0.1 Prelude: Approximation and Rounding

Practice exercises

1. Round each number up, down, or off to the precision indicated.

   This problem also appears in Section 1.1 #3.

   (a) My calculations show I need a cross brace around 9.388 feet long. I want the board to be long enough, so round up to the nearest foot.

9.388 rounds up to **10 feet**

   (b) Gas mileage is usually rounded down to the nearest one decimal place. What is the gas mileage for a car measured as getting 42.812 miles per gallon? What about a car getting 23.09 miles per gallon?

42.812 rounds down to **42.8 mpg**

23.09 rounds down to **23.0 mpg**

   (c) The population estimate was 4.2 million people, but revised estimates suggest 4,908,229 people. Report the revised estimate rounded appropriately. What if a different estimate was 4,890,225? Would that change your answer?

4,908,229 ≈ **4.9 million**

4,890,225 ≈ **4.9 million**

} same answer :)

2. (a) Callista needs \$117 cash for a mani-pedi at the local salon. The ATM allows her to withdraw multiples of \$20. How much money should she withdraw and how many \$20 bills is that? Did you round up, down, or off?

Round \$117 up to nearest \$20
so she needs [\$120] 120÷20 = [6 bills]
Wanted to be sure she had enough
money so I [rounded up]

(b) Bahari is buying some 8-packs of sparkling water for today's community hour. He expects up to 23 people to be there. He calculates that he will need $23 \div 8 = 2.875$ 8-packs. How many 8-packs should he bring? Did you round up, down, or off?

Again, want to be sure he has enough
so [rounded up] 2.875 to get [3 8-packs]

(c) Tzuf has \$20 to buy apples for the new year's celebration. A bag of apples costs \$3.49. Tsuf calculates that they can afford $20 \div 3.49 = 5.7306...$ bags. How many bags can they buy? Did you round up, down, or off?

They don't have enough money for 6 bags,
only 5.7306... so [rounded down]
They can only afford [5 bags]

(d) Eiji read that life expectancy in the United States is 77.28 years whereas in Japan it is 84.62 years. How might he describe these life expectancies in (whole) years? Did you round up, down, or off?

77.28 ≈ [77 years] in United States
84.62 ≈ [85 years] in Japan.
I rounded [off]

3. Round off the calculated number(s) to give an answer that is reasonable and no more precise than the information given.

(a) The snow removal budget for the city is currently at $8.3 million but the city council is requesting a reduction of $1.15 million per year. We calculate that after three years of cuts, the snow removal budget will be $4,8079... million.

one decimal place

two decimal places

I would round to one decimal place (least precise)

4.8079... ≈ $4.8 million

(b) A cup of cooked red lentils has around 190 calories and 6.4 grams of dietary fiber, while a cup of cooked chickpeas has around 172 calories and 12.0 grams of dietary fiber. We calculate that lentils provide 0.03368421... grams per calorie whereas chickpeas provide 0.06976744... grams per calorie.

each number has 2 digits that are significant

lentils: 0.03368421... ≈ 0.034 g/cal

Chickpeas: 0.0697674... ≈ 0.070 g/cal

(c) Hibbing [Minnesota] is the former boyhood home of Bob Dylan, basketball great Kevin McHale and the location of the Hull-Rust-Mahoning Open Pit Iron Mine, which has the largest iron-ore pit in the world. Hibbing is also the birthplace of [baseball star] Roger Maris.

(source: http://hibbing.areaconnect.com/)

In 2000 the population of Hibbing, Minnesota was reported at just over 17,000 residents. Based on a projected 0.4% decrease per year, the 2010 population was calculated to be 16,332.110... people.

probably use 2 digits for answer

population 16,332.110 ≈ 16,000 people

It's fine if you did 16,300 or even 16,332
It would not be fine to keep digits after the decimal point because there can't be part of a person!

4. It is easiest to compare the size of decimal numbers when they are written the same precision. For example, \$1.7 million is more money than \$1.34 million because when we write both numbers to two decimal places we see

$$1.7 = 1.70 > 1.34$$

The symbol $>$ means "greater than;" it points to the smaller number. Alternatively, when we expand both numbers we see

$$1{,}700{,}000 > 1{,}340{,}000$$

In each story, write all of the decimal numbers given to the same precision and list the numbers from largest to smallest using $>$ signs.

(a) Dawn tested a water sample from her apartment and found 21.19 ppm of sulfate. She volunteers at a local soup kitchen where the water sample tested at 21.3 ppm. (The abbreviation **ppm** stands for "parts per million. Not to worry – sulfate levels below 250 are considered safe for human consumption.)

21.19
21.3 = 21.30
30 is bigger than 19 so $\boxed{21.3 > 21.19}$

(b) There are approximately 1.084 million quarters in circulation in the United States, compared to 1.786 million dimes, 1.6 million \$5 bills, and 1.42 million \$10 bills.

quarters: 1.084 smallest
dimes: 1.786 biggest
\$5 bills: 1.600 next
\$10 bills: 1.420 middle

$\boxed{1.786 > 1.6 > 1.42 > 1.084}$

Surprising? → #dimes > #\$5 bills > #\$10 bills > #quarters