Subject: Mathematics	**Grade**: Four (4)	**Strand**: Number	**Duration:** 60 Minutes
Topic: Mental computation	**Focus Question**: How can I estimate and verify my answers?		
Standard:	Use the basic operations, number relationships, patterns, number facts, calculators and appropriate software to compute and estimate in order to solve real world problems involving fractions, percentages and decimals.		
Attainment Targets:	Explain the processes of the basic operations, use estimation appropriately, and demonstrate proficiency with basic facts.		
Benchmarks:	Model the number operations: addition and subtraction of two digit numbers		
Materials:	a novel or textbook with no more than 250 pages, 2 or 3 other books		

Specific Objectives

- *By the end of the lesson, students will be able to:*
  - Estimate the answers to addition and subtraction problems involving 2 digit numbers
  - Determine the reasonableness of computed or estimated answers

Prior Learning:

- *Students should already be able to:*
  - Use and write numbers in standard form.
  - Round two-digit numbers to nearest ten.

Content Summary

- There are many useful strategies that students can use when they make estimates:
  - Partitioning and benchmarking allow students to use known facts to make estimates
  - Rounding allows students to make multiples of 10 which are easier to add because they end in zero.
- An estimate is never wrong; some estimates are more reasonable than others, however.

Engage

- Show students a book (a novel or textbook with no more than 250 pages). Hold up the book and thumb through it in front of students. Ask students to guess the approximate number of pages in the book. Tell them to write their estimates down.
- Provide students with an opportunity to refine their estimates by giving them a benchmark:
  - Open it to between a quarter and a third of the way through.
  - Show students where the book has been opened to and tell them what page number the book has been opened to (**do not** tell them that this is about a quarter or a third of the book).
  - Allow students to change their initial estimate of the number of pages in the book if they want.

- Tell them not to erase the initial estimate but to write down a new one.

- Finally, provide greater opportunity for students to further refine their estimates:
  - Develop a more useful benchmark for students by showing them another book with fewer (or more) pages than the one you have been using up to this point.
  - Tell students the number of pages in this book. Allow them to further refine their estimates, if they want, by writing a new estimate.
- Tell students the exact number of pages in the book and allow them to compare it to their initial, second and final estimates. Discuss the estimates that students made by asking questions such as:
  - Did anyone's final (or first or second) guess fall between x and y pages?
  - How did you change your guess when I partitioned the book and showed you where page ____ was?
  - How did your guess change when you saw the second book?
  - Now that you know the exact number of pages in the book, what guesses would you accept as good enough? What guesses would be too high? Too low?

Explore

- Discuss with students what an estimate is. Ask questions such as
  - Can you recall a time when you had to make an estimate?
  - When you estimate a quantity, does your guess have to be the precise amount?
  - How far away from the exact amount should an estimate be to be acceptable?
- Ensure that students know that an estimate is never 'wrong', but that some estimates are better than others.
- Introduce students to benchmarking as an estimation strategy. Tell students that they do benchmarking when they use their knowledge of a familiar fact to guess an unknown quantity.
- Allow students to practice benchmarking by discussing the following questions:
  - If 80 + 80 = 160,
    - About how much is 78 + 87?
    - Can you think of another pair of numbers that would give a sum close to but more than 160?
    - What about a pair of numbers that gives a sum close to but less than 160?
  - Allow students to explore similar activities in order to build their benchmarking skills:
    a) If 60 + 50 = 110, identify some pairs of numbers that would give sums that are less than but close to 110. What about pairs that give sums close to but more than 110?
    b) You are estimating the answer to 96 + 43, what known fact can you use to benchmark your estimates?

- Expose students to rounding as an estimation strategy. Discuss reasonable estimates to the addition: 18 + 9, identifying identify the tens that are closest to each addend. Ensure that students understand that 18 can be rounded to 20 and 9 can be rounded to 10 and that 18 + 9 is approximately 20 + 10. Discuss, therefore, the best estimate of 18 + 9.

Explain

- Allow students to explain how they would use rounding to estimate the answers to the following:
  - 97 + 69
  - 34 + 47
  - 92 + 84

Extension

Allow students to research other strategies they could use to add or subtract 2-digit numbers mentally.

Evaluation

Students' Evaluation

Below are some pairs of addends. What is the best estimate of the answer to each exercise? Write a sentence explaining how you made your estimate.

1) 76 + 46 is approximately _____

   The strategy I used was to: _____

2) 89 + 52 is approximately _____

   The strategy I used was to: _____

3) 45 + 49 is approximately _____

   The strategy I used was to: _____

4) 74 + 95 is approximately _____

   The strategy I used was to: _____

5) 28 + 81 is approximately _____

   The strategy I used was to: _____

6) 98 + 86 is approximately _____

   The strategy I used was to: _____

Teacher Evaluation

What percentage of students able to:	**0% - 50%**	**51% - 80%**	**81% - 100%**
Estimate the answers to addition and subtraction problems involving 2 digit numbers			
Determine the reasonableness of computed or estimated answers			

Comments:

Areas of strengths

Areas of weaknesses

Actions to be taken