MathCastle

Grade 5

Complete course booklet • 7 topics

Contents

1 Decimal Operations

Multiplying and dividing decimals

1.1 Counting Decimal Places

The Big Idea

Multiply as if the points were not there, then put the point back. The answer has as many decimal places as the two factors have *together*.

Finding 2.4×3

Ignore the point: $24 \times 3 = 72$. There was one decimal place, so the answer is 7.2.

Sanity check

2.4 is close to 2, so the answer should be near 6 — and 7.2 is. A misplaced point would give 0.72 or 72, both clearly wrong.

1.2 In Plain Terms & More Examples

In plain terms

Multiply as if the points were not there, then count how many decimal places the two numbers had together and put the point back that far from the right.

Finding 1.5×4

Ignore the point: $15 \times 4 = 60$. One decimal place, so the answer is 6.0.

Finding 0.3×0.2

Ignore the points: $3 \times 2 = 6$. Two decimal places, so the answer is 0.06.

A multi-step problem

You buy 3 notebooks at \$2.40 each and pay with a \$10 bill. Step 1: $3 \times 2.40 = 7.20$. Step 2: the change is $10 - 7.20 = \$2.80$.

2 Multiplying Fractions

Straight across, and why

2.1 Why Straight Across Works

The Big Idea

Multiplying fractions means taking a **part of a part**. Cutting a rectangle both ways shows why you multiply tops and bottoms separately.

(diagram in the online version)

Finding $\frac{2}{3} \times \frac{3}{4}$

Straight across: $\frac{2 \times 3}{3 \times 4} = \frac{6}{12} = \frac{1}{2}$.

It gets smaller

Multiplying by a fraction less than 1 makes the result *smaller* — surprising at first, but taking part of something gives less than you started with.

2.2 In Plain Terms & More Examples

In plain terms

Multiply the top numbers together and the bottom numbers together, then simplify. Taking a part of a part gives a smaller result.

Finding $\frac{3}{5} \times \frac{5}{6}$

Straight across: $\frac{3 \times 5}{5 \times 6} = \frac{15}{30} = \frac{1}{2}$.

Finding $\frac{1}{2} \times \frac{2}{3}$

Straight across: $\frac{1 \times 2}{2 \times 3} = \frac{2}{6} = \frac{1}{3}$.

3 Volume

Filling a box with unit cubes

3.1 Counting Cubes

The Big Idea

Volume counts the **unit cubes** that fill a solid. One layer holds length $\times$ width cubes, and there are height layers.

(diagram in the online version)

The formula

For a rectangular box, $V = l \times w \times h$, measured in **cubic** units.

A 4 by 3 by 2 box

One layer is $4 \times 3 = 12$ cubes, and there are 2 layers: 24 cubic units.

3.2 In Plain Terms & More Examples

In plain terms

Volume counts the unit cubes that fill a box: multiply length by width by height. The answer is in cubic units.

A 5 by 2 by 3 box

$V = 5 \times 2 \times 3 = 30$ cubic units.

A 6 by 4 by 2 box

$V = 6 \times 4 \times 2 = 48$ cubic units.

4 The Coordinate Plane

Plotting ordered pairs

4.1 Across Then Up

The Big Idea

An ordered pair (x, y) is a set of directions from the origin: go **across** x, then **up** y. The order matters — $(2, 5)$ and $(5, 2)$ are different places.

(diagram in the online version)

Plotting (2, 3)

From the origin, move 2 right and then 3 up.

4.2 In Plain Terms & More Examples

In plain terms

An ordered pair (x, y) means go across x first, then up y. Swapping the numbers lands you somewhere else.

Plotting $(4, 1)$

From the origin, move 4 right and 1 up.

Plotting $(0, 3)$

Move 0 across (stay on the vertical axis) and 3 up.

5 Order of Operations

Which operation goes first

5.1 The Agreed Order

The Big Idea

Without a rule, $2 + 3 \times 4$ could be 20 or 14. Everyone agrees to do **multiplication and division before addition and subtraction**, with brackets first of all.

Evaluating $2 + 3 \times 4$

Multiply first: $3 \times 4 = 12$. Then add: $2 + 12 = 14$.

5.2 In Plain Terms & More Examples

In plain terms

Do brackets first, then multiplication and division, and only then addition and subtraction — working left to right within each step. This agreed rule is the **order of operations** (often remembered as PEMDAS).

Evaluating $10 - 2 \times 3$

Multiply first: $2 \times 3 = 6$. Then subtract: $10 - 6 = 4$.

Evaluating $(6 + 2) \times 3$

Brackets first: $6 + 2 = 8$. Then multiply: $8 \times 3 = 24$.

6 Converting Units

Metric prefixes and time

6.1 Multiply or Divide?

The Big Idea

Going to a **smaller** unit means you need *more* of them, so multiply. Going to a bigger unit means fewer, so divide.

Metres to centimetres

One metre is 100 centimetres, so 3 metres is $3 \times 100 = 300$ centimetres — more of a smaller unit.

6.2 In Plain Terms & More Examples

In plain terms

Changing to a smaller unit needs more of them, so multiply; changing to a bigger unit needs fewer, so divide.

Kilometres to metres

One kilometre is 1000 metres, so 5 km $= 5 \times 1000 = 5000$ m.

Minutes to hours

One hour is 60 minutes, so 240 min $= 240 \div 60 = 4$ hours.

7 Powers of Ten

What happens to the digits

7.1 Shifting Places

The Big Idea

Multiplying by 10^n moves every digit n places to the **left**. The digits never change — only what each place is worth.

(diagram in the online version)

Finding 43×10^2

Two places left: 43 becomes 4300.

7.2 In Plain Terms & More Examples

In plain terms

Multiplying by 10^n slides every digit n places to the left; the digits stay the same, only their value grows.

Finding 6×10^3

Three places left: 6 becomes 6000.

Finding 25×10^2

Two places left: 25 becomes 2500.