

UM PRINTABLES

PREMIUM EDUCATIONAL RESOURCES

GRADE 7 - CCSS ALIGNED - 7.NS.A.1 & 7.NS.A.2

Integer Operations Reference Wheels

Visual Models for Add, Subtract, Multiply & Divide

A student-facing reference tool that addresses a major gap in integer resources: most are drill-based and skip the visual-conceptual models the CCSS explicitly calls for. This mega unit delivers 4 printable Reference Wheels (one per operation) with three rotating panels each - visual model, algorithm with worked example, and real-world context. Includes anchor charts, vocabulary foldable, practice problems with detailed answer keys, assembly guide, and standards alignment.

4 WHEELS

Add - Sub - Mul - Div

3 PANELS

Visual - Algo - Real

32 PROBLEMS

8 per operation

BOTH VERSIONS

Color + B&W



Teacher Resource - Grades 7-8 - 80+ Pages

PREVIEW

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Teacher Notes & How to Use This Resource

A research-based approach to integer operations that centers visual-conceptual models.

Welcome to **Integer Operations Reference Wheels**, a comprehensive Grade 7 resource built around the visual models that the Common Core State Standards (CCSS) explicitly require for integer arithmetic. Most commercially available integer resources emphasize drill-based practice with rules and shortcuts, but skip the conceptual scaffolding that allows students to *understand* why those rules work. This mega unit is designed to fill that gap.

The resource is organized as four printable **Reference Wheels** — one each for addition, subtraction, multiplication, and division of integers and rational numbers. Every wheel has three rotating panels: Panel 1 shows the visual model (number-line jumps for addition and subtraction, chip models for addition and subtraction, number-line patterns for multiplication and division); Panel 2 shows the algorithm with a fully annotated worked example; Panel 3 shows a real-world context with a complete solution. Students assemble the wheels themselves as a notebook foldable and then use them as a year-long reference tool.

Why Visual Models Matter (Research Base)

The CCSS Standards for Mathematical Practice (SMP 2, 4, 5, 7) call for students to **reason abstractly and quantitatively**, model with mathematics, use appropriate tools strategically, and look for and make use of structure. The Number-Line and Chip models are not decorative — they are the **conceptual infrastructure** on which the rules for integer operations rest. Research by the National Council of Teachers of Mathematics (NCTM) consistently shows that students who learn integer operations through visual models outperform peers who learn only the rules, especially on transfer tasks involving novel contexts (Bofferding, 2014; Whitacre et al., 2017). This resource gives you the visuals the standards demand, in a format students actually want to use.

What's Inside This Mega Unit

Component	Description	Pages
Cover & TOC	Branded cover page and clickable Table of Contents	~3
Teacher Notes	How to use, CCSS alignment matrix, pacing guide	~4
Vocabulary Foldable	4-term foldable (additive inverse, absolute value, terminating & repeating decimals) + deep-dive pages	~10
Addition Wheel	3 panels, color + B&W;, notebook version, anchor chart, 8 problems + key	~10
Subtraction Wheel	Same 7-part structure as Addition	~10
Multiplication Wheel	Same 7-part structure	~10

Vocabulary Foldable — Printable Template

Cut along solid lines, fold along dashed lines, glue into notebook.

This template prints two per page to fit composition notebooks. Print on cardstock for durability.

Printable Template

OUTSIDE (visible)		INSIDE (lift flap to see)	
Additive Inverse		Additive Inverse The opposite of a number. Two numbers are additive inverses if their sum is zero. The additive inverse of a is $-a$, so $a + (-a) = 0$.	
		Absolute Value The distance of a number from zero on the number line. Distance is always positive (or zero), so absolute value is always positive (or zero). Written $ a $.	
		Terminating Decimal A decimal number that has a finite number of digits after the decimal point. The decimal expansion stops (terminates) rather than continuing forever.	
		Repeating Decimal A decimal number in which a digit or group of digits repeats forever. Written with a bar over the repeating part (e.g., $0.\overline{3} = 0.3333\dots$).	

