# Algebra/Geometry: Process Engineer – Design

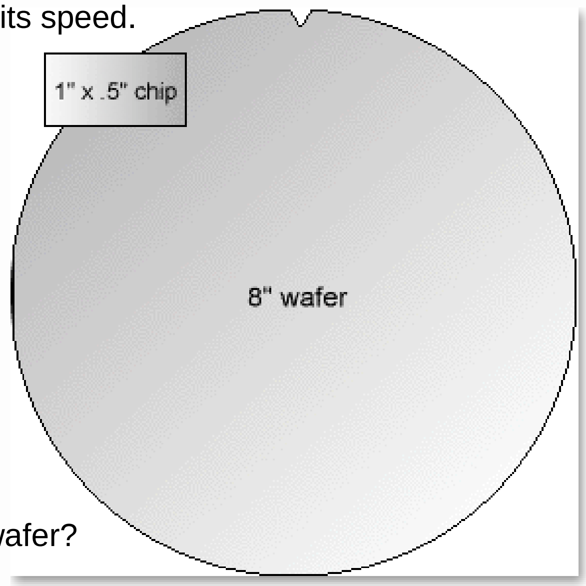
**Micron Technology, Inc**

**Job Description:** Responsible for all aspects of product development including design verification and circuit debug, device characterization, text methodology, yield optimization, and cost reduction.

## Problem:

In the semiconductor industry, *shrink* refers to the reduction in die (or chip) size.

- Reducing the size of the die can reduce the cost of manufacturing per die, since you get more die on each wafer.
- Computers and other devices that require memory are getting smaller and smaller, yet they need more and more memory. Therefore, the memory chips need to be smaller.
- The smaller the die, the smaller or shorter the circuitry. This means the electrical charges can travel faster from one point to the next. Therefore, shrinking the die can also increase its speed.




Wafer diameter = **8 inches**
Area of a circle = $\pi r^2$ (pie x radius$^2$)

Original chip size:

**x = .5 inch**
**y = 1 inch**

1. What is the area of the wafer?

2. What is the area of the chip?

3. Find the number of possible chips per wafer?

***The process engineers tell us that we can shrink the chip by 20%...***

4. What are the new x and y dimensions of the chip?

5. What is the new area of the chip?

6. The x and y dimensions are reduced by a factor of 0.8. By what percentage did the area decrease?

7. Find the number of possible chips per wafer with the new chip size?

ORIGINAL chip size: ______ good chips per wafer.
New chip size: ______ good chips per wafer.

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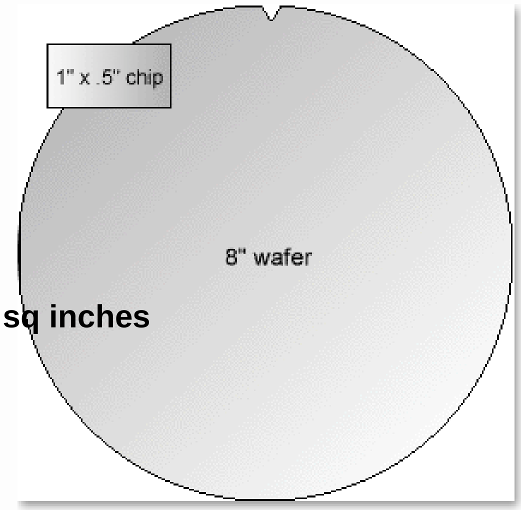
***See problem for details.***




## Solution:

Original chip size: x = .5 inch y = 1 inch

$A_1$ = area of Wafer, $A_2$ = area of Chip

1. What is the area of the wafer?

area = $\pi r^2 = 3.14 \times 4^2$inches = 3.14 x 16 = **50.24 sq inches**

2. What is the area of the original chip?

area = x * y = .5 inch x 1 inch = **.5** square inch

3. Find the number of possible chips per wafer?

$A_1 \div A_2$ = # of chips 50.24 ÷ .5 = 100.48 or **100 possible chips**

***The process engineers tell us that we can shrink the dimensions of the chip by 20%...***

4. What are the new x and y dimensions of the chip?

100%- 20% = 80% = .5 x 80% = **.4** inches 1inch x 80% = **.8** inches

5. What is the new area of the chip?

area = length * width = .4 inch x .8 inch = **.32** square inches

6. The new x and y dimensions are 80% of the original. By what percentage did the area decrease?

(% of length) x (% of width) = (% of area) = 80% x 80% = 64% of original

or

$$\% \text{ of original} = \frac{\text{new area}}{\text{original area}} = \frac{.32 \text{ square inches}}{.5 \text{ square inches}} = 64\%$$

100% - 64% = **36% decrease**

7. Find the number of possible chips per wafer with the new chip size?

$A_1 \div A_2$ = # of chips, 50.24 ÷ .32 = **157** possible chips

ORIGINAL chip size: _**100**__ good chips per wafer.

NEW chip size: _**157**__ good chips per wafer.