WHOLE NUMBERS AND DECIMALS
ADDITION AND SUBTRACTION

This unit is about computing with whole numbers and decimals using addition and subtraction. Some applications of these skills include balancing checkbooks and ledgers, calculating perimeter, and determining the best method to solve a problem.

Place Value

Add and Subtract Whole Numbers

Add and Subtract Decimals

Checking Accounts

Perimeter

Choosing the Best Method

Place Value

The chart below shows the place-value positions for each digit in the number, 72,486.94.

This number is read “seventy-two thousand, four hundred eighty-six **and** ninety-four hundredths.

*Note: The **decimal point** is read as **“and”**.

The mixed number for $72,486.94 = 72,486\frac{94}{100}$.

Hundred Millions	Ten Millions	Millions	Hundred Thousdands	Ten Thousands	Thousands	Hundreds	Tens	Ones	and	Tenths	Hundredths
				7	**0**	**0**	**0**	**0**			
					2	**0**	**0**	**0**			
						4	**0**	**0**			
							8	**0**			
								6			
									.	**9**	
										0	**4**

7 2, 4 8 6 . 9 4

Let's take a look at the value of each digit.

Digit	Value			
$\underline{7}2,486.94$	$7 \times 10,000$	=	$70,000$	
$7\underline{2},486.94$	$2 \times 1,000$	=	$2,000$	
$72,\underline{4}86.94$	4×100	=	400	
$72,4\underline{8}6.94$	8×10	=	80	
$72,48\underline{6}.94$	6×1	=	6	
$72,486.\underline{9}4$	9×0.1	=	0.9	(9 tenths)
$72,486.9\underline{4}$	4×0.01	=	0.04	(4 hundredths)

Let's take a look at where place value is used in everyday math.

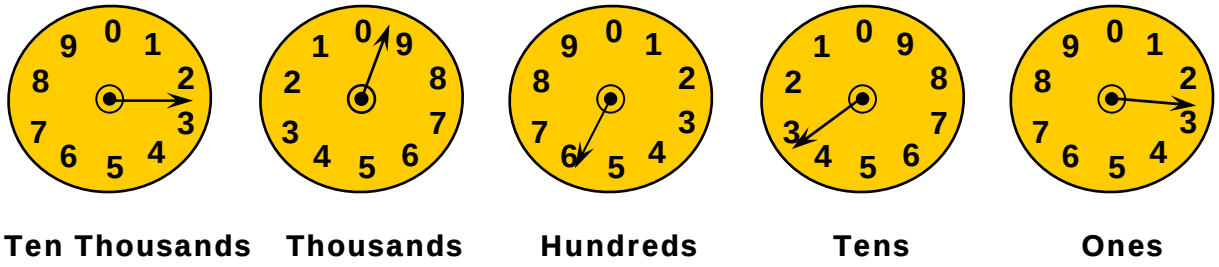
Reading a Meter

Shari is a meter reader for American Electric Power. As part of her job responsibilities, Shari reads electric meters and enters the readings into a hand-held computer.

Electric meters measure the number of kilowatt hours used. A KILOWATT HOUR (KWH) is equal to 1 kilowatt of electricity used for 1 hour.

1 KWH = 1 kilowatt of electricity/hr

An electric meter shows five dials as illustrated below.



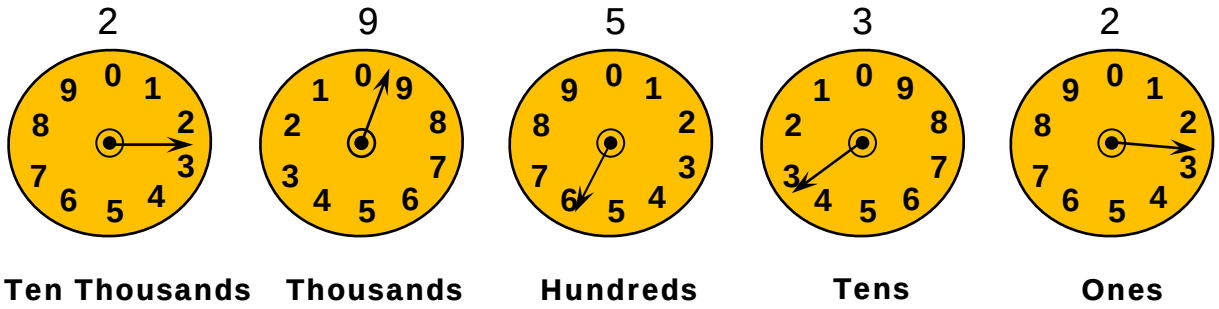
To read the meter dials:

Step 1: Choose the number that was **just passed** as the arrow rotates from 0 through 9. Note that the numbers on some dials run clockwise and some run counterclockwise.