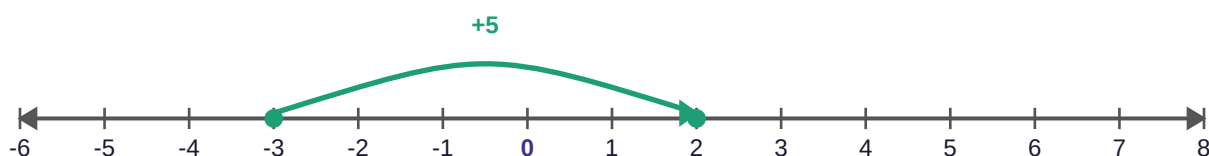
Cut along solid horizontal lines (between flaps). Fold along the vertical fold line. Glue back of right column into notebook. Lift flaps to reveal inside content.

Addition Wheel — Panel 1: Number Line & Chip Model

CCSS: 7.NS.A.1a, 1b, 1c, 1d

Number-Line Model for Addition

To add integers on a number line, start at the first number and move **right** if you're adding a positive (the distance shown by the second number's absolute value) or **left** if you're adding a negative. The arrow above the line shows the move.



Chip Model for Addition

In the chip model, green (+) chips represent +1 and red (-) chips represent -1. When a green chip meets a red chip, they form a **zero pair** that cancels out ($+1 + (-1) = 0$). To add, combine all chips, then cancel zero pairs. The uncanceled chips give the answer.

Step 1: Combine chips for $-3 + (-5)$



Step 2: Form zero pairs (3 of them)



Step 3: Remaining chips = -3 → answer: $-3 + (-5) = -8$



Why Two Models?

The number-line model emphasizes **direction and distance** (good for students who think spatially). The chip model emphasizes **cancellation** (good for students who like concrete counters). Both arrive at the same answer — and seeing both helps students generalize.

Addition Wheel — Panel 2: Algorithm & Worked Example

CCSS: 7.NS.A.1a, 1b, 1c, 1d

Addition Algorithm

Once students understand the visual model, they can use the algorithm for speed. The algorithm has two cases based on the signs of the addends.

Case 1: Same Signs

Rule: Add the absolute values. Keep the common sign.

Examples:

- $5 + 8 = 13$ (both +, answer +)
- $-4 + (-7) = -11$ (both -, answer -)
- $-12 + (-5) = -17$

Case 2: Different Signs

Rule: Subtract the smaller absolute value from the larger. Take the sign of the number with the larger absolute value.

Examples:

- $-8 + 5 \rightarrow |-8| - |5| = 3$, sign of $-8 \rightarrow -3$
- $-4 + 11 \rightarrow 11 - 4 = 7$, sign of $+11 \rightarrow +7$
- $9 + (-9) \rightarrow 0$ (additive inverses!)

Worked Example (annotated)

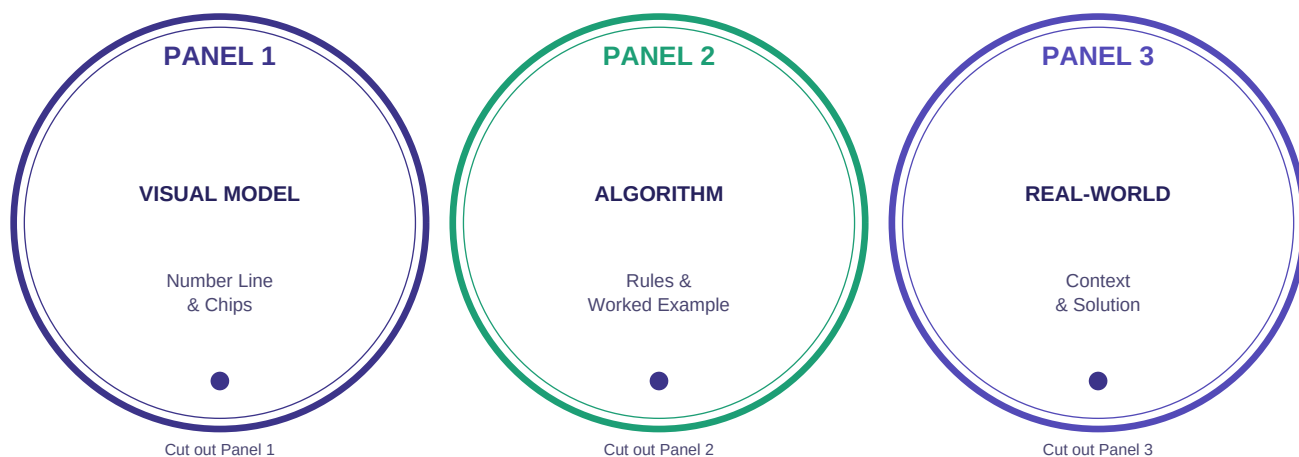
Step	Work	Reason
1	$-15 + 8$	Identify the problem
2	Different signs $\rightarrow$ use Case 2	Signs don't match
3	$ -15 = 15, 8 = 8$	Find absolute values
4	$15 - 8 = 7$	Subtract smaller absolute value from larger
5	Sign of $-15 \rightarrow$ answer is -7	Larger absolute value is 15 (negative)
6	Check: $-7 + 8$ should = 1, then $1 + (-8)$ should = -7 ... or: $ -7 = 7$, plus 8 doesn't equal 15, so verify via number line: start at -15 , move $+8$ right $\rightarrow$ lands on -7 $\square$	Verify with visual model

