

Children's Restoration Network

Project One-on-One

Title of Unit: Primes, Multiples, and Factors Lesson 1

Lesson Plan Objectives:

- To find the factors of a number
- To find multiples of a number
- To recognize **prime numbers**

Materials needed:

1. The student's CRN notebook
2. Copy of CRN **Primes, Multiples and Factors** worksheet
3. Pencils
4. Calculator
5. Three copies of the **100 square grid**
6. Reward stickers

Background information for tutor:

Recognizing primes, multiples and factors is a bedrock of number theory. Students need to have a good working knowledge of these concepts in order to access higher-level Math.

Vocabulary: A good working knowledge is required; seek to impart this by using the words as you tutor and encouraging your student to use them rather than learn by drill.

- | | |
|---|---|
| • | Product - the number found as the result of a multiplication problem e.g. $3 \times 4 = 12$ |
| • | Quotient - the result of a division problem e.g. $18 \div 2 = 9$ |
| • | Multiples - products of a number and another whole number |
| • | Factors - numbers that divide evenly into another number with no remainder |
| • | Prime number - a number greater than 1 that has <i>exactly two factors</i> , one and itself |
| • | Composite number - a number greater than 1 that has more than two factors |
| • | Divisor - the number that is doing the dividing |
| • | Dividend - the number that is being divided |

Tutoring Strategies:

- Verbal praise for completion of each section and for effort is a good strategy to boost confidence.
- You can reinforce praise with reward stickers at your discretion - just remember that, like currency, if you award them too freely they lose value.
- The use of color is particularly effective when learning multiples and working with the 100 square grids in identifying patterns.
- This unit links closely with the units on multiplication and division and it is advisable to use this lesson as the springboard.

Tutor preparation:

1. Read the lesson plan for this unit.
2. Print out the Primes, Multiples and Factors worksheet
3. Print out 3 copies of the 100 square grid

Steps in lesson:

1. Share the objective of the lesson with the student and distribute the worksheet.

2. Consider the definition of the word 'factors' in the first section of the worksheet. Encourage the student to recognize that in this lesson all factors are whole numbers.
3. Work through using the example as shown and complete the factors section.
4. Talk about the meaning of multiples. Use other words with 'multi' as a prefix such as *multi-colored; multi-layered cake; multi-level parking garage* etc. See if the student can appreciate the connection or come up with other words that mean multiple.
5. Complete the section on factors and multiples.
6. Go over the definition of a prime number by saying:
"A PRIME NUMBER is a number greater than 1 that has exactly two factors, one and itself." Examples are 2, 11, 31, 17, 19, 37, and 61. Can you think of any more?"
7. Go over the definition of a composite by saying:
"It is a number greater than 1 that has more than two factors. Like a composition of music or objects in art a COMPOSITE NUMBER is **composed** of other numbers. Just remember that it is composed of more than two factors and must be bigger than 1. 4 is a composite number because it has 3 factors: 1, 2 and 4..."
8. Ask her to complete the questions on Composite Numbers.
9. Ask your student to circle the prime numbers in the next two exercises.
10. To assess comprehension ask if several more numbers are prime or composite. Remind your student that 1 is neither prime nor composite, and that 2 is the only even prime. Ask the student to explain why 0 is neither prime nor composite (*because it is < 1*).
11. Go over the definitions of Divisor, Dividend, and Quotient and review the others.
12. Have the student read and complete the "Powers 2 Be" exercise. *Solution:*

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

13. Go over the true/false statements orally with your student to assess her comprehension:
 - "Any whole number, except 0 and 1, is either prime or composite." (*True*)
 - "No composite number is an even number." (*False*)
 - "All prime numbers are odd numbers." (*False*)
14. Ask the student if there are any questions. Commend her for her hard work. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- The 100 square grid is a rich resource for spotting number patterns with multiples get students to explore further and describe their findings.
- Have student discuss a strategy she could use to explain what she has learned in the form of a letter to a child who is under the rule of an organization called 'The Powers 2b.' "Write a secret letter to share the truth of what you have learned today!"

Assessment of learning:

1. Student should note in her CRN notebook ideas discussed in this lesson.
2. Tutor will monitor progression through the lesson and make a note of areas of difficulty and success for a follow-up lesson.

Children's Restoration Network

Project One-on-One

Title of Unit: Place Value

Lesson 2

Lesson Plan Objectives:

- To recognize 'large' numbers (up to trillions) and the value of each period, comma, and digit.

Materials needed:

1. The student's CRN notebook
2. Number and comma cards
3. A die
4. Grid paper (please see CRN grid paper available below)
5. Pencil
6. Reward stickers
7. Place value worksheet

Background information for tutor:

Students often have trouble with large numbers - numbers much larger than anything they can count. Learning how to calculate place value will help large numbers be more manageable.

Students should explore the concept of big and small to begin thinking about numbers this large. For example, 1000 may be considered a big number if we tried to squeeze 1000 people into the room that you are working in now, but 1000 is a small number if put 1000 grains of sand onto a beach or an ocean. So what do we really mean by big?

IT'S A QUESTION OF YOUR PERSPECTIVE!

For youth, the world of numbers is limited to things that we can count (such as money, length, time etc...) - but what about things that are harder to count, such as the number of atoms in a cell, the number of stars in the sky? The student may be faced with such questions as she matures.

Consider how you will use *observational assessment* as you progress through the lesson... by questioning the student e.g. "Which is bigger a billion or a trillion?"

Tutoring Strategies:

- For many students knowing place value may be a concept that they are familiar with for smaller numbers up to a thousand. Some students will instinctively tell you that they do not like 'big numbers' perhaps because they have difficulty recognizing the number.
- Use the number and comma cards to test the student's ease with saying numbers and understanding their place value.
- On a general note please remember 'A B C' students often fail because they are either Afraid, Bored or Confused. Acknowledge difficulties and allow the student to verbalize anxieties in Math or any of her studies. But, remind her of progress she makes in the lessons and praise specific things, e.g. "Good job James, I found your explanation very clear!", "Keep it up, Yinka, you tackled that question with more confidence!", "I know its hard, and I really admire you for not quitting, Esteban!".
- Please know that she really doesn't need to hear how much you or anyone else hated Math at school, but you can share if you had trouble with Math and overcame it.
- Show a 'Lets just get through the ordeal!' attitude with your enthusiasm, good humor and optimism. Know when to leave a concept for another day too - Rome was not built in a day!
- Stay positive and motivated - you are awesome for doing this!

- Reassure the student; let her know you believe that with encouragement she is going to overcome challenges and struggles when she is ready.
- Be willing to discuss concerns, encourage her to do the same and get to the recognize what is at the heart of anxieties - for instance if the student says she "hates" big numbers because they are "stupid" - rather than getting into debate about her emotive choice of words, or denying her the right to be frustrated, ask what she means by big numbers. It's a more fruitful avenue for understanding...be prepared to step back too.
- None of us learns or teaches well when we are upset, so be kind and generous to yourself, too.

Make the choice to rejoice!

Tutor preparation:

1. Read and print the lesson plan for this unit and gather necessary materials.
2. Print out the associated worksheet and two sheets of grid paper.

Steps in lesson:

1. Share with the student the objectives of the lesson and discuss the concept of "bigness."
2. Arrange the number cards to show **1357203** on the table, without commas or spacing.
3. Have the student name the number (*one million, three hundred fifty seven thousand, two hundred three*).
4. If the student is unsure of the name of this number try to break it down - ask "How many units?" "How many tens?" etc. - it's important that she **say** the number for herself...
5. Ask the student to place comma cards in the correct place (after the 1 and after the 7).
Say: "I want you to notice that this number has two 3s with different values. What is the value of each?" (3 thousand and 3 units).
6. "Notice that, from left to right, the first comma shows millions and the second shows thousands."
7. Ask: "How many more numbers would I need for another comma? (3)
"What would this number be called?"
"How much bigger is this than one million?"
"How many zeros does a million have?" (6)
8. "If you ever forget just do this ...

Write out 1000,000

Now under each digit write the word 'million' e.g.

| | | | | | | |
|----|---|---|----|---|---|---|
| 1, | 0 | 0 | 0, | 0 | 0 | 0 |
| m | i | l | l | i | o | n |

9. Repeat this exercise of arranging the index cards with a few other numbers, and repeat the same line of questioning.
10. Distribute the worksheet - go over the place value chart.
Say "This chart is one you may have seen before - it helps us to recognize the value of each digit in a number"
11. Using the grid paper ask the student to set up a place value chart.
12. Ask the student to complete the exercises to indicate the place value of the underlined digits, which go up to trillions on their grid paper.
13. We are now ready for a game to reinforce what we have been learning!
Give out a pair of dice to the student.
Have the student roll one die.



14. Each time the student rolls the die, lay out that many number cards and have the student name the number.
15. This game can be made more complex or challenging by rolling two dice then naming numbers beyond 6 digits - for example if a first die shows 5 and the second shows 4 the total is 9. The student would then have to come up with a 9-digit number.
16. Mental arithmetic and skills of rounding numbers can also be tested e.g. *"Add together the next two numbers you get from your card arrangements, multiply the number you have on your cards by the next number that you get on your dice"* etc.
17. Ask the student to tell you when a million could be considered a big number (a million at a concert) and when it could be considered a small number (a million left handed people on the planet).
18. Make an observational assessment - write 150,057,075,017 in the students CRN notebook. Have the student tell the place value of each 5, each 7 etc. Use the Worksheet's place value chart if needed.
19. Explain to the student that you wish to weigh up how much she has learned now and request that she write a few sentences in her CRN notebook. This can also be in the form of a word web.
20. Ask the student if there are any questions and if there is anything that she would like to cover more specifically next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Explore use of the dice and cards to practice mental arithmetic as well as naming numbers.

Assessment of learning:

1. Student should note in her CRN notebook to show ideas associated with place value in this lesson.
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty and success for a follow-up lesson.

Solutions to worksheet :

Please remember to hear the student say each word, use the place value chart - its easier. The solutions for each place value underlined is given here. Accept reasonable alternatives, some are suggested below.

1. 7 thousands "This is thirty seven thousand, three hundred and ninety"
2. 8 hundreds
3. 9 ten thousands
4. 3 tens
5. 2 millions
6. 5 hundred thousands
7. 2 ten thousands (accept 20 thousands)
8. 9 ten millions
9. 2 millions
10. 5 millions
11. 7 ten thousands
12. 6 millions
13. 9 ten thousands (accept 90 thousands)
14. 3 ten millions
15. 5 trillions
16. 7 ten millions (accept 70 millions)
17. 8 hundred millions
18. 2 billions
19. 4 tens
20. 5 hundred thousands
21. 8 ten billions (accept 80 billions)

Children's Restoration Network

Project One-on-One

Title of Unit: **Multiplication of whole numbers** Lesson 3

Lesson Plan Objectives:

- To practice short-cut rules for multiplication facts.

