Answer on Question #79539 – Math – Statistics and Probability

Question

A company producing steel nails receives an order for 5000 nails of length 5.0 cm. Due to external factors such as temperature and pressure, the lengths of the nails produced by the machine is normally distributed with a standard deviation of 1.6 mm. Acceptable lengths must have a tolerance of 2.0 mm.

1. If the machine is set to produce nails with a mean length of 5.0 cm, determine the percentage of nails that are acceptable.

2. Nails produced that are shorter than the minimum acceptable length have to be scrapped. If the cost to produce 1 nail is 45 cents, how much does the company lose due to scrapping?

3. If no more than 2% of nails are to be scrapped, what should the new mean be set at? Assume the standard deviation remains unchanged.

Solution

1. $P(5.0 - 0.2 < X < 5.0 + 0.2) = P\left(\frac{4.8 - 5.0}{0.16} < Z < \frac{5.2 - 5.0}{0.16}\right) =$

$= P(-1.25 < Z < 1.25) = P(Z < 1.25) - P(Z < -1.25) =$

$= 0.8944 - 0.1056 = 0.7888.$

2. $P(X < 4.8) = P(Z < -1.25) = 0.1056.$

$S = 5000 * 0.1056 * 45 = 23760 = \$237.60.$

3. $P(Z < z) = 0.02 \rightarrow z = -2.05 \rightarrow \frac{4.8 - \mu}{0.16} = -2.05 \rightarrow$

$\rightarrow \mu = 4.8 + 0.16 * 2.05 = 5.128 \; cm.$

Answer: 1. 0.7888; **2.** \$237.6; **3.** 5.128.