SPECIFIC LEARNER OUTCOMES – Number

N2 Use estimation strategies, including:
• front-end rounding
• compensation
• compatible numbers
in problem-solving contexts.

PROCESSES
Communication (C), Connections (CN), Mental Mathematics and Estimation (ME), Problem Solving (PS), Reasoning (R), Technology (T), Visualization (V)

EVIDENCE the student has achieved the outcomes:
Each student will:
• Use a variety of estimation strategies to find approximate products and quotients of whole numbers.
• Analyze different estimation strategies for finding products.
• Identify the essential elements of estimating quotients.

TEACHER NOTE
• In this assessment task, students will demonstrate their understanding of estimating products and quotients. They will estimate the number of lines of print in four popular children’s novels (products). They will then explain which estimation strategy they prefer and determine the accuracy of that strategy. Students will then estimate the number of pages read each day (quotients). Again, they will explain why they prefer a particular strategy and analyze the accuracy of that strategy.

• Students may have access to a calculator or a multiplication chart. Students should be able to use a variety of estimation strategies. These may include:

a) Front End Strategy
Multiply the digit on the left-hand side of each factor. Then multiply by a power of 10 to accommodate for place value.

42 x 605    (4 x 6) x 10 x 100
24 x 1 000
24 000

This strategy works well when both factors are close to the number represented by the front-end digit.
b) **Compensation Strategy:**

Use front-end estimation and then compensate for accuracy.

\[
\begin{align*}
12 \times 28 & = 10 \times 20 \\
& \quad + 200 \\
\text{Compensate for approximately 12 rows of 8} & = 10 \times 8 = 80 \\
& \quad + 200 + 80 \\
& = 280
\end{align*}
\]

c) **Rounding to Multiples of 10:**

- Round one or more factors to the nearest multiple of 10 (10s, 100s or 1 000s) and multiply.

\[
\begin{align*}
16 \times 98 & = 16 \times 100 \\
& = 1600
\end{align*}
\]

This strategy works well when at least one of the factors is close to a multiple of 10 and the resulting calculation is easily carried out.

*When multiplying 2-digit by 3-digit numbers, 1-digit by 2-digit numbers or 1-digit by 3-digit numbers, it is more accurate to round the larger factor.*

\[
\begin{align*}
18 \times 487 & = 8 768 \\
18 \times 500 & = 9 000 \text{ or } 18 \times 490 = 8 820 \\
20 \times 487 & = 9 740 \text{ or } 20 \times 490 = 9 800
\end{align*}
\]

- Round one number up and one number down

\[
\begin{align*}
35 \times 74 & = 40 \times 70 \\
& = 2800
\end{align*}
\]

This strategy works well when neither of the factors is close to a multiple of 10 and the resulting calculation is easily carried out.

d) **Compatible Numbers**

The purpose of this strategy is to produce mentally manageable numbers.

\[
\begin{align*}
32 \times 255 & = 30 \times 250 \text{ (think of quarters)} \\
& = 7500
\end{align*}
\]

\[
\begin{align*}
71 \times 113 & = 70 \times 11 \times 10 \\
& = 770 \times 10 \\
& = 7770
\end{align*}
\]
In a division problem, change one or both numbers so that the dividend is divisible evenly by the divisor.

\[ 622 \div 8 = 640 \div 8 = 80 \]

*Since grade 5 students are only expected to divide by a single-digit, it is more accurate to only change the dividend when applying this strategy, not the single-digit divisor.*

\[ 445 \div 6 = 74 \]
but \[ 450 \div 5 = 90 \]

• Early finishers can estimate the number of words in each book when each line contains about 9 words.
**ESTIMATING- Student Assessment Task**

Kaytlyn and her friends each read a novel over spring break. Kaytlyn said she had read the most because her book was the thickest. Hayden pointed out that his book had more lines on a page so he actually read the most. Finally, Josée and Kim decided they should all estimate the number of lines in their novels to settle the argument.

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1. Use a variety of strategies to estimate the number of lines in each book. Show all your thinking below.

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2. Which of the strategies you used to estimate do you think is the easiest? Which strategy do you think is the most accurate? Explain your answers.
3. Use estimation strategies to find out about how many pages per day each student read. Show the strategies you used to estimate.

