CEMSE
CENTER FOR ELEMENTARY MATHEMATICS AND SCIENCE EDUCATION
THE UNIVERSITY OF CHICAGO

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Everyday Mathematics

Partial-Quotients Division

Partial-Quotients Division

Partial-quotients is a simpler way to do long division. Many children like partial-quotients because it is easier to understand than some other methods.

Partial-quotients division involves:

- Finding multiples of the divisor;
- Finding partial quotients; and
- Finding the sum of the partial quotients.

Partial-Quotients Division

Let's use partial-quotients division to solve 296 ÷ 8.

First we think about how many [8s] are in 296.

It can help to make a list of easy multiples of 8.

$1 \times 8 = 8$	
$10 \times 8 = 80$	
$2 \times 8 = 16$	[double 1×8]
$5 \times 8 = 40$	[take ½ of 10×8]
$20 \times 8 = 160$	[double 10×8]
$50 \times 8 = 400$	[solve $10 \times (5 \times 8)$]

296 is between 160 and 400, so we can stop here.

Partial-Quotients Division

First we set up the problem.

$8\overline{)296}$

We will write the partial quotients here.

Easy Multiples

$1 \times 8 = 8$
$10 \times 8 = 80$
$2 \times 8 = 16$
$5 \times 8 = 40$
$20 \times 8 = 160$
$50 \times 8 = 400$

Partial-Quotients Division

Now we ask: *How many [8s] are in 296?*

From the list of multiples, we see that there are at least 20 [8s] = 160 in 296.

Our first partial quotient is 20.

Easy Multiples
1 × 8 = 8
10 × 8 = 80
2 × 8 = 16
5 × 8 = 40
20 × 8 = 160
50 × 8 = 400

$8\overline{)296}$

Partial quotients

Partial-Quotients Division

We record 20 to the right of the problem and $20 \times 8 = 160$ below 296.

Then we subtract to find the difference.

$$8\overline{)296}$$

$$-\ 160$$

$$136$$

Partial quotients

20

Easy Multiples

$1 \times 8 = 8$
$10 \times 8 = 80$
$2 \times 8 = 16$
$5 \times 8 = 40$
$20 \times 8 = 160$
$50 \times 8 = 400$

Partial-Quotients Division

Next we ask: *How many [8s] are in 136?*

From the list of multiples we see that there are at least 10 [8s] = 80 in 136.

So 10 is our second partial quotient.

Easy Multiples
1 × 8 = 8
10 × 8 = 80
2 × 8 = 16
5 × 8 = 40
20 × 8 = 160
50 × 8 = 400

$$\begin{array}{r|l} 8 & 296 \\ -\ 160 & \\ \hline 136 & \end{array}$$

Partial quotients

20

Partial-Quotients Division

We record 10 to the right of the problem and $10 \times 8 = 80$ below 136.

We subtract to find the difference.

	Partial quotients
$8\overline{)296}$	
$-\ 160$	20
136	
$-\ 80$	10
56	

Easy Multiples

$1 \times 8 = 8$
$10 \times 8 = 80$
$2 \times 8 = 16$
$5 \times 8 = 40$
$20 \times 8 = 160$
$50 \times 8 = 400$

Partial-Quotients Division

We ask: *How many [8s] are in 56?*

From the list of multiples, we see that there are at least 5[8s] = 40 in 56.

So 5 is our third partial quotient.

Easy Multiples
1 × 8 = 8
10 × 8 = 80
2 × 8 = 16
5 × 8 = 40
20 × 8 = 160
50 × 8 = 400

8 ⟌ 296	Partial quotients
− 160	20
136	
− 80	10
56	

Partial-Quotients Division

We record 5 to the right of the problem and 5 × 8 = 40 below 56.

We subtract to find the difference.

	Partial quotients
8)296	
− 160	20
136	
− 80	10
56	
− 40	5
16	

Easy Multiples

1 × 8 = 8
10 × 8 = 80
2 × 8 = 16
5 × 8 = 40
20 × 8 = 160
50 × 8 = 400

Partial-Quotients Division

Next we ask: *How many [8s] are in 16?*

From the list of multiples, we see that there are exactly 2 [8s] in 16.

So 2 is our final partial quotient.

Easy Multiples
1 × 8 = 8
10 × 8 = 80
2 × 8 = 16
5 × 8 = 40
20 × 8 = 160
50 × 8 = 400

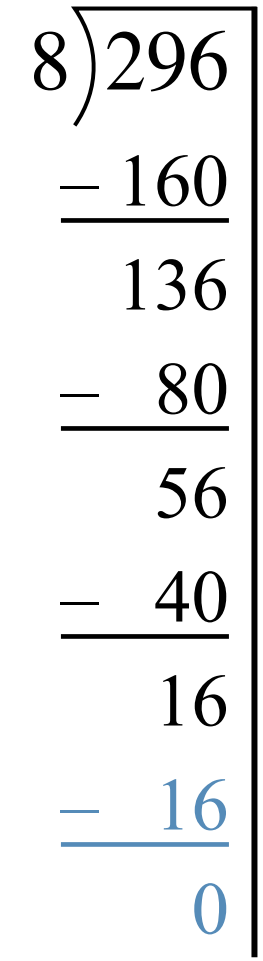
	Partial quotients
8 ⟌ 296	
− 160	20
136	
− 80	10
56	
− 40	5
16	

Partial-Quotients Division

We record 2 to the right of the problem and 2 × 8 = 16 below 16.

We subtract to find the difference.

Since the difference is 0, there is no remainder.



Partial quotients

20

10

5

2

Partial-Quotients Division

Finally, we add the partial quotients to arrive at our result.

$296 \div 8 = 37$

Add the partial quotients.

$$\begin{array}{r} 20 \\ 10 \\ 5 \\ +\ 2 \\ \hline 37 \end{array}$$

Partial-Quotients Division

When children use partial-quotients division they practice a variety of skills related to number sense and algebraic reasoning. For example:

- Using equivalent names for numbers;
- Using multiples;
- Practicing doubling and halving;
- Using addition, subtraction, multiplication, and division; and
- Understanding division as a way to answer questions such as “How many 8s are in 296?”