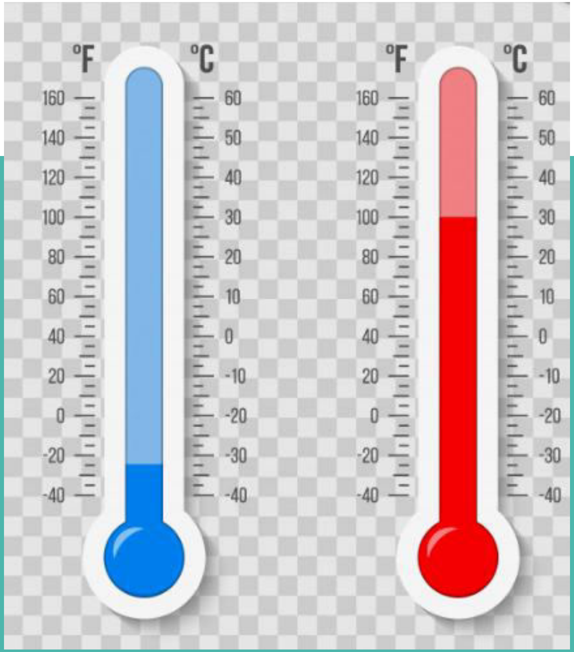
b. Store B: $n = \frac{T-5}{9}$

c. Store C: $n = \frac{T-5}{p}$

d. Store D: $n = \frac{T-f}{p}$

Each equation in the second set is the **inverse** of the corresponding equation in the first question. Each isolated variable is now an output, while previously it was an input. The variable that was previously isolated is now an input.

# 16.2 From Celsius to Fahrenheit (page 29)



# INTERESTING FACTS

⇨Most countries use Celsius temperature scale (water freezes at 0 degrees and boils at at 100 degrees)

⇨U.s and a very few countries use fahrenheit scale (water freezes at 32 degrees and boils at 212 degrees)

⇨The Rankine scale is a temperature scale that is sometimes used in engineering systems, typically alongside measurements in Fahrenheit.

| | Kelvin | Celsius | Fahrenheit | Rankine |
|---|---|---|---|---|
| Absolute zero (by definition) | 0 K | −273.15 °C | −459.67 °F | 0 °R |
| Freezing point of brine (zero point of Fahrenheit scale, old definition) | 255.37 K | −17.78 °C | 0 °F | 459.67 °R |
| Freezing point of water[5] | 273.15 K | 0 °C | 32 °F | 491.67 °R |
| Boiling point of water[6] | 373.1339 K | 99.9839 °C | 211.97102 °F | 671.64102 °R |

# 16.2 From Celsius to Fahrenheit

**If we know the temperature in degrees Celsius, *C*, we can find the temperature in degrees Fahrenheit, *F*, using the equation:**

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

**In your groups, Complete Questions 1-3 ( Page 29 and 30 )**

1. Complete the table with temperatures in degrees Fahrenheit or degrees Celsius.

| $C$ | 0 | 100 | 25 | | | |
|---|---|---|---|---|---|---|
| $F$ | | | | 104 | 50 | 62.6 |

2. The equation $F = \frac{9}{5}C + 32$ represents a function. Write an equation to represent the inverse function. Be prepared to explain your reasoning

3. The equation $R = \frac{9}{5}(C + 273.15)$ defines the temperature in degrees Rankine as a function of the temperature in degrees Celsius. Show that the equation defines the inverse of that function.

# How did it go?

| | | | | | | |
|---|---|---|---|---|---|---|
| $C$ | 0 | 100 | 25 | 40 | 10 | 17 |
| $F$ | 32 | 212 | 77 | 104 | 50 | 62.6 |

2. $C = (F - 32) \cdot \frac{5}{9}$ (or equivalent).

