Everyday Mathematics

Partial-Quotients Algorithm
(Focus Algorithm)

Partial-Quotients Algorithm

We use partial-quotients division to solve problems such as:

$$6\overline{)534}$$

The problem is read, "534 divided by 6."

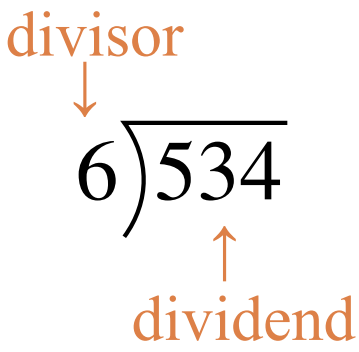
534 is the dividend, the number we are dividing.

6 is the divisor, the number we are dividing by.

Partial-Quotients Algorithm

Partial-quotients division involves:

- Breaking the dividend into parts,
- Finding multiples of the divisor,
- Finding partial quotients, and
- Finding the sum of the partial quotients.



Definitions:

A multiple of a number is the product of that number and some counting number (1, 2, 3, 4, 5, etc.).

The product is the answer to a multiplication problem.

The quotient is the answer to a division problem.

The sum is the answer to an addition problem.

Partial-Quotients Algorithm

We will solve: $6\overline{)534}$

We can approach this problem by thinking about:

How many [6s] are in 534?

Or

What times 6 will equal 534?

Partial-Quotients Algorithm

To find 534 ÷ 6, begin by thinking about easy *multiples* of 6:

$1 \times 6 = 6$ $\qquad\qquad$ $10 \times 6 = 60$

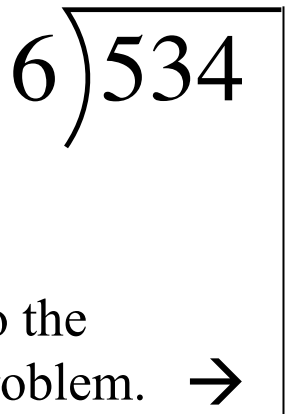
Let's use these two facts to generate some others:

$2 \times 6 = 12$ [double 1×6]
$4 \times 6 = 24$ [double 2×6]
$5 \times 6 = 30$ [take ½ of 10×6]
$15 \times 6 = 90$ [solve $3 \times (5 \times 6)$]
$20 \times 6 = 120$ [double 10×6 or solve $10 \times (2 \times 6)$]
$50 \times 6 = 300$ [solve $10 \times (5 \times 6)$]
$100 \times 6 = 600$ [double 10×6]

Our dividend of 534 is between 300 and 600,
so we can stop here.

Partial-Quotients Algorithm

Set up our notation for using the partial-quotients method.



Write partial quotients here:

↓

Draw a line to the right of the problem. →

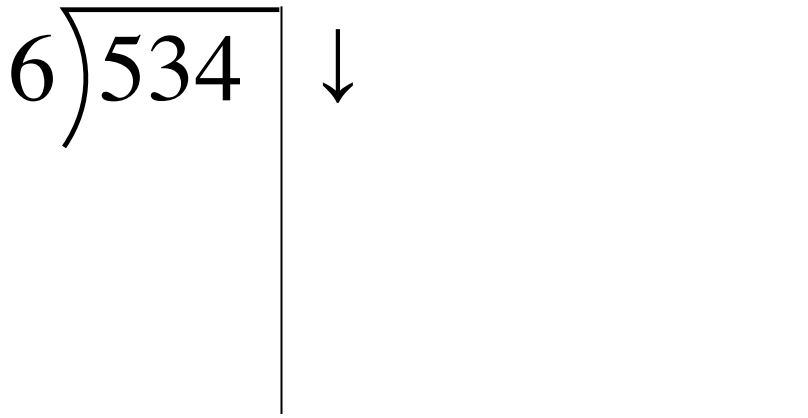
Partial-Quotients Algorithm

How many [6s] are in 534?