Materials needed:

1. The student's CRN notebook
2. Copy of *Multiplication of whole numbers* worksheet
3. Access to a watch/clock with a minute hand to time student
4. Pencils
5. Copy of Times Table Grid Paper
6. Copy of Times Table Match Game
7. Reward stickers

Background information for tutor:

We all remember learning our multiplication tables and the sense of achievement when you finally master multiplication facts up to 12. What a privilege as a tutor to help a student grasp these facts!

It's vital that we do not go over the top in drilling times tables into students, but present it in a way that may be new and unique and also reinforcing what they have learned at school. Remember: this is a *process* of recognizing and recalling patterns.

Please be aware that this lesson plan is designed to cover your needs and time constraint as a tutor and the needs of the student. Some students may take several sessions to get through this lesson plan. This is expected and ok.

Relax! Have fun!

Well done!

Tutoring Strategies:

- Games, singing rhymes, and drill learning help with memorization.
- It requires, like most study, time, diligence and patience. It does not have to be seen as some great mountain that has to be scaled, it's not always easy but it is rewarding - not only in accessing higher levels of Math but also in terms of personal achievement.
- Step back and consider this: some lessons will plant a seed, some will water it, but it is only with plenty practice, over time, that a student will completely master multiplication or any other concept and we will see the increase.
- Encourage them: to practice beyond a lesson, not just alone but with friends; to trust that they do not have to rely on a calculator; to take ownership - the more practice they get the better they will become.
- Remind students that multiplication is linked to work that they will do in many areas of Math this year and in years to come - e.g. fractions, decimals, percentages, algebra and calculations in geometry. All students need to have a good understanding of multiplication. It is also relevant to real life as the exercises demonstrate.
- Praise for completing sections and for effort is a good strategy to boost confidence.

Tutor preparation:

1. Read through the lesson plan for this unit.
2. Print out the *Multiplication of whole numbers* worksheet.
3. Print out the CRN Grid Sheet.

Steps in lesson:

1. Share the objective of the lesson with the student.
2. Ask the student to tell you which of the times tables she finds the easiest and why.
3. As an initial means of assessment give out a copy of *Times Table Grid*.
4. Request that the student complete as much of the grid as she can in 2-3 minutes.
5. Discuss her times table grid. Note any times tables that she needs to practice most.
6. Explain that in this segment of the lesson you are going to go over some short-cuts - a couple tricks to make multiplication even easier.
7. Distribute the worksheet and work through the short-cuts section with her. Read:

"We'll be looking at *Multiplying by 5: Odds and Evens*

*If you're multiplying an **even** number by 5, halve the number and then place a zero after it.*

Example: $6 \times 5 = ?$ Step 1: Half of 6 is 3

Step 2: Place a zero after it: 30

Step 3: The answer is 30

How about trying 12×5 ? – we can see that half of 12 is 6, place a zero after it to get 60, which is the answer. It works for all even numbers, even big ones!

*When multiplying an **odd** number by 5, subtract one, take half, and place a 5 at the end.*

Example: $9 \times 5 = ?$ Step 1: $9 - 1 = 8$

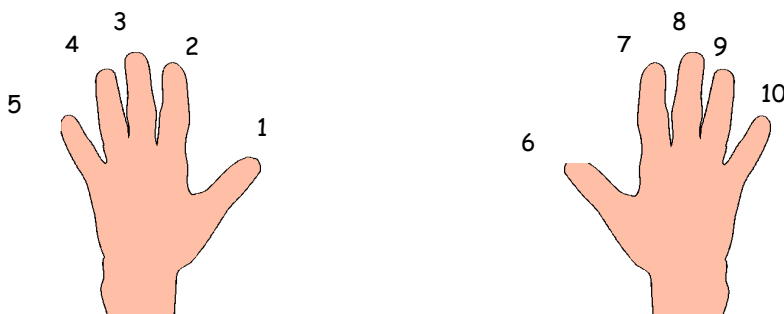
Step 2: Half of 8 is 4

Step 3: Place a five after it: 45

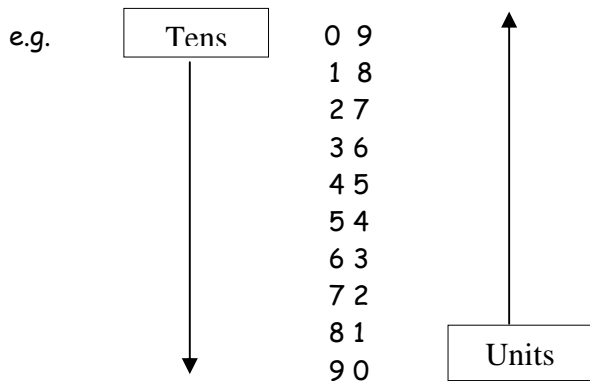
Step 4: The answer is 45

8. If the student has not done so allow her to complete the 5 times tables on the grid.
9. Explain that we are now going on to a short-cut for learning the *9 times tables* (which many students may find difficult) called '*Helping hands*'.
10. Work through this section of the worksheet. Say "Place your hands out in front of you, with your palms facing you and your fingers spread out. Number your fingers by counting on them, starting from left. Your left thumb will be 1; your right pinkie will be 10." (Use diagram)

Helping hands!



11. Say "Next, we are going to choose a number that we can multiply by 9- lets start with 4. Fold down finger number 4. Now look at your hands. There are 3 fingers up to the left of 4 and 6 fingers up to the right of finger number 4. So, $4 \times 9 = 36$ "
12. Explain that the trick only works with numbers less than 10.
13. Allow the student to try this for all facts up to 10×9 and complete the grid. She may go to 12×9 and should notice that with the multiples of 9 the units column goes down by 1 each time and the tens column goes up by one each time -



14. Pause and recap on what you have learned about the 5 and 9 short-cuts.
15. Ask the student to complete her times table grid if she has not done so already and describe any patterns that she can see. Suggest patterns if she has trouble.
16. Have the student write any short-cuts that she can see or can recommend.
17. Once the grid is complete, go on to the Times Table Match Game. The aim is to match the 25 multiplication questions to their solutions and to do it quickly. Students compete against themselves to improve their time. Students who need more practice can continue working with the grid - cover up numbers and have them give the answer.
18. Pause and summarize by asking the student to recall what she has learned and then to write in her CRN notebook an explanation. The student should have enough time to do this, wherever you are in the lesson plan.
19. Ask the student if there are any questions. Commend her for her hard work. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Challenge the student to improve her time with the Times Table Match Game.
- Please use the Times Table Match cards again - they are a great start to any lesson - you can use different numbers or get the student to make up some cards of her own.
- Discuss what strategy your student would use to help a friend with times tables.

Assessment of learning:

1. Student should note in her CRN notebook ideas discussed in this lesson.
2. Tutor will monitor progression through the lesson and make a note of areas of difficulty and success for a follow-up lesson.
3. Observational assessment: Write 6×796 ; ask the student to estimate and then work out the actual value (estimate is $6 \times 800 = 4800$; actual is 4776). Accept estimates that the student can reasonably justify.

Children's Restoration Network

Project One-on-One

Title of Unit: Division of whole numbers Lesson 4

Lesson Plan Objectives:

- To practice short-cut rules for division facts.
- To divide whole numbers and money amounts by 2-digit whole numbers using estimating to check the sense of their answers.

Materials needed:

1. The student's CRN notebook
2. Copy of **Division of whole numbers** worksheet
3. Access to a watch/clock with a minute hand to time student
4. Pencils
5. Copy of **Division Match Game**
6. Print out Copy of completed Times Table Grid
7. Reward stickers

Background information for tutor:

Division is the flip side of the multiplication coin. It is a good idea to do some work on multiplication on the multiplication lesson before this lesson. Have fun!

Tutoring Strategies:

- You will be explaining several division rules and shortcuts that are useful.
- Review the vocabulary list in Lesson Plan 1 on 'Primes, multiples and factors.'
- Emphasize that people often use division to solve practical problems.
- Division can help to figure out how to form teams of equal numbers, how many toys or books will fit on a shelf, and how to split a plate of cookies among friends.
- Make the connection: to divide you need to know your multiplication facts.
- Again remember that this is a *process* of seeing and recalling patterns.
- Praise for completing sections and for effort is a good way to boost confidence.

Tutor preparation:

1. Read and print the lesson plan for this unit.
2. Print out the **Division of whole numbers** worksheet.
3. Print out Copy of Times Table Grid Paper.

Steps in lesson:

1. Share the objective of the lesson with the student.
2. Give out a completed copy of *Times Table Grid*, randomly cover over 10 answers (starting with easier questions) and ask the student to tell you solutions. This will help you to get an idea of her mastery/recall of multiplication facts: e.g. cover over $2 \times 6 = 12$, $5 \times 5 = 25$; $7 \times 8 = 56$; $9 \times 9 = 81$; $12 \times 11 = 132$
3. Next try the **Division Match Game** - get the student to match as many of the 20 cards as she can, time her and ask her to try to improve for next time.
4. Distribute **Division of whole numbers** worksheet.
5. Explain that you are going to go over some divisibility rules.

"Divisibility Rules:

The rules below can help you to quickly tell whether a number is divisible by another number."

6. Explain that you are going to work on some division problems from the sheet and then a word problem.
7. Work through the division questions on the worksheet. Once this is satisfactorily completed say "Suppose you had this problem. Your favorite TV program is on in exactly 64 minutes, before you can watch you have chores to do. You must hang up your clothes, make your bed, take out the garbage and empty the dishwasher. How much time can you spend equally on each one?"
8. Encourage the student to recognize that this essentially is a division problem and have her write the equation. ($64 \div 4 = 16$)
9. Pause. Ask student if there are any short-cuts that she can recall or can recommend?
10. Pause and summarize the lesson. Question the student, rather than just asking "What have we learned today?" use prompts to recall what she has learned and ask her to write a summary in her CRN notebook. It's best that this is not rushed. Leave about 10 - 15 minutes at least toward the end to wind down and pack-up.
11. Ask the student if there are any questions. Commend her for her hard work. The worksheet can be stapled into her notebook.
12. Take out the **Division Match Game** to end the lesson trying to improve on her earlier time. You can also extend this by getting another student to try and beat her time.

Additional suggestions and options:

1. Challenge the student to - make up word problems, improve on her time with the Times Table Match Game and **Division Match Game**.
2. Have the student discuss a strategy she could use to explain divisibility to a friend.

Assessment of learning:

1. Student should note in his or her CRN notebook ideas discussed in this lesson.
2. Tutor will monitor progression through the lesson and make a note of areas of difficulty and success for a follow-up lesson.
3. The *Matching card games* are a great resource - students (especially boys) tend to enjoy games of mental speed.

Completed times tables grid

| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 7 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
| 8 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| 9 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 |
| 10 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 11 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 110 | 121 | 132 |
| 12 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

Children's Restoration Network
Project One-on-One

Title of Unit: Decimals

Lesson 5

Lesson Plan Objectives:

- Rounding decimals to solve practical problems

Materials needed:

1. The student's CRN notebook
2. Copy of **Decimals** worksheet
3. Pencils
4. Calculator
5. *A variety of supermarket receipts with at least 5 items purchased*
6. Reward stickers

Background information for tutor:

The focus of this lesson will be on using decimals in context. Rounding decimals is a functional skill for daily problem-solving.

