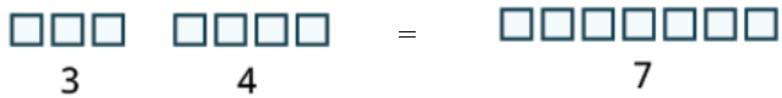
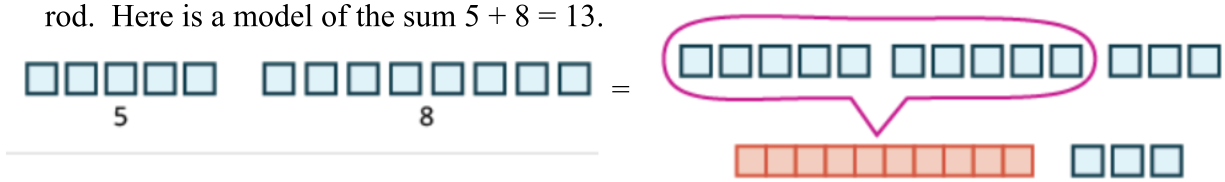
1.2 Addition of Whole Numbers

The operation addition combines numbers to get a sum. We use the notation 3 + 4 to represent the sum of 3 and 4. We can model this operation using small squares as counters.



When the sum of two numbers is greater than 10, we can exchange 10 of the blocks for a rod. Here is a model of the sum 5 + 8 = 13.



10 + 3 = 13

For large numbers, we can use expanded notation to show the underlying mathematics of adding two numbers.

Consider the sum 5,231 + 4,426.

5,000	+	200	+	30	+	1	=	5,231
4,000	+	400	+	20	+	6	=	4,426
9,000	+	600	+	50	+	7	=	9,657

This would be a cumbersome method for adding large numbers, so we choose to use the shorthand notation of aligning the numbers by place value and adding the digits as shown at right:

	5,	2	3	1
+	4,	4	2	6
	9,	6	5	7

And now consider 32,782 + 4,617:

30,000	+	2,000	+	700	+	80	+	2	=	32,782
		4,000	+	600	+	10	+	7	=	4,617
30,000	+	6,000	+	1,300	+	90	+	9	=	
30,000	+	6,000	+	1,000 + 300	+	90	+	9	=	
30,000	+	7,000	+	300	+	90	+	9	=	37,399

We will always use the conventional shorthand notation as shown as right, but it is good to know that expanded form is the underlying concept used in all operations on whole numbers.

		1			
	3	2,	7	8	2
+		4,	6	1	7
	3	7,	3	9	9

Demonstration Problems	*Practice Problems*
1. (a) 541 + 328 =	**1. (b)** 263 + 126 =
2. (a) 16,283 + 21,432 =	**2. (b)** 35,317 + 27,552 =
	Answers: **1. (b)** 389; **2. (b)** 62,869

Vocabulary and Properties

Numbers that are being added together are called *addends*. The result of numbers added together is called the *sum*.

Identity Property of Addition
The sum of 0 and any number is that number.
That is, $0 + a = a$

Commutative Property of Addition
Changing the order of two addends does not change the sum.
That is, $a + b = b + a$

Associative Property of Addition
Changing the grouping of addends does not change the sum.
$(a + b) + c = a + (b + c)$

These properties can help us when we add many numbers together. The addition becomes easier if we look for pairs of numbers that have a sum of 10 or a multiple of 10. For example:

$$\begin{aligned} 13 + (2 + 7) + (8 + 9) &= (13 + 7) + (2 + 8) + 9 \\ &= 20 + 10 + 9 \\ &= 39 \end{aligned}$$

Demonstration Problems	*Practice Problems*
3. (a) 2 + 5 + 8 + 7 + 5 =	**3. (b)** 4 + 1 + 5 + 6 + 9 =
4. (a) 23 + 49 + 17 =	**4. (b)** 81 + 17 + 23 + 90 =
	Answers: **3. (b)** 25; **4. (b)** 211

Identifying Key Words used in Problem Solving

Addition		
Key Words or Phrases	*Examples*	*Mathematical Expressions*
added to	5 added to 7	7 + 5
plus	0 plus 78	0 + 78
increased by	12 increased by 6	12 + 6
more than	11 more than 25	25 + 11
total	the total of 8 and 1	8 + 1
sum	the sum of 4 and 133	4 + 133

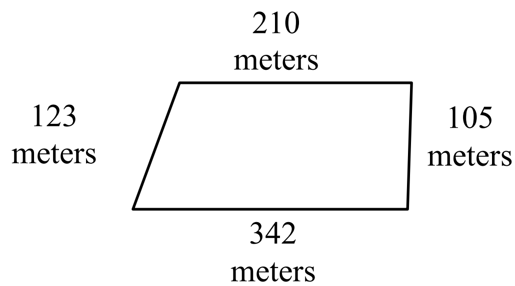
Demonstration Problems	*Practice Problems*
5. (a) Find the total of 25 and 77.	**5. (b)** Find the sum of 241 and 28.
6. (a) What is 17 more than 8?	**6. (b)** What is 300 increased by 57?
	Answers: **5. (b)** 269; **6. (b)** 357

Perimeter

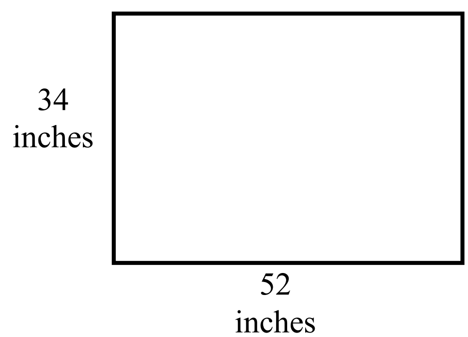
Perimeter: A continuous line forming the boundary of a closed geometric figure, or the length of such a line. Perimeter comes from Latin, where *peri* = around, *metron* = measure.

To find the perimeter of a polygon, add the lengths of all the sides of the polygon.

To find the perimeter of the trapezoid to the right, add the lengths of the four sides.

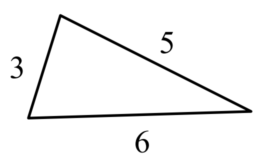


To find the perimeter of a rectangle, identify the lengths of all four sides and add them together.

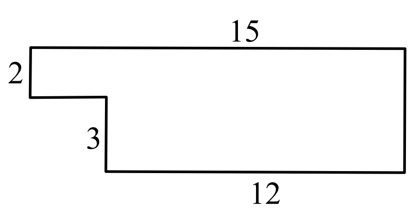


Demonstration Problems

7. (a) Find the perimeter.

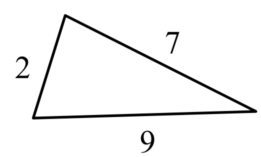


8. (a) Find the perimeter.

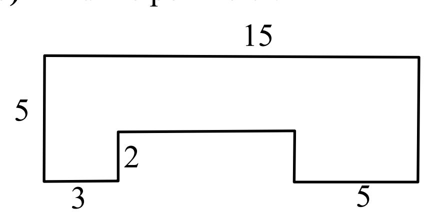


Practice Problems

7. (b) Find the perimeter.



8. (b) Find the perimeter.



Answers: **7. (b)** 18; **8. (b)** 44