Chapter 12

The Real Numbers and Their Representation

MATHEMATICAL IDEAS

THIRTEENTH EDITION ●●●●

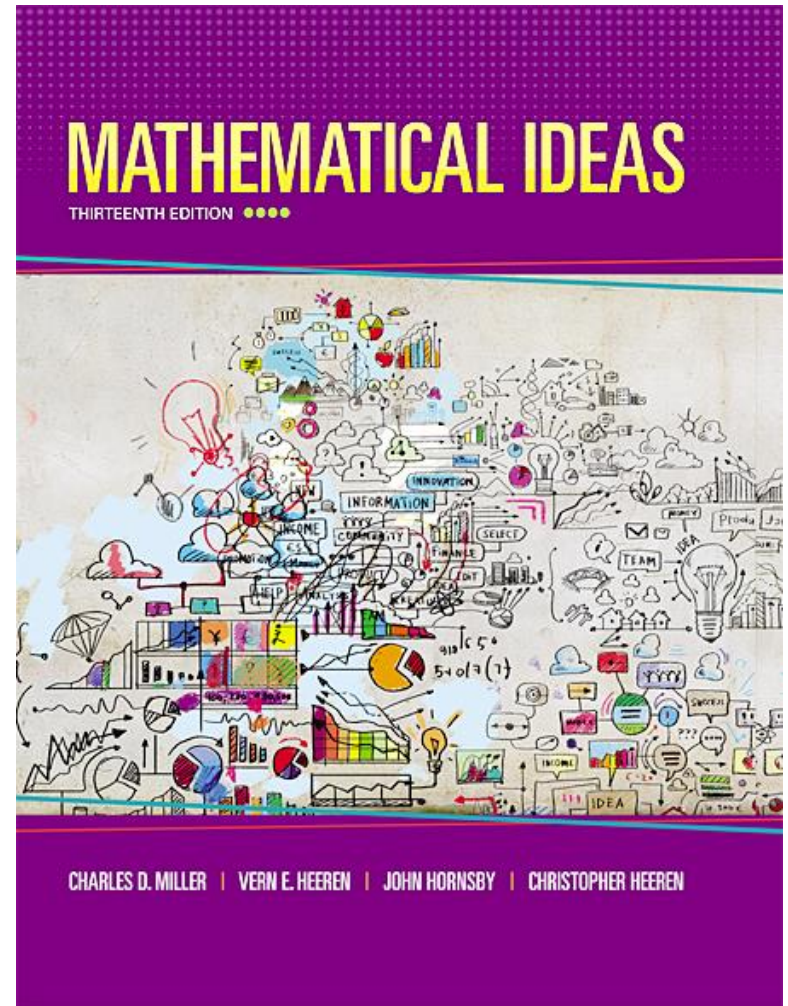CHARLES D. MILLER | VERN E. HEEREN | JOHN HORNSBY | CHRISTOPHER HEEREN

PEARSON

Chapter 6: The Real Numbers and Their Representation

12.1 Rational Numbers and Decimal Representation

12.2 Irrational Numbers and Decimal
     Representation

12.3 Applications of Decimals and Percents

Section 12-3

Application of Decimals and Percents

Application of Decimals and Percents

- Perform operations of arithmetic with decimal numbers.

- Round whole numbers and decimals to a given place value.

- Perform computations using percent.

- Convert among forms of fractions, decimals, and percents.

- Find percent increase and percent decrease.

- Apply formulas involving fractions and decimals from the allied health industry.

Operations with Decimals

Operations by hand will be detailed but the use of a calculator is suggested.

Addition and Subtraction of Decimals

To add or subtract decimal numbers, line up the decimal points in a column and perform the operation.

Example: Adding and Subtracting Decimal Numbers

Find each of the following.

a) $0.51 + 2.8 + 10.42$ b) $13.2 - 7.614$

Solution

a)
$$
\begin{array}{r}
0.51 \\
2.8 \\
+\ 10.42 \\
\hline
13.73
\end{array}
$$

b)
$$
\begin{array}{r}
13.200 \\
-\ 7.614 \\
\hline
5.586
\end{array}
$$
Attach zeros.

Multiplication of Decimals

To multiply decimals, multiply in the same manner as integers are multiplied. The number of decimal places to the right of the decimal point in the product is the *sum* of the numbers of places to the right of the decimal points in the factors.

Division of Decimals

To divide decimals, move the decimal point to the right the same number of places in the divisor and dividend so as to obtain a whole number in the divisor. Divide in the same manner as integers are divided. The number of decimal places to the right of the decimal point in the quotient is the same as the number of places to the right in the dividend.

Example: Multiplying and Dividing Decimal Numbers

Find each of the following.

a) 4.17×6.542 b) $18.994 \div 3.7$

Solution

a) $417 \times 6542 = 2728014$

so with 5 decimal places: 27.28014

b)

$$\begin{array}{r} 5.13 \\ 37 \overline{)189.94} \end{array}$$

Rounding Decimals

Since all digits may not be needed in a practical problem, it is common to *round* a decimal to the necessary number of decimal places.

Rounding a Decimal

Step 1   Locate the **place** to which the number is being rounded.

Step 2   Look at the next **digit to the right** of the place to which the number is being rounded.

Step 3A If this digit to the right is **less than 5**, replace it and all digits following it with zeros. Do not change the digit in the place to which the number is being rounded.

Rounding a Decimal

Step 3B   If this digit is **5 or greater**, replace it and all digits following it with zeros, but also add 1 to the digit in the place which the number is being rounded. (If adding 1 to a 9, replace the 9 with 0 and add 1 to the next digit to the left. If that next digit is also 9, repeat this procedure, and so on, to the left.)

Example: Rounding Numbers

Round 5.1763 to the nearest hundredth.

