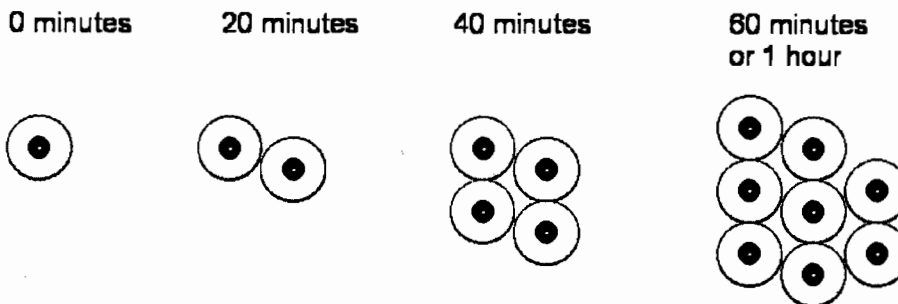


Multiplying Cells

T1



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.

Time (minutes)	0	20	40	60	80	100	120	140
Number of cells	1	2	4	8	16	32	64	128 756
Number of cells as a power of 2	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7

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?

No

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. $2^9 = 180$ 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

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 $\times 8$
 or $8^1, 8^2, 8^3, 8^4, 8^5$
 $8^5 = 32,768$

512 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.

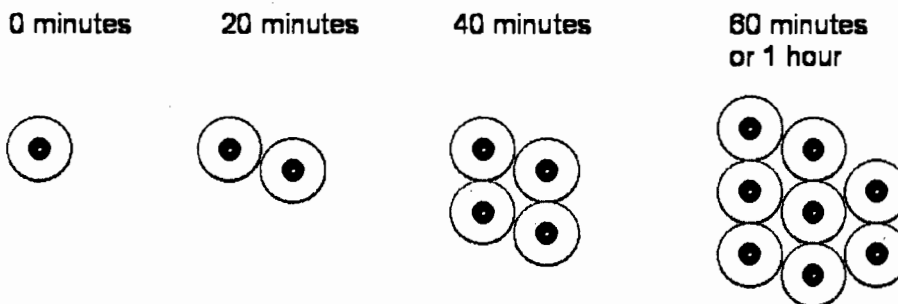
5 hr 40 min

Show how you figured it out.

5 hr = 32,768

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

\times
 $2 = 131,072 \leftarrow 40 \text{ min}$



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Is she correct?

NO, SHE ISN'T

If not, then what is the correct number?

2^9

Explain how you figured it out.

Time in minutes is power to which 2 must be applied to find 2^0 the number of cells. Therefore, 3 hours is $3 \times 60 = 180$ minutes $\cdot 2^{\frac{180}{20}} = 2^9$ cells

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

272,768

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

Show how you figured it out.

$$5 \cdot 60 = 300$$

$$\frac{300}{20} = 15$$

$$2^{15} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \quad \cdot 15$$

$$\begin{array}{r} 3256 \\ \times 16 \\ \hline 11536 \\ 32560 \\ \hline 34096 \\ \quad 8 \\ \hline 272768 \end{array}$$

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

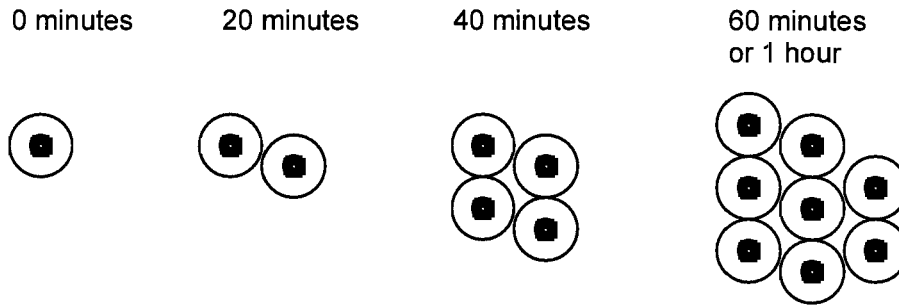
272768

Give your answer to the nearest 20 minutes.

340 minutes

Show how you figured it out.

$$\begin{aligned} 2^{17} &= 100000 \\ 2^{16.5} &= 92681.9... \\ 2^{17} &= 131072 \\ \text{Thus, it's} \\ &17 \times 20 \text{ minutes.} \end{aligned}$$



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Is she correct?

NO

If not, then what is the correct number?

