Mental Computation Activities

Show Your Thinking

Materials

- Tens rods and unit cubes from sets of base-ten blocks (or use other concrete models for tenths, such as fraction strips and fraction circles)

Activity

Initially, students should use concrete materials to help them answer mental computation questions. The materials provide a concrete representation of the numbers in the question and of the operations used to find an answer.

Provide pairs of students with a set of base-ten rods and unit cubes. Establish that the rod represents one whole, and the unit cube, one tenth. Write a question involving decimal numbers on the board. The following are examples of questions appropriate to each grade level:

- **Grade 4**: 2.1 + 3.2, 4.3 + 2.5
- **Grade 5**: 4.5 + 3.7, 6.2 – 3.7
- **Grade 6**: 4 X 1.4, 5.4 ÷ 3

Instruct the students to use the base-ten materials to help them solve the problem. Remind them that they may exchange a tens rod for 10 unit cubes (or vice versa) when necessary. Challenge students to find more than one method of solving the problem.

Invite a few pairs to explain to the class how they found their solution, and ask them to use the base-ten materials to demonstrate their thinking.

Include a variety of strategies so that students can observe that different methods can be used to solve a problem. Have students think about the different strategies by asking:

- “Which strategies are similar? How are they alike?”
- “Which strategy, in your opinion, works well? Why?”
- “Which strategy would you use if you were to solve a problem like this again?”

Provide other problems for students to solve. Observe whether students modify their strategies in order to solve the problem in more efficient ways.
Mental Computation Activities

In Your Head!

Activity
On the board, write a question involving decimal numbers (see examples in the previous activity). Challenge the students to answer the question “in their heads.” Allow students some quiet thinking time to answer the question independently.

Next, have pairs or triads of students share strategies for finding the answer. Students, including those who were unsuccessful in finding a strategy, will hear how other students approached the problem.

Ask individual students to explain and demonstrate their strategies to the rest of the class. Encourage students to use manipulatives and diagrams to explain their thinking process.

Provide problems that allow students to practise particular strategies. Students need many opportunities to develop thinking strategies and to extend their use of their own algorithms.

Sample practice strategies include:
- addition of easy decimals (3.4 + 5.1 \( \rightarrow \) tenths do not exceed nine)
- addition of decimals to whole numbers (4.7 + 2.3 \( \rightarrow \) tenths become whole number)
- compensation (6.5 + 7.9 is 0.1 less than 6.5 + 8.0)
- subtraction of easy decimals (6.7 – 3.2 \( \rightarrow \) no “borrowing” required)
- subtraction to get whole numbers (8.1 – 3.1 \( \rightarrow \) equal # of tenths)
- subtraction of tenths from whole numbers (4.0 – 3.7)
- compensation (4.1 – 2.7 \( \rightarrow \) could be seen as
  0.1 more than 4.0 – 2.7
  OR
  0.6 less than 4.1 – 2.1 (need to subtract another 0.6)
  OR
  0.3 more than 4.1 – 3.0 (subtracted 0.3 too much, need to replace it)
Mental Computation Activities

It “Bottles” My Mind!

Materials

- 3 bottles, each labelled with a different capacity
  - Bottle A: 1.2 L
  - Bottle B: 1.5 L
  - Bottle C: 2.4 L

Activity

Show students the three bottles and ask them to observe the capacity labels. Have students mentally calculate:
- the total capacity of Bottles A and B
- the capacity of 5 bottles the size of Bottle A
- the difference in capacity between Bottles A and C
- whether Bottles A and B, combined, amount to more than 2 L
- the amount that each of three people would receive if the juice from a full Bottle A was shared equally

Have students explain how they found their answers.

Buying Foreign Currencies

Activity

From a newspaper or a website (e.g., www.xe.net/ucc), obtain the exchange rate between the Canadian dollar and other currencies. Record this information on the board.