- On the first, third, and fifth dials, the numbers rotate clockwise (the same as the hands on a clock).
- On the second and fourth dials, the numbers rotate counterclockwise (opposite direction of clockwise)

Step 2: Each dial is in its PLACE-VALUE position.

Let's read the meters.



*Remember, read the number that was **just passed**. For these dials, the meter reader is always counting forwards, either in a clockwise rotation or a counterclockwise rotation.

The meter in the illustration above reads 29,532 kilowatt hours. The arrows rotating clockwise are in ten thousands, hundreds, and ones place. The arrows rotating counterclockwise are in thousands and tens place.

The value of each digit for each meter is illustrated below:

$$\begin{aligned} 2 \times 10{,}000 &= 20{,}000 \\ 9 \times 1{,}000 &= 9{,}000 \\ 5 \times \phantom{1{,}}100 &= \phantom{2{,}}500 \\ 3 \times 10 &= \phantom{2{,}5}30 \\ 2 \times 1 &= \phantom{2{,}53}2 \\ &\overline{29{,}532} \end{aligned}$$

Shari would enter 29,532 KWH into the hand-held computer.

Add and Subtract Whole Numbers

In this section, we will look at adding and subtracting whole numbers. Estimating is an important component because we can use estimates to check that the real answer is reasonable.

Sum is the answer to an addition problem.

Difference is the answer to a subtraction problem.

Example 1: Estimate the sum: $245+378+2995$

Since the smallest number is in hundreds, round each number to the nearest hundred.

$$\begin{array}{ccccc} \underline{2}45 & + & \underline{3}78 & + & \underline{29}95 \\ \downarrow & & \downarrow & & \downarrow \\ 200 & & 400 & & 3000 \end{array}$$

*Look at tens place to round to hundreds. If the number in tens place is 5 or higher, round up; otherwise, hundreds place remains as is.

*Notice that in the 2995, since 9 is the highest single digit, we need to think 29 + 1 = 30.

Therefore, 200 + 400 + 3000 = 3,600.

The estimated sum of $245+378+2995$ is 3,600.

Example 2: What is the actual sum of $245+378+2995$?

Line up the numbers from right to left so that all place values are in line.

Add the ones.

$$\begin{array}{r} {\scriptstyle 1} \\ 245 \\ 378 \\ +2995 \\ \hline 8 \end{array} \qquad {\scriptstyle 10}\ (5+5)+8=18$$

Add the tens.

$$\begin{array}{r} {\scriptstyle 2\ 1} \\ 245 \\ 378 \\ +2995 \\ \hline 18 \end{array} \qquad {\scriptstyle 10}\ (9+1)+{\scriptstyle 11}\ (7+4)=21$$

Add the hundreds.

$$\begin{array}{r} {\scriptstyle 2\ 1} \\ 245 \\ {\scriptstyle 1}378 \\ +2995 \\ \hline 618 \end{array} \qquad {\scriptstyle 12}\ (9+3)+{\scriptstyle 4}\ (2+2)=16$$

Add the thousands.

$$\begin{array}{r} {\scriptstyle 2\ 1} \\ 245 \\ {\scriptstyle 1}378 \\ +2995 \\ \hline 3618 \end{array} \qquad 2+1=3$$

The actual sum of $245+378+2995$ is 3,618.

*Notice that the estimate of the same problem in Example 1, 3600, is close to the actual sum, 3618. The actual answer is reasonable.

Example 3: Estimate the difference: $5428 - 3764$

Since the smallest number is in thousands, round each number to the nearest thousand.

