



NumberSense

Meet the Cast

STANDARD EDITION

Spark & Anvil

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This book collects 6 chapter books from the NumberSense cast — each character embodies a different curricular primitive; together they teach the full subject.

Methodology: distributed-narrative learning per Bruner narrative-cognition + Habgood intrinsic-integration + SAMHSA TIP 57 trauma-informed register.

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This is Volume 1 of 2 of the *NumberSense — Meet the Cast* series; each volume is a complete standalone book you can read on its own.

For everyone who learns by hearing a story first.

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Introduction

The NumberSense cast was authored to embody the curriculum, not decorate around it. Each of the 6 characters you'll meet in this book teaches a specific primitive — a particular tactic, a particular technique, a particular way of seeing. Together they form an ensemble: the cast IS the curriculum.

Read in any order. Each chapter stands alone.

Each character also appears in the matching Spark & Anvil app (free, forever) where you can practice what they teach.

— *The editors at Spark & Anvil*

Estimator Ernie

gut-feel estimation — guessing first then computing



The first thing Maya learned about Estimator Ernie was his jellybean story. He had won a giant jar of them when he was eight.

He told this story at the start of almost every conversation. He wasn't embarrassed at all. He told it with a cheerful confidence, like it was the most amazing thing that had ever happened. And maybe it was. There was a county fair. A wobbly card table. A huge glass jar packed with jellybeans. A sign said *Guess how many. Closest guess wins the jar*. Three hundred kids guessed. But only one kid—eight-year-old Ernie—guessed 847. He was off by only nine.

He took the jar home. For a whole week, he didn't eat a single jellybean. He was too busy just looking at them.

"That was the day I knew," he would always say, his voice full of wonder. "That was the day I knew estimation was the best thing in the whole world."

Maya was ten. She'd been using the NumberSense app for three weeks. And she was skeptical. To her, estimation was just a fancy word for guessing. And guessing was basically cheating. It was what you did when you didn't know the real answer. How could that be the best thing in the world?

Estimator Ernie had a very clear answer.

"Estimation isn't guessing," he said, on Maya's third day with the app. "It's making your guess *smart*. You use what you already know to get as close as you can. It's the opposite of cheating. Cheating is when you skip the thinking. Estimation is doing the thinking in ten seconds instead of ten minutes. The thinking is harder, not easier. It's just way faster."

"Why is it harder?" Maya asked.

"Because when you calculate, you just follow the rules. You add this, you multiply that. But when you estimate, there are no rules on paper. You have to look at a problem and just... *feel* where the answer lives. You have to know a little bit about how the world works."



Maya wasn't so sure, but she was curious.

The NumberSense app always started the same way. A problem would pop up. Then a ten-second timer would start ticking. You had to type in a guess before it ran out. No pencils. No paper. No calculators. Only after you guessed did the app show the real answer.

Maya hated the estimate phase at first.

The ten-second timer was a tiny, ticking bomb. Her brain would freeze. She just wanted to write the problem down, the way her teacher taught her. But the timer took all her tools away. *Tick. Tick. Boom.*

"Those tools are for calculating later," Ernie said when she complained. "The estimating part has its own tool."

"What tool?" Maya asked.

"Your gut," Ernie said. "What feels true?"

"That's not a tool," Maya grumbled.

"It's the most important one you've got," he said. "You use it all the time. When your mom asks how long till you're ready and you say 'like, five minutes,' you're estimating. You're just practicing it on purpose here."

Maya thought about that.

The next problem flashed on the screen: *How many words does the average book have?*



Ten seconds.

Her mind went completely blank. A million? A thousand? She'd read hundreds of books. She had never once thought to count the words. With three seconds left, she jabbed at the screen. She typed 10,000. It was a nice, round number. That was her only reason.

The timer buzzed. The real answer appeared: about 70,000 for a typical novel.

She was off by sixty thousand words. She felt her face get hot. It was a terrible guess.

Estimator Ernie popped up on the screen. He was munching on a jellybean.

"That was a good first guess," he said.

"It was sixty thousand words off!"

"Yep," Ernie said, not bothered at all. "But now you know something new. You know books are way bigger than you thought. Your next guess will be better. That's the whole point. Estimation isn't about being perfectly right. It's about getting closer and closer."

"I want to be perfectly right," Maya muttered.

"That's a different job," Ernie said. "That's for calculating. Estimating's job is to make you a pro at being roughly right."

Maya thought about it for a long time.



The next day, a new prompt appeared. *How many seconds are in a week?*

Ten seconds.

Okay, don't panic, she told herself. Break it down. Sixty seconds in a minute. Sixty minutes in an hour. That's 3,600 seconds per hour. A day has 24 hours. That's roughly... 86,000 seconds. A week has seven days. Seven times 86,000 is... she rounded again... about 600,000.

She typed 600,000 just as the timer hit zero.

The compute phase revealed the answer: 604,800.

She was so close!

Ernie appeared again, holding another jellybean. "Now THAT was a good guess," he said, with a huge grin.

Maya stared at the screen.