Addition Reference Wheel — Printable Template

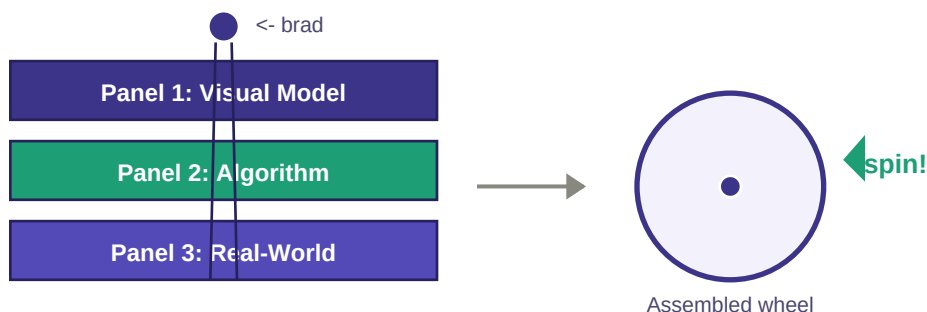
Print on cardstock. Cut out 3 circles, stack, fasten with a brad.

This printable template shows the three panels of the Addition Reference Wheel as separate circles. Students cut out all three circles, stack them in order (Panel 1 on top, Panel 2 in the middle, Panel 3 on the bottom), and fasten them together with a brad through the center dot. The top panel can then spin to reveal each section.

Print on cardstock (65 lb or heavier) for durability.



How to assemble (side view):



Step 1: Cut out all three circles along the outer edges.

Step 2: Punch a small hole through the center dot of each circle.

Step 3: Stack the circles: Panel 1 on top, Panel 2 in the middle, Panel 3 on the bottom.

Step 4: Insert a brad fastener through the center hole and spread the legs on the back.

Step 5: Spin Panel 1 to reveal each section!

Addition Anchor Chart Poster

Print on letter or 11x17 paper for classroom display.

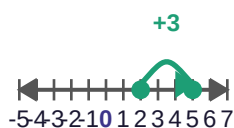
Post this anchor chart in your classroom for year-long reference. It summarizes the key rules, visual models, and worked examples for integer addition.

INTEGER ADDITION

CCSS 7.NS.A.1a, 1b, 1c, 1d

Add integers using the number-line and chip models. Same signs: add absolute values, keep the sign. Different signs: subtract absolute values, take the sign of the larger.

VISUAL MODEL



KEY RULES

Same signs:
add |values|,
keep the sign.

Different signs:
subtract |values|,
sign of larger |value|.

Zero pair rule:
 $a + (-a) = 0$

WORKED EXAMPLES

$$\begin{aligned} 5 + 8 &= 13 \\ -4 + (-7) &= -11 \\ -8 + 5 &= -3 \\ -4 + 11 &= +7 \\ 5 + (-5) &= 0 \\ 9 + (-2) &= +7 \end{aligned}$$

Addition Practice Problems

8 problems covering 7.NS.A.1a, 1b, 1c, 1d. Show your work.