Tutoring Strategies:

- The learner will gain knowledge of how to round decimals to a given place; she will then draw on this in the context of financial budgeting problems.
- Spoken and written commendation for completion of each section and for sustained effort is always a good policy to heighten confidence.
- **This lesson plan can be used over several sessions so please do not feel rushed.**

Tutor preparation:

1. Examine and print the lesson plan for this unit.
2. Print out the **Decimals** worksheet.
3. Have ready an assortment of receipts to share with your student.

Steps in lesson:


1. Share the purpose of the lesson with the student.
2. Take out one of the receipts. Ask the student to pick out the two most and least expensive items.
3. Say that you want a rough idea what the bill came to after the first 3 items were totaled; can she guess what it was? Check on the calculator. You may continue this process with some of the other receipts.
4. Ask why being able to estimate the cost of your shopping list may be a good idea before getting in line to make a purchase (you may be on a budget, using a fixed price voucher, etc.).
5. Explain that there should be no stigma or negativity about budgeting and estimating the cost of things before you buy. It is not so much about how much we have but how wisely we spend it. Share personal anecdotes to bring this home - ask if she has any experiences about being short-changed or getting too much change back.

6. Explain that today we hope to improve on confidence, speed and accuracy in doing this type of problem.
7. Hand out the **Decimals** worksheet.
8. Read the hot tip:
11. Work through the rules for rounding and the example of rounding 1.9229 to the nearest thousandth and tenth.
12. Go over the rules for rounding, emphasizing the location of the decider.

To round a decimal to a given place:

1. **Find a place you are rounding.**
2. **Look at the digit immediately after it, to the right. This is the decider.**
3. **If the digit is less than 5, round down.**
4. **If the digit is 5 or more, round up.**
5. **Drop all the digits to the right of the place you are rounding to.**

13. Progress through Section 2 questions 1-24, which put these rules into effect. Depending on the ability of the student expect this to last either the remainder of the lesson or be done quite rapidly.
14. Award a sticker upon satisfactory completion or good effort towards it.
15. Encourage the student to recognize where the decimal should go in exercises 25 - 30.
16. In the next section the emphasis is on mental arithmetic to solve decimal-related word problems - ask the student to make notes in her CRN notebook.
17. Lead your student through the first 3 questions in this section. Encourage her to use rounding before she starts working out the actual answer:
 For question 1 have her read out the problem:
 "Grace buys a pair of plants that cost \$8.59 each.
 How much change does she receive from \$20 to the nearest dollar?"
18. Ask her to visualize the problem. She may then write down the relevant information.
19. Ask "What plan can we come up with to solve this?"
 "What numbers need to be rounded?" (\$8.59)
 "What is \$8.59 to the nearest dollar" (remind them that 5 is the decider so it rounded up to \$9)
 "How much is in a pair?" (2)
 "So, how much does it cost for a pair of plants at \$8.59 each, to the nearest dollar?" ($\$9 \times 2 = \18)
 "How much change does Grace get from \$20 ($\$20 - \$18 = \2)"
20. Allow your student to practice rounding with Cornelius' receipt in question 2. Solution:

| | Actual | Rounded to nearest \$ | |
|------------------------|--------|-----------------------|---|
| Milk | 2.49 | ...2... |  |
| Bread | 2.69 | ...3... | |
| Cheese | 1.95 | ...2... | |
| Chicken | 6.37 | ...6... | |
| Ice Cream | 3.99 | ...4... | |
| Toothpaste | 2.25 | ...2... | |
| Water | 2.09 | ...2... | |
| Melons x 2 @ 3.49 each | 6.98 | ...7... | |
| Sub- Total: | | ...28... | |

21. For question 3 accept any reasonable suggestion to reduce the bill to less than \$20 - e.g. buy less chicken, buy one less melon, take off the water etc... These are real decisions that the young person is likely to have to make for herself as a consumer; encourage her to share her reasoning and explain that there is no right or wrong answer.

22. Ask what effect her suggestions will have on the bill; we need to reduce it by about \$8. So, for e.g. removing the cheese (\$2) and one melon (\$3) already takes about \$5 off the bill. Finding smaller quantities of other items such as chicken and bread will reduce it further.
23. Allow the student to work through the remaining two problems. Provide assistance as needed.
24. For question 4, read: "Corrine has been given a \$15 book voucher as a birthday gift. She wishes to buy a pencil case for \$2.99 and a book for \$7.99. She is standing at the check-out and asks for help to estimate if she can afford to get two pencils for 99 cents. What would you advise and why?"
25. Again tease out from the student what calculations need to be done (*rounding gives a total of \$11 with the pencil case and book and \$13 if she adds both pencils - she must also be aware that there is a sales tax. Corrine can always ask what the tax comes to before making a decision*)
26. For question 5, ask her to read: "*Precious is planning a vacation to Washington DC, the return flight costs \$235 and the hotel is \$75 a night. She has \$500 assigned in her budget for her flight and accommodation. How many nights can she afford to stay at the hotel?*"
27. Ask, "To the nearest 100 how much is her flight? (\$200) "How much does she have left out of \$500 for accommodation? ($\$500 - 200 = \300) "How many nights can she stay?" (It may help for her to work out the cost of one night then 2 nights up the answer of 4 nights or $300 \div 75 = 4$)
28. Pause and summarize the lesson. Question the student; rather than just asking "What have we learned today?" use prompts to recall what she has learned and ask her to write a summary in her CRN notebook. It's best that this is not rushed. Leave about 15 minutes toward the end of each session.

Additional suggestions and options:

- Challenge the student to - make up word problems/use other receipts.
- Challenge her to apply the skills she has practiced at every opportunity.

Assessment of learning:

1. The student should note in her CRN notebook ideas discussed in this lesson.
2. Tutor will monitor progression through the lesson and make a note of areas of difficulty and success for a follow-up lesson.

Children's Restoration Network
Project One-on-One

Title of Unit: Fractions Lesson 6

Lesson Plan Objectives:

- To find fractions of money amounts by multiplication

Materials needed:

1. The student's CRN notebook
2. Fraction tower blocks
3. Copy of fractions worksheet
4. Monopoly or play money
5. *Magazines, ads, or newspaper articles that mention fractions*
6. Pencil
7. Reward stickers

Background information for tutor:

Finding fractions of money amounts is a useful skill to master. The very fact that often clock and watch faces are circular in shape helps us, readily judge fractions of an hour that we have as we go through a day.

Tutoring Strategies:

- Remind students that the word *'of'* indicates *multiplication* in Math.

Tutor preparation:

1. Read through the lesson plan for this unit and collect materials.
2. Print out the associated worksheet.
3. Think of instances in your own life where you have used fractions.

Steps in lesson:

1. Share the objective of the lesson with the student.
2. Discuss fractions in the real world with the examples that you have or articles.
3. Using play money, help the student to visualize a situation such as the one in the example below. Use the play money to see if the student can figure out what half, quarter, or a third of an amount is. Ask questions such as - "Here is \$12 in play money. What is $\frac{1}{3}$ of it? Here is \$9. What is it half of?"
4. Distribute the worksheet and ask the student to read aloud the example:
"Leroy buys a package of copier paper at $\frac{3}{4}$ of the cost. The package originally cost \$2.40. How much did Leroy pay?"
Ask, "What operation do you use when you need to find a fraction of a number?" (Multiplication)
5. Go over the worked example:
6. Have the student do the remaining exercise questions on the worksheet.
7. Notice some shortcuts- Finding $\frac{1}{2}$ is like dividing by 2 - ask what finding $\frac{1}{3}$ would be like. (dividing by 3)
What about finding $\frac{1}{4}$? (4)
8. Ask if she can see a pattern (*If the numerator is one then you just divide by the denominator*)
9. For more practice, explore the fraction tower blocks. Students can use these to compare relative fraction sizes and equalities.
10. The tutorial is just about finished; make clear to the student that you hope to determine how much she has learned and ask for a few sentences in her CRN notebook. This can also be in the form of a word web.
11. Ask the student if there are any questions and if there is anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Continue practicing fractions with the play money to help illustrate the concept and its relevance to daily tasks.
- Use the index cards to make flash cards of simple or common fraction problems.

Assessment of learning:

1. Student should have a word web in his or her CRN notebook to show ideas associated with fractions.
2. The tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.

3. As you brain storm you can create a word web using the newspaper articles, coupons etc. to trigger conversation. The aim here is to grab the student's interest and raise her awareness. Try to find articles that would interest a young person - for instance, do not overdo it with fine-print financial services brochures quoting interest rates.
4. Begin to break down the word 'percent' to its root meaning, - 'per' means 'out of' and 'cent' means 100. Discuss the words listed in the background information above.
5. Take out the blank 100 square grids. Ask student to show you, if she can, the following percentages by shading in appropriate sections of the grid with a color marker: 1%, 5%, 10%, 25%, 50%, 75%, 100%
6. Ask the student to staple or glue the completed grids into her CRN notebook. Award a sticker if she is able to show these seven.
7. Take out the CRN sales game and cards to give the student a break from her paper and pen skills. Based on estimation and her comprehension of percents, ask her to match the appropriate final cost card with the advertised discount on the board.
8. Distribute the Percent Application worksheet and have the student work through the first section, which will summarize what you have done so far.
9. We are now ready for the second section and our third objective - Finding a percent of a number. Percentage problems that require us to find some percent or rate of a number can be translated to :

$$\text{percent} \times \text{number} = \text{answer}$$

because '*of*' means 'multiply' or 'times' in math, so 25% of 80 is 25% *times* 80.

This can be written as:

$$\frac{25}{100} \times \frac{80}{1} \quad \text{and simplified to} \quad \frac{1}{4} \times \frac{80}{1} = 20$$

Explain that we can use mental math to estimate percentages if we can remember the fractional equivalents of the percentages in step 5. For example, the fractional equivalent of 25% is $\frac{1}{4}$. So 25% of 80 = $\frac{1}{4}$ of 80.

10. Continue working through Section 2. Again award a sticker for effort and completion.
11. Explain to the student that we will now move on to our next objective which is to apply the understanding of percent to a few simple examples of the real world situation of sales, discounts, and taxes.
12. Work through section 3. Refer to solutions in previous sections to aid understanding.
13. The lesson is almost complete; explain to the student that you wish to assess how much she has learned today, and request that she write a few sentences in her CRN notebook. This can also be in the form of a word web.
14. The student should have enough time to do this and to read it back to you.
15. Ask the student if there are any questions or anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Design a simple percentages game that includes fun facts and figures and matching - the Guinness Book of World Records is a great resource.
- Get the student to create a pack of percentage match sales cards of her own.

Assessment of learning:

1. Student should have a word web in her CRN notebook to show ideas associated with percent.
2. Tutor will monitor progression through the Percent Application worksheet and make a note of areas of difficulty for a follow-up lesson.

