Algebra/Geometry: Process Engineer – Cost

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:

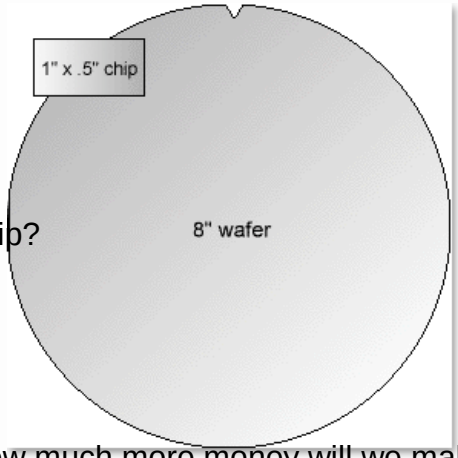
Memory chips are fabricated on silicon wafers. Efforts are made to "shrink" the chip size so that more chips can be made per wafer.

Original chip size: x = .5 inch / y = 1 inches - 100 possible chips per wafer

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

NEW chip size: x = .4 inch / y = .8 inch - 157 possible chips per wafer

Wafer diameter = 8 inches
Area of a circle = πr^2



Assuming that each processed wafer costs $500 ...

1. What is the cost per chip to process the original chip?

2. What is the cost per chip to process the new chip?

3. How much cheaper is it to produce the new chip?

4. If we sell 1,000,000 of these chips every month, how much more money will we make each month with the new chip?

5. The cost to develop the shrink of this chip was $7,000,000. How long will it take to pay for the shrink?

Assuming the company has a 10% profit sharing program (this means that every quarter--three-month period--10% of the profits are divided among the employees equally) and employs 5,000 people...

6. How much would your quarterly profit-sharing check increase with this shrink?

7. How much would you have to shrink the chip to be able to buy a $225 digital camera with your profit-sharing check?

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Solution

Assuming that each processed wafer costs $500 ...

1. What is the cost to process the original chip?
Cost of processed wafer ÷ # of chips
$500 ÷ 100 chips = **$5** per chip

2. What is the cost to process the new chip?
Cost of processed wafer ÷ # of chips
$500 ÷ 157 chips = **$3.18** per chip

3. How much cheaper is it to produce the new chip?
$5 - $3.18 = **$1.82**

4. If we sell 1,000,000 of these chips every month, how much more money will we make each month?
Savings per chip x # of chips sold = additional income / month
$1.82 x 1,000,000 chips = **$1,820,000 / month**

5. The cost to develop the shrink of this chip was $7,000,000. How long will it take to pay for the shrink? (Assume 30 days per month)
Cost of development ÷ additional income / month
$7,000,000 ÷ $1,820,000 = 3.84 months
3 months + (30 days x .84) = **3 months 25 days**

6. *(See problem for details.)* How much would your quarterly profit-sharing check increase with this shrink?
increased income/month x 3 months x 10% = additional profits to share
$1,820,000 x 3 x .10 = $546,000
profits to share ÷ #employee = $ for each employee
$546,000 ÷ 5000 employees = **$109.20 increase for each employee**

7. If our chips are selling steadily at $5.00 and our customers are purchasing 1 million parts per month, how much would the company have to shrink the chip to be able to buy a $225 digital camera with your profit-sharing check?
Work the problem in reverse:
$ needed x #employee = amount needed to split
$225 x 5000 = **$1,125,000**
$1,125,000 x 10 = **$11,250,000** total profits needed
(share 10% of profits)
$11,250,000 ÷3 months = $3,750,000 per month
$3,750,000 ÷ 1,000,000 chips = **$3.75** profit per chip needed
$5 (original cost) - $3.75 = $1.25 cost per chip needed
cost per wafer ÷ cost per chip = #chips
$500 (cost per wafer) ÷ $1.25 = **400** chips needed per wafer
50.24 (area of wafer) ÷ 400 chips = **.125** sq inches (area needed)
needed area ÷ original area = % percent of original area
.125÷ 5 = .25 or 25% of original area
(% of dimensions)^2 = (% of area)
$\sqrt{}$ .25 = .5 or 50% of original dimensions
or **50%** reduction
CHECK:
.5 (original width) x 50% = .25 inches
1 (original length) x 50% = .5 inches
new chip area = .25 x .5 = **.125** square inches