Solve each problem in the workspace provided. Show your work using either the visual model or the algorithm (or both!). Check your answers with the detailed answer key on the next page.

Problem 1 [Same sign]

$$-6 + (-9)$$

Workspace:

Problem 2 [Same sign]

$$12 + 7$$

Workspace:

Problem 3 [Different sign]

$$-8 + 5$$

Workspace:

Problem 4 [Different sign]

$$-4 + 11$$

Workspace:

Problem 5 [Three integers]

$$5 + (-3) + (-2)$$

Workspace:

Problem 6 [Word problem]

At 6 AM the temperature was -4 F. By noon it had risen 9 F. What was the temperature at noon?

Workspace:

Problem 7 [Additive inverse]

Find x if $x + 14 = 0$

Workspace:

Problem 8 [Absolute value]

Evaluate $|-6| + |-3| - |2|$

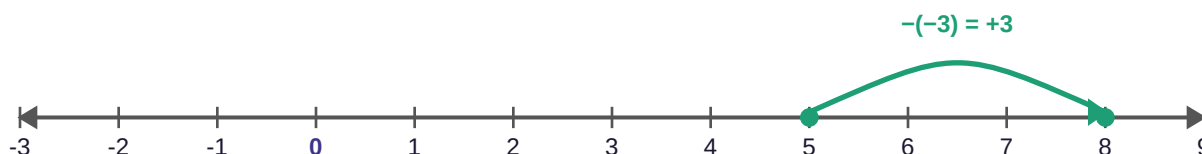
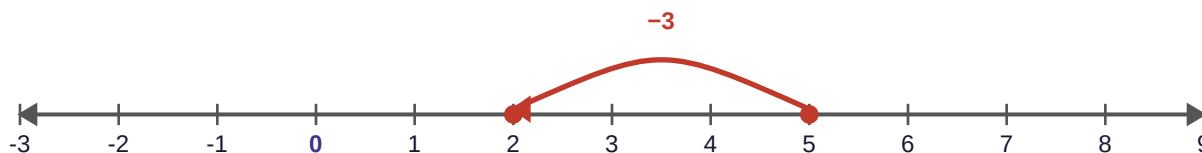
Workspace:

Subtraction Wheel — Panel 1: Number Line & Chip Model (Keep-Change-Change)

CCSS: 7.NS.A.1c, 1d

Number-Line Model for Subtraction

On a number line, subtraction means moving in the **opposite direction** of the second number. So $5 - 3$ means start at 5, then move **left** 3 units (because we subtracted a positive 3). But $5 - (-3)$ means start at 5, then move **right** 3 units (because we subtracted a *negative* — the opposite direction). This is why subtracting a negative is the same as adding a positive.



Chip Model for Subtraction

To subtract with chips, you may need to add **zero pairs** first. For example, to compute $3 - (-2)$, you start with 3 positive chips, but you need to take away 2 negative chips. Since there are no negative chips to remove, you add 2 zero pairs (2 positive + 2 negative). Now remove the 2 negatives. You're left with $3 + 2 = 5$ positive chips. So $3 - (-2) = 5$.

Multiplication Wheel — Panel 1: Number-Line Pattern Model

CCSS: 7.NS.A.2a, 2c

Number-Line Pattern Model for Multiplication

Multiplication is repeated addition. 3×2 means 'start at 0, add 2 three times' — three jumps of +2 to the right, landing on 6. -3×2 means 'start at 0, add 2 negative-three times' — but you can't physically add something negative-three times! Instead, we extend the pattern: each time we decrease the first factor by 1, the answer decreases by 2 (the second factor). This leads to the sign rule.