$5428 - 3764$
$\downarrow \quad \downarrow$
$5000 \quad 4000$

*Look at hundreds place to round to thousands. If the number in hundreds place is 5 or higher, round up; otherwise, thousands place remains as is.

Therefore, 5000 – 4000 = 1000.

The estimated difference of $5428 - 3764$ is 1,000.

Example 4: What is the actual difference of $5428 - 3764$?

Line up the numbers from right to left so that all place values are in line.

Subtract the ones.

$$\begin{array}{r} 5428 \\ -3764 \\ \hline 4 \end{array} \qquad (8 - 4 = 4)$$

Subtract the tens.
*Borrow from hundreds place.

$$\begin{array}{r} {\scriptstyle 3\ 12} \\ 5\cancel{4}\,\cancel{2}8 \\ -37\,64 \\ \hline 64 \end{array} \qquad (12 - 6 = 6)$$

Subtract the hundreds.
*Borrow from thousands place.

$$\begin{array}{r} {\scriptstyle 4\ 13\ 12} \\ \cancel{5}\,\cancel{4}\,\cancel{2}8 \\ -3764 \\ \hline 664 \end{array} \qquad (13 - 7 = 6)$$

Subtract the thousands.

$$\begin{array}{r} {\scriptstyle 4\ 13\ 12} \\ \cancel{5}\,\cancel{4}\,\cancel{2}8 \\ -3764 \\ \hline 1664 \end{array} \qquad (4 - 3 = 1)$$

The actual difference of $5428 - 3764$ is 1,664.

*Notice that the estimate of the same problem in Example 3, 1000, is close, but could be closer. However, the actual answer is still reasonable when comparing it to the estimate.

Subtraction can be checked using addition.

Example 5: Check the answer to the previous problem using addition.

5428	1664
–3764	+3764
1664	5428✓

Example 6: Find the difference: 4000 – 1582

$$\begin{array}{r} \ 9\ \ 9 \\ \ {}^{3}\!\not{4}\ {}^{1}\!\not{0}\ {}^{1}\!\not{0}\ {}^{1}0 \\ -\ 1\ 5\ 8\ 2 \\ \hline \end{array}$$

To borrow in this problem, go to thousands place since there are 0 hundreds and 0 tens. Work from thousands place back over to ones, place by place, working right to left.

Step 1: Borrow from the 4 to get 10 hundreds leaving 3 thousands.

$$\begin{array}{r} \ {}^{3}\!\not{4}\ {}^{1}0\,0\,0 \\ -\ 1\ \ 5\,8\,2 \\ \hline \end{array}$$

Step 2: Borrow from the 10 hundreds to get 10 tens leaving 9 hundreds.

$$\begin{array}{r} \ \ \ 9 \\ \ {}^{3}\!\not{4}\ {}^{1}\!\not{0}\ {}^{1}0\,0 \\ -\ 1\ \ 5\ \ 8\,2 \\ \hline \end{array}$$

Step3: Borrow from the 10 tens to get 10 ones leaving 9 tens.

$$\begin{array}{r} \ 9\ \ 9 \\ \cancel{{}^{3}4}\ \cancel{{}^{1}0}\ \cancel{{}^{1}0}\ {}^{1}0 \\ -\ 1\ 5\ 8\ 2 \\ \hline \end{array}$$

Step 4: Now we're ready to subtract.

$$\begin{array}{r} \ 9\ \ 9 \\ \cancel{{}^{3}4}\ \cancel{{}^{1}0}\ \cancel{{}^{1}0}\ {}^{1}0 \\ -\ 1\ 5\ 8\ 2 \\ \hline \ 2\ 4\ 1\ 8 \end{array}$$

The difference of 4000 – 1582 is 2,418.

Check by adding.

$$\begin{array}{r} 4000 \\ -1582 \\ \hline 2418 \end{array} \qquad \begin{array}{r} 2418 \\ +1582 \\ \hline 4000\checkmark \end{array}$$

Example 7: Find the difference: 7006 – 2379

$$\begin{array}{r} \ 9\ \ 9 \\ \cancel{{}^{6}7}\ \cancel{{}^{1}0}\ \cancel{{}^{1}0}\ {}^{1}6 \\ -\ 2\ 3\ 7\ 9 \\ \hline \end{array}$$

To borrow in this problem, go to thousands place, since there are 0 hundreds and 0 tens. Work from thousands place back over to ones, place by place, working right to left.