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4. What is important to remember when estimating division problems?
### Scoring Guide – Estimating

<table>
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<th>Level Criteria</th>
<th>Estimates the product (3-digit by 2-digit)</th>
<th>Evaluates estimation strategies</th>
<th>Estimates the quotient (3-digit divided by 1-digit)</th>
<th>Identifies the essential elements of estimating quotients</th>
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<tr>
<td><strong>Wow!</strong></td>
<td>Shows a thorough understanding of estimation by using a variety of strategies which take into consideration the numbers being multiplied</td>
<td>Defends selections of the easiest and most accurate strategies with sound mathematical support</td>
<td>Shows a thorough understanding of estimation by rounding the dividend to the nearest multiple of the divisor (powers of 10)</td>
<td>States and illustrates with examples the importance of rounding only the dividend to make it divisible by the divisor</td>
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<td><strong>YES</strong></td>
<td>Shows a clear understanding of estimation by using a variety of strategies</td>
<td>Defends selections of the easiest and most accurate strategies with support</td>
<td>Shows a clear understanding of estimation by rounding the dividend to a multiple of the divisor (powers of 10)</td>
<td>States the importance of rounding only the dividend to make it divisible by the divisor</td>
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<td><strong>YES, BUT...</strong></td>
<td>Shows a clear understanding of one type of estimation strategy</td>
<td>Defends selections of the easiest and most accurate strategies with minimal support</td>
<td>Shows an understanding of estimation by rounding both the dividend and divisor to workable numbers</td>
<td>States the importance of rounding the dividend in general terms</td>
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<td><strong>NO, BUT...</strong></td>
<td>Shows some understanding of rounding but fails to apply a complete estimation strategy or doesn’t estimate – multiplies original numbers</td>
<td>Identifies the easiest and most accurate strategies with no explanation</td>
<td>Shows little or no understanding of estimation by dividing the original numbers and then may or may not round the quotient</td>
<td>States the importance of rounding in vague terms</td>
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<td>INSUFFICIENT / BLANK</td>
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**ESTIMATING - Student Assessment Task**

Kaytlyn and her friends each read a novel over spring break. Kaytlyn said she had read the most because her book was the thickest. Hayden pointed out that his book had more lines on a page so he actually read the most. Finally, Josée and Kim decided they should all estimate the number of lines in their novels to settle the argument.

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5. Use a variety of strategies to estimate the number of lines in each book. Show all your thinking below.

**The Hostile Hospital**

\[
\begin{align*}
255 & \rightarrow 25 \\
21 & \rightarrow 20 \\
\therefore \quad 250 & \times 20 = 5000 \\
\text{Add on more group of} & \quad 250 \\
5000 + 250 & = 5250
\end{align*}
\]

**The Bellmaker**

\[
\begin{align*}
336 & \rightarrow 330 \\
37 & \rightarrow 30 \\
300 & \times 7 = 2100 \\
9000 & \times 20 = 18000 \\
9000 & \times 20 = 18000 \\
9000 & + 2100 + 900 + 210 = 12910
\end{align*}
\]
6. Which of the strategies you used to estimate do you think is the easiest? Which strategy do you think is the most accurate? Explain your answers.

Sunwing is the easiest because multiplying by 850 is simple (do it in your head) because it’s like counting quarters.

Most accurate is Hostile Hospital cause you compensate for rounding.
7. Use estimation strategies to find out about how many pages per day each student read. Show the strategies you used to estimate.

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Kaytlyn

I rounded my first division sentence (above) to 240 ÷ 6 (right) to get an easy answer.

Hayden

I rounded my first division sentence (a) to 350 ÷ 5 to get an answer.

I did the same as Kaytlyn and Hayden.
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8. What is important to remember when estimating division problems?

It's important to remember to round to a divisible number.

Example:

$\overline{6\sqrt{371}} \rightarrow \overline{6\sqrt{376}} \rightarrow \overline{6\sqrt{360}}$

Starter sentence: 37 not divisible by six

Starter sentence: 36 not divisible by six

$\overline{5\sqrt{362}} \rightarrow \overline{5\sqrt{366}} \rightarrow \overline{5\sqrt{350}}$

Starter sentence: 36 not divisible by five

Starter sentence: 35 divisible by five

It's also important to divide properly and - properly, and it makes it easier to make the bigger number a multiple to the smaller number.
Kaytlyn and her friends each read a novel over spring break. Kaytlyn said she had read the most because her book was the thickest. Hayden pointed out that his book had more lines on a page so he actually read the most. Finally, Josée and Kim decided they should all estimate the number of lines in their novels to settle the argument.

