



Roots of Reason

Chunking

Break a hard problem into easier parts **without changing its value**.

1

Break it

into useful chunks

$$175 \longleftrightarrow 140 + 35$$

2

**Work with the
chunks**

$$140 \div 7 = 20 \quad 35 \div 7 = 5$$

3

**Put them back
together**

$$20 + 5 = 25 \text{ so } 175 \div 7 = 25$$

whole $\rightleftharpoons$ chunks · the pieces change, the value never does



Roots of Reason

Choose Useful Chunks

Place value

$$347 \rightarrow 300 + 40 + 7$$

*break by hundreds, tens, ones***Reach a
benchmark**

$$58 + 27 \rightarrow 58 + 2 + 25$$

*get to 60 first, then it's easy***Use a fact you
know**

$$8 \times 7 \rightarrow 8 \times 5 + 8 \times 2$$

*fives and twos are fast facts***Compatible
multiple**

$$175 \div 7 \rightarrow 140 + 35$$

*both pieces divide evenly by 7***Go past,
compensate**

$$6 \times 39 \rightarrow 6 \times 40 - 6$$

*borrow an easy number, pay it
back*

There is often more than one good choice.



Roots of Reason

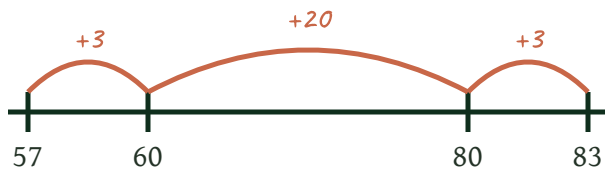
Break Apart to Add and Subtract

+

Break an addend to reach a friendly number

$$57 + 26$$

$$57 + 3 + 20 + 3$$



$$= 83$$

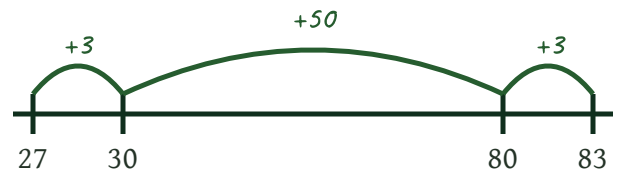
What number were you trying to reach? **60**, then **80**.

-

Break the distance into manageable pieces

$$83 - 27$$

count up: 27 → 30 → 80 → 83



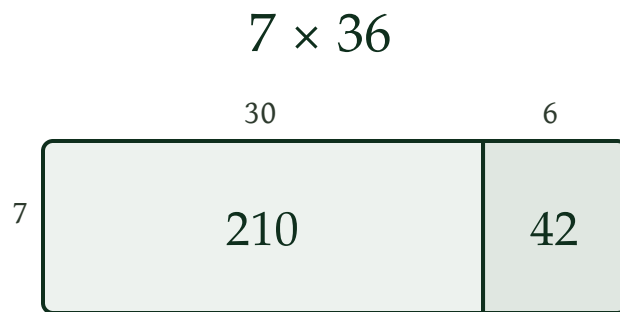
$$3 + 50 + 3 = 56$$

The answer is the **distance** between 27 and 83, walked in easy steps.



Roots of Reason

Multiply in Chunks



$$210 + 42 = 252$$

$$\begin{aligned}
 &7 \times 36 \\
 &= 7 \times (30 + 6) \\
 &= 7 \times 30 + 7 \times 6 \\
 &= 210 + 42 \\
 &= 252
 \end{aligned}$$

*Every chunk of the rectangle gets multiplied.
None may be skipped.*

also works backward

$$\begin{aligned}
 6 \times 39 &= 6 \times (40 - 1) = 240 \\
 &\quad - 6 = 234
 \end{aligned}$$

*go past to a friendly factor, then
take the extra back out*

Break one factor. Multiply every chunk. Recombine.



Roots of Reason

Divide in Chunks

$252 \div 7$ · two ways to write the same thinking

A Break the dividend

$$252 = 210 + 42$$

$$210 \div 7 = 30$$

$$42 \div 7 = 6$$

$$30 + 6 = 36$$

Each piece divides **evenly** by 7. That is what makes it a good chunk.

B Subtract groups away

252	<i>start</i>
$- 210$	<i>30 groups of 7</i>
42	
$- 42$	<i>6 groups of 7</i>
0	$30 + 6 = 36$

Pull out easy groups until nothing is left. The quotient is the **groups removed**.

Choose chunks that are easy multiples of the divisor. Any size chunk is allowed.



Roots of Reason

Fractions Can Chunk Too

$$\frac{11}{4} = \frac{8}{4} + \frac{3}{4} = 2 \frac{3}{4}$$



Two whole bars of fourths, then **3 more fourths**. Eleven fourths never changed.

more than one way

$$\frac{7}{8} = \frac{4}{8} + \frac{3}{8}$$

$$\frac{7}{8} = \frac{2}{8} + \frac{5}{8}$$

The pieces can change. The total cannot.



Roots of Reason

There Is More Than One Way

$$168 \div 6$$

$$120 + 48$$

20 + 8 groups

2 chunks

$$60 + 60 + 48$$

10 + 10 + 8 groups

3 chunks

$$180 - 12$$

30 - 2 groups

go past, come back

all three land on 28

Which is easiest for you?



Roots of Reason

The Same Idea Keeps Coming Back

$$57 + 26$$

break an **addend** to reach a friendly number



$$7 \times 16$$

break a **factor** and multiply each chunk



$$175 \div 7$$

break a **dividend** into compatible multiples



$$\frac{11}{4}$$

break a **fraction** into wholes and parts



$$7(x + 3)$$

break an **expression** using distribution: $7x + 21$

decompose



work



recompose

Break it into useful chunks.

Work with the chunks.

Put the results back together.