Step 1: Borrow from the 7 to get 10 hundreds leaving 6 thousands.

$$\begin{array}{r} {}^{6}\cancel{7}\,{}^{1}0\,06 \\ -\ 2\ \ 379 \\ \hline \end{array}$$

Step 2: Borrow from the 10 hundreds to get 10 tens leaving 9 hundreds.

$$\begin{array}{r} \phantom{{}^{6}}9 \\ {}^{6}\cancel{7}\,{}^{1}\cancel{0}\,{}^{1}0\,6 \\ -\ 2\ 3\ 7\,9 \\ \hline \end{array}$$

Step3: Borrow from the 10 tens to get 16 ones leaving 9 tens.

$$\begin{array}{r} \phantom{{}^{6}}9\ 9 \\ {}^{6}\cancel{7}\,{}^{1}\cancel{0}\,{}^{1}\cancel{0}\,{}^{1}6 \\ -\ 2\ 3\ 7\ 9 \\ \hline \end{array}$$

Step 4: Now we're ready to subtract.

$$\begin{array}{r} \phantom{{}^{6}}9\ 9 \\ {}^{6}\cancel{7}\,{}^{1}\cancel{0}\,{}^{1}\cancel{0}\,{}^{1}6 \\ -\ 2\ 3\ 7\ 9 \\ \hline 4\ 6\ 2\ 7 \end{array}$$

The difference of 7006 – 2379 is 4,627.

Check by adding.

$$\begin{array}{r} 7006 \\ -2379 \\ \hline 4627 \end{array} \qquad \begin{array}{r} 4627 \\ +2379 \\ \hline 7006\checkmark \end{array}$$

Example 8: Read through this problem and solve. Look for key words that aid in determining the correct method for solving.

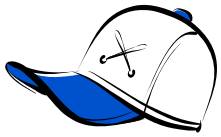
The 4-H club mowed lawns to earn money for a trip to a professional baseball game. On Monday they earned $150, on Tuesday they earned $126, and on Wednesday they earned $100. What is the total amount of money that the club earned?

The key word is total – this is an addition problem because all of the money is being put together.

$$150 + 126 + 100 = \$376$$

The club earned $376 for the trip.

Example 9: The 4-H club set a goal to earn $500 to cover all the baseball game trip expenses. So far they have earned $376. How much more must they earn?



The key phrase is "how much more". This is a subtraction problem because the amount of money earned is being compared to the amount of money needed.

$$500 – 376 = \$124.$$

The club must earn $124 for their trip to the professional baseball game.

Add and Subtract Decimals

To add and subtract decimals, be sure to **line up the decimal points** so that the place values will also line up; that is, tenths with tenths, hundredths with hundredths, and so on.

Example 1: Find the sum: 8.3 + 17.82 + 15

We'll estimate first so that we can check our final answer to see if it is reasonable.

$$\begin{array}{ccccc} 8.3 & + & 17.82 & + & 15 \\ \downarrow & & \downarrow & & \downarrow \\ 8 & & 18 & & 15 \end{array}$$

Round each number to the nearest whole number. Look at tenths place to determine if ones place rounds up or stays the same.

$$8 + 18 + 15 = 41$$

Now let's determine the actual answer.

*Note: 15 is a whole number. The decimal point is located at the end of a whole number. So, write 15 as "15." in the actual addition.

$$\begin{array}{r} {}^{1}8.3 \\ {}^{2}17.82 \\ \underline{15.00} \\ 41.12 \end{array}$$

Two zeros are added to 15 as place holders. These zeros do not change the value of the 15 since:

$$15.00 = 15\frac{00}{100} = 15$$

The sum is 41.12 and is read "41 and 12 hundredths" ($41\frac{12}{100}$).

The actual answer (41.12) is reasonable because the estimate was 41.

Example 2: Find the difference: 5.308 – 3.746

$$\begin{array}{r} {}^{4}\cancel{5}.{}^{1}\cancel{2}{}^{1}\cancel{3}0\,8 \\ -\ 3.\ \ 7\ 4\ 6 \\ \hline 1.\ \ 5\ 6\ 2 \end{array}$$

The difference is 1.562 and is read "1 and 562 thousandths" $(1\frac{562}{1000})$.

