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# Mental math strategies

Mental math isn’t explicitly part of most curricula, but students who can’t answer relatively-simple equations in their heads with speed or automaticity will likely struggle with harder content. But before answering the question, “How can I improve my mental math?”, it’s helpful to know the definition(s) of mental math.The Manitoba Association of Mathematics Teachers defines mental math as: A combination of cognitive strategies that enhances flexible thinking and number sense. It is calculating mentally without the use of external memory aids. It improves computational fluency by developing efficiency, accuracy, and flexibility. Or, from students’ perspectives, it’s:Math done in your headMath that is done in the mind, quickly and efficientlyWarming up your head with mathTo do math instantly, without the effort put into operations and processesMath that you understand so well that you don’t need to write anything down to do calculations/find the answerPrince Edward Island’s Department of Education believes “mental mathematics must be a consistent part of instruction in computation from primary through the elementary and middle grades.”Wayne Watts, educator and author of numerous math textbooks, once said: “Number sense cannot be taught. It can only be developed.”The science behind it is convincing, too.Research-backed benefits of mental mathCredit: Jinx!For example, an oft-cited study of a 1st grade class found that students who quickly recall addition facts had more cognitive resources to learn other skills and concepts.In the journal Cogent Education, researchers ran another study with 118 students in 5th grade exploring how mental computation and mathematical reasoning affect each other.The evidence was fascinating: [There] is a significant positive correlation between mental computation and mathematical reasoning. It is noteworthy that rather than exposing students to familiar classical problems, students need to be enabled to deal with exceptional/non-routine problems, and especially young children should be encouraged to do mental computing in order for developing both skills. Duke researchers published a study in Clinical Psychological Science about mental math -- from a health perspective.After brain-scanning 186 undergraduates, results suggested engaging the brain’s prefrontal cortex during mental math exercises is linked to better emotional health.Thankfully, you’re already helping students build core mental math skills when you teach rounding, estimating and fact fluency -- developing number sense, as well as how they remember and reproduce steps and solutions.It's mental math practice time!To improve how your students build and practice these mental math skills, try the 12 strategies below. Use the ones that best work for you.1. Introduce mnemonic devicesStudents who struggle with basic fact fluency can improve by using mnemonic devices -- cues such as rhymes and acronyms to help recall information.In her master’s thesis, Teaching Through Mnemonics in Elementary School Classrooms, Arianne Waite-McGough found teachers understand the positive impact this device can have on students within and “beyond the classroom walls.” Current research shows that singing, moving and overall enjoyment of a subject enhances the learning process and long term recall of material. All of these requirements are present when using mnemonics in the classroom. My research proved similar findings. All of the teachers that I surveyed noted higher levels of learning, engagement and fun while singing songs based on the core content material. Take this mnemonic device for a multiplication fact as an example:I need to be 16 years old to drive a 4x4 pickup truck.Because they must be easy to remember, it helps if the cues involve:RhymesTangible objects or scenariosQuick stories that distill larger chunks of informationAlthough you can think of mnemonic devices yourself and share them with students, it’s beneficial if you run an activity that gets them to make their own.They’ll likely find it easier to remember mnemonic devices they create. 2. Read math booksThere are many math books that effectively contextualize the processes behind solving equations, helping students commit them to memory.Depending on student age, consider:Each Orange Had 8 Slices -- This book focuses on counting and addition, presenting problems in easy-to-process sentences. It sets a new scene, complete with questions, with each turn of the page.The Grapes of Math -- Containing basic multiplication problems, this book is a series of illustrated riddles. Each riddle offers clues and secrets to solving a specific equation, helping students improve reading comprehension along with math skills.Sir Cumference -- Set in medieval times, this book series focuses on measurement and geometry. With occasional help from his son and wife, Radius and Lady Di of Amater, the knight Sir Cumference