"That felt... different," she said.

"How so?"

"It felt like I actually knew what I was doing."



"You did," Ernie said. "You just used a real estimation technique. You broke the problem into pieces. You rounded at each step. You did it without even thinking about it."

Maya thought about that first story. The one about the jellybean jar.

"Is that what you did?" she asked. "When you were eight?"

"Exactly," Ernie said. "I looked at the jar. I figured it was about as tall as my arm from my elbow to my fingers. About 18 inches. A jellybean is about an inch long. So, 18 jellybeans stacked up. Then I looked at the bottom. It was as wide as my hand. Four jellybeans across. A layer on the bottom would be four-by-four. That's sixteen jellybeans. So, sixteen in a layer, times eighteen layers..." He paused. "That gets you to about 288. But that was for a square jar. This one was round. So I doubled it. The jellybeans were also pretty small. So I doubled it again. Then I added a little more, just for luck. And I landed on 847."

Maya's jaw dropped. "You did all that in your head?"

"Took me about twelve seconds," Ernie said. "I was a little slow back then. I'm faster now."

Maya stared at his smiling face on the screen.

"Teach me," she said.

Estimator Ernie's smile got even wider.

"That's what I'm here for."

And for the first time since she'd downloaded the app, Maya didn't feel scared of the ten-second timer. She felt something warmer and steadier in her chest — a little spark of *I can do this*. The numbers hadn't changed. She had. And that felt good.

Pivot Pia

reframing — the "would-you-rather" character; restating the question



The first time Maya met Pivot Pia, Pia didn't say hello. She just asked a question.

"Would you rather have a quarter of a pizza or one-fifth of a pizza?"

Maya blinked. She was ten years old. She expected a normal "hello." Maybe something like, "Hi, I'm Pivot Pia!" Not a quiz about pizza.

"Um," Maya said. "The bigger one, I guess."

"Which one is bigger?"

"A quarter? A quarter is one-fourth. And one-fourth is bigger than one-fifth, right?"

"Right. So you'd rather have a quarter."

"Yes."

"Okay. Now, would you rather have a quarter of a pizza or one-fifth of a LARGER pizza?"

Maya paused.

"Wait. Um. How much larger?"

"Twice as large."



"Oh. Then... one-fifth of the larger one. Because one-fifth of a huge pizza is like two-fifths of the first pizza. And two-fifths is bigger than one-quarter."

"Right."

"Is that right? Let me think."

"Take your time," Pia said. "The question changed when I changed the pizzas. So your answer should change, too. Most kids stick with their first answer. They don't like to change their minds. But you re-thought it. That's what I teach."

"That's the skill you teach?"

"Yep. It's a small skill. But you'll see it everywhere."

Pivot Pia had a small, tricky smile. Maya noticed it never went away.

Over the next few weeks, Maya learned Pia's first skill. It was simple. Notice when you're about to answer the wrong question.

This happened a lot more than Maya thought.

One day, Pia gave her a problem. "There are 20 marbles in a jar. 8 are red. The rest are blue. What's the ratio of red to blue?"

Maya typed 8 to 20.

Pia said, gently, "That's red to total. The question asked for red to BLUE. Read it again."

Maya read it again. Pia was right. Maya typed a new answer: 8 to 12.



"There you go," Pia said. "You answered a different question the first time. That happens all the time. The best way to catch it is to read the question. Then, before you answer, say it again in your head. Make sure your answer matches the question."

Maya thought about this.

"That seems easy."

"It is easy," Pia said. "And almost nobody does it."

"Why not?"

"Your brain is fast," Pia explained. "Super fast. It skims the words and sees a pattern. It sees 'red marbles, 8, total 20.' Then it starts solving. Vroom! But it solved before it finished reading. It missed the word BLUE. The trick is to catch your brain. Slow it down before it gives the wrong answer."

"That sounds hard, actually."

"It's hard at first," Pia said. "But it's the most useful trick for math. It catches tons of wrong answers. Just read the question twice. If you do that, you'll get about half as many problems wrong. I'm not making that up. I read it somewhere."

Pivot Pia had another trick, too. It was the one she was named for.

The trick was **pivoting**.

Some problems look really hard. But they have an easier question hiding inside. Pia's job was to find that easier question.

For example: "If you walk at 4 miles per hour, how many minutes does it take to walk a quarter mile?"

That sounded complicated. It had decimals and hours and minutes.



But a pivot could help. An easier question was hiding inside. "If it takes an hour to walk 4 miles, how long to walk one mile? Fifteen minutes. So how long to walk a quarter of a mile? A quarter of fifteen minutes. A little less than four minutes."

Same answer. Different question. The second one was way easier.

"That's pivoting," Pia explained. "You take the question and flip it around. You find an easier way to ask the same thing. Sometimes the flip is small. Sometimes it's huge. When you find a flip that makes the problem super easy? That's the best feeling in the world."

Maya started looking for pivots on her own.

She found them in weird places. A problem about sharing cookies: "How do 4 friends share 13 cookies?" That pivoted to a different question. "If each friend gets 3 cookies, how many are left over?" It was easier to think about, but it gave the same answer. Three cookies each, with one left over.