Check by adding.

5.308	1.562
–3.746	+3.746
1.562	5.308✓

Example 3: Find the difference: 12 – 5.3524

This type of problem is often missed because placing the decimal point at the end of the whole number (12.) is overlooked. So, we'll estimate first so that we can check our final answer to see if it is reasonable.

12 – 5.3524	Round each number to the nearest whole number.
↓ ↓	Look at tenths place to determine if ones place
12 5	rounds up or stays the same.

$12 - 5 = 7$

Now let's determine the actual answer.

$$\begin{array}{r} \phantom{{}^{11}}\ 9\ 9\ 9 \\ {}^{11}\cancel{12}.{}^{1}\cancel{0}{}^{1}\cancel{0}{}^{1}\cancel{0}{}^{1}0 \\ -\ \ 5.\ 3\ 5\ 2\ 4 \\ \hline 6.\ 6\ 4\ 7\ 6 \end{array}$$

The number 12 is a whole number; thus, place a decimal point at the end of the number.

Four zeros are added to 12 as place holders. These zeros do not change the value of the 12 since:

$$12.0000 = 12\frac{0000}{10000} = 12$$

The difference is 6.6476 and is read "6 and 6476 ten- thousandths" $(6\frac{6476}{10,000})$.

The actual answer (6.6476) is reasonable because the estimate was 7.

Check by adding.

12.0000	6.6476
–5.3524	+5.3524
6.6476	12.0000✓

Example 4: Find the difference: 8.6 – 2.953

This type of problem is often missed because add zeros as place holders overlooked. So, we'll estimate first so that we can check our final answer to see if it is reasonable.

$8.6 - 2.953$
$\downarrow \quad \downarrow$
$9 \quad 3$

Round each number to the nearest whole number. Look at tenths place to determine if ones place rounds up or stays the same.

$9 - 3 = 6$

Now let's determine the actual answer.

$$\begin{array}{r} {\not 7}\not 8.{}^{15}\not 6\,{}^{1}\not 0\,{}^{1}0 \\ -\ 2.\ 9\ 5\ 3 \\ \hline 5.\ 6\ 4\ 7 \end{array}$$

(9 above the 0)

Two zeros are added to 8.6 as place holders. These zeros do not change the value of the 8.6 since:

$$8.600 = 8\frac{600}{1000} = 8\frac{6\not 0\not 0}{10\not 0\not 0} = 8\frac{6}{10} = 8.6$$

The difference is 5.647 and is read "5 and 647 thousandths" $(5\frac{647}{1000})$.

The actual answer (5.647) is reasonable because the estimate was 6.

Check by adding.

8.600	5.647
−2.953	+2.953
5.647	8.600✓

Checking Accounts

A checking account will allow the account holder to pay bills or expenses without carrying or mailing large amounts of cash. When a checking account at a bank or credit union is opened, a checkbook with a supply of checks is issued. In addition, a check register is provided to keep a record of each transaction that occurs within the checking account. Each check will be printed with the account holder's name and address, the number of the check, the name of the bank that maintains the account, and the account number. Deposit slips are also provided so that the account holder may deposit money into the account.

When a deposit is made, the account holder is putting money into the account. The value of the cash is added to the current balance.

When a check is written, the account holder is taking money out of his account, so the amount indicated on the check is subtracted from the current balance in the account. The *payer* is the person who writes and signs the check. The *payee* is the person or company to whom the check is written.

Deposit:	Money In	**Add (+)**
Check:	Money Out	**Subtract (–)**

Example 1: Stu Pigeon purchased license plates for his car on February 23. The plates cost $43.50. Write check number 101 to the Ohio Motor Vehicle Department for this amount.

Stu Pigeon
15 Buckeye Lane
Somewhere, Ohio 12345

February 23 20 10

No. 101
7–89
520

Pay To the Order of Ohio Motor Vehicle Department $43.50

Forty-three and 50/100 ---------- DOLLARS

North Bank of Somewhere

For License plates Stu Pigeon

In order to keep anyone from changing a check:

*Write the numbers as close to the dollar sign as possible.