The Pattern That Reveals the Sign Rule

Look at this sequence of products. The first factor decreases by 1 each row. Watch what happens to the answer:

$$\begin{aligned} 3 \times (+2) &= +6 \\ 2 \times (+2) &= +4 \\ 1 \times (+2) &= +2 \\ 0 \times (+2) &= 0 \\ -1 \times (+2) &= -2 \leftarrow \text{pattern continues} \\ -2 \times (+2) &= -4 \\ -3 \times (+2) &= -6 \end{aligned}$$

Each row's answer is 2 less than the previous row. The pattern shows that **negative $\times$ positive = negative** — not because of a memorized rule, but because the pattern demands it.

Now extend the same pattern with a negative second factor:

Extending to Negative $\times$ Negative

$$\begin{aligned} 3 \times (-2) &= -6 \\ 2 \times (-2) &= -4 \\ 1 \times (-2) &= -2 \\ 0 \times (-2) &= 0 \\ -1 \times (-2) &= +2 \leftarrow \text{pattern flips to positive!} \\ -2 \times (-2) &= +4 \\ -3 \times (-2) &= +6 \end{aligned}$$

Each row's answer is **+2 more** than the previous. The pattern shows that **negative $\times$ negative = positive**. This is not an arbitrary rule — it's the only way the pattern can continue consistently.

Visualizing 3×2 with Number-Line Jumps

Division Wheel — Panel 2: Algorithm & Long Division → Decimal

CCSS: 7.NS.A.2b, 2c, 2d

Division Algorithm & Long Division → Decimal

Integer division uses the same sign rules as multiplication. But CCSS 7.NS.A.2d also requires students to **convert any rational number a/b to a decimal using long division**, and to identify whether the decimal terminates or repeats. This is a major gap in most TPT integer resources — this wheel walks students through it.

Integer Division Sign Rules

Same signs → **positive**. $24 \div 6 = 4$, $-24 \div (-6) = +4$.

Different signs → **negative**. $-24 \div 6 = -4$, $24 \div (-6) = -4$.

Multiply absolute values, then apply the sign rule.

Long Division: Converting $1/4$ to a Decimal

To convert $1/4$ to a decimal, divide 1 by 4 using long division. The process stops when the remainder is 0 — this means the decimal **terminates**.

$$1 \div 4 = 0.25 \text{ (terminates, remainder = 0)}$$

$$\begin{array}{r} 4 \overline{) 1} \\ \underline{0} \\ 10 \\ \underline{8} \\ 20 \\ \underline{16} \\ 40 \\ \underline{36} \\ 40 \\ \underline{36} \\ 4 \end{array} = 0.25$$

Long Division: Converting $1/3$ to a Decimal

Now convert $1/3$. Divide 1 by 3. The remainder cycles: 1, 10, 10, 10, ... (after the first step, we always get a remainder of 1 again). The decimal **repeats** forever with the digit 3. We write it with a bar over the repeating digit: $0.\overline{3}$.

$$1 \div 3 = 0.333... = 0.\overline{3} \text{ (repeats, never hits remainder 0)}$$

$$\begin{array}{r} 3 \overline{) 1} \\ \underline{0} \\ 10 \\ \underline{9} \\ 10 \\ \underline{9} \\ 10 \\ \underline{9} \\ 10 \\ \underline{9} \\ 10 \end{array} = 0.\overline{3}$$

Assembly Guide — Step-by-Step Instructions

How students cut, stack, and fasten each Reference Wheel.

The Reference Wheels are designed to be assembled by students themselves. The assembly process takes about 10 minutes per wheel and uses materials commonly found in classrooms: scissors, a hole punch or push pin, and a brad fastener (also called a paper fastener or split pin).

Materials Needed

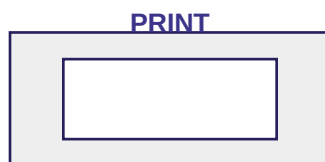
For each student, per wheel:

- 1 printed Reference Wheel template (color or B&W;)
- Scissors
- 1 brad fastener (small metal or colored)
- Hole punch or push pin
- Glue stick (if gluing into notebook)

Optional for durability: cardstock, laminator, clear tape.