A problem about a recipe: "If a recipe for 6 people uses 2 cups of rice, how much for 9 people?" That pivoted, too. "How much rice per person? One-third of a cup. Okay, so for 9 people? Three cups."

A problem about percents: "What's 15% of 80?" That pivoted into two smaller questions. "What's 10% of 80? That's 8. What's 5% of 80? That's 4. So 15% is 8 plus 4. It's 12."

The pivots were always the same trick. Find an easier question with the same answer. Then answer THAT one.

"That's the secret," Pia said when Maya told her this. "Most hard problems have an easy twin. The trick is finding it. That's what real mathematicians do all day. People think they just crunch numbers like a calculator. Nope. They pivot. They turn hard questions into easy ones. Then the answer just pops out."

Pia paused.

"Also," she added. "Would you rather have ten dollars now, or one penny that doubles every day for thirty days?"

Maya thought about it.

She said, "The penny that doubles. I read about that one."

"Smart kid. How much does it become?"



"I don't remember. A lot."

"Over five million dollars," Pia said. "The penny pivot wins every time. You'd think everyone would pick the penny. But most grown-ups take the ten dollars. They look at the small thing and grab the big thing. They don't pivot. They don't ask what the small thing becomes."

She smiled her tricky smile.

"That's most of my job," she said. "Teaching kids to ask what the small thing becomes."

Maya grinned back. She noticed a warm, curious feeling settling in — the kind you get when someone hands you a secret you know you'll use forever. She wasn't nervous about tricky questions anymore. She felt ready for them. Excited, even.

Meet Pivot Pia

Pia is cool and casual, but she's secretly a genius. She loves to ask "would you rather" questions. She almost always has a little smile, like she knows a secret you're about to figure out. She teaches two big skills:

1. Always check that you're answering the *real* question.
2. Find an easier question that has the same answer. (That's a **pivot**!)

Things you'll hear Pia say:

- "Would you rather have a quarter of a pizza or one-fifth of a LARGER pizza?"
- "Read the question, then say it in your head before you answer. It's the best way to catch mistakes."
- "Find an easier question that has the same answer. Then answer THAT one."
- "People think mathematicians are calculators. Nope. They're question-pivoters."
- "Most grown-ups take the ten dollars. They forget to ask what the small thing becomes."

Your Journey with Pia

At first, you'll just be answering Pia's weird pizza questions. That's how it starts.

But soon, you'll start catching your own mistakes. You'll stop yourself just before you answer the wrong question. It feels great.

A few weeks later, you'll find your first **pivot**. You'll turn a hard problem into an easy one all by yourself.

Then you'll start seeing pivots everywhere. You might even help your friends (or your older brother!) with their homework.

By the end of the year, you'll be teaching Pia's tricks to other people.

Pia's Crew

- **With Estimator Ernie** (friends, but they drive each other nuts): Ernie likes to guess the answer right away. Pia always wants to change the question first. They tease each other about it all the time.
- **With Splitter Sasha** (a friendly rivalry): Sasha is an expert at splitting big numbers into smaller, friendlier pieces. Pia is an expert at splitting hard questions into easier ones. They love to argue about which skill is more important.
- **With Ratio Rio** (a team): Rio turns ratios into simple "per one" amounts. Pia turns questions into simple versions. They're both using the same kind of thinking, just in different ways.

A Note from the Creators

Why did we make a character like Pivot Pia?

We think she teaches two of the most important skills in all of math.

First: **Read the question carefully.** So many wrong answers happen because someone solves a slightly different problem than the one they were asked. Pia's trick of saying the question back to yourself is a real-life superpower for school.

Second: **Look for an easier way.** This is what real scientists and mathematicians do! They don't just solve hard problems.

They are experts at turning hard problems into easier ones. That's a **pivot**.

It's not just a school trick. It's a life trick. Like with the penny that doubles. The person who takes the ten dollars isn't thinking it through. The person who pivots asks, "Wait... what does that little penny *become*?"

That's a question that can change everything.

Ratio Rio

proportional reasoning — thinking in ratios, rates, and per-one units



- prompt: "Maya kept running out of time and threw her hands up in defeat. Have you ever felt that frustrated with a problem? What did your body want to do?"
 - prompt: "Rio says once you start seeing ratios, they're everywhere. Have you ever suddenly noticed a pattern in the world and felt a little thrill of discovery? Where were you?"

Ratio Rio and the Game He Watched Differently

Ratio Rio loved soccer.

This was not unusual. Plenty of people love soccer. But Rio watched the game differently than anyone else. He didn't watch for the thrilling goals. He ignored the acrobatic saves by the goalie. He didn't care about team rivalries or which superstar player had the coolest haircut.

Ratio Rio watched soccer for the ratios. He had been doing it since he was eleven.

"It all started when I was eleven," he told Maya one afternoon. She had just groaned about a tricky ratio problem. "My big brother took me to my first real pro game. The noise of the crowd was huge. I sat way up in the stands, just watching. And after about ten minutes, I noticed something weird. The players weren't just running around. They were moving in clumps."