must solve math-related challenges that pose threats to his family and kingdom.Secrets of Mental Math -- As opposed to a children’s book, this guide promises to “have you thinking like a math genius in no time” with the help of “mathemagician” Arthur Benjamin. Since it’s 200+ pages long, you might find more success in selecting key excerpts and reading -- and applying -- the mental math tricks with your students. There’s also a foreword by Bill Nye the Science Guy!As you read books out loud, your students can practice their mental math. Alternatively, you may use books as a way to leverage the benefits of peer teaching.Just pause after identifying an equation, giving them time to work through the problems in their heads. After they share their responses, read on to discover the answer.3. Provide relevant word problemsMany students will be more receptive to math drills and practice if the material is engaging.David Kember, a professor in curriculum methods and pedagogy, and his team published an article inActive Learning in Higher Education about the motivators of student learning.Upon interviewing 36 undergraduate students, Kember concluded: Teaching abstract theory alone was demotivating.Relevance could be established through: showing how theory can be applied in practice, establishing relevance to local cases, relating material to everyday applications, or finding applications in current newsworthy issues. In other words, if students don’t find your math lesson relevant, their motivation to learn will greatly diminish.A straightforward, yet effective, way of enlivening content is by creating math word problems. This is because you can tailor questions to students.For example, you can:Reference Student Interests -- By framing your word problems with student interests, you should grab attention. If most of your class loves baseball, a measurement problem could involve the throwing distance of a famous outfielder. Using cross-cultural and cross-curricular connections with help strengthen students’ neural loops.Make Questions Topical -- Word problems based on current events or issues can engage students by providing clear, tangible ways to apply knowledge. Not only will students find your lessons more interesting, they’ll believe it’s worth knowing.Include Student Names -- Naming a question’s characters after your students is an easy way make it relatable, motivating your class to tackle the problem.By capturing interest, student motivation should increase when practicing skills important for mental math.Note: If they struggle with world problems, teach the mnemonic, “STAR”:Search the word problem Translate the words into an equation Answer the problem Review the solution4. Play estimation games in classEstimation games are fun math activities that encourage students to develop skills and techniques they can use to simplify equations in their heads.Easy to run but challenging to play, a popular estimation game in many classrooms involves only two dice and a sheet of paper that’s divided into two columns. One column lists the values on each dice face, whereas the other contains numbers of your choosing.For example:To play, pair students together. Taking turns rolling the dice, they must add the corresponding numbers together in their heads. For example, if a student rolls five and six, the equation is 878 + 777. Without pencil, paper or calculator, the student must solve the equation. If he or she is within a range of five numbers -- verifying the solution with a calculator -- the answer is considered correct.The first student to answer five questions right wins.For more advanced classes, you can simplify the numbers but require multiplication instead of addition.5. Play fact fluency games in classA fun alternative to flashcards, fact fluency games allow students to build recall and reproduction skills important for mental math.Engaging options for 1st to 8th grade classes include:Math Facts Bingo -- Create bingo cards that contain answers to different equations. Then, hand them out to students. Instead of calling numbers, state equations such as 8 x 7. After determining the product is 56, they can check off the number if it’s on their cards.Stand Up, Sit Down -- Pick a number and share it with students. Then, read equations out loud. Sitting in a circle, students must stand if the answer matches the number you picked. If they incorrectly stand or remain seated, eliminate them until one student remains.101 and Out -- As the name implies, the goal is to score as close to 101 points as possible without going over. Start by dividing your class into groups, giving each a die along with paper and a pencil. Groups take turns rolling the die, deciding if it’s best to count the number at face value or multiply it by 10. After each roll, the number is added to the group’s total. The game ends when a group hits 101 points or goes over -- whichever comes first.As skill-building as they are engaging, your students’ improvement