

**Problem: Using Ratios and Working with Formulas\***  
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**Background:**

Kim works with a variety of formulas every day to calculate various aspects of productivity in her area. Among other things, she calculates the following:

- Defect ratio--the ratio of monitors that are taken off the line because of defects to the total number of monitors that are completed successfully in a give time. Defect ratio is calculated to help Kim observe and analyze production problems--to figure out where they are occurring, how often, and why.
- “Tag time”--the amount of time for that it takes for each operator to perform his or her particular function, such as assembly, on the line for a particular product. Tag time gives production employees information about how quickly they need to work in order to meet the production goal.

These values must be calculated frequently because they change according to the particular product that is being made, the customer demand for that product, and the production problems that may arise.

**Problem:**

You are the production manager for an area of the plant that produces a variety of types of computer monitors. The shift that you supervise is over, and you need to do the following:

- Set up a formula and calculate the daily defect ratio, expressed as a percent, for each of the six production lines you manage.

Line Number	Monitors Taken off	Monitors Completed	Production Goal
Line 1	9	250	240
Line 2	8	263	240
Line 3	13	242	240
Line 4	6	154	145
Line 5	5	144	145
Line 6	2	160	145

- Set up a formula for and calculate the “tag time” for lines 1, 2, and 3 for tomorrow’s production of a different product, Monitor C. The production goal for each of the three lines is 520. Calculate the tag time based on an 8-hour day; but subtract 5 minutes per hour for short hourly breaks and 5 minutes for delays resulting from defects. Subtract an additional one hour for the entire day to account for a one half hour lunch break and two fifteen-minute breaks. Determine the number of seconds in which each assembler who works on the line will need to perform his or her function on the monitor, if the production goal is to be met.

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\* All values given are fictitious because the actual information is proprietary.

**Solution: Using Ratios and Working with Formulas<sup>†</sup>**  
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Formula used to calculate defect ratio:

$$\text{defect ratio} = \text{monitors taken off the line} \div (\text{monitors completed} + \text{monitors taken off})$$

Line Number	Monitors taken off	Monitors completed	Production goal	Defect ratio
Line 1	9	250	240	3.4 %
Line 2	8	263	240	2.9 %
Line 3	13	242	240	5 %
Line 4	6	154	145	3.8 %
Line 5	3	144	145	2 %
Line 6	2	160	145	1.2 %

Formulas used to calculate “tag” time:

$$(8 \text{ hours} \times (60 \text{ min} - 5 \text{ min breaks} - 5 \text{ min defects})) - (30 \text{ minutes lunch} - 15 \text{ min AM} - 15 \text{ min PM}) = \text{minutes available}$$

$$\text{“tag” time (seconds per function)} = (\text{minutes available} \times 60 \text{ seconds}) \div \text{number of units to be completed}$$

$$400 \text{ minutes} - 60 \text{ minutes} = 340 \text{ minutes}$$

$$340 \text{ minutes} \times 60 \text{ seconds} \div 520 \text{ units} = 39.23 \text{ seconds per function}$$

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