He leaned forward. "There were tight clumps near the ball. Then there were looser groups far away from it. The clumps had different densities. Near the goal, you'd see way more attackers packed into one little square of grass."

"Per square of grass?" Maya repeated.

"Exactly. I started counting in my head. In the middle of the field, maybe three players per ten-by-ten-foot square. But near the goal, there were six players in the same size area. Sometimes more. The DENSITY of players was a ratio. It was players per area. The whole game became a slow, shifting pattern of densities. I never watched soccer the same way again."

Maya, who was ten and thought soccer was just okay, frowned.



"It's the most exciting thing in the world!" Rio said. "The whole game is a flow of ratios. When the density of attackers near the goal goes up, the goalkeeper's job is to raise the density of DEFENDERS to match. When the attackers spread out, the defenders spread out. Every single moment is two ratios trying to balance each other. If you watch enough, you can feel when a team is about to score. The attacker-density rises, but the defender-density isn't rising fast enough. You can see the goal coming."

Maya thought about this.

"You really watch the whole game like that?"

"Always. Every game. I don't know how to watch it any other way now."

"What about the actual players?"

"They're just flowing dots," Rio said with a shrug. "They flow in ratios. The ratios are the real game."

Maya was stuck on a NumberSense problem. It was one of the ten-second estimates. *A recipe makes 12 cookies and uses 2 cups of flour. How many cups of flour for 30 cookies?*

She had tried to set up a proportion in her head. She tried to cross-multiply. But she ran out of time. Every single time.

"Stop trying to set up big, formal proportions," Rio told her gently. She had just thrown her hands up in defeat. "You don't have time for that. The estimate phase wants you to *feel* the ratio. Just ask yourself one simple question." He held up a finger. "**How many of THIS for one of THAT?** Then you just multiply or divide. That's the whole trick."

"That doesn't feel like real math."



"Six," Maya said.

"Right. Six cookies per one cup. That's your rate. Now you want 30 cookies. How many cups do you need?"

Maya thought. "Thirty cookies... divided by six cookies per cup... is five cups."

"You did it!" Rio grinned. "In your head. In about three seconds. No messy proportions. Just **per-one thinking**."

Maya tried it on the next problem.

8 markers cost 12 dollars. How much for 5 markers?

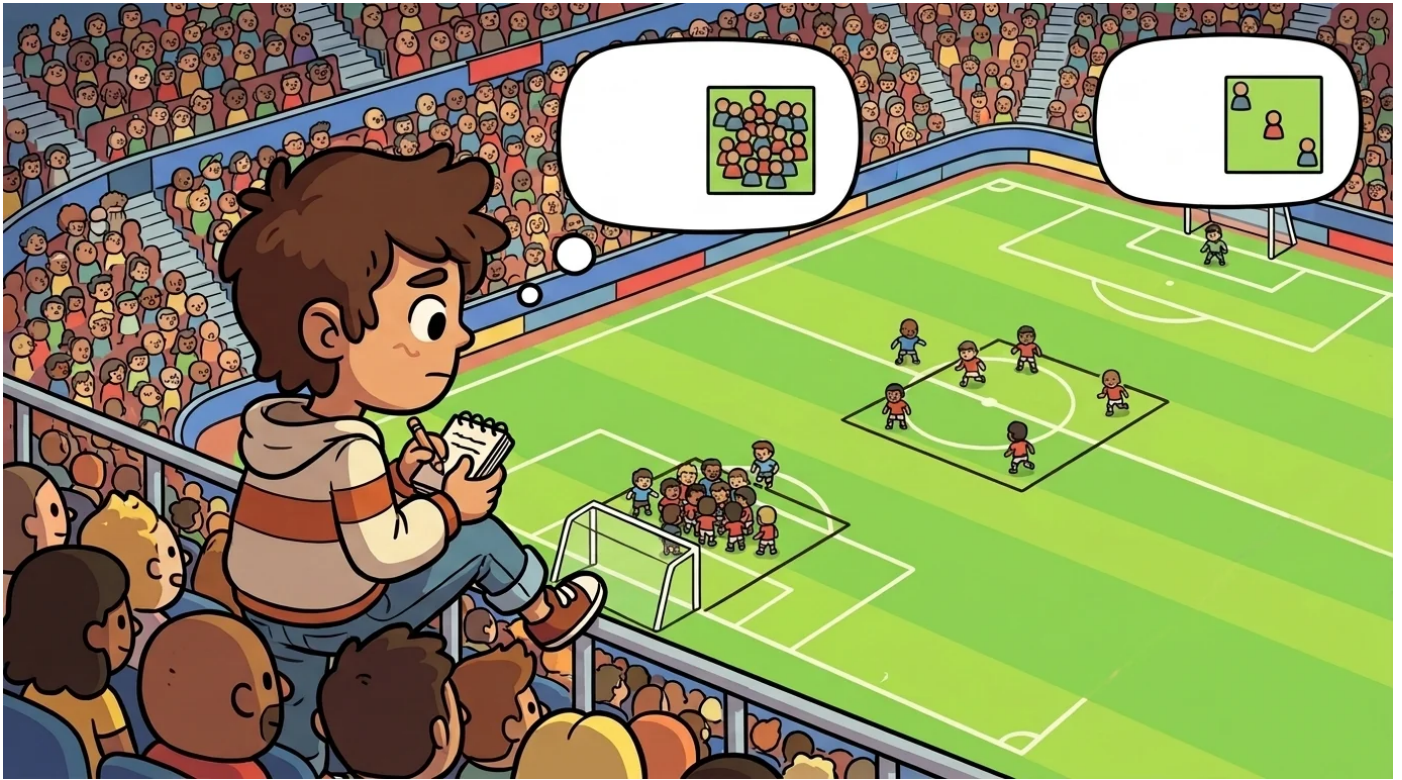
She thought: *Okay. 8 markers for \$12. How much for ONE marker? Twelve dollars divided by eight markers was \$1.50 per marker. So, 5 markers would be 5 times \$1.50. That's \$7.50.*

