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**

$140 \div 7 = \mathbf{20}$ $35 \div 7 = \mathbf{5}$

3 **Put them back together**

$20 + 5 = \mathbf{25}$ so 175 ÷ 7 = 25

whole ⇄ 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.

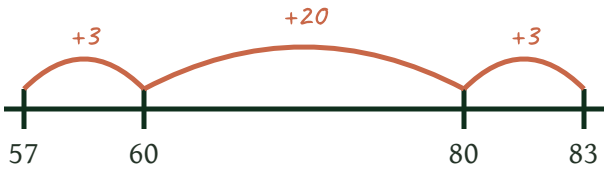
Roots of Reason

Chunking Addition and Subtraction

+ Break an addend to reach a friendly number

$$57 + 26$$

$$57 + \boxed{3} + \boxed{20} + \boxed{3}$$



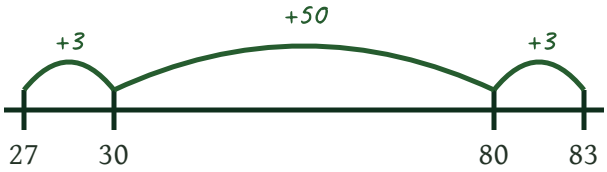
$= 83$

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

7×36

210 + 42 = 252

7×36

$= 7 \times (30 + 6)$

$= 7 \times 30 + 7 \times 6$

$= 210 + 42$

$= \mathbf{252}$

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

also works backward

$6 \times 39 = 6 \times (40 - 1) = 240 - 6 = \mathbf{234}$

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 ÷ 7 · two honest ways to write the same thinking

A Break the dividend

$$252 = 210 + 42$$

$$210 \div 7 = \mathbf{30}$$

$$42 \div 7 = \mathbf{6}$$

30 + 6 = 36

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

B Subtract groups away

252	*start*
− 210	*30 groups of 7*
42	
− 42	*6 groups of 7*
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 ÷ 6

120 + 48	60 + 60 + 48	180 − 12
20 + 8 groups	10 + 10 + 8 groups	30 − 2 groups
2 chunks	*3 chunks*	*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
↓	
7×16	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.