in fact fluency should be clear after playing a few rounds of these math games.6. Encourage the use of math apps and websitesAn alternative or supplement to drills and worksheets, consider using a digital program that features a range of problems aligned with different skills.Such math apps and websites prompt students to continuously answer questions in an often-engaging environment, building a range of skills important for mental math. Popular options include:Prodigy Math -- Aligned with math curriculum from across the English-speaking world, Prodigy automatically differentiates content and gives adaptive feedback tailored to each student. Teachers like you can also make in-game assignments to deliver custom content.NRICH -- An ongoing project by the University of Cambridge, this website features math games, articles and problems. It divides resources by United Kingdom key stages and United States grade levels, allowing your students to easily access the right content.Math Is Fun -- This website contains content suitable for younger students, using concise sentences and cartoon characters. On top of exercises that cover essential math skills, there are games and puzzles.Because all students need is a computer or mobile device to use these programs, it’s likely some will voluntarily practice at home.7. Round up when multiplying by 9There are simple ways to alter difficult equations, making them easier to solve with mental math.Students can use existing rounding and fact fluency skills when multiplying by 9, 99, 999 and any number that follows this pattern.First, tell students to round up the 9 to 10. Second, after solving the new equation, teach them to subtract the number they just multiplied by 10 from the answer.For example, 67 x 9 will lead to the same answer as 67 x 10 - 67. Following the order of operations will give a result of 603. Similarly, 67 x 99 is the same as 67 x 100 - 67.Despite more steps, altering the equation this way is usually faster and allows students complete it in their heads.8. Double and halveWhen mastering multiplication beyond basics, students can quickly use mental math skills to multiply two integers when one is an even number.They just need to halve the even number and double the other number. They stop this process when the even integer cannot be halved, or when the equation becomes manageable.Using 33 x 48 as an example, here’s the process:33 x 4866 x 24132 x 12264 x 6528 x 31,584The only prerequisite to this mental math trick is understanding the 2-times table.9. Cover-copy-compareNormally used as an intervention tactic, Cover-Copy-Compare can have a place in most fact fluency lessons.There are three steps to this mental math practice, which are:Creating a Math Fact Sheet -- Divide a sheet into two columns, writing about 10 math facts pertaining the same skill in the left column. Include number-sentences and answers. In the right column, write “Responses.” Distribute copies of the sheet to students.Running the Exercise -- The goal for students is to study the math facts in the left column, correctly reproducing them in the “Responses” column. To do so, give them time to study the facts. After, they fold the paper to cover the left column while writing -- from memory -- the first fact in the “Responses” column. If correct, the student can move onto the next fact. If incorrect, the student tries again until he or she has properly reproduced the math fact.Recording Mastered Skills -- Once a student has completed a certain number of sheets related to a common skill, you can award him or her a badge that denotes skill mastery. This gamification strategy can make the exercise more engaging.To go beyond basic fact fluency, you can make sheets that focus on rounding, memorizing steps to complex equations and more.10. Use the Taped-Problem approachA useful active learning strategy, the taped-problem approach is one of the most effective ways for students to build fact fluency, indicates a 2004 study that pioneered the strategy.First, obtain or make an audio recording of basic math problems that has short pauses between stating the problem and revealing the answer. Second, provide each student with a pencil and paper.As you play the recording, students must write out each equation and try to solve it before the answer is revealed. If the student cannot solve the question, he or she writes down the correct answer. If the student reaches an incorrect answer, he or she crosses it out and writes the right response.You can lengthen the pauses so students don’t depend on hearing the answers, whereas you can shorten them to encourage automaticity.11. Building blocksWondering how to improve mental math speed across your class? Familiarize students with building blocks such as multiplication tables or fractions, decimal, and percent equivalents.The more your students become familiar how multiplication tables or equivalents look, the quicker they’ll be able to recognize and solve problems in