Example:

1 Canadian dollar ($1.00 CAD) buys:
- 0.83 US dollars
- 0.704 euros
- 9.196 Mexican pesos
- 98.305 Japanese yen
- 1.133 Australian dollars

Have students mentally calculate the amount of different currencies that could be purchased with $10 CAD … $100 CAD … $1000 CAD … $10 000 CAD.
Mental Computation Activities

Multiplying Decimal Numbers by 10, 100, 1000, and 10 000 (Grades 5 and 6)

Activity
Have students explore the effect of multiplying a decimal number by 10, 100, 1000, and 10 000. Record 4.53 on the board and ask students to use their calculators to multiply the number by 10, 100, and 1000. Have them describe the results and discuss why the number of spaces the decimal shifts to the right corresponds to the number of zeroes in the multiplier. Have students predict the result of multiplying 4.53 by 10 000 and check their predictions using their calculators.

Pose the following questions:

- “Why is 45.3 the answer to 4.53 x 10?”
  
  One explanation might be that $4 \times 10 = 40$, $5$ tenths $\times 10 = 5$, and $3$ hundredths $\times 10 = 3$ tenths, so $4.53 \times 10 = 40 + 5 + 0.3 = 45$.
  
  Another explanation may come from a student who uses estimation as a method for solving multiplication/division problems. Knowing that the answer will have the digits 453, the only question that remains is where to place the decimal. Since $4 \times 10 = 40$, the answer will be around 40. Given the possible scenarios of 0.453, 4.53, 45.3, 453, and 4530, the one that's closest to 40 is 45.3

- “Why is 453 the answer to 4.53 x 100?”
- “When might you multiply a decimal number by 10 or 100 in real life?”
- “What is a rule for multiplying a decimal number by 10, 100, 1000, and 10 000?”

Provide practice by recording questions on the board (e.g., 6.55 x 100, 2.784 x 1000) and having students explain how they calculated the answers mentally.

Also provide problems set in a context for students to solve mentally:

- The length of a table is 1.75 m. What is the length of 10 tables placed end to end?
- Chicken soup is on sale for $0.37 a can. How much would 10 cans cost? How much would 1000 cans cost?
- A car uses 0.263 L of fuel per minute when driving. How much fuel will it use in 100 minutes?
Mental Computation Activities

Dividing Decimal Numbers by Powers of 10
(by 10 and 100 in Grade 5, and by 10, 100, 1000, and 10 000 in Grade 6)

Activity

Have students explore the effect of dividing a decimal number by 10, 100, 1000, and 10 000. Record 372 on the board and ask students to use their calculators to divide the number by 10, 100, and 1000. Have them describe the results and discuss why the number of spaces the decimal shifts to the left corresponds to the number of zeroes in the divider. Have students predict the result of dividing 372 by 10 000 and check their predictions using their calculators.

Pose the following questions:

- “Why is 37.2 the answer to 372 ÷ 10?”
- “Why is 3.72 the answer to 372 ÷ 100?”
- “When might you divide a decimal number by 10 or 100 in real life?”
- “What is a rule for dividing a decimal number by 10, 100, 1000, and 10 000?”

Provide practice by recording questions on the board (e.g., 418 ÷ 100, 357.9 ÷ 1000) and have students explain how they calculated the answers mentally.

Also provide problems set in a context for students to solve mentally:

- A classroom measuring 8.5 m has 10 desks placed side by side in a row. What is the length of a single desk?
- A truck driver filled up his gas tank with 100 L of gas for $97.80. What was the cost of a single litre of gas?
Mental Computation Games

Cross Out

A game for 2 players

Materials

- two pieces of scrap paper or blank paper
- a pencil
- two dice

Activity

Each player puts the numbers 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1.0 on a piece of paper.

Player one rolls the two dice. The player may then add, subtract, multiply, or divide the two numbers on the dice (representing tenths) to get one of the numbers on his or her piece of paper. The player then crosses out that number.

For example, player one rolls a 2 and a 4. The player may add 0.2 + 0.4 = 0.6 to cross out 0.6, the player may subtract 0.2 from 0.4 to cross out 0.2, the player may multiply 0.2 by 0.4 to cross out 0.8, or the player may divide 0.4 by 0.2 to get 0.2.

The players take turns rolling, computing, and crossing out the numbers. As soon as a player cannot cross out a number he or she is out of the game.

The remaining player continues to roll, compute, and cross out numbers until he or she also cannot cross out a number.