2^9

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

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

Show how you figured it out.

140 128
160 256
180 512
200 1024
220 2048
240 4096
260 8192
280 16384
300 32768

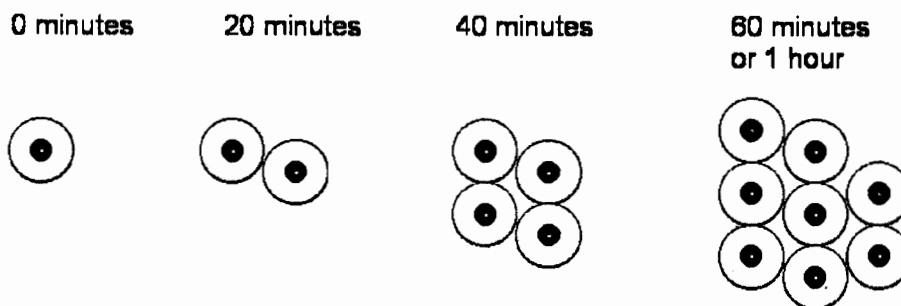
5. How long will it take for the number of cells to reach at least 100,000?

Give your answer to the nearest 20 minutes.

340

Show how you figured it out.

320 65536
340 131072
360
380
400



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2^9

Explain how you figured it out.

140 128 = 2^7 , 160 256 = 2^8 , 180 512 = 2^9

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

65536

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

Show how you figured it out.

$$5 \times 60 = 300, 2^{\sqrt{300}}^{15}$$

$2 \times 2 = 4$	$2 \times 16 = 32$	$2 \times 128 = 256$	$2 \times 1024 = 2048$	$2 \times 8192 = 16384$
$2 \times 4 = 8$	$2 \times 32 = 64$	$2 \times 256 = 512$	$2 \times 2048 = 4096$	$2 \times 16384 = 32768$
$2 \times 8 = 16$	$2 \times 64 = 128$	$2 \times 512 = 1024$	$2 \times 4096 = 8192$	$2 \times 32768 = 65536$

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

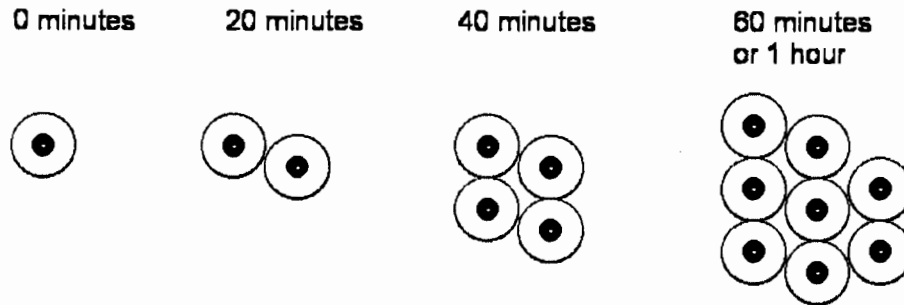
Give your answer to the nearest 20 minutes.

5 hrs 40 min

Show how you figured it out.

$$\begin{array}{r} 2 \overline{) 100000} \\ 2 \overline{) 50000} \\ 2 \overline{) 25000} \\ 2 \overline{) 12500} \\ 2 \overline{) 6250} \\ 2 \overline{) 3125} \\ 2 \overline{) 1562} \\ 2 \overline{) 781} \\ 2 \overline{) 390} \\ 2 \overline{) 195} \\ 2 \overline{) 97} \\ 2 \overline{) 48} \\ 2 \overline{) 24} \\ 2 \overline{) 12} \\ 2 \overline{) 6} \\ 2 \overline{) 3} \\ 2 \overline{) 1} \end{array}$$

$$\begin{array}{r} 17 \\ \times 20 \\ \hline 340 \\ \hline 6 \overline{) 340} \\ 30 \\ \hline 40 \end{array}$$



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Is she correct?

No

If not, then what is the correct number?

2^9

Explain how you figured it out.

time	140	160	180 (3 hrs)
# of cells	128	256	512
# of cells as a power of 2	2^7	2^8	2^9

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.

time	3 hrs	4 hrs	5 hrs
# of cells	512	4096	32768
# as a power of 2	2^9	2^{12}	2^{15}

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 minutes

Show how you figured it out.

time	300	320	340	360
# of cells	32768	65536	131072	262144
# as a power of 2	2^{15}	2^{16}	2^{17}	2^{18}