Solutions:**2.1 Find the percent of the following:**

- 1) 10% of 20 = **2**
- 2) 25% of 600 = **150**
- 3) 60% of 2400 = **1440**
- 4) 50% of 90 = **45**

Section 3:
Using percent
everyday

| | |
|------------------------------------|----------------------|
| 25% of 60 m = $\frac{1}{4}$ of 60m | 15m |
| 25% of 440 km | 110 km |
| 25% of 120mm | 30 mm |
| 10% of 30 books | 3 books |
| 10% of 40 cameras | 4 cameras |
| 10% of 80 airplanes | 8 airplanes |
| 75% of 200 plants | 150 plants |
| 75% of 600 buildings | 450 buildings |
| 75% of 16 artists | 12 artists |
| 50% of 1000 teachers | 500 teachers |
| 50% of 120 students | 60 students |
| 50% of 844 schools | 422 schools |
| 5% of \$12 | \$0.60 |
| 20% of \$90 | \$18 |
| 37% of \$200 | \$74 |
| 18% of \$44 | \$7.92 |
| 1% of \$500 | \$5 |
| 3% of \$500 | \$15 |
| 62% of \$300 | \$186 |
| 54% of \$200 | \$108 |

Lesson Plan Objectives:

- To add and subtract integers using integer cards and the number line.
- To apply addition and subtraction of integers to Celsius and Fahrenheit temperatures

Materials needed:

1. The student's CRN notebook
2. Copy of integers worksheet
3. *A number line strip from -10 to +10*
4. Index cards
5. Reward stickers
6. A large thermometer

Background information for tutor:

Students learn and use rules to decide the sign of the sum of integers.

Tutoring Strategies:

- Be sure that students recognize that a sum such as $-3 + -7$ is said as "*Negative 3 add negative 7*" and that the sign in front of a digit belongs that digit.

Tutor preparation:

1. Read and print the lesson plan for this unit and collect materials.
2. Print out the associated worksheet.
3. On two index cards draw a negative sign in blue ink and a positive sign in red ink.
4. Create a *number line strip* on paper, which shows the integers from -10 to +10.

| | | | | | | | | | | | | | | | | | | | | |
|-----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|
| -10 | -9 | -8 | -7 | -6 | -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|


Steps in lesson:

1. Share the objective of the lesson with the student and distribute the worksheet.
2. Introduce the rule shown in the introduction to the worksheet - as you go through this use the number line strip to help illustrate the point:
 - 1.1 To add integers with like signs:**
 1. Add the numbers
 2. Use the sign of the two integers (addends)

Example $-1 + -6$
Ignoring the signs and adding the numbers gives $1 + 6 = 7$
Now use the sign of the addends which gives -7
 - 1.2 To add integers with unlike signs:**
 1. Find the difference. (Drop the signs and subtract the numbers)
 2. Use the sign of the addend farther from zero

Example $-8 + +6$
The difference is $8 - 6 = 2$
Now using the sign of the addend furthest from zero means using the sign from -8 which gives -2
3. Be sure that the student recognizes 'like' negative signs in addition such as: $-2 + -4$, $-1 + -5$ and unlike or different signs such as: $-4 + +7$, $-2 + +3$

- Ask the student to make up four like and unlike integer sums of her own to show that she understands the difference and which rule to apply.
- Allow her to reiterate the rule for the sum as she solves it.
- Ask the student to find the sum of the numbers in Section 1 using the rules.
- Go over the rules for subtraction and complete Section 2 questions.

 Subtracting an integer is the same as adding the opposite of that integer.

- In Section 3 the student will find the number strip does not extend as far as she needs it to. She can either draw a sketch in her CRN book or visualize the problem to solve it. Let the student keep the number strip you made for future use.
- Remind students who use the wrong operation for temperature that *rise* means addition and *fall* in temperature means subtraction.

Additional suggestions and options:

- Most students will benefit from using a vertical number line to solve problems. Allow students to develop use of the number line to summarize word problems.

Assessment of learning:

- Student should have a word web in her CRN notebook to show ideas associated with the addition rules of integers.
- Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.

Solutions

1.3 Exercise Questions

Use the rules above to find each sum. Use integers cards or a number line to help you check your answers:

- | | | | |
|-------------------|--------------------|--------------------|--------------------|
| 1. $-7 + +5 = -2$ | 2. $+1 + -4 = -3$ | 3. $-2 + -5 = -7$ | 4. $+8 + +5 = +13$ |
| 5. $+2 + -6 = -4$ | 8. $-8 + +4 = -4$ | 11. $+2 + -4 = -2$ | 14. $+5 + -3 = +2$ |
| 6. $-8 + +6 = -2$ | 9. $+8 + -2 = +6$ | 12. $-9 + +2 = -7$ | 15. $-4 + +9 = +5$ |
| 7. $+4 + -2 = +2$ | 10. $-3 + +4 = +1$ | 13. $-7 + +1 = -6$ | |

Choose the correct answer to complete each statement:

- | | |
|--------------------------------------|--|
| 1. positive + positive = a) positive | 3. positive + negative = c) can't tell |
| 2. negative + negative = b) negative | 4. negative + zero = b) negative |

2.1 Exercise Questions

Subtract:

- | | | |
|-------------------|--------------------|---------------------|
| 1. $+8 - +4 = +4$ | 6. $+9 - +7 = +2$ | 11. $-8 - -10 = +2$ |
| 2. $+5 - +8 = -3$ | 7. $+7 - -4 = +11$ | 12. $-3 - +5 = -8$ |
| 3. $-4 - +5 = -9$ | 8. $-5 - +8 = -13$ | 13. $-7 - +2 = -9$ |
| 4. $-6 - +2 = -8$ | 9. $+8 - +10 = -2$ | 14. $+9 - +11 = -2$ |
| 5. $-3 - -7 = +4$ | 10. $+3 - -2 = +5$ | 15. $-5 - -3 = -2$ |

Temperature

| Original temperature | Climb, Increase, Rise? | Fall, drop, decrease? | New Temperature |
|----------------------|------------------------|-----------------------|-----------------|
| 35 °C | □ 15° | - | + 50 °C |
| -10 °C | 20° | - | + 10 °C |
| -20 °C | 6° | - | -14 °C |
| 36 °C | - | 40° | -4 °C |
| 52 °C | - | 15° | +37 °C |
| -5 °C | - | 10° | -15 °C |
| 0 °C | - | 12° | -12 °C |
| -8 °C | 4° | - | -4 °C |

Children's Restoration Network

Project One-on-One

Title of Unit: Order of operations

Lesson 9

Lesson Plan Objectives:

- To use order of operations to compute with whole numbers

Materials needed:

1. The student's CRN notebook
2. Personal whiteboard
3. Copy of Order of operations worksheet
4. Calculators (scientific and simple four function)
5. Reward stickers

Background information for tutor:

The orders of operations are universal rules that have been created by agreement among mathematicians. According to the order of operations, computations take the order of 'PEMDAS,' which students can easily remember by the phrase Please Excuse My Dear Aunt Sally - this stands for Parenthesis, Exponents, Multiplication, Division, Addition, and Subtraction. Simple four-function calculators do not usually compute using the order of operations. Scientific calculators (calculators that have an algebraic operating system) do compute using these rules.

Tutoring Strategies:

- Students need to be aware firstly what we mean by an 'operation' - it's an opportunity for some humor (i.e. do we mean a surgical procedure?) as you ask them what they think it means in terms of a Math problem.
- Operations are not numbers but a process that changes them such as +, -, ÷, x and powers or exponents.
- They need to understand that when faced with multiple operations they have to follow the order of operations.
- To get a sense of lesson readiness you may ask students to compute $(50 + 25) - 62$, which gives 13; $3 + 4 \times 5$ (which should give 23 if we use PEMDAS).

Tutor preparation:

1. Read the lesson plan for this unit.
2. Print out the associated worksheet.
3. Try to get a scientific calculator and a simple four-function calculator.

Steps in lesson:

1. Share the objective of the lesson with the student.
2. Clarify what we mean by operations, ask student to list some (+, -, ÷, x and powers or exponents).
3. On your whiteboard or a piece of paper write $2 \times 215 + 3 \times 150$.
4. Ask student to find the value.
5. Distribute the calculators; have the student key in the exercise and ask what number appears in the display (880 or 64,950 depending upon the calculator they use).
6. Explain, "Some calculators follow the rules for the order of operations. To avoid confusion mathematicians around the world have agreed on these rules."
7. Distribute the worksheet and have the student read aloud the rules and example on the first page.
8. As she reads the PEMDAS rules emphasize that students work from left to right.
9. Point out that the example involves addition and subtraction and that by agreement multiplication is done before addition no matter where it occurs in an expression.

10. Tell students that as she works from left to right, if division occurs before multiplication she should divide first and vice versa. The same rule applies to subtraction and addition.
11. On the board or on a piece of paper write $6 + 54 \div 2 - 4 \times 5$.
12. Ask the student to give the order of operations and then compute: Divide $54 \div 2 = 27$, multiply $4 \times 5 = 20$, add $6 + 27 = 33$, subtract $33 - 20 = 13$.
13. Ask her to use a scientific calculator to follow the order of operations.
14. Discuss the 'hot tip' at the bottom of the first page.
15. Ask the student to do questions 1 - 6 assessing the order of operations and then computing each exercise.
16. Award a sticker and/or verbal praise for completion of this section.
17. As the student continue working through to question 20 ask her to explain her methods.
18. The lesson is almost complete; explain to the student that you wish to assess how much she has learned today and request that she write a few sentences in her CRN notebook. This can also be in the form of a word web.
19. The student should have enough time to do this and to read it back to you.
20. Ask the student if there are any questions and if there is anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Challenge the student to make up word problems to match expressions that she solved in the exercises.
- Have a student work with another student. Ask them to use their calculators, using each of the digits 2,3,4,6 and 8 once, to create an expression whose value is 10 (Sample answer: $3 \times 4 - 6 + 8 \div 2$)

Assessment of learning:

1. The student should note in her CRN notebook ideas associated with order or operations.
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.
3. You may make up a couple of extra questions to test understanding.

Children's Restoration Network

Project One-on-One

Title of Unit: Finding the area and perimeter

Lesson 10

Lesson Plan Objectives:

- To use formulas to find the perimeter and area of rectangles, and apply this knowledge to solve practical problems.

Materials needed:

- The student's CRN notebook
- Copy of *Finding area and Perimeter* worksheet
- Pencils
- Grid paper
- Reward stickers

Background information for tutor:

The use of formulas is an important step in algebra. This lesson links in with geometry as the student uses formulas to find the perimeter and area of rectangles and extends this practice to find strategies for everyday problem solving.

Tutoring Strategies:

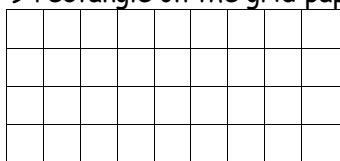
- Students need to be aware that the formulas are like recipes or instructions that we follow that can be represented in words or letters, numbers and symbols.
- There are two formulas that the student will be using in this lesson - it is useful for the student to make a note of them in her CRN notebook as well as on the worksheet, so that she does not have to keep turning back and forth.
- Award a sticker and/or verbal praise for completion of each section and for effort.