Step 1: Print the Wheel Templates

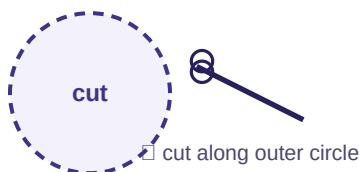
Print one copy of each Reference Wheel template per student. Choose the color version for vibrant visual cues, or the B&W; version if printing on colored cardstock. Cardstock (65 lb or heavier) is strongly recommended — regular paper tears easily after repeated spinning.



Templates → cardstock

Step 2: Cut Out Each Wheel

Using scissors, cut along the outer circle of each wheel template. Take care to cut smoothly — jagged edges make the wheel wobble when spun. If students struggle with circular cuts, trace a cup or compass as a guide.



CCSS Standards Alignment & Pacing Guide

Complete mapping of every activity in this resource to specific CCSS sub-standards.

This page provides a complete crosswalk between the components of this resource and the Common Core State Standards for Mathematics, Grade 7, The Number System (7.NS.A). Use this page when planning your integer operations unit, writing lesson plans, or communicating with administrators about standards coverage.

Complete Standards Crosswalk

Standard	What Students Can Do	Where in This Resource
7.NS.A.1a	Describe situations in which opposite quantities combine to make 0.	Vocab foldable (additive inverse); Add Wheel Panel 1
7.NS.A.1b	Understand $p + q$ as the number $ q $ from p , in the direction indicated by q 's sign.	Add Wheel Panel 1 (number-line model)
7.NS.A.1c	Understand subtraction as adding the additive inverse, $p - q = p + (-q)$.	Sub Wheel Panel 1 (KCC visual) + Panel 2 (algorithm)
7.NS.A.1d	Apply properties of operations to add & subtract rationals.	Add & Sub practice problems, Mixed practice
7.NS.A.2a	Understand multiplication of rationals; interpret products in real contexts.	Mul Wheel Panel 1 (number-line pattern) + Panel 3 (real-world)
7.NS.A.2b	Understand division of rationals; interpret quotients in real contexts.	Div Wheel Panel 1 (number-line groups) + Panel 3 (real-world)
7.NS.A.2c	Apply properties of operations to multiply & divide rationals.	Mul & Div practice problems, Mixed practice
7.NS.A.2d	Convert a rational number to a decimal via long division; know terminating vs repeating.	Div Wheel Panel 2 (long-division); Vocab foldable (terminating/repeating)

2-3 Week Pacing Recommendation

The following pacing guide assumes a 50-minute daily math period. Adjust as needed for block schedules or shorter periods. The schedule builds in a day for vocabulary development (critical foundation), three days per operation (one day per panel), and two days for mixed review and assessment.

Day	Focus	Resource Component	Homework
1	Pre-assessment + Vocabulary foldable	Vocab foldable template	Finish foldable, study terms

COMPLETE RESOURCE OVERVIEW

What's Inside This Mega Unit

Integer Operations Reference Wheels | Grade 7 | 80+ Pages | CCSS 7.NS.A.1 & 7.NS.A.2

79	4	32	4
PAGES	WHEELS	PROBLEMS	ANCHOR CHARTS

COMPONENT	WHAT STUDENTS GET	PAGES
Cover & TOC	Branded cover + clickable Table of Contents	1-4
Teacher Notes	How to use, CCSS alignment, pacing guide	5-7
Vocabulary	4-term foldable + deep-dive visual pages	8-17
Addition Wheel	3 panels + template + anchor chart + 8 problems	18-29
Subtraction	KCC algorithm + visual models + practice + key	30-41
Multiplication	Sign-rule patterns + algorithm + real-world	42-54
Division	Long division to decimal + repeating decimals	55-67
Assembly Guide	Step-by-step illustrated student instructions	68-70
Mixed Practice	12-problem review + detailed solutions	71-74
CCSS & Pacing	Standards crosswalk + 2-3 week unit pacing	75-79

VISUAL MODELS	CCSS ALIGNED	PRINT & GO
Number lines & chip models for conceptual understanding	7.NS.A.1a-d & 7.NS.A.2a-d fully covered	No prep needed ready for classroom use immediately

- ☐ Student-assembled foldable wheels
- ☐ Year-long classroom reference tool
- ☐ Detailed answer keys with visuals
- ☐ Differentiation strategies included