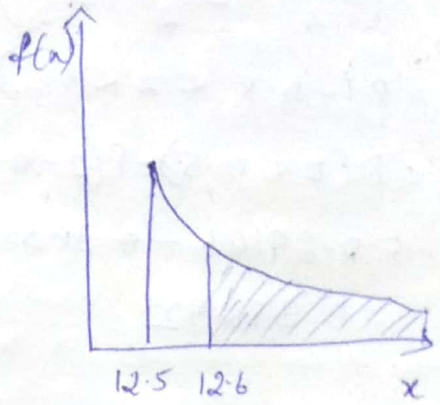
1) Let the continuous random variable D denote the diameter of the hole drilled in an alum sheet. The target dia achieved is 12.5mm $f(d) = 20e^{-20(d-12.5)}$, $d \geq 12.5$. If a part with dia > 12.6mm is scrapped. what is the proportion of those parts? what is CDF when dia is 11mm. what is conclusion

Soln

$$P(X > 12.60) = \int_{12.6}^{\infty} 20e^{-20(x-12.5)}\,dx$$

$$= 0.1353 \simeq 13.53\%$$



CDF

$$F(x) = P(X \leq x) = \int_{-\infty}^{x} f(u)\,du$$

for $-\infty < x < \infty$

$F(x) = 0 \quad x < 0 \Rightarrow$ for $x < 12.5$

$F(x) = 0.05x \quad 0 \leq x \leq 20$

$F(x) = 1 \quad 20 < x$

$$F(x) = \int_{12.5}^{x} 20e^{-20(u-12.5)}\,du$$

$$= 1 - e^{-20(x-12.5)} \text{ for } x \geq 12.5$$

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2) Please compute the following

a) $P(Z > 1.26)$, $P(Z < -0.86)$, $P(Z > -1.37)$, $P(-1.25 < Z < 0.37)$

$= 0.1038$ $= 0.195$ $= 0.915$ $= 0.5387$

$P(Z \leq -4.6) = 0$

b) Find the value z such that $P(Z > z) = 0.05$

$= -1.65$

c) Find the value of z such that $P(-z < Z < z) = 0.99$

$= 2.58$

3) Current flow in a copper wire follow a normal dist $\mu = 10$ mA and variance of 4 $(mA)^2$. What is the prob that current exceed 13 mA? What is the prob that current is blw 9 and 11 mA? Determine the current which has a prob 0.98.

Soln $P(9 < X < 11)$

$= P\left[\frac{9-10}{2}, \frac{X-10}{2}, \frac{11-10}{2}\right]$

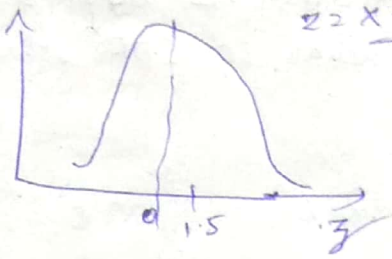
$= P(-0.5 < z < 0