Solution

The digit 7 is in the hundredths place. To round, note the 6 in the thousandths place. We drop the digits after the 7 and increase the 7 by 1.

Answer: 5.18

Converting Between Decimals and Percents

To convert a percent to a decimal, drop the percent symbol (%) and move the decimal point two places to the left, inserting zeros as placeholders if necessary.

To convert a decimal to a percent, move the decimal point two places to the right, inserting zeros as placeholders if necessary, and attach a percent symbol (%).

Example: Converting Percents to Decimals

Convert each percent to a decimal.

    a) 47%   b) 5.6%

Solution

    a) 0.47

    b) 0.056

Example: Converting Decimals to Percents

Convert each decimal to a percent.

    a) 0.457   b) 1.8

Solution

    a) 45.7%

    b) 180%

Converting a Fraction to a Percent

To convert a fraction to a percent, convert the fraction to a decimal, and then convert the decimal to a percent.

Example: Converting Fractions to Percents

Convert $\dfrac{4}{5}$ to a percent.

Solution

$$\dfrac{4}{5} = 0.8 = 80\%.$$

Examples Involving Percents

The next few slides show examples involving percents.

Example: Finding a Percent of a Number

Find 15% of 80.

Solution

The word "of" means to multiply.

$$(15\%)(80) = (0.15)(80) = 12$$

Example: Finding What Percent One Number is of Another

What percent of 120 is 18?

Solution

We let $0.01x$ represent "what percent."

$(0.01x)(120) = 18$

$$1.2x = 18$$

$$x = 15$$

So 18 is 15% of 120.

Example: Finding a Number of Which a Given Number is a Given Percent

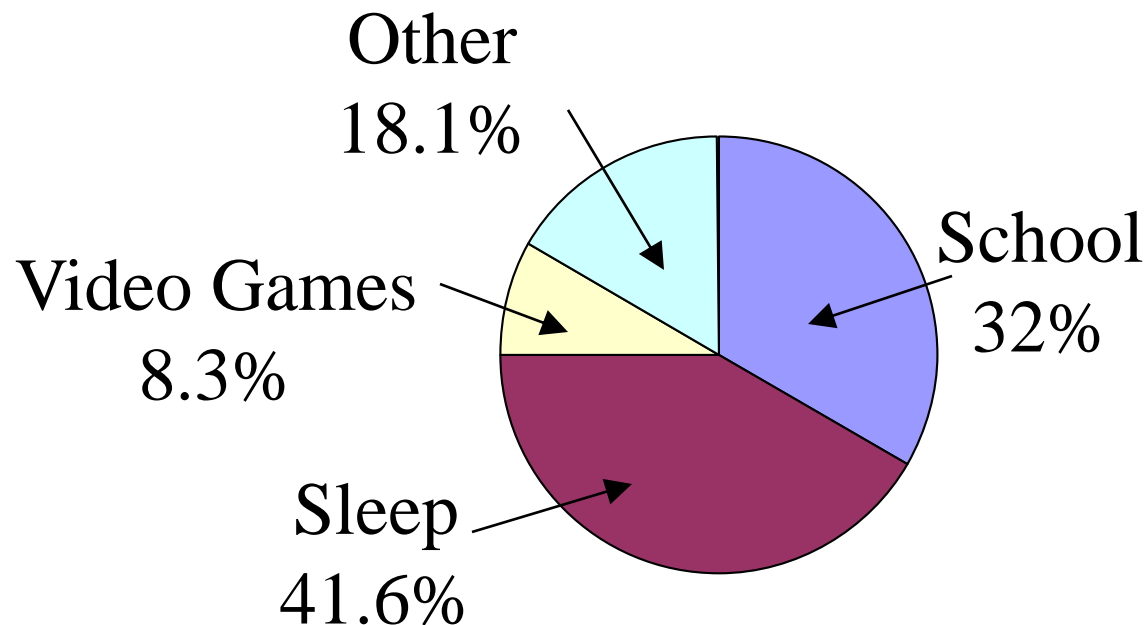40 is 80% of what number?

Solution

$$40 = 0.80x$$

$$x = 50$$

So 40 is 80% of 50.

Application: Interpreting Percents From a Graph

Below is a graph of Jackson's typical 24-hour day. Use the graph to determine the amount of time he spends each day on video games.

Application: Interpreting Percents From a Graph

Solution

According to the graph, 8.3% of the 24 hours was spent on video games.

This is $(0.083)(24) = 1.992$ or about 2 hours.

Finding Percent Increase or Decrease

1. To find the **percent increase from a to b**, where $b > a$, subtract a from b, and divide this result by a. Convert to a percent.

2. To find the **percent decrease from a to b**, where $b < a$, subtract b from a, and divide this result by a. Convert to a percent.

Example: Solving Problems about Percent Change

The percent increase from $5 to $9 is:

$$\frac{9-5}{5} = \frac{4}{5} = 80\%$$

The percent decrease from 8 sales to 6 sales is:

$$\frac{8-6}{8} = \frac{2}{8} = 25\%.$$

Example: Determining a Child's Dose of a Drug

If *D* represents the usual dose of a drug, the corresponding child's dose, *C,* is calculated by the following formula:

$$C = \frac{\text{body surface area in square meters}}{1.7} \times D$$

Determine the approximate dose for a child weighing 40 pounds if the usual adult dose is 50 milligrams.
(*Source*: Hegstad, Lorrie N., and Wilma Hayek. *Essential Drug Dosage Calculations*, 4th *ed*. Prentice Hall, 2001.)

Example: Determining a Child's Dose of a Drug

Solution

The body surface area of a child weighing 40 pounds is 0.74 m². Apply the formula.

$$C = \frac{0.74}{1.7} \times 50$$

$$C = 22$$

The child's dose is 22 milligrams.