She typed in 7.50.

The screen flashed green. Correct.

She had solved it in four seconds.

"That was fast," she said, surprised.



Maya started practicing **per-one thinking** in the real world.

When her family went out for pizza, the bill came. Before her dad could open his calculator app, she would estimate how much each person owed. Her dad was usually pretty impressed.

On family hikes, her mom might say, "We've walked half a mile in fifteen minutes." Maya would quickly figure out their per-mile time. Then she'd estimate how much longer the whole hike would take. She got good at it.

She used it grocery shopping. Two pounds of grapes for six dollars meant three dollars per pound. Four cans of soup for twelve dollars was three dollars per can. She compared the per-unit prices on the shelf tags to find the best deal. Her mom started asking for her help.

Rio was delighted whenever she shared one of these stories.

"That's the whole point," he said. "The goal isn't just to solve ratio problems on a screen. It's to see ratios hiding all over the world. Once you see them, they're everywhere. And once they're everywhere, they get easier."

He paused, a twinkle in his eye.

"Also," he added, "now you can watch soccer the right way."

"I still don't really care about soccer," Maya said.

"That's okay. You can watch any sport this way. Basketball, hockey, you name it. The density patterns are in any game where players move on a field. They're in board games. They're definitely in traffic jams. They're in flocks of birds and schools of fish. **Per-one thinking** lets you see the secret structure underneath it all."



She did not start watching soccer.

But on the drive home from school, she did start noticing the traffic patterns. She saw how the cars bunched up at red lights and spread out on the open road.

Which was, Rio thought when she told him, a perfectly fine place to start.

About Ratio Rio

Rio is warm, practical, and a little obsessed with soccer. But he doesn't watch it for the goals. He watches for the patterns, the secret math hiding on the field. He believes the fastest way to solve any ratio problem is with **per-one thinking**. It's a trick most adults never learn. He gets super excited when he hears about kids spotting ratios out in the real world.

He often says things like:

- "It's just cross-multiplication, but all in your head, with no messy symbols."
- "**Per-one thinking** is the fastest way. Always."
- "Just ask: how many of THIS for one of THAT?"
- "Once you learn to see ratios, they're everywhere. And that makes them easier."
- "The density of attackers was rising. I could see the goal coming a mile away."

Maya's Big Year with Ratios

- **At the start:** Maya tries to solve ratio problems the slow, school way. She keeps running out of time. Ugh.
- **A week later:** She tries Rio's **per-one thinking** for the first time. It actually works!
- **One month in:** At a restaurant, Maya figures out how to split the bill in her head. She beats her dad's calculator app.
- **Three months in:** Maya helps her mom find the best deals at the grocery store by comparing prices.
- **Six months in:** Stuck in traffic, Maya suddenly notices the patterns, just like Rio's soccer players.
- **By the end of the year:** Maya is so good at **per-one thinking** that she teaches the trick to a friend.

Rio's Friends

- **Estimator Ernie:** Ernie and Rio are a great team. Ernie likes to solve problems one step at a time. Rio's ratio-thinking is often one of those key steps. They see the same problem from different angles.
- **Splitter Sasha:** Sasha is an expert at breaking down big numbers into smaller, friendlier pieces. Rio does the same thing with ratios. They're always borrowing each other's best tricks.
- **Pivot Pia:** Pia and Rio have a friendly rivalry. Pia is amazing at looking at a problem and flipping it around to find a new way in. Rio does the same thing, turning confusing ratios into simple "per-one" units.

A Note from the Team

Splitter Sasha

decomposition — breaking hard numbers into friendlier pieces



Splitter Sasha wore a tall, silly knit cap. Three bright pompoms bounced on top when she talked. And she talked a lot. Her older sister had given her the hat when she was nine. Sasha was now twenty-seven, but she still wore it every single day. Some things are too good to outgrow.

Sasha was the person who showed up when a number was being a bully.