and outside the classroom.A study in the Journal of Neuro science titled, “Why mental arithmetic counts: Brain activation during single digit arithmetic predicts high school math scores”, tested 33 high school students on their ability to solve addition and subtraction equations.All of them performed well, which correlated to their math PSAT scores. Interestingly, as neurobiologist Dr. Susan Barry outlined: Those students with higher math PSAT scores engaged parts of the brain, the left supramarginal gyrus and bilateral anterior cingulate cortex, which have been associated with arithmetic fact retrieval. In contrast, those students with lower math PSAT scores engaged the right intraparietal sulcus, a region involved with processing numerical quantity. In completing the test in the scanner then,students with the higher math PSAT scores relied more on their memory of arithmetic facts. 12. Number talksRuth Parker, the CEO of the Mathematics Education Collaborative, and Kathy Richardson, one of the nation’s leading educators of elementary mathematics, developed this mental math practice.To start, pose an abstract math problem. Take 18 x 5 as an example problem and ask your students to try and solve it in their heads.Naturally, in a class of 20+ students, you’ll likely find they answered correctly -- but differently.Number talks are a perfect way to illustrate that there’s creativity in math. They’re also a great way to begin your math lesson or encourage parents to do with their kids!In the article “Fluency Without Fear: Research Evidence on the Best Ways to Learn Math Facts”, professor of mathematics education and co-founder of Stanford University’s you cubed, Jo Boaler, writes: Research tells us that the best mathematics classrooms are those in which students learn number facts and number sense through engaging activities that focus on mathematical understanding rather than rote memorization. So, we trust these activities will help your students’ mental math practice this school year and beyond.Ready to share these mental math secrets?Okay, they’re not really secrets. But using these mental math practices should help your students build rounding, estimating and fact fluency skills -- allowing them to solve many equations with ease and automaticity, preparing them to tackle tougher content.Armed with increased confidence, you may notice an uptick in student engagement and motivation.These benefits, in and of themselves, make a strong case for practicing mental math. Create or log in to your teacher account on Prodigy Math, the online math platform designed to help students build mental math skills through an engaging game-based learning environment. Mental math is an important skill for students of all ages. Applying mental math strategies can help you work faster and more accurately without a calculator. In this article, we will list 9 strategies that will help you improve your skills. We’ll also include some tips and tricks to make mental math easier and faster! From my 14+ years of teaching experience, I have observed that there are many students in high school that rely heavily on their calculators instead of using these mental math strategies. By applying these tips and tricks they can work faster and apply these strategies to other topics such as Algebra and multiplying fractions. Mental math strategies are simply methods or techniques that you can use to do math more quickly and accurately using your brain. These strategies can be used for addition, subtraction, multiplication, division, and more! Here are my favorite mental math strategies that you can use: Bridge to ten is when we count on to the next 10 and then add what is left. Having knowledge of ‘friends of ten‘ which is basically recalling number combinations that add to 10, is essential prior knowledge. Source: Rocking Dan Teaching Man YouTube The Bridge to ten strategy is great for simple additions such as 8+6. You can change this to 8+ 2 + 4. It is also great for questions such as 47 + 8. Which can be bridged to ten as follows: 47 + 3 + 5. Number lines are a helpful tool for this strategy. This mental math strategy can be used with addition and multiplication. It states that you can change the order of the numbers being added or multiplied and get the same answer. For example, 2+3 = 3+2. Let’s say you’re adding up a list of numbers: Instead of starting from left to right, try grouping them using ‘friends of ten’. So you can see the total is 20 + 30 + 4 = 54 This can help you keep track of the numbers more easily and calculate the addition faster using this mental math strategy. This mental math strategy can be used for addition. To use this strategy, you simply need to add 10 and then subtract 1. For example, let’s say you’re trying to add 56+9 You can add the numbers like this: Then, it becomes much easier to calculate the addition mentally because it is very easy to add 10 to a number. Near doubles strategy is when you double a number and then