3.
$$R = \frac{9}{5}(C + 273.15)$$
$$R = \frac{9}{5}C + 491.67$$
$$R - 491.67 = \frac{9}{5}C$$
$$(R - 491.67) \cdot \frac{5}{9} = C$$

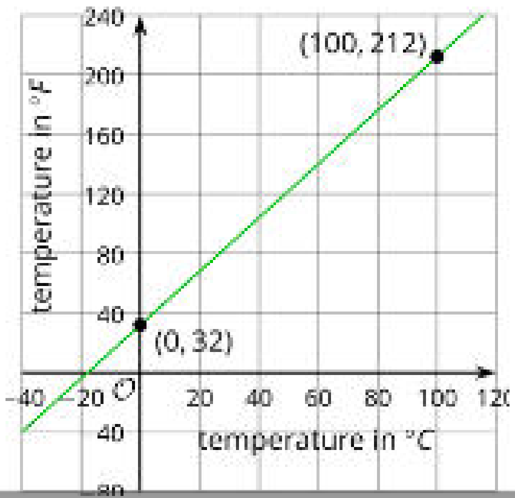
What does the inverse function  for the equation in question 2 tell us?

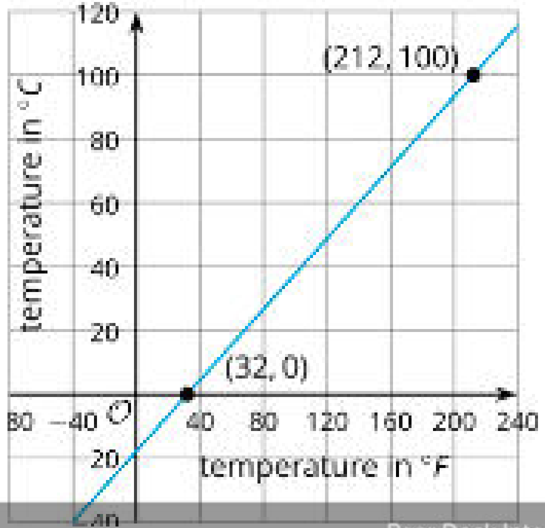
$$C = (F - 32) \cdot \frac{5}{9} \qquad F = \frac{9}{5}C + 32$$

**Suppose we want to find the temperature in Celsius when it is 10 degrees Fahrenheit and when it is 90 degrees Fahrenheit. Which equation would you use? Why?**

Here are two graphs of the two functions relating temperature in Celsius and Fahrenheit.

What do you Notice?



# 16.3 Info Gap: Custom Mugs (Page 30)

# I will give your group either a problem card or a data card

## If I give you a problem card

1. Silently read your card and think about what information you need to answer the question.

2. Ask your partner for the specific information that you need.

3. Explain to your partner how you are using the information to solve the problem.

4. Solve the problem and explain your reasoning to your partner.

## If I give you a Data Card

1. Silently read the information on your card.

2. Ask your partner “What specific information do you need?” and wait for your partner to *ask* for information. *Only* give information that is on your card. (Do not figure out anything for your partner!)

3. Before telling your partner the information, ask “Why do you need that information?”

4. After your partner solves the problem, ask them to explain their reasoning and listen to their explanation.

When you are done, I will review your work, and give you a new set of cards and repeat the activity, trading roles.

# How did it go?

Problem Card 1:

1. 18 mugs. (The result of the computation is $n = 18.75$, but it is not possible to get a fractional number of mugs and rounding up to 19 mugs would mean the price being over the budget.)

2. $n = \frac{120}{p-4.40}$ (or equivalent)

Problem Card 2:

1. \$9.40

2. $p = \frac{120}{n} + 4.40$ (or equivalent)

# 16.3 Info Gap (Questions)

1. Do both equations define functions? How can we tell?

2. In which situation is the first equation more useful?

Problem Card 1:

1. 18 mugs. (The result of the computation is $n = 18.75$, but it is not possible to get a fractional number of mugs and rounding up to 19 mugs would mean the price being over the budget.)

2. $n = \frac{120}{p-4.40}$ (or equivalent)

Problem Card 2:

1. $9.40

2. $p = \frac{120}{n} + 4.40$ (or equivalent)


# 16.5 Cool Down: Carnival Functions