The players then each add up on their paper the numbers that they could not cross out. The player with the lowest total wins the game.
Connect Four
A game for 2 players

Materials
- “Connect 4” Gameboard (either the Addition or the Multiplication Gameboard)
- counters (coins, washers, etc.)

Activity
Player one covers two of the numbers at the bottom of the game board. The player then adds those numbers together and covers the sum on the playing area.
Player one then removes his or her counters from the bottom numbers.
Player two then completes the same steps with any two numbers.
The game continues until one of the players has four counters in a row.
The multiplication version is played the same way, with the students multiplying instead of adding.

Being Number One!
A game for 2 players

Materials
- two dice (two different colours)
- scrap paper

Activity
The players decide which die will represent the ones-column digit, and which one will represent the tenths-column digit.
The first player rolls the two dice and states the value. The player can then decide to hold at that number or roll again. If the player continues to roll, the player adds to his or her total until deciding to stop or until the total score exceeds ten.
If the player’s score exceeds ten, the player goes back to a score of zero.
The second player follows the same steps as the first.
The player who has the score closest to ten, without going over, wins the round. The game continues for five rounds with the players alternating who goes first.
SKUNK

A game for the whole class

Materials

- blackboard
- 1 scrap of paper for each student
- two dice (two different colours)

Activity

All the students begin each round by standing.

The teacher states the place value of each die (e.g., “The red die represents the ones-column digit. The blue die represents the tenths-column digit”).

The teacher rolls the dice and prints the number on the board under the letter “S” of SKUNK. The students write this number down as their first score. The teacher tells the students that they may either stay standing, or sit down and keep the score they have.

The students who choose to sit down do not add any more numbers to their scores. They are not allowed to stand up again until the next round.

The teacher keeps rolling and adding on the numbers until the total for the round exceeds 10. Any students who are standing when the number exceeds 10 lose all of the points from that round.

The teacher follows the same process for the remaining rounds (“K”, “U”, “N”, and “K”). The students add up their totals for the game. The student with the highest total wins the game.

```
e.g.  S   K   U   N   K
      1.4  2.3  4.5  5.3  2.1
      5.4  2.6  2.3  4.2  1.1
      2.5  4.5  3.3  1.3  3.5
      3.4  4.5  4.3
```

Students may have scores of 1.4, 6.8 or 9.3 for the “S” round of this game of SKUNK, depending on whether they sat down after 1.4, 5.4, or 2.5 was written on the board. However, any students who didn’t sit down after the 2.5, and were still standing when 3.4 was rolled on the dice, will have a score of 0 for the “S” round since that pushes the tally over 10.
### Connect Four – Addition Gameboard

<table>
<thead>
<tr>
<th></th>
<th>1.3</th>
<th>0.6</th>
<th>0.8</th>
<th>1.6</th>
<th>0.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>0.5</td>
<td>1.1</td>
<td>0.7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>1.8</td>
<td>1.2</td>
<td>0.3</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td>0</td>
<td>0.1</td>
<td>1.9</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>

0   0.1  0.2  0.3  0.4

0.5  0.6  0.7  0.8  0.9

1
## Connect Four – Multiplication Gameboard

<table>
<thead>
<tr>
<th>0.1</th>
<th>4.2</th>
<th>6</th>
<th>7</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.8</td>
<td>1</td>
<td>3.6</td>
<td>0.6</td>
<td>6.4</td>
</tr>
<tr>
<td>0.5</td>
<td>0.2</td>
<td>7.2</td>
<td>8.1</td>
<td>0.7</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>1.8</td>
<td>1.4</td>
<td>9</td>
</tr>
<tr>
<td>2.5</td>
<td>0.3</td>
<td>3.5</td>
<td>0.4</td>
<td>4.9</td>
</tr>
<tr>
<td>2.4</td>
<td>5</td>
<td>2</td>
<td>2.7</td>
<td>5.4</td>
</tr>
<tr>
<td>0.9</td>
<td>1.2</td>
<td>5.6</td>
<td>4</td>
<td>0.8</td>
</tr>
</tbody>
</table>

PLACE A PAPERCLIP ON A NUMBER FROM THE ROW BELOW

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

PLACE A PAPERCLIP ON A NUMBER FROM THE ROW BELOW

| 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |