MathCastle

Grade 4

Complete course booklet • 8 topics

Contents

1 Multi-Digit Multiplication

Breaking numbers apart to multiply

1.1 The Area Model

The Big Idea

Split each number into its places and multiply the parts, then add. Drawing it as a rectangle shows why nothing gets missed: the pieces fill the whole area.

(diagram in the online version)

Finding 23×4

$20 \times 4 = 80$ and $3 \times 4 = 12$. Adding the parts, $80 + 12 = 92$.

1.2 In Plain Terms & More Examples

In plain terms

Break each number into tens and ones, multiply every piece, then add the pieces up — that is the **distributive property**, $a(b + c) = ab + ac$. Nothing gets skipped.

Finding 34×6

$30 \times 6 = 180$ and $4 \times 6 = 24$. Add them: $180 + 24 = 204$.

Finding 52×7

$52 \times 7 = (50 + 2) \times 7$, which equals, which is $7 \times 50 + 7 \times 2$. Add them: $350 + 14 = 364$.

A multi-step problem

A school orders 3 boxes of 24 pencils and 2 boxes of 36 pencils. Step 1: $3 \times 24 = 72$. Step 2: $2 \times 36 = 72$. Step 3: add the parts, $72 + 72 = 144$ pencils in all.

2 Long Division

Quotients and remainders

2.1 Sharing What Is Left

The Big Idea

Divide as far as you can in whole groups. Whatever cannot be shared is the **remainder**, and it is always smaller than the divisor.

The check

Always: divisor $\times$ quotient $+$ remainder $=$ the original number. If that fails, something went wrong.

Finding $47 \div 5$

$5 \times 9 = 45$, and $47 - 45 = 2$. So the quotient is 9 remainder 2. Check: $5 \times 9 + 2 = 47$.

2.2 In Plain Terms & More Examples

In plain terms

Share into equal groups as far as you can; whatever is left over is the remainder, and it is always smaller than the number you divided by.

Finding $58 \div 6$

$6 \times 9 = 54$, and $58 - 54 = 4$. So 9 remainder 4. Check: $6 \times 9 + 4 = 58$.

Finding $73 \div 8$

$8 \times 9 = 72$, and $73 - 72 = 1$. So 9 remainder 1. Check: $8 \times 9 + 1 = 73$.

3 Equivalent Fractions

Simplifying to lowest terms

3.1 Lowest Terms

The Big Idea

A fraction is in **lowest terms** when the top and bottom share no factor except 1. Divide both by their greatest common factor to get there in one step.

(diagram in the online version)

Simplifying $\frac{6}{8}$

Both share the factor 2: $\dfrac{6 \div 2}{8 \div 2} = \dfrac{3}{4}$. The picture shows the same shaded amount.

3.2 In Plain Terms & More Examples

In plain terms

A fraction is in lowest terms when the top and bottom share no common factor but 1. Divide both by the biggest factor they share.

Simplifying $\frac{8}{12}$

Both share 4: $\dfrac{8 \div 4}{12 \div 4} = \dfrac{2}{3}$.

Simplifying $\frac{9}{15}$

Both share 3: $\dfrac{9 \div 3}{15 \div 3} = \dfrac{3}{5}$.

4 Adding Fractions

Same denominator, then different

4.1 Why Denominators Must Match

The Big Idea

You can only add pieces that are the **same size**. The denominator names the piece size, so it must match before you add the tops.

(diagram in the online version)

Finding $\frac{2}{8} + \frac{3}{8}$

The pieces are both eighths, so add the counts: $2 + 3 = 5$ eighths, or $\dfrac{5}{8}$.

4.2 In Plain Terms & More Examples

In plain terms

When the denominators already match, just add or subtract the top numbers — the piece size (the bottom) stays the same.

Finding $\frac{3}{10} + \frac{4}{10}$

Same tenths, so add the tops: $3 + 4 = 7$, giving $\frac{7}{10}$.

Finding $\frac{5}{6} - \frac{2}{6}$

Same sixths, so subtract the tops: $5 - 2 = 3$, giving $\frac{3}{6} = \frac{1}{2}$.

5 Decimals to Hundredths

Tenths, hundredths and lining up the point

5.1 Place Value After the Point

The Big Idea

The places keep dividing by ten past the decimal point: tenths, then hundredths. Lining up the points lines up the places.

Adding $2.40 + 1.35$

Line up the points. Hundredths: $0 + 5 = 5$. Tenths: $4 + 3 = 7$. Wholes: $2 + 1 = 3$. The sum is 3.75.

5.2 In Plain Terms & More Examples

In plain terms

Line up the decimal points so tenths sit under tenths and hundredths under hundredths, then add place by place.

Adding $3.25 + 1.50$

Hundredths $5 + 0 = 5$, tenths $2 + 5 = 7$, wholes $3 + 1 = 4$: the sum is 4.75.

Adding $0.60 + 0.35$

Hundredths $0 + 5 = 5$, tenths $6 + 3 = 9$: the sum is 0.95.

6 Factors and Multiples

What divides evenly

6.1 Factors in Pairs

The Big Idea

Factors come in **pairs** that multiply to the number, which is why you only have to test up to the square root — after that the pairs repeat.

(diagram in the online version)

The factors of 12

1×12, 2×6, 3×4. So the factors are $1, 2, 3, 4, 6, 12$ — six of them. Each pair is one possible array.

6.2 In Plain Terms & More Examples

In plain terms

A factor divides evenly with nothing left over; a multiple is what you get by counting up in steps of the number.

The factors of 18

1×18, 2×9, 3×6. So the factors are $1, 2, 3, 6, 9, 18$.

The first multiples of 4

Count up in fours: $4, 8, 12, 16, 20, \ldots$

7 Angles

Measuring and classifying turns

7.1 Naming Angles

The Big Idea

An angle measures a **turn**. A quarter turn is 90° (a right angle), and a half turn is 180° (a straight angle).

(diagram in the online version)

The three names

Less than 90° is **acute**. Exactly 90° is **right**. Between 90° and 180° is **obtuse**.

This angle

It opens less than a quarter turn, and it measures 55°, so it is acute.

(diagram in the online version)

7.2 In Plain Terms & More Examples

In plain terms

An angle measures how far something turns. Compare it to a right angle (90°): smaller is acute, bigger (up to 180°) is obtuse.

A 120° angle

It is more than 90° but less than 180°, so it is obtuse.

A 30° angle

It is less than 90°, so it is acute.

8 Line Plots

Showing data with dots

8.1 Reading a Line Plot

The Big Idea

Each dot is one measurement. Stacks show repeats, so the tallest stack is the most common value and the spread left to right is the **range**.

(diagram in the online version)

Finding the range

The largest value is 8 and the smallest is 3, so the range is $8 - 3 = 5$.

8.2 In Plain Terms & More Examples

In plain terms

Each dot is one measurement. The tallest stack is the most common value (the mode), and the distance from smallest to largest is the range.

Reading a plot

For the values $2, 3, 3, 3, 5$, the value 3 appears most, so the mode is 3.

Its range

The largest is 5 and the smallest is 2, so the range is $5 - 2 = 3$.