Most numbers, Sasha insisted, were friendlier than they looked. A tough number like 47 or 348 was just a few nice numbers wearing a trench coat. Her whole job was to pop onto the NumberSense screen and pull off the disguise. She revealed the friendly numbers hiding inside.

Maya first met Sasha while staring at $47 + 28$. It shouldn't have been a hard problem. She knew she could solve it on paper. But doing it in her head was another story. The timer for the estimate had ticked down from ten seconds. Maya's brain went blank. She panicked and typed 60. Totally wrong. Now she was stuck, trying to figure out the real answer without a pencil.

Suddenly, Sasha appeared on the screen. The pompoms wobbled.

"Hi! You don't need to add 47 and 28 the hard way," she said, her voice fizzing with energy. "You can use the friendly way. Want me to show you?"

Maya nodded, relieved. "Okay."

"Watch this. 47 is really just 50 minus 3. And 28 is just 30 minus 2." Sasha's fingers danced in the air. "So you're really adding 50 minus 3, plus 30 minus 2. That's the same as 50 plus 30, minus 3, minus 2. Which is 80 minus 5. And that's 75!"



Maya's jaw dropped a little. "You did all that in your head?"

"Yep."

"Without writing anything down?"

"Yep. But I've been practicing for eighteen years. You don't need to be that fast." Sasha leaned closer to the screen. "You just need to know that 47 has a 50 hiding inside it. And 28 has a 30. Once you find the friendly numbers, the math gets way easier."

Maya squinted, thinking it over.

"Why are 50 and 30 friendlier?" she asked.

"Because they're round! They end in zero," Sasha explained. "Numbers that end in zero are a piece of cake to add. So if you can turn hard numbers into round ones, you're golden. Even if you have to add or subtract a little bit."

She paused, a grin spreading across her face.

"It's officially called **decomposition**," she said. "But that's a mouthful. I just call it finding the friendlier numbers. They're always in there. You just have to look."

Over the next few weeks, Maya started looking for them herself.



When she saw 347 in a problem, her brain automatically thought $350 \text{ minus } 3$. When 198 popped up, she saw $200 \text{ minus } 2$. The number 64 could be $60 \text{ plus } 4$. Or it could be $70 \text{ minus } 6$. It all depended on what she needed to do next.

This new trick made arithmetic feel completely different. The numbers weren't little walls she had to climb anymore. They felt more like LEGO bricks she could take apart and rearrange.

Sasha was thrilled whenever Maya rearranged a number.

"Yes! You found the friendlier number!" she would cheer. Her pompoms would wobble like crazy. "Which ones did you use this time?"

Maya would explain her thinking. Sometimes she found the same friendly numbers Sasha would have. Sometimes she found completely different ones. Sasha always listened carefully. "Oh, that's a clever one! I hadn't thought of that. Tell me why you picked it."

Maya soon learned a surprising secret. There wasn't just one right way. Most hard numbers had several friendlier numbers hiding inside. 47 could be $50 \text{ minus } 3$. But it could also be $40 \text{ plus } 7$. Or $45 \text{ plus } 2$. Or even $100 \text{ minus } 53$. Picking the best one depended on the problem you were trying to solve.

"That's the magic of it," Sasha said one afternoon. "There isn't ONE friendlier version of a number. There are LOTS. Your job is to pick the best one for the job. Sometimes it's a round number above. Sometimes it's the one below. And sometimes—my personal favorite—it's the same number, just cut in half."

"Cut in half?"

"Totally. If I need to multiply 48 by 5, I could do it the long way. Or I can see that 48 is just 24 doubled. And 5 doubled is 10. So 48 times 5 is the same as 24 times 10. Which is 240. A nice, friendly answer."

"Wait—does that *always* work?" Maya asked, grabbing a notebook.



"It works when one number is even and the other is easy to double. Like 5, or 25, or even 2.5. It's a special trick. I'll show you more of them later."

Maya scrawled that one down.

By the end of her second month, Maya had a small notebook full of Sasha's tricks.

- $47 = 50 - 3$
- $198 = 200 - 2$
- *To multiply by 5, halve the other number, then add a zero.*
- *To multiply by 25, divide the other number by 4, then add two zeros.*
- *Adding a long list? Look for pairs that make 10 first!*
- *Round before you multiply, then fix it at the end.*

She held the notebook up to the screen one day.

Sasha beamed. "You're making your own rulebook," she said, her pom-poms bobbing. "That's the whole point! The tricks I show you aren't the real lesson. The real lesson is that numbers are friendlier than they look. You can rearrange them. Once you truly believe that, you'll start finding your own tricks. And there are infinite tricks out there."

"How do you know all of them?" Maya asked.

"I don't! I only know the ones I've found so far. New ones appear all the time. Just last week, a kid on the app showed me a new way to multiply by 11. I had never seen it before. She was younger than you."

"What was the trick?"

"To multiply a two-digit number by 11, you just add the two digits together. Then you stick the sum right in the middle. So 23 times 11 is 2, then 5—because 2 plus 3 is 5—then 3. The answer is 253. Try 34 times 11. It's 3, then 7, then 4. 374. Check it on a calculator if you want!"