Recall the multiples we came up with:

$50 \times 6 = 300$

$100 \times 6 = 600$



600 is greater than 534, so there are fewer than 100 [6s] in 534. But 300 is less than 534, which means that there are at least 50 [6s] in 534. So let's use 50 as our first partial quotient.

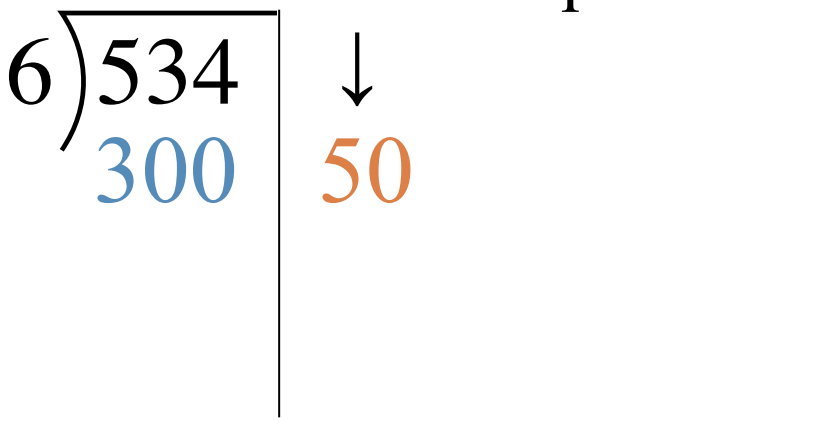
Partial-Quotients Algorithm

The first partial quotient is 50.

Record 50 to the right of the problem.

$50 \times 6 = 300$

Record 300 below the dividend.



Partial-Quotients Algorithm

Now subtract to find the difference.

234 is the remainder.

	Partial quotients
$6\overline{)534}$	↓
$-\ \underline{300}$	50
234	

Partial-Quotients Algorithm

How many [6s] are in 234?

Recall the multiples we came up with:

$20 \times 6 = 120$

$50 \times 6 = 300$

	Partial quotients
$6\overline{)534}$	↓
$\underline{300}$	50
234	

300 is greater than 234, so there are fewer than 50 [6s] in 234. But 120 is less than 234, which means that there are at least 20 [6s] in 234. So let's use 20 as our second partial quotient.

Partial-Quotients Algorithm

The second partial quotient is 20.

Record 20 to the right of the problem.

$20 \times 6 = 120$

Record 120 below the 234.

	Partial quotients
$6\overline{)534}$	↓
$-\ \underline{300}$	50
234	
120	20

Partial-Quotients Algorithm

Now subtract to find the difference.

114 is the new remainder.

		Partial quotients
6 ⟌	534	↓
	300	50
	234	
–	120	20
	114	

Partial-Quotients Algorithm

How many [6s] are in 114?

Recall the multiples we came up with:

$15 \times 6 = 90$

$20 \times 6 = 120$

	Partial quotients
$6\overline{)534}$	↓
$-\ 300$	50
234	
$-\ 120$	20
114	

120 is greater than 114, so there are fewer than 20 [6s] in 114.

But 90 is less than 114, which means that there are at least 15 [6s] in 114. So let's use 15 as our third partial quotient.

Partial-Quotients Algorithm

The third partial quotient is 15.

Record 15 to the right of the problem.

$15 \times 6 = 90$

Record 90 below the 114.

	Partial quotients
6 ⟌ 534	↓
300	50
234	
120	20
114	
90	15

Partial-Quotients Algorithm

Now subtract to find the difference.

	Partial quotients
$6\overline{)534}$	↓
$-\ 300$	50
234	
$-\ 120$	20
114	
$-\ 90$	15
24	

Partial-Quotients Algorithm

How many [6s] are in 24?

Recall the multiples we came up with:

$4 \times 6 = 24$

Since there are exactly 4 [6s] in 24, the fourth partial quotient is 4.

		Partial quotients
6 ⟌	534	↓
	300	50
	234	
	120	20
	114	
−	90	15
	24	

Partial-Quotients Algorithm

The fourth partial quotient is 4.

