SOLUTIONS

1.1 Variables and functions – Practice exercises

1. A 32 pound bag of dog food costs \$29.97, but a 8 pound bag costs \$11.28.

   (a) Identify and name the variables, including the units.

hint: choose a letter that helps you remember what it stands for

both the weight and the cost change

$\Rightarrow$ W = weight of bag (pounds)
C = cost of dog food (\$)

don't forget the units

   (b) Which variable is dependent and which is independent?

the cost depends on the weight of the bag

$\Rightarrow$ C ~ dep
W ~ indep

   (c) What might a 16 pound bag of dog food cost? Explain the reasoning behind your guess.

Definitely between \$11.28 and \$29.97

Hmm. $16 = \frac{1}{2} \cdot 32$ and $\frac{1}{2} \cdot \$29.97 = \$14.99$

Also $16 = 2 \cdot 8$ and $2 \cdot \$11.28 = \$22.56$

Probably between \$14.99 and \$22.56

Still not sure $\Rightarrow$ guess \$20

there are fancier methods for approx. that assume costs are "linear" but not sure if that's even true.

tells us rent changes so that's one of the 7 variables

2. Rent in the Riverside Neighborhood is expected to increase 7.2% each year. Average rent for an apartment is currently \$830 per month. *Story also appears in 3.4 #3*

time is the other less obvious variable

(a) Identify and name the variables, including the units.

R = rent for apt in Riverside (\$/month) ~dep

Y = time (years from now) ~ indep

notice units on R are \$/month

(b) Explain the dependence using a sentence of the form "R is a function of Y"

(c) Which number is a constant in this story: the percent increase (7.2) or the apartment rent (830)?

(d) What is a realistic domain for this function? That means, for how many years might this sort of increase in rent continue? Express your answer as an inequality.

Huh? Maybe 10 years? $0 \le Y \le 10$

means "less than or equal to"

(e) What is the average rent expected to be in 1 year? In 2 years? In 3 years? Note that

$$7.2\% = \frac{7.2}{100} = 7.2 \div 100 = .072$$

Try figuring it out.

remember: $\approx$ means approximately

start: \$830/mo

1 year: 7.2% of \$830 = .072 × 830 = \$59.76 increase

$\Rightarrow$ \$830 + \$59.76 = **\$889.76/mo after 1 year**

be sure to use new value – that's what % increase means

2 years: 7.2% of \$889.76 = .072 × 889.76 $\approx$ \$64.06

$\Rightarrow$ \$889.76 + \$64.06 = **\$953.82/mo in 2 years**

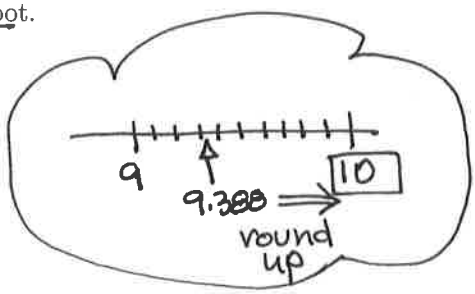
3 years: 7.2% of \$953.82 = .072 × 953.82 $\approx$ \$68.67

$\Rightarrow$ \$953.82 + \$68.67 = **\$1,022.49/mo at 3 years**

3. Round each number up, down, or off to the precision indicated.
For a discussion of rounding, see Prelude: approximation

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

$9.388 \approx$ 10 feet

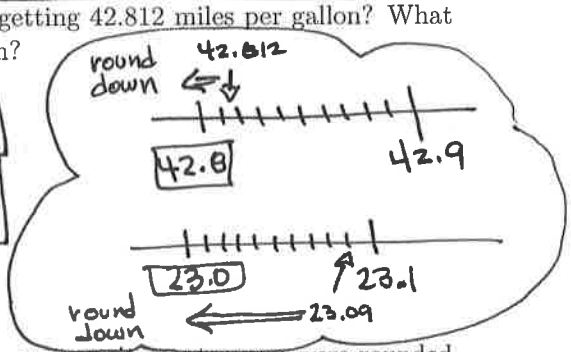


(b) Gas mileage is usually rounded down to the nearest one decimal place. What is the gas mileage for a car measured as getting 42.812 miles per gallon? What about a car getting 23.09 miles per gallon?

mpg stands for miles per gallon

$42.812 \approx$ 42.8 mpg

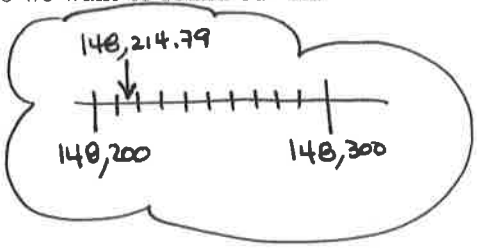
$23.09 \approx$ 23.0 mpg



yes, it's closer to 23.1, but said round down

(c) The original budget estimates for the new community center gym were rounded to the nearest hundred (that means ending in 00), so we want to round our bid of \$148,214.79 to the nearest hundred.

\$148,214.79 ≈ \$148,200



(d) The population estimate was 4.2 million people, but revised estimates suggests 4,908,229 people. Report the revised estimate rounded appropriately.

should agree with precision of 4.2 ⇒ one decimal place

not sure how we converted? — more info in Section 1.4. Recall 1 million = 1,000,000

4,908,229 people

= 4.908229 million people

≈ 4.9 million people

4. It's about time! In each story, time is one (or both) of the variables. Identify and name the variables, including units and dependence.

Stories also appear in 1.1 Exercises

(a) The Nussbaums planted a walnut tree years ago when they first bought their house. The tree was 5 feet tall then and has grown around 2 feet a year.

H = height walnut tree (feet) ~ dep

T = time since planted tree (years) ~ indep

(b) After his first beer, Stephen's blood alcohol content (BAC) was already .04 and as he continued to drink, his BAC level rose 45% per hour.

Story also appears in 2.4 Exercises and 3.4 #1

S = Stephen's blood alcohol content (BAC) ~ dep

H = time he's drinking (hours) ~ indep

(c) When McKenna drives 60 mph (miles per hour) it takes her 20 minutes on the highway to get between exits, but when traffic is bad it can take her an hour.

S = speed Mckenna drives (mph) ~ indep

T = time between exits (min) ~ dep

(d) The sun set at 6:00 p.m. today and I heard on the radio that it sets about 2 minutes earlier each day this time of year. *Hint: measure the sunset time in minutes after 6:00 p.m.*

S = time the sun set (minutes after 6:00 p.m.) ~ dep

D = time from now (days) ~ indep

check that you have
Name: H ✓
Description: height ✓
units: feet ✓
Dependence: dep
for each variable ✓

indicates height is changing over time, so those are our variables

notice that her time depends on how fast she drives, so time is dep variable here.

because she has to drive slower. that means her speed changes.

hey – both variables are time!