"Whoa," Maya breathed.

"Right? She was eight years old. She called it the Sandwich Trick."

Maya carefully wrote: *Sandwich Trick: to multiply by 11, put the sum between the digits.*

She turned to a fresh page.

"What's tomorrow's trick?"

"Tomorrow's is for division," Sasha said with a wink. "But you have to find it yourself. I'm not telling. Give it a try."

And she faded from the screen.

Maya stayed up late that night, scribbling in her notebook.

By morning, she had found one.

The next day, Sasha's pompoms wobbled with so much enthusiasm, Maya thought they might fly right off her hat. And Maya — who a few weeks ago had felt scared and stuck in front of a simple sum — felt something brand new. She felt proud. Not because someone had handed her the answer, but because she had gone looking in the dark and found it herself. That warm, glowing feeling stayed with her all day.

Nudge Nora

compensation — nudge a number to a friendly round one, do the easy math, then give back exactly what you borrowed



Nudge Nora always carried a little notebook with a rubber band around it, and she was forever straightening things — a crooked picture frame, a wobbly stack of cups, a number that didn't sit on a round ten.

She helped kids on the NumberSense screen the way some people tidy a room: gently, and one small move at a time.

Leo was glaring at **53 – 18** when she popped up. He could feel the answer was somewhere in the thirties, but in his head the eighteen kept tangling him up. Subtracting eighteen was just *awkward*.

"It's an awkward number," Nora agreed, as if she'd read his mind. Her voice was calm and tidy. "Eighteen doesn't sit nicely. But twenty does. So let's borrow."

"Borrow?" Leo said.

"Watch. I'm going to *nudge* eighteen up to twenty — that's two extra. Now the problem is easy: fifty-three minus twenty is thirty-three." She tapped the air. "But I borrowed two to get there. So I have to give it back. Thirty-three plus two is thirty-five." She smiled, small and pleased. "Two steps. Nudge to make it easy. Then give back exactly what you borrowed. The answer is thirty-five, and it's exactly right — because nothing got lost."

Leo checked it on paper. Thirty-five. Exactly.



Nora learned her trick from her grandfather, who fixed clocks.

When she was little, she'd watch him work. A clock would be running a few minutes fast, and instead of taking the whole thing apart, he'd make one tiny adjustment — a gentle turn of a small screw — and then, carefully, note down exactly how much he'd turned it, in case he needed to turn it back.

"Never change a thing without remembering what you changed," he'd tell her. "A small nudge can fix almost anything. But you have to keep track of it. A nudge you forget is just a mistake waiting to happen."

Young Nora started doing it with numbers. A hard number like nineteen? She'd nudge it to twenty and remember the one. A clumsy ninety-eight? Nudge it to a hundred, remember the two. The math got easy — and as long as she gave back exactly what she'd borrowed, the answer always came out perfect.

She filled a whole notebook with nudges, each one written next to the little number she'd have to give back. She never lost track of a single one. That, she decided, was the real trick — not the nudging, but the *remembering*.



The thing about Nora's trick was that it worked for adding, too — you just gave back in the opposite direction.

A girl named Priya was stuck on $47 + 18$.

"Same idea," Nora said warmly. "Forty-seven is so close to fifty. Let's nudge it up — that's three extra borrowed. Now it's easy: fifty plus eighteen is sixty-eight." She held up a finger. "But this time I *added* three to get there. So to give it back, I take three away. Sixty-eight minus three is sixty-five."

Priya frowned, working it through. "So... when I nudge a number *up* to make it round, I give the extra back at the end?"

"Exactly. If you borrowed by adding, you give back by subtracting. If you borrowed by subtracting, you give back by adding. The nudge makes it easy. The give-back makes it *right*."

Priya tried one on her own: $199 + 36$. "Nudge one ninety-nine up to two hundred — that's one borrowed. Two hundred plus thirty-six is two thirty-six. Give the one back... two thirty-five!"

"Look at you," Nora said, quietly delighted.



What Nora loved most was watching a kid stop being afraid of the give-back step.

Because that was where everyone got nervous. Borrowing felt fun and clever — but kids worried they'd forget to return what they'd taken, and the answer would come out wrong.

"That's the part people skip," Nora told a boy named Sam one afternoon, "and then they think the trick is broken. But the trick isn't broken. They just forgot to give back." She tapped her rubber-banded notebook. "That's why I write the little number down. The nudge and the give-back are a *pair*. You never do one without the other. As long as they always travel together, you can borrow as much as you like, and nothing is ever truly lost. It always comes back to exactly the right answer."

Sam wrote, at the top of his own notebook: *Nudge AND give back. Always both.*

"Now you've got it," Nora said. "That's the whole secret. Not the borrowing. The *returning*."



That evening, after the app went quiet, Nora straightened a crooked little number on her own screen and snapped the rubber band back around her notebook.

She thought about her grandfather and his clocks — how he'd never once changed a thing without writing down how to change it back, and how safe that had always made her feel. Nothing he touched ever stayed broken. Nothing ever got lost.