adjust. This is great when adding two consecutive numbers. For example 7 + 8 is the same as double 7 plus 1, which equals 15. Or you can adjust by doubling the larger number and subtracting 1. For example 14+15 is the same as double 15 minus 1 , which equals 29. The compensation strategy uses rounding up or down to make it easier to calculate an addition mentally. First you want to round the second number up to the closest ten. Then you compensate by subracting. For example 47+19 This works for subtraction too. For example, 76-29 I LOVE this strategy! It is genius. Doubling and halving is a mental math strategy for multiplication. It works by halving one number (the larger one works best) and doubling the other number. For example 48 x 5 The distributive property states that when you are multiplying a number by a certain sum or difference, you can multiply the number by each term in the sum or difference and then add the products together. For example: 10 x (24 + 16) = 10 x 24 + 10 x 16 = 240 + 160 =400 Algebraically the distributive law looks like this: This is a great mental math strategy to use for something like 99x 4 Landmark numbers, such as multiples of ten or a hundred, are familiar with students so they can be used as a mental math strategy when adding. For example 97 + 68. 97 is so close to 100. So you could add 3 to 97 and then subtract 3 from 68. Students often know how to double or multiply by 2 but their number facts for the 4 and 8 times tables are often not as strong. Repeated doubling is a mental math strategy to help with this. To multiply a number by four, double it twice. For example, 12 x 4 To multiply a number by 8, double it three times. For example 25 x 8 There are many more mental math strategies that I use regularly. These are just a few that I teach my high school mathematics students in our numeracy support sessions. In my experience students need to be reminded of these strategies and given opportunities to practice them regularly. As you can see, using mental math strategies can help you work faster and more accurately without a calculator. Try out these strategies the next time you’re doing your math homework. Some mental addition strategies include bridge to ten, commutative property, using landmark numbers, adding 9, and near doubles. Examples of these mental math strategies are outlined in this article. Mental math strategies are techniques we use to perform mathematical calculations in our heads, without the need for written or external aids, like calculators. These strategies are particularly useful for solving arithmetic problems quickly and efficiently. Here are some common mental math strategies. Start with one number and count forward or backward by the other number to find the sum or difference. For example, to mentally add 7 + 3, start with 7 and count 3 more: 7, 8, 9, 10. When adding or subtracting numbers, try to make them into multiples of 10 or friendly numbers. For instance, to add 8 + 7, you can add 2 to 8 to make it 10, and then add 5 more to get 15. Recognize and use the fact that doubles (e.g., 4 + 4) and near doubles (e.g., 4 + 5) have simple solutions. For near doubles, you can adjust the result by adding or subtracting 1. Know that the order of addition doesn't change the result. For example, 5 + 3 is the same as 3 + 5. Break down numbers into smaller, more manageable parts. For example, to add 48 + 36, you can split 36 into 30 + 6 and add 48 + 30 first and then add the remaining 6. When subtracting, think about how much needs to be subtracted to reach the nearest multiple of 10. For example, to subtract 7 from 18, you can subtract 2 to get to 16 and then subtract 5 more. Use estimation to quickly get a rough idea of the answer before performing the exact calculation. This helps in quickly identifying unreasonable results. When adding multiple numbers, you can cross out common digits to simplify the calculation. For example, when adding 27 + 38 + 43, you can add 20 + 30 + 40 first and then add the remaining 7, 8, and 3. Recognize and use number patterns and relationships to solve problems more easily. For example, knowing that every 10 numbers have the same digit in the units place (e.g., 12, 22, 32, 42) can help simplify calculations. If your kids need practice on mental math worksheets, we have some they can get started with. For students at the grade 1 level, we start with adding simple numbers. In this set of worksheets all sums are less than 10. This set contains simple addition problems with sums up to 20. We have several sets of mental addition worksheets for grade 2 students. Some that include no regrouping, and others that include regrouping. A good starting point is this page. Our subtraction sentences worksheets are appropriate for students learning mental subtraction. If you are looking for mental math worksheets for the higher grades, we have included those under the addition, subtraction, multiplication and division categories for each grade.