Tutor preparation:

- Read and print the lesson plan for this unit.
- Print out the associated worksheet.
- Print out at least 3 sheets of grid paper.

Steps in lesson:

- Share the objective of the lesson with the student and distribute the worksheet.
- Remind the student that the perimeter is the distance all the way around a figure.
- Students often confuse the area and perimeter definitions and/or formula. A good memory jogger is to say, "*Just remember Perimeter Mall - it is just off 285 in Georgia. 285 goes around the perimeter of downtown Atlanta.*"
- Go over the formula for area and perimeter of a rectangle from the worksheet. Explain that we are going to explore these formulas starting with perimeter.
- Draw a 4 by 9 rectangle on the grid paper.



- Ask, "How long is the rectangle?" (9 units)
"How many sides are 9 units long?" (2)
"How wide is the rectangle?" (4 units)

- "How many sides are 4 units long?" (2)
7. Explain that because rectangles have 2 pairs of sides that are congruent (the same length), she can write a formula for finding the perimeter of any rectangle.
 8. Referring back to the worksheet indicate: $P = (2 \times l) + (2 \times w)$ and say " *The perimeter, P, of a rectangle equals two times its length, l, plus two times its width, w.*"
 9. Now compute the perimeter of the 9 by 4 rectangle you have drawn (26 units).
 10. Request that the student use the formula to find the perimeter of remaining shapes in the exercise. We are now ready to move on to area of a rectangle.
 11. Elicit that area is the number of square units needed to cover a surface.
 12. Refer to the 9 by 4 rectangle that you drew earlier and ask, " *How many squares are in each row?*" (9)
" *How many rows are there?*" (4)
 13. Remind students that if we know the number of squares in each row and the number of rows we know the length and width, and she can multiply to find the total number of squares, or area, of any rectangle.
 14. Referring back to the worksheet indicate: $A = l \times w$ and say " *The area, A, of a rectangle equals its length, l, times its width, w.*"
 15. Compute the area of the 9 by 4 rectangle.
 16. Emphasize that area is reported in square units e.g. in^2 , cm^2 , ft^2
 17. Ask the student to complete the exercises on finding the area of rectangles.
 18. Pause and summarize by asking the student to recall each formula and then to write in her CRN notebook an explanation of how the area and perimeter formulas are similar and how they are different.
 19. Explain that we are now going to use these formulas to solve everyday problems and that a good 5 step strategy is to:
 - a) **Imagine:** Create a mental picture
 - b) **Name:** List the facts and the questions
 - c) **Think:** Choose and outline a plan
 - d) **Compute:** Work the plan
 - e) **Check:** Test that the solution 'makes sense' or is reasonable
 20. Ask the student to do problem-solving questions in the final section, and assess her use of the five steps listed above.
 21. As the student continues working through to question 20 ask her to explain her methods.
 22. As we end this lesson explain to the student that you wish to assess learning today, request that she write a few sentences in her CRN notebook. This can also be in the form of a word web.
 23. The student should have enough time to do this and to read it back to you.
 24. Ask the student if there are any questions. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Challenge the student to make up word problems.
- Have the student discuss a strategy she could use to find the area and perimeter of irregular shapes.

Assessment of learning:

1. Student should note in her CRN notebook ideas discussed in this lesson.
2. Tutor will monitor progression through the lesson and make a note of areas of difficulty and success for a follow-up lesson.
3. Observational assessment: note whether the student understands the difference between area and perimeter and the kinds of units in which each is reported.

Children's Restoration Network

Project One-on-One

Title of Unit: Calculations with metric and standard units Lesson 11

Lesson Plan Objectives:

- To estimate and measure metric and customary length.
- To choose the most appropriate metric and customary unit of length.

Materials needed:

1. The student's CRN notebook
2. Copy of Measurement worksheet
3. 30 cm ruler
4. Tape measure or retractable inch measurer
5. ***A dime OR ANY COIN***
6. Base ten blocks (units and rods if possible)
7. Reward stickers
8. Guinness Book of World Records

Background information for tutor:

Units of length, capacity and weight are all concrete concepts that have real life relevance to students. An awareness of distances is pivotal to everyone's perception of the physical world we live in; estimating length is a useful skill for your student. Who else may be interested in predicting length or distance? - e.g. astronauts, surgeons, athletes, builders, architects, artists etc. It's an interesting fact that over time people in some cultures such as in England tend to have grown in height from one century to the next, due to better nutrition - this has had an impact on the way public transport has been designed (anyone one who has ridden an old bus will notice the low level ceilings). This lesson will be helped greatly by such anecdotes and having access to unusual lengths, as documented in a publication such as the Guinness Book of World Records - e.g. world's tallest/shortest man or woman, longest hair etc...

Tutoring Strategies:

- Ask the student questions such as these -
 - How far away do you live from school in miles?
 - How tall are you?
 - What is the difference in our heights?
 - What is a good estimate of the length of the table we are working at?
 - Suppose we had no vehicles? How long would it take to walk about a mile, or to school, the library or the local store?
 - Is a mile further than a kilometer?
- These are all examples of some basic questions about length that students may be interested in.
- This lesson will use simple experiments and require some measuring equipment such as a tape measurer.

Tutor preparation:

1. Read and print the lesson plan for this unit.
2. Print out the associated worksheet.

Steps in lesson:

1. Share the objectives of the lesson and background information with the student.
2. Tell her that we will define and elaborate on what we mean by *metric and customary units*.

3. Clarify that the metric system of measurement is the most commonly used worldwide and is based on the number 10.
4. Customary units, as the name suggests, follow a custom or tradition of a particular location, - customary units existed before metric units were adopted and were also used in some European countries before joining the European Community.
5. Explain that one major reason why metric units came into operation was to address the need to standardize measuring units as nations began to trade more and needed to agree fairly what quantities were being actually traded.
6. Ask the student to brainstorm and name as many units of measurement as she can.
Can she differentiate between which of these may be metric and which of these may be customary?
7. Explain that the millimeter, centimeter, decimeter, meter and kilometer are all metric units of length. The inch, foot, yard and mile are all customary units of length.
8. There are many interesting ratios or comparative measurements that have been discovered. The ancient Greeks, about whom she may learn in Social Studies, called these Golden Ratios.
9. For instance, ask the student if she would mind you measuring her height with the tape measure - she has to stand tall and barefoot. Record this measurement.
10. Next ask her if you may measure her arm span - this will require her to spread her arms out wide and you will measure her arm span from the tip of her index fingers. It is advisable to measure with care to avoid getting into her personal space - e.g. measure arm span across the back rather than across the chest.
11. You should find that her arm span is the same as her height.
Ask "Do you think this is generally true for everyone?"
12. You can do a mini experiment - asking the student to measure your height and arm span to demonstrate her theory or prediction.
13. Now ask if you may measure the distance from the student's wrist to her elbow on either her right or left arm.
14. Record this measurement.
15. Now measure the length of her shoe or foot.
16. The measurements should be about the same length.
17. This is an example of another fascinating ratio that you may again want to try on yourself or another student.
18. A quick way to do the last experiment, if you have no measuring equipment handy, is to simply take a shoe off and put it between wrist and elbow on one arm to prove the theory.
19. Distribute the worksheet.
20. Ask the student to read through the introductory sections of the worksheet with you, filling in the gaps as she goes.
21. Have the student measure the width of a dime; explain that this is 1 millimeter thick.
22. Next ask her to measure the base 10 unit block. She should recognize that this is 10mm or 1cm along each side.
23. Now we can measure the length of the base 10 rod, she should recognize that this is 10 cm or 1dm long.
24. Measure a meter along the floor with her using the metric side of the tape measure.
25. Lay 10 rods along its length and she should recognize that 1m is 100cm or 10 dm long.
26. Mention that long distances are measured in kilometers for metric units or miles for customary units.
27. In her CRN notebooks make a chart that lists 5 items and her estimated dimensions in customary and or metric units e.g. the width of the room, table, worksheet, door, her height etc...
28. Ask student to measure the actual length - how close were her estimates?
29. The lesson is almost complete explain to the student that you wish to assess how much she has learned today and request that she write a few sentences in her CRN notebook. This can also be in the form of a word web.
30. The student should have enough time to do this and to read it back to you.

31. Ask the student if there are any questions and if there is anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Challenge students to research other Golden ratios.
- Pi is also an interesting number: it's the ratio between the circumference and diameter of a circle and is the same ratio for all circles - this is another interesting avenue for exploration.
- Have a student work with another student. Ask her to continue estimations of the length of nearby everyday objects e.g. a paper clip, width of a finger (about 1cm).
- Using maps, discuss scale drawings and how a few cms on a map can represent km in real life.

Assessment of learning:

1. Student should note in his or her CRN notebook to show ideas associated with measurement in this lesson.
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.
3. You may make up a couple of extra questions to test understanding.

Lesson Plan Objectives:

- To appreciate geometry in the real world
- To measure and identify angles

Materials needed:

1. The student's CRN notebook
2. 30 cm ruler
3. Protractor
4. Pencil
5. Angle cards
6. *A picture or photograph in which geometric shapes can be spotted*
7. Reward stickers

Background information for tutor:

A number of key vocabulary words will be used in this lesson - right angle, obtuse angle, straight angle, and reflex angle.

It is important for student to recognize angles using the correct name. She should also know how to measure angles with a protractor.

Tutoring Strategies:

- A concrete illustration will help to bring angles home to the student - ask if she can think where we may see any of the angles that you are going to examine... look around the teaching room that you are in at objects with corners - for example - book edges, desks, chairs, hands of a clock etc.
- This lesson moves away from the worksheet as a resource.
- Instead you will use angle cards that will test the student's recall.
- Your *observational appraisal* is again, a relatively uncomplicated but useful means of assessment.
- Both you and the student need to have a good working knowledge of how to use a protractor.

Tutor preparation:

1. Read and print the lesson plan for this unit.
2. Gather necessary materials, including examples of angles.

Steps in lesson:

1. Share the objectives of the lesson and background information with the student.
2. Next go over the definitions of each type of angle with the student from index cards that you have.
3. Ensure that the definitions of the four kinds of angles are clearly understood. (e.g. cover over the definition and ask the name of the angle).
4. Make this more concrete with either: A display of each type of angle, or reference to real-life examples - e.g. spotting the shapes in the room, or a drawing or photograph.
5. Show her that in terms of increasing angle size the order is:

Acute

Right

Obtuse

Straight

Reflex

6. Call out the following angles and ask the student to write in her CRN notebook whether the angles are *acute, right, obtuse, straight or reflex*: 45° (*acute*), 90° (*right*), 4° (*acute*), 112° (*obtuse*), 175° (*obtuse*), 200° (*reflex*), 180° (*straight line*).
7. Distribute the index cards to the student and ask her to measure the angles and write in her notebook the correct classification as well as the angle measure.
8. Commend her efforts and work.
9. Review definitions and check index cards.
10. The tutorial is nearly finished. Explain to the student that you wish to weigh how much she has learned today and ask for a few sentences in her CRN notebook. This can also be in the form of a word web.
11. The student should have enough time to carry this out and to read it back to you.
12. Ask the student if there are any questions and if there is something that she would like to cover in more depth next time.

