Mrs. Lucas's class has a 2-hour science lab.

She gives each student a dish with one cell in it.

She tells the class that in 20 minutes the cell will divide into two cells, and each 20 minutes after that each cell in the dish will divide into two cells.

1. Complete the second row in this table to show how the number of cells increases during the lab.

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<td>Number of cells as a power of 2</td>
<td>$2^0$</td>
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2. Olan says that the numbers of cells can be written in the form $2^n$.

Complete the third row in the table to show how the number of cells can be written in this form.
3. Linda says that the number of cells after 3 hours will be $2^7 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$.

Is she correct?

Yes $\checkmark$ 1

If not, then what is the correct number?

$2^9$ or 512 cells

Explain how you figured it out.

There are 180 minutes in 3 hours. $2^9 = 512$ according to the pattern if you continue the first row to 180 and continue the rest of the rows.

4. How many cells will be in the dish after 5 hours?

32,768 cells $\checkmark$ 1

Give your answer as a normal number, not as a power of 2.

Show how you figured it out.

After 1 hr = 8
After 2 hr = 64
After 3 hr = 512
After 4 hr = 4,096
After 5 hr = 32,768

Each hour, the number increases by $\times 8$, $8^1, 8^2, 8^3, 8^4, 8^5$

$8^5 = 32,768$

5. How long will it take for the number of cells to reach at least 100,000?

Give your answer to the nearest 20 minutes.

5 hr 40 min $\checkmark$ 1

Show how you figured it out.

$5 \text{ hr} = 32,768$

$2 = 65,536 \rightarrow 20 \text{ min}$

$2 = 131,072 \rightarrow 40 \text{ min}$ $\checkmark$ 1
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Complete the third row in the table to show how the number of cells can be written in this form.
3. Linda says that the number of cells after 3 hours will be $2^7$ ($= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$).

Is she correct? \[\text{No, she isn't}\]

If not, then what is the correct number?

\[2^9\] \[\checkmark\]

Explain how you figured it out.

\[\text{Time in minutes is power to which } 2 \text{ must be applied to find } 2^0 \text{ the number of cells. Therefore, 3 hours is } 3 \times 60 = 180 \text{ minutes } = 2^{\frac{180}{60}} = 2^9 \text{ cells} \] \[\checkmark\]

4. How many cells will be in the dish after 5 hours?

\[2^{72,768} \times 0\]

Give your answer as a normal number, not as a power of 2.

Show how you figured it out.

\[5 \times 60 = 300\]

\[\frac{300}{20} = 15 \checkmark\]

\[2^{15} = \frac{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}{4 \times 4 \times 4 \times 4} = \frac{\sqrt{32,560}}{16} \times 16 = 1153.6 \times 15 = 32560\]

\[32560 \times \frac{32560}{91.6} = 72765\]

5. How long will it take for the number of cells to reach at least 100,000?

Give your answer to the nearest 20 minutes.

Show how you figured it out.

\[2^{10.5} = 97681.9\]

\[2^{17} = 131,672 \checkmark\]

Thus, it is \[17 \times 20 = 340\] minutes.
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3. Linda says that the number of cells after 3 hours will be $2^7 (= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2)$
   Is she correct? 
   
   \[ \text{NO} \]  

   If not, then what is the correct number? 
   
   \[ 2^9 \checkmark \]  

   Explain how you figured it out.
   because $2^7$ would only be 2 hours and 40 min. we need 3 hours so it would be 180 so it would $2^9$ not $2^7$. 

4. How many cells will be in the dish after 5 hours? 
   
   \[ 32,768 \checkmark \]  

   Give your answer as a normal number, not as a power of 2.
   Show how you figured it out.

   \[
   \begin{array}{c|c|c|c|c|c}
   140 & 128 & 160 & 256 & 180 & 512 \\
   200 & 1024 & 220 & 4096 & 270 & 963 \checkmark \\
   340 & 4230 & 300 & 32768 \\
   \end{array}
   \]

5. How long will it take for the number of cells to reach at least 100,000?
   
   Give your answer to the nearest 20 minutes.
   
   \[ 340 \checkmark \]  

   Show how you figured it out.

   \[
   \begin{array}{c|c|c|c|c}
   320 & 65.536 & 340 & 1310.72 \checkmark \\
   360 & 380 & 500 \\
   \end{array}
   \]
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   Is she correct? 
   \[ \text{No} \] \[ \text{Yes} \checkmark \] 1

   If not, then what is the correct number?
   
   Explain how you figured it out.
   \[ 140 \quad 128 = 2^7, \quad 160 \quad 256 = 2^8, \quad 180 \quad 572 = 2^9 \]

4. How many cells will be in the dish after 5 hours?
   
   Give your answer as a normal number, not as a power of 2.
   Show how you figured it out.
   \[ 5 \times 60 = 300 \quad \sqrt[3]{300} \] \[ 15 \checkmark \] 1

5. How long will it take for the number of cells to reach at least 100,000?
   
   Give your answer to the nearest 20 minutes.
   Show how you figured it out.
   \[ 2 \sqrt[5]{100,000} \] \[ 2 \sqrt[5]{50,000} \] \[ 2 \sqrt[5]{25,000} \] \[ 2 \sqrt[5]{12,500} \] \[ 2 \sqrt[5]{6,250} \] \[ 2 \sqrt[5]{3,145} \] \[ 2 \sqrt[5]{125} \] \[ 2 \sqrt[5]{66} \] 1
Multiplying Cells

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   Is she correct?
   - No
   If not, then what is the correct number?
   - $2^9$

   Explain how you figured it out.
   
<table>
<thead>
<tr>
<th>Time</th>
<th>140</th>
<th>160</th>
<th>180 (3 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td># of</td>
<td>128</td>
<td>256</td>
<td>512</td>
</tr>
<tr>
<td>cells</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of</td>
<td>$2^7$</td>
<td>$2^8$</td>
<td>$2^9$</td>
</tr>
<tr>
<td>cells</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>as a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of 2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. How many cells will be in the dish after 5 hours?
   - 32,768 cells

   Give your answer as a normal number, not as a power of 2.
   Show how you figured it out.
   
<table>
<thead>
<tr>
<th>Time</th>
<th>3 hrs</th>
<th>4 hrs</th>
<th>5 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td># of cells</td>
<td>512</td>
<td>4096</td>
<td>32768</td>
</tr>
<tr>
<td># as a power of 2</td>
<td>$2^9$</td>
<td>$2^{12}$</td>
<td>$2^{15}$</td>
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5. How long will it take for the number of cells to reach at least 100,000?
   - 340 minutes
   Give your answer to the nearest 20 minutes.
   Show how you figured it out.
   
<table>
<thead>
<tr>
<th>Time</th>
<th>300</th>
<th>320</th>
<th>340</th>
<th>360</th>
</tr>
</thead>
<tbody>
<tr>
<td># of cells</td>
<td>32768</td>
<td>65536</td>
<td>131072</td>
<td>262144</td>
</tr>
<tr>
<td># as a power of 2</td>
<td>$2^{15}$</td>
<td>$2^{16}$</td>
<td>$2^{17}$</td>
<td>$2^{18}$</td>
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