Record 4 to the right of the problem.

$4 \times 6 = 24$

Record 24 below the 24.

	Partial quotients
$6\overline{)534}$	↓
$\underline{300}$	50
234	
$\underline{120}$	20
114	
$\underline{90}$	15
24	
24	4

Partial-Quotients Algorithm

Now subtract to find the difference.

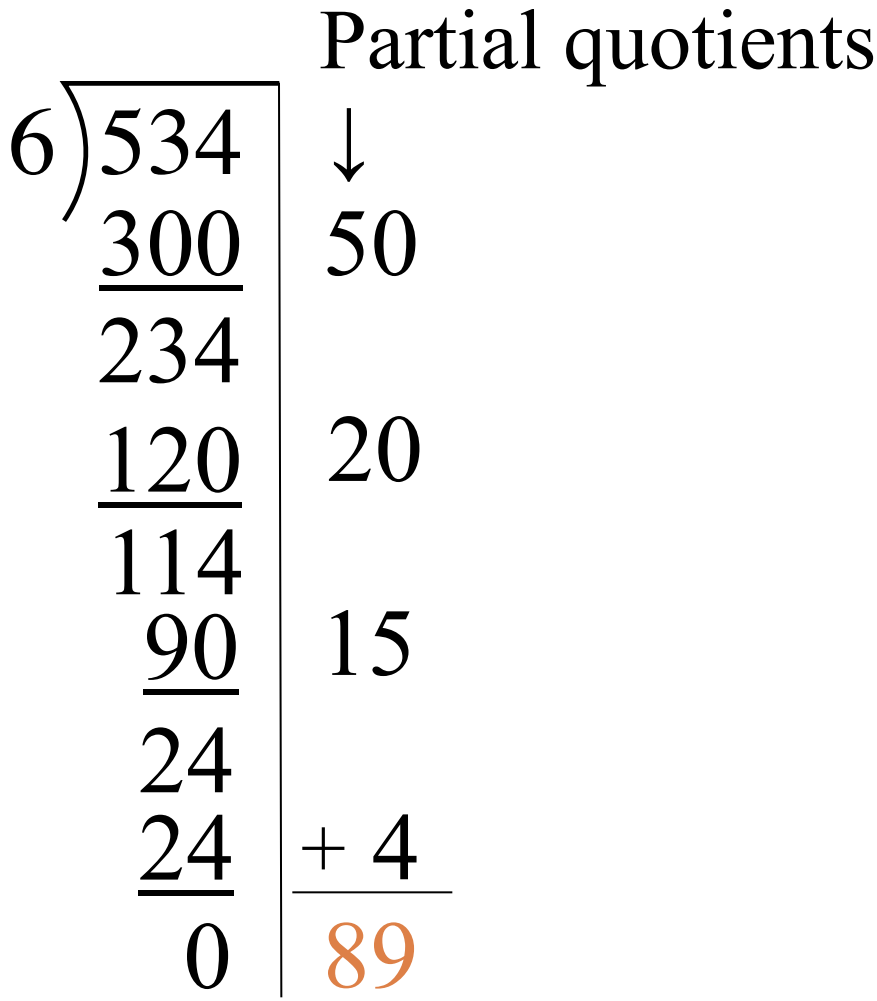
The remainder is 0. Since the remainder is less than 6, we are done subtracting multiples of the divisor.

	Partial quotients
6)534	↓
300	50
234	
120	20
114	
90	15
24	
−24	4
0	

Partial-Quotients Algorithm

Now add the partial quotients.

The quotient is 89.



Partial-Quotients Algorithm

$534 \div 6 = 89$

Note that when children use the partial-quotients division method to solve a division problem, they have the opportunity to practice a variety of skills related to developing number sense and algebraic reasoning.

These skills include:

- *Using equivalent names for numbers when breaking down the divisor*
- *Using multiples to solve the problem*
- *Practicing doubling and halving (if they use a fact strategy such as the one in this presentation)*
- *Using all four operations — addition, subtraction, multiplication, and division.*