Additional suggestions and options:

- Acronyms are a great way to remember the order of things and recall lists, e.g. the order of operations is recalled by *PEMDAS 'Please excuse my dear aunt Sally'* (please see Lesson plan 9 for more detail). Ask the student to think up some acronyms for the order of angle size -

Acute

Right

Obtuse

Straight

Reflex

'AROSR'

- Use the index cards as flash cards to play matching games - e.g. group all the acute angles - reflex angles etc - who can do this the quickest.
- The student can also make her own flash cards on index cards.

Assessment of learning:

1. The student should note in her CRN notebook ideas associated with angles in this lesson.
2. Throughout the lesson, question at frequent intervals her understanding of the definitions.

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Project One-on-One

Title of Unit: Properties of Quadrilaterals and Triangles Lesson 13

Lesson Plan Objectives:

- To appreciate geometry in the real world
- To classify quadrilaterals and triangles
- To find missing angles of quadrilaterals and triangles

Materials needed:

1. The student's CRN notebook
2. 30 cm ruler
3. Protractor
4. Pencil, scissors
5. A dress pattern or other clothing pattern
6. *A shell, leaves, flowers etc. for discussion about geometry*



7. An assortment of triangles and quadrilateral cut-outs (please see CRN worksheet for this lesson and cut out shapes on the last page)
8. *A picture or photograph in which geometric shapes can be spotted*
9. Reward stickers

Background information for tutor:

The polygons are *classified* or grouped in two ways: by the length of their sides and by the measures of the angles.

Tutoring Strategies:

- It's very important that this lesson 'come to life' and jump off the page. Geometry has been known to send many students to sleep - which is a great pity... when we are so surrounded by such a great cloud of witnesses!
- Students should gain an appreciation for the truth that the very buildings that we live, work, study, worship and socialize in were all **designed**, the transport that we use, even the clothes on our backs, the shoes that we wear, the computers we use and the tables and chairs we use as we study, the packaging of our food - they are all designed - design is everywhere and in everything - including nature - we see symmetry in animal prints (e.g. a tiger), geometry in the way fish swim, fossils etc... all of this shows design.. it is all based on our understanding of shapes - today we are just going to look at the tip of the iceberg!
- Ask the student questions about what she knows about polygons (closed shapes, 2 dimensional shapes with straight edges) such as triangles and quadrilaterals.
- A tangible illustration will help to bring this topic home to students - ask if they can think where we may see any of the shapes that you are going to examine in each day.
- Keep in mind that *observational evaluation* is a relatively straightforward but effective means of assessment for all lesson plans.

Tutor preparation:

1. Read and print the lesson plan for this unit and gather necessary materials.
2. Print out the associated worksheet.
3. Ensure that you clearly understand the definitions of the four kinds of triangles and the types of quadrilaterals.
4. Make this more concrete with either - A display of each type of shape, or reference to real-life examples, or spotting the shapes in a drawing or photograph.

| |
|-------------------------|
| Steps in lesson: |
|-------------------------|

1. Share the objectives of the lesson and distribute the worksheet.
2. Go through Section 1: *Food for thought* in the worksheet.
Ask: "Why do you think that the study of shapes is relevant to us today?" (It helps us to understand the world we are in)
"Why are buildings, cars, airplanes etc. designed the way that they are?"
"Who decided?"
"What do they base their judgements on?"
"What about the ancient pyramids in Egypt?"
"What kind of shapes were they based on?" (*triangles, pyramids*)
"Why?" (*most sturdy*)
3. Take out the dress pattern, if you are able to obtain one, to show that clothes are cut from shapes that are basically sewn together. Complete Section 1.
4. Referring to Section 2 of the worksheet, ask: "How can we check that the six triangles are either equilateral, isosceles, scalene or right angle?" (Measure the lengths of sides with a ruler; measure the size of the angles with a protractor).
5. Next display other examples of each type of triangle - either by drawing them or having cutouts ready.
6. Ask the student to classify (or group) triangles in two ways - by its sides and by its angles.
7. Once she has worked through the True/False exercises and the student satisfactorily understands the definitions, guide her to recognize that every equilateral triangle is an acute triangle.
8. Next ask the student to read aloud the explanation that, for all triangles, the sum of all three angles is 180° . Explain that you are going to demonstrate this.
 1. Fold a piece of paper into a triangle, taping or gluing loose pieces if needed.
 2. Now ask the student to put a dot in each corner.
 3. Ask the student to cut off each of the 3 dotted corners.
 4. Now ask her to rearrange the 3 torn off edges so that they lay, with the dots and edges meeting. They should find that this forms a 180° straight line. This can be checked on the protractor by laying the pieces under it.
 5. Distribute the protractor to the student and ask her to check that the angles of the triangles in the worksheet add up to 180° .
 6. Summarize by asking the student to define the different types of triangles.
9. Commend her efforts and work through finding the missing angles section of the worksheet.
10. Award a sticker and verbal praise as we move on to the next section - quadrilaterals.
11. Explain that we are now going on to classifying quadrilaterals or 4-sided shapes.
12. Go over the definitions.
13. Ask the student to classify the quadrilateral cutouts.
14. Ask the student to read through the introductory sections of the section on finding missing angles of worksheet with you, filling in the blanks as they go.
15. Emphasize the angles sum to 360 degrees with quadrilaterals - because they are all basically formed by the sum of two triangles.
16. Assign the problems in this third section. Review definitions and check solutions.

17. The lesson is nearly finished; explain to the student that you wish to gauge how much she has learned today and ask for a few sentences in her CRN notebook. This can also be in the form of a word web.
18. The student should have enough time to accomplish this and to read it back to you.
19. Ask the student if there are any questions and if there is anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Fractals are a fascinating area of Math as its touches upon art and design - fractals are designs that are generated from Math equations. A great website is www.fractalus.com. This has superb fractal galleries. It's definitely an attention grabber for those with access to the Internet at the tutorial site.
- For those who do not have ready access, ask the student to investigate fractals further - here are a few:



Assessment of learning:

1. Student should note in her CRN notebook to show ideas associated with measurement in this lesson.
2. Throughout the lesson question at frequent intervals her understanding of the definitions e.g. *"Is this an isosceles triangle?"*, *"I am thinking of a shape that has four sides that are the all equal what is it?"* - or by drawing shapes in her CRN notebook and asking her to name them, or writing the names and asking her to draw the shapes.

Lesson Plan Objectives:

- To understand that regrouping helps to simplify a problem before solving.
- To simplify expressions by collecting like terms

Materials needed:

1. The student's CRN journal
2. Copy of *Simplify by collecting 'like' terms* worksheet
3. Shape cut-outs
4. Scissors
5. Glue
6. Reward stickers

Background information for tutor:

Evaluating a simplified expression is usually easier than evaluating it in the given form.

Tutoring Strategies:

- Students need to understand what is meant by 'like terms.'
- It helps to link this to the idea of regrouping objects such as miscellaneous shapes.

Tutor preparation:

1. Read and print the lesson plan for this unit.
2. Print out the associated worksheet.

Steps in lesson:

1. Share the objective of the lesson with the student.
2. Ask the student what comes to mind when you say the word 'like terms'.
3. Scatter cutout shapes on the table. Ask the student to regroup or sort them.
4. Distribute the worksheet; ask the student to read through the first section and begin to do the regrouping of the shapes in questions 1 - 6.
5. As she assigns a letter to represent each shape, mention that the letter does not have to necessarily be the first letter of the word name of the shape. For example, in exercise 6 she will notice that we have cubes and cylinders, which both begin with the letter c. What do we use to represent each group now? The exercise suggests that we could use x and y - what expression do we get?

Pause here and explain that we can use any letter so long as we agree that it represents the object that we have agreed upon.
6. Point out that there are some letters that we tend not to use in forming algebraic expressions because they could be confused as letters - can they think of any? (l looks like 1, o looks like zero, s can look like 5, b can look like 6, even x can look like a multiplication sign so it helps to make it a cursive x i.e. \times)
7. Work through section 2 - we progress from the manipulatives to more general uses.
8. Explain that the letter does not necessarily have to represent an object here - it is just an unknown. We are generalizing here and thereby finding out more about the world of numbers moving from specific to universal rules.
9. The worksheet has plenty of examples- let the student talk through problems 1-30.

10. Questions 31 - 40 include subtraction - it is important to remind the student that the sign in front of a number or term stays with it when we collect like terms.
11. Discuss the hot tip that we do not put 1 in front of a letter or term - it's a given that if we see it on its own there is only one 'lot of' this term.
12. We can now move on to section 3, which is for the more able student who understands exponents or powers. Ask the student to read the introduction.
13. The key teaching point is that we collect like terms, in this case where the base number or terms have the same power. The base number or term is the part of the expression that is not a power, for example: in $2x^3$, x is the base term and 3 is the exponent. You can explain that the 2 is called the coefficient of x^3 .
14. Work through questions 1 -10. Award a sticker for effort.
15. Assess comprehension throughout by asking the student to explain her reasoning.
16. The lesson is almost complete; explain to the student that you wish to assess how much she has learned today and request that she write a few sentences in her CRN notebook. This can also be in the form of a word web. The student should have enough time to do this and to read it back to you.
17. Ask the student if there are any questions and if there is anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Encourage the student to regroup a number of shapes and objects.
- Explore how a retailer may use regrouping to assess demand and supply.

Assessment of learning:

1. Student should have a word web in her CRN notebook.
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.

Solutions

2.1: State whether the expression for each statement is true or false

- | | |
|--|--|
| 1. 3 apples + apple + banana + 3 bananas = $4a + 4b$ true | 4. $8n+2m+3n+3m = 11n + 5m$ true |
| 2. $2 + 6e + e = 2 + 5e$ false | 5. $9z+y+11x+7z = 9x + 20y$ false |
| 3. $4c+3+5c+2y = 8c + 3 + 2y$ false | |

By collecting 'like' terms simplify the following expressions:

- | | | |
|-------------------------------------|--|--|
| 1. $5x + 3y + 6x + y = 11x + 4y$ | 9. $9v + 3w + 11v + 2w = 20v + 5w$ | 17. $v + 7w + 13v + 5w = 12w + 14v$ |
| 2. $12e + 3f + 7e = 19e + 3f$ | 10. $90j + 5j + 10j = 105j$ | 18. $3 + 8i + 7 + 4i = 10 + 12i$ |
| 3. $2v + 4w + 11v + 5w = 13v + 9w$ | 11. $21m + 4 + 31 + 9m = 30m + 35$ | 19. $4x + xy + 9x = xy + 13x$ |
| 4. $20j + 2i + 4j + 5i = 24j + 7i$ | 12. $2d + 2e + 4e = 2d + 6e$ | 20. $5a + 4a + 5ab = 9a + 5ab$ |
| 5. $6r + 5a + 2r + 1 = 8r + 5a + 1$ | 13. $29 + 5w + 10 + 7w = 39 + 12w$ | 21. $9vw + 6vw + 10v = 15vw + 10v$ |
| 6. $2h + 2 + 9h + 8 = 11h + 10$ | 14. $18 + 2f + 4 + 5f = 22 + 7f$ | 22. $12u + 2v + 4u = 16u + 2v$ |
| 7. $2v + 4w + 3w = 2v + 7w$ | 15. $8 + 9w + 15v + 9w = 8 + 18w + 5v$ | 23. $8c + 5 + 11c + 9 = 19c + 14$ |
| 8. $70p + 5p + 5q = 75p + 5q$ | 16. $2j + 2i = 2j + 2i$ | 24. $24a + 2b + 4a + 5 = 28a + 2b + 5$ |