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2. Which of the strategies you used to estimate do you think is the easiest? Which strategy do you think is the most accurate? Explain your answers.

I think that the way I estimated is the easiest and the most accurate. If you rounded by the nearest hundred you would be too off. 

ex. \[ \frac{184}{27} \times 30 \quad \frac{5400}{526} \times 30 \quad \frac{7290}{7816} \quad \frac{7200}{7200} \]

Rounding by the nearest 10th is the easiest and most accurate.
3. Use estimation strategies to find out about how many pages per day each student read. Show the strategies you used to estimate.

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- **Kaytlyn**
  
  Round the big number so it is divisible by the small number.
  
  \[
  \frac{255}{150} = \frac{3}{2}
  \]
  
  Up to 300

- **Hayden**
  
  Round down to 60
  
  \[
  \frac{51}{60} = \frac{30}{60}
  \]

- **Josee**
  
  Round to 180
  
  \[
  \frac{180}{60} = \frac{30}{60}
  \]

- **Kim**
  
  243 is about 240
  
  \[
  \frac{243}{81} = \frac{24}{81}
  \]
4. What is important to remember when estimating division problems?

It is important to make sure the divisor is able to go into the dividend evenly. If you don't they number will be a decimal, and the point of estimation is to get a whole number.
Kaytlyn and her friends each read a novel over spring break. Kaytlyn said she had read the most because her book was the thickest. Hayden pointed out that his book had more lines on a page so he actually read the most. Finally, Josée and Kim decided they should all estimate the number of lines in their novels to settle the argument.

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![Estimation of lines in novels]

- **The Hostile Hospital**
  - Estimation:
    - $\frac{1250}{20} \times \frac{255}{20} = \frac{31250}{400} = \frac{5000}{30}$
    - Approx. 5000 lines

- **The Bellmaker**
  - Estimation:
    - $\frac{1340}{40} \times \frac{336}{40} = \frac{44960}{1600} = \frac{13600}{40}$
    - Approx. 13600 lines
2. Which of the strategies you used to estimate do you think is the easiest? Which strategy do you think is the most accurate? Explain your answers.

I think that my strategy was easy & fairly accurate, because all I did was round the numbers to the nearest tenth, and multiplied.
3. Use estimation strategies to find out about how many pages per day each student read. Show the strategies you used to estimate.

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Kaytlyn

\[
6 \sqrt{255} \\
5 \sqrt{250} \\
25 \\
0
\]

Hayden

\[
5 \sqrt{336} \\
68 \\
5 \sqrt{340} \\
30 \\
40
\]

Josee

\[
3 \sqrt{184} \\
36 \\
5 \sqrt{180} \\
15 \\
3
\]

Kim

\[
8 \sqrt{243} \\
24 \\
10 \sqrt{240} \\
20 \\
40
\]
4. What is important to remember when estimating division problems?

alway round and the number should end with a zero because its easier
**ESTIMATING- Student Assessment Task**

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1. Use a variety of strategies to estimate the number of lines in each book. Show all your thinking below.

![Estimation Strategies]

The Hostile Hospital

You could round the number of lines by the nearest tenths place.

\[21 \approx 2.6\]

Multiply the number of lines per page and the number of pages:

\[255 \times 21 = 5365\]

The Bellmaker

You could round the number of lines by the nearest tenths place.

\[37 \approx 4.0\]

Estimate the number of lines per page and multiply the number of pages by the number of lines per page:

\[
\frac{336}{134.4} \approx 25.0
\]
2. Which of the strategies you used to estimate do you think is the easiest? Which strategy do you think is the most accurate? Explain your answers.

The easiest is if you estimate the number of lines and multiply by the number of pages.

The most accurate is to estimate the number of lines and multiply by the number of pages.
3. Use estimation strategies to find out about how many pages per day each student read. Show the strategies you used to estimate.

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Kaytlyn

Kaytlyn would probably have to read around 40 pages a day if she wanted to finish it in 6 days.

\[
\sqrt{256} = 16
\]

Hayden

\[
\frac{336}{5} = 67.2
\]

Josee

\[
\frac{x}{10} = 1
\]

Kim

\[
\frac{31}{8} = 3 \text{ R}1
\] 61 pages a day for three days with 1 page remainder.

\[
\frac{248}{31} = 8 \text{ R}0
\]

She read 31 pages a day.
4. What is important to remember when estimating division problems?

To double check your answer and when you divide round to the nearest number so you can divide with smaller numbers.