*Draw a line from the amount written as words to the word dollars.

Keeping a Record

The account holder should keep a record of every check that is written so that he or she will know how much money is left in the account. This record is calculated in a **check register** and keeps such information as the date, the check number, to whom the check was written, the amount of the check, and the new balance. The figure below illustrates how checkbook registers are kept.

Check Register			Debits (-)			Credits (+)		Balance	
Number	Date	Description of Transaction	Checks	Fees		Deposits	Interest	$234	72
	1/30	Deposit				375	00	375	00
								609	72
100	2/6	National Electric	35	24				35	24
								574	48
101	2/23	Ohio Motor Vehicle Dept	43	50				43	50
								530	98
	2/27	Deposit				35	00	35	00
								565	98
	3/1	Bank charge	5	00				5	00
								560	98

Let's take another look at the check register again with the deposits highlighted in green (remember, these amounts are added to the balance) and the checks and bank charges are highlighted in red (these amounts are subtracted from the balance).

Check Register			Debits (-)			Credits (+)		Balance	
Number	Date	Description of Transaction	Checks	Fees		Deposits	Interest	**$234**	**72**
	1/30	Deposit				375	00	375	00
								609	72
100	2/6	National Electric	35	24				35	24
								574	48
101	2/23	Ohio Motor Vehicle Dept	43	50				43	50
								530	98
	2/27	Deposit				35	00	35	00
								565	98
	3/1	Bank charge	5	00				5	00
								560	98

*Notice that the balance is computed after each transaction and a new balance is figured and recorded in the gray area.

Example 2: What is the new balance after the deposit on 1/30 is made?

The previous balance was $234.72. **Add on the deposit** of $375.

New Balance = 234.72 + 375 = $609.72

Example 3: What is the new balance after the check to National Electric is written and sent for payment?

The previous balance was $609.72. **Subtract the check** amount of $35.24.

New Balance = 609.72 – 35.24 = $574.48

*Note: It is good practice to check all calculations with a calculator to avoid overdrawing from a checking account. Extra bank fees are added to an overdrawn account. An overdrawn account is an account where the account holder writes out checks totaling an amount that is higher than the money deposited in the account.

Perimeter

P**erimeter** is the distance around a figure and is measured in plain units.

inches (in) yards (yd) feet (ft) centimeters (cm)

To find the perimeter of a straight edged figure, **add** all the sides.

Example: Mr. Smith wants to enclose his rectangular yard with a fence. If his yard measures 35 feet long and 20 feet wide, how much fencing will he need?

35 ft

20 ft

*Since the yard is rectangular in shape, the opposite sides are equal.

Add all the sides together to get the total number of feet.

35 + 20 + 35 + 20 = 110

We can solve this problem another way using a formula.

In this formula, we add the length and width, and then double that amount since we calculate the total distance around.

$P = 2(l + w)$	Substitute: length = 35, width = 20
$P = 2(35 + 20)$	Add inside parenthesis first.
$P = 2(55)$	Multiply.
$P = 110$	

Is there another formula that can be used? Can we double each of the sides first, and then add? Yes!

$P = 2l + 2w$	Substitute: length $= 35$, width $= 20$
$P = 2(35) + 2(20)$	Multiply.
$P = 70 + 40$	Add.
$P = 110$	

Mr. Smith will need a total of 110 feet of material to enclose his yard.

Choosing the Best Method

Steven's car uses approximately 25 gallons of gasoline each week. The cost of the gasoline is $2.89 per gallon.

Example 1: About how much money should Steven plan to spend on gasoline each week?

For some problems, an **estimate** is enough to solve the problem.

In this problem, since Steven does not need to know the exact amount, he ESTIMATES.

$2.89 is about $3 $\quad 3 \times 25 = 75$

Therefore, Steven decides to have $75 per week for gas.

Example 2: When Steven purchases his gas, the clerk in the store must calculate the EXACT amount. How much will the clerk charge Steven for 25 gallons of gas?

$$2.89 \times 25 = 72.75$$

Therefore, Steven will pay exactly $72.75 for the gas.

Did Steven estimate enough money to cover his actual charges?

Steven estimated $75. The actual charges were $72.75.

✓ Yes!

The following flowchart can be used to choose the best method of computation.