2.2: By collecting 'like terms simplify the expressions that include taking away -

- | | | |
|-------------------------------------|--|----------------------------------|
| 25. $9a - 6a = 3a$ | 29. $5ab - 2ab = 3ab$ | 33. $50z + 20z - 14z = 56z$ |
| 26. $8a - 3a + 2b + 3b = 5a + 5b$ | 30. $15w - 10w + 3v = 5w + 3v$ | 34. $30mn - 12mn + 8 = 18mn + 8$ |
| 27. $16e - 6e + 8f - 2f = 10e + 6f$ | 31. $20de - 10de + 15f - 7f = 10de + 8f$ | |
| 28. $12h - 3h + 4 - 1 = 9h + 3$ | 32. $19c - 12c + 10 = 7c + 10$ | |

Section 3: Collecting like terms with powers

- | | | |
|---|--|--|
| 1. $x^2 + 6x^2 = 7x^2$ | 5. $3g^7 + 5g^2 + 2g^7 = 5g^2 + 10g^7$ | 9. $12e^3 + 2 + 6e^3 = 18e^3 + 2$ |
| 2. $m^3 + 4m^3 = 5m^3$ | 6. $7x^4 + 3x^4 + 3x + x = 10x^4 + 4x$ | 10. $4c^2 + 2c^2 + c^3 + 10c^3 = 6c^2 + 11c^3$ |
| 3. $2x^2 + 4x^2 + x^3 + 5x^3 = 6x^3 + 6x^2$ | 7. $3c^2 + 8c^2 + 2c^3 + c^3 = 11c^2 + 3c^3$ | |
| 4. $2 + y^2 + 8y^2 + 1 = 3 + 9y^2$ | 8. $3y^3 + 5y^3 + 2y + 8y = 8y^3 + 10y$ | |

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Project One-on-One

Title of Unit: Solving equations

Lesson 15

Lesson Plan Objectives:

- To solve equations by using inverse operations.

Materials needed:

- The student's CRN notebook
- Copy of *Solving Equations* worksheet
- Red pen
- Pencil
- Reward stickers
- Calculator

Background information for tutor:

In this lesson the student will be introduced to the strategy of isolating the variable on one side of the equation.

Tutoring Strategies:

- The student can learn how to find the unknown amount by undoing operations. She needs to be aware that the inverse of addition is subtraction, the inverse of multiplication is division and vice versa.
- A common error is that students forget to do the inverse operation to both sides. The idea of scales and balancing sides, doing the same thing to both sides is a useful memory jogger.

Tutor preparation:

- Read and print the lesson plan for this unit.
- Print out the associated worksheet.

Steps in lesson:

- Share the objective of the lesson with the student and distribute the worksheet.
- Discuss inverses or opposites.

The inverse operations:

| | Inverse |
|-----------|----------|
| Operation | |
| add | subtract |
| multiply | divide |

Ask, "What is the inverse of adding 3?" (*subtracting 3*)

"What is the inverse of subtracting 4?" (*adding 4*)

"What is the inverse of multiplying by 8?" (*dividing by 8*)

"What is the inverse of dividing by 7?" (*multiplying by 7*)

- Have the student complete the matching exercise.
- Follow the worked example from the worksheet.
- Remind the student "When you add, subtract, multiply or divide the same number on both sides of an equation, it balances."
- Have the student use a red pen (or another color) to perform the inverse operation on both sides of an equation. Using a red pen will help her to focus on the original problem, the inverse of that operation, and the fact that the inverse can be performed on both sides.
- Ask the student to continue to work through the exercise questions.

8. Ask the student to recap what she has learned verbally and give a brief written summary of the lesson in her CRN notebook.

Additional suggestions and options:

- In the CRN notebook, have the student write an explanation as if to a friend who missed the lesson. The explanation should include examples and a clear explanation of inverse operations.

Assessment of learning:

1. Student should have a word web in his or her CRN notebook to show ideas.
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.

Solutions

1) $a = 3$ 2) $y = 3$ 3) $j = 7$ 4) $w = 12$

5) $e = 2$ 6) $p = 5$ 7) $r = 12$ 8) $e = 5$

9) $h = 4$ 10) $g = 11$ 11) $e = 8$ 12) $w = 3$

13) $f = 13$ 14) $y = 6$ 15) $g = 10$

16) $e = 13$ 17) $r = 12$ 18) $c = 4$

19) $y = 7$ 20) $h = 15$ 21) $p = 13$

22) $m = 12$ 23) $k = 33$ 24) $v = 20$

25) $g = 8$ 26) $c = 70$ 27) $w = 50$

28) $i = 12$ 29) $j = 72$ 30) $a = 40$

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Project One-on-One

Title of Unit: Word Problems Lesson 16

Lesson Plan Objectives:

- To solve problems by writing and solving an equation.

Materials needed:

1. The student's CRN notebook
2. Copy of *Word Problems* worksheet
3. Reward stickers
4. Calculator

Background information for tutor:

To write equations you translate phrases and sentences into mathematical expressions.

Tutoring Strategies:

- Before writing an equation, students need to identify the variable that will represent the unknown information e.g. "Let C equal the commission."
- There are 5 steps in the worksheet to solve word problems - *Imagine, Name, Think, Compute, Check*.
- A word web is useful for summarizing the lesson.

Tutor preparation:

1. Read and print the lesson plan for this unit.
2. Print out the associated worksheet.

Steps in lesson:

1. Share the objective of the lesson with the student and distribute the worksheet.
2. Have a student read aloud the example problem. Work through each step.
3. Ask the student to picture herself in the problem and discuss whether she would pay more or less than \$29.95 for the camera. (*she'd pay more - add sales tax.*)
4. Have the student copy the facts and questions from step 2 in her CRN notebook. Elicit that the question requires two different answers.
5. Work through the *Think* step with the student. Ask the student to explain the parts of each equation. Emphasize the "*Let*" statements.
6. Have the student compute the tax and compare her answer with the example.
7. Ask the student why the sales tax is \$1.50 (*rounded to the nearest cent*).
8. Ask the student to compute the total cost and compare her answers.
9. Continue through the remaining exercise questions. Check answers with a calculator.
10. Ask the student to recap on what she has learned verbally and give a brief written summary of the lesson in her CRN notebook.

Additional suggestions and options:

- Challenge the student to make up some word problems about starting her own company.

Assessment of learning:

1. Student should have a word web in his or her CRN notebook to show ideas
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.

Lesson Plan Objectives:

- To use properties of exponents to evaluate and simplify expressions involving powers.

Materials needed:

1. The student's CRN notebook
2. Copy of *Exponents* worksheet
3. Pencil
4. Reward stickers

Background information for tutor:

Rules are applied to simplify equations containing exponents.

Tutoring Strategies:

- The lesson assumes a certain level of prior knowledge and is geared primarily for students who are either doing Pre-Algebra, Algebra 1, or Algebra 2.

Tutor preparation:

1. Read and print the lesson plan for this unit and collect materials.
2. Print out the associated worksheet.

Steps in lesson:

1. Share the objective of the lesson with the student and distribute the worksheet.
2. Clarify what we mean by the base number or term and the exponent or power:
"In a^n a is the base number and n is the exponent"
3. Go over the concept summary chart which gives 5 rules of exponents:
Rule 1 $a^m \times a^n = a^{m+n}$ Rule 4 $a^{-1} = 1/a$
Rule 2 $a^n \div a^m = a^{n-m}$ Rule 5 $(a^m)^n = a^{mn}$
Rule 3 $a^0 = 1$
4. Ask the student to go over the rules and try to write them from memory.
5. Go over the worked examples with the student, and then move on to the equations.
6. Ask the student to tell you which rule should be applied to which equation.
7. Explain to the student that you need to review how much she has learned and ask for a few sentences in her CRN notebook. This can also be in the form of a word web.
8. The student should have enough time to do this and to read it back to you.
9. Ask the student if there are any questions or if there is anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Encourage the student to make and use flash cards matching example equations to rules.

Assessment of learning:

1. Student should have a word web in her CRN notebook to show ideas associated with the rules of exponents.
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.

Solutions

1. a^6
2. r^9
3. a^{10}
4. w^{11}
5. k^{18}
6. v^{12}
7. h^3
8. h^{15}
9. a^2
10. $1/10$
11. 1
12. $1/7$

Simplify by adding the indices and multiplying the coefficients, where possible:

13. $15x^2$

14. $18y^3$

15. $-84m^{11}$

16. $-12a^7$

Simplify by subtracting the indices and dividing the coefficients, where possible:

17. $\underline{2x}$

18. $\underline{32y^6}$

19. $\underline{3x^2}$

20. $\underline{2x^8}$

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Project One-on-One

Title of Unit:

Probability

Lesson 18

Lesson Plan Objectives:

- To understand the meaning of *probability*
- To recognize the difference between theory and experiment
- To find the probability of simple events

Materials needed:

1. The student's CRN notebook
2. Copy of *Probability* worksheet
3. Two dice
4. *A coin*
5. *Packet of colored M&Ms/Skittles or small colored candy*
6. Pencil
7. Reward stickers

Background information for tutor:

Probability describes the frequency with which we can expect a given event to occur. Probability is measured on a scale of 0 - 1, 0 being impossibility and 1 being certainty.

Tutoring Strategies:

- The lesson consists largely of conducting experiments to find the probability of events.

Tutor preparation:

1. Read and print the lesson plan for this unit and collect materials.
2. Print out the associated worksheet.

Steps in lesson:

1. Share the objective of the lesson with the student and distribute the worksheet.
2. Ask the student what comes to mind when you say the word 'probability.'
3. Refer students to the worksheet and go over the definition of probability. Read:
Probability refers to the likelihood of an event happening.

We are live in a world where the concept of probability is always being calculated on some level. We might decide to carry an umbrella based on the likely accuracy of a weather report. Insurance companies set premiums based on the likelihood of a driver having an accident; they factor in things like the type of car, the experience of the driver, age and gender.

4. Discuss that an event is one or more outcomes (or results); for example, rolling a dice - there are six outcomes.
5. Then direct the student to do the coin experiment.
6. The student should find that the theoretical probability of getting heads on a coin is 0.5. The experimental probability will be different.
7. Inform the student that it has been found that the more experiments that we do the closer we get to the theoretical probability.