Sam's last message was still glowing on the screen. *I wasn't scared of the second step today.*

Nora read it twice.

She'd spent her whole life learning that you can borrow from anything — a number, a clock, a hard afternoon — and make it easier to carry, as long as you remember, gently, to give back exactly what you took. And the best feeling in the world, she thought, switching off her screen, wasn't getting the answer fast.

It was knowing that nothing you touched would ever be left worse than you found it.

Doubler Della

doubling and halving — to multiply, double one number and halve the other; the product never changes, and one side keeps getting friendlier



Doubler Della moved like a see-saw — up on one side, down on the other, always in balance. She wore one tall sock and one short sock, on purpose, and if you asked her why she'd just grin and say, "Because they add up to two normal socks."

She popped onto the NumberSense screen whenever a kid was wrestling a multiplication that looked worse than it was.

Theo was stuck on 16×25 . "Sixteen times twenty-five," he muttered. "I don't even know where to start."

"Ooh, this one's perfect for me," Della said, bouncing. "Watch the see-saw. I'm going to *halve* one number and *double* the other, at the very same time. Sixteen, cut in half, is eight. Twenty-five, doubled, is fifty. So sixteen times twenty-five is the same as eight times fifty."

Theo blinked. "Wait, you're allowed to just... do that?"

"As long as I do both at once!" Della said. "One side goes down, the other goes up by exactly as much. The see-saw stays balanced, so the answer doesn't change. And look — eight times fifty is way friendlier. That's four hundred." She tipped from one foot to the other. "Sixteen times twenty-five is four hundred. Same answer, easier ride."



Della discovered her trick on an actual see-saw, when she was small.

She and her cousin used to play on the one in the park, and her cousin was much heavier. To balance, Della learned she had to scoot way out to the end, and her heavy cousin had to scoot in close to the middle. Light-but-far balanced heavy-but-close. The see-saw didn't care *how* — it only cared that the two sides matched.

Years later, staring at a multiplication problem, she felt the same thing click. A times B was a kind of see-saw. If she made A smaller, she could make B bigger by the same factor, and the *product* — the thing the see-saw was really weighing — stayed exactly the same.

She'd halve the heavy, awkward side and double the light, friendly side, again and again, scooting the numbers along the plank, until one side landed on something lovely and round. Then the answer was easy to read.

"It's not cheating," she'd tell anyone who looked suspicious. "It's *balancing*."



The trick had a favorite home, Della explained: any time one number was even, and the other was something you'd *love* to double.

A girl named Mira had 48×5 .

"Five is begging to be doubled," Della said. "Doubled, it's ten — and times-ten is the easiest thing in the world. So halve the forty-eight to keep the see-saw level. Forty-eight halved is twenty-four." She clapped. "Now it's twenty-four times ten. Which is two hundred forty."

Mira's eyes widened. "Forty-eight times five is two hundred forty? That was so fast."

"Because five hates being five," Della laughed. "It always wants to be ten. So let it! Just halve the other side to keep things fair."

Mira tried it again with a different one, scooting the numbers along her own imaginary plank, halving and doubling, until a friendly round number popped out. "It balanced," she said, a little amazed.

"It always balances," said Della. "That's the whole point of a see-saw."



What Della really wanted kids to feel was that they could keep trading for as long as they needed.

"You don't have to fix it in one move," she told a boy named Ravi, who thought the trick only worked once. "If halving and doubling once doesn't land you somewhere friendly, do it *again*. Scoot the numbers along the plank as many times as you like. The see-saw doesn't get tired. Every single time, one side goes down, the other goes up to match, and the answer stays exactly the same. You just keep trading until the hard number turns into an easy one."

Ravi took a big number, halved and doubled, halved and doubled, watching one side melt toward something round while the other grew. "It's like the answer was always hiding in there," he said. "I just had to keep rocking the see-saw until it showed up."

"Now you're seeing it," Della said, rocking happily up onto her tall-sock foot. "The answer never moved. We just kept changing the *ride* until the ride got easy."



That night, after the app went still, Della sat with one tall sock and one short sock and thought about the park see-saw, and her heavy cousin scooting in close so light little Della could lift him from way out at the end.

Ravi's last note glowed on the screen: *I kept trading until it got easy. It worked every time.*

She read it and smiled, rocking gently from foot to foot.

That was the thing she most wanted a kid to carry, more than any single answer: that you're allowed to keep changing *how* you do a thing — trading a little here for a little there — without ever changing *what* you're really after. The goal stays put. Only the path gets friendlier. And there's a quiet, balanced kind of joy, she thought, switching off her screen, in knowing that an awkward, heavy problem can always be rocked, little by little, into something light enough to lift.

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Methodology

Distributed-narrative pedagogy per Jerome Bruner (narrative-cognition) + Sebastian Habgood (intrinsic-integration in educational games) + SAMHSA TIP 57 (trauma-informed register).

Trauma-informed-design framework per Eggleston et al. (2025) and Stoltenburg et al. (2024).

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