8. Now go to the packet of colored M&Ms/Skittles and complete a chart in the student notebook that shows the probability of picking a color from the packet at random.
9. Explain to the student that we will now apply the understanding of probability to a few simple real-world examples. Work through the final section of the worksheet.
10. The tutorial is just about concluded; explain to the student that you wish to gauge how much she has learned now and ask for a few sentences in her CRN notebook. This can also be in the form of a word web.
11. The student should have enough time to do this and to read it back to you.
12. Ask the student if there are any questions and if there is anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Encourage the student to explore careers where probability may play an important factor - e.g. statistician, marketing, financial planning etc...

Assessment of learning:

1. Student should have a word web in her CRN notebook to show ideas associated with probability.
2. Tutor will monitor progression through the probability worksheet and make a note of areas of difficulty for a follow-up lesson.

Lesson Plan Objectives:

- To help students understand mean, mode, range, and median.
- Help students to gain a grasp of statistics as the practical edge of Math, which deals with making sense of data and converting it into useful information.

Materials needed:

1. The student's CRN notebook
2. Copy of *Averages* worksheet
3. *Ads or articles that show real life examples of statistics*
4. Reward stickers

Background information for tutor:

As human beings we collect data all the time, we analyze this and try to convert it into useful information - whether it be to forecast weather, make purchases, compare prices, exchange services we are constantly processing information. *Statistics* is that branch of Math that is concerned with analyzing *data*.

Statistics that show where items are concentrated in a distribution of data are called *measures of central tendency*. Three measures of central tendency that we will explore in this lesson are the *mean*, the *median* and *mode*.

Statistics that measure how spread out the distribution of data is are called *measures of dispersion*. This lesson discusses *range* as a *measure of dispersion*.

Tutoring Strategies:

- Remember that for some students they may know the names, but it is common for students to get confused about the definitions.
- It is sometimes an effective teaching tool to try to personalize in some way each definition - it's mentally a bit like attaching some glue or a sticky pad that helps the concept to stick more closely in the students mind. It also helps stimulate their creativity and forges imaginative connection for even the most difficult concepts.
- Invest some emotion - so that this is not just a dull list of yet more words to learn. Even if you feel a bit silly at first, there is nothing more disarming and endearing for a young person, faced with what is for many, the daunting subject of Math, to see an adult prepared to make a bit of a fool of themselves so that they get it!
- Enjoy...Make it engaging. Students may not be great Mathematicians but the hope is that they will at least enjoy it and see its relevance to their world. You know what you are comfortable with and how your relationship has developed with your student.

Tutor preparation:

1. Read and print the lesson plan for this unit.
2. Print out the associated worksheet.
3. Bring along any readily available documentation that demonstrates statistics in the real world - e.g. US Census figures, any newspaper articles that quote 'facts' such as the mean, Guinness Book of World records, advertisements.

Steps in lesson:

1. Share the objective of the lesson with the student and distribute the worksheet.

2. To get a sense of lesson readiness you may ask the student to define in her own words what the *mean*, *median*, *mode* and *range* are.
3. Explain that the branch of mathematics that we are examining is called *Statistics*. A statistician is a person whose career involves analyzing statistics. Government departments such as education, military and social services and corporations all have statisticians or people whose jobs involve analyzing in depth data, but in a way we are all statisticians on some level - even if we don't think we especially 'get' Math!
4. Discuss: statistics helps us to describe data in many useful ways.
5. Point out that one way to analyze data is how spread out it is and another way is to analyze how the data is grouped.
6. Explain that we are going to start with the definitions of the range, mean, median and mode and go through worked examples with them.
7. Ask the student to read through the definitions on the first page of the worksheet.
8. At the end of her reading pause to quiz her on each.
9. Read over the definitions and ask what each means.
10. You can reverse this and beginning with the definition, play 'Jeopardy' and ask what the word was from the definition.
11. For example when we come to the Range say (*in Southern drawl for those who dare!*) "Just like the Lone Ranger cowboy - the range spreads out far and wide. I can spot it a mile away! It's the biggest take-away the smallest."
12. For the Mean say, in exasperated tones, "The mean is the meanest of these (*critters*), we have to do all these calculations to find the mean - add all the numbers then divide by how many there are... if that isn't mean what is?!"
13. For the Median say "Its name sort of gives it away - it's the medium between largest and smallest of the data: its middle."
14. Remind the student that to its important to put the data in order before we try to calculate the median - it's usual to put it in order starting from smallest to largest.
15. Students sometimes get the mean and median confused so really go to town on making these distinctions clear.
16. For the Mode say " If the mode could be a person it would probably be a very trendy and a bit vain. Mode means fashionable in French, and in Math the mode is the most popular number or most frequently occurring." You can go a step further and call it *Minnie Mode* because it requires the fewest (*minimum*) calculations - you just have to look to see which number comes up the most or is the most frequently occurring.
17. Pause to reflect that there is not always even a mode ("It only wants to be seen in a crowd") because numbers do not always repeat in a distribution, such as in their worksheet example.
18. There may also be two modes, in which case the data is said to be *bi-modal*. This is where two numbers repeat the same number of times - with the distribution 1, 3, 3, 3, 4, 5, 5, 5, 7, 8, 9, for instance, the modes are 3 and 5.
19. The student should now be ready for the problem solving exercise questions.
20. Pause again to go over the definitions of the mean, median, mode, and range.
21. Point out we all use these practical tools to collect and sort useful information.
22. You may brainstorm places where data may be collected and what kind of information may be useful.

Place

Question to answer using statistics

| | |
|---------------|---|
| Hospital | What is the mean average cost of a certain procedure? |
| School | What is the Grade point average of each student? |
| Clothes Store | What are the best selling (or modal) sizes, styles etc... |

23. Allow the student to continue working through the problem solving activities section.
24. Award a sticker and or verbal praise for completion of this section.
25. The lesson is almost complete; explain to the student that you wish to assess how much she has learned today and request that she write a few sentences in her CRN notebook. The student should have enough

time to do this reflective exercise and to read it back to you. You may also make up a few questions to test if she really understood the key concepts. It's best to go over a question that she has done in the exercise rather than give her a 'test'.

26. Ask the student if there are any questions and if there is anything that she would like to cover in more detail next time. The worksheet can be stapled into her notebook.

Additional suggestions and options:

- Challenge the student to make up exercise questions on averages of her own.
- Ask the student to design a Who's Who in the Math Hall of Fame for the more artistically inclined - here she can characterize the mean, mode, median and range as personalities, and, given their Math definitions, explain why she has given them these traits.

Assessment of learning:

1. Student should note in her CRN notebook to show ideas associated with averages.
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.
3. You may make up a couple of extra questions to test understanding. Remember - no one wants to find at the end of a session that she has a not really understood and now she has a test just to pour salt in the wound - we must be reasonable in our expectations and make assessment on a continuous basis as we progress through a lesson. It's vital for each student, regardless of her ability, to come away feeling that she has learned something that they can hear "well done!"

Solutions

| | Range | Mean | Median | Mode |
|----------------------------------|--------|--------|--------|------|
| 2, 2, 3, 5, 7, 8, 10, 19 | 17 | 7 | 6 | 2 |
| 70, 110, 90, 70, 60 | 50 | 80 | 70 | 70 |
| 104, 94, 97, 99, 95, 90, 93 | 14 | 96 | 95 | none |
| 83, 85, 108, 81, 71, 89, 87, 107 | 34 | 89.25 | 86 | none |
| \$5.25, \$6.50, \$4.90, \$5.75 | \$1.60 | \$5.60 | \$5.50 | none |

Lesson Plan Objectives:

- To interpret bar graphs and line graphs
- To make a bar graph

Materials needed:

1. The student's CRN notebook
2. Ruler (straightedge)
3. Graph paper
4. Pencil
5. Reward stickers
6. *Newspapers and magazines*
7. A pair of dice

Background information for tutor:

This lesson links well with the previous lesson plan - number 19 - on averages.

Tutoring Strategies:

- Ask the students questions what they recall about the mean, mode, median and range.
- A concrete presentation will help to bring this topic home to students.
- Remember that *observational assessment* is a relatively easy but powerful tool.
- This lesson moves away from using a worksheet and is very much more skills based.

Tutor preparation:

1. Read the lesson plan for this unit and gather necessary materials.
2. Print out the graph paper - two sheets of graph paper per student.
3. Cut out six bar and line graphs from newspapers or magazines to bring to the session.
4. No problem if you do not have time to prepare these six cut out examples. Work more closely with the worksheet examples; you may want to grab a newspaper or magazine for next lesson to discuss as a follow-up.

Steps in lesson:

1. Share the objectives of the lesson and background information with the student.
2. Take a selection of bar and line graphs from the newspaper or magazine resources and ask students to describe what information they give. Six graphs should be enough, three of each.
3. Ask if she can tell the difference between line and bar graphs.
4. Remind the student that a *bar graph is used to compare information or data*, and a *line graph shows changes in data over time*.
5. Have her tell you which of the graphs you brought is which type.
6. Discuss the *titles* and *labels* of the graphs and how these help the student know what the graphs are about.
7. Point out the horizontal (x) and vertical (y) axes.
8. To remember which is which say " *x is across and y is high*".
9. To remember that the horizontal is across say " *Remember horizontal horizon. Its like the horizon, close your eyes imagine that you are on a beach and you can see the most beautiful sunset you have ever seen, if this helps!*"
10. Talk about the scale and the intervals used on each graph, explaining that the intervals are equal.

11. For the line graph you may point out similar things as well as questions pertaining to the time scale. Time is the horizontal axes of a line graph.
12. Ask the student to write a question for each graph that you could give to another student to try or that she could try herself a week from now. She should also agree on the answers with you.
13. Note whether the student's questions reflect an understanding of the relationship between the coordinate values and the slope and what that means about the data.
14. Emphasize again *scale, intervals, and the vertical and horizontal axes*.
15. Now distribute the grid paper, ensure the student has a sharp pencil and a straightedge.
16. Show the student that you can make a vertical or horizontal bar graph by referring to the examples and explanation in the next section.
17. Give out a pair of 1-6 number cubes or small dice to the student.
18. Have the student roll the dice 25 times and tally the sums.
19. Next have the student make a bar graph showing the times each sum occurred.
20. Ask the student to tell you about her bar graph.
21. Make an observational assessment - note whether the scale of the student's bar graph begins at 0 and equal intervals are used.
22. Work through the steps of making a horizontal bar graph.
23. Ask why she used the chosen interval.
24. The lesson is almost complete; explain to the student that you wish to assess how much she has learned today and request that she write a few sentences in her CRN notebook. This can also be in the form of a word web.
25. The student should have enough time to do this and to read it back to you.
26. Ask the student if there are any questions and if there is anything that she would like to cover in more detail next time. The graphs can be stapled into her notebook.

Additional suggestions and options:

- Have the student look up the lengths of five kinds of dinosaurs other than the ones in the exercise and then draw a vertical bar graph to display the data.
- Ask the student to conduct a survey of music tastes, favorite books, authors, food, ice-cream flavors etc. and share her findings in the form of a bar graph.

Assessment of learning:

1. Student should note in her CRN notebook to show ideas associated with graphs in this lesson.
2. Tutor will monitor progression through the worksheet and make a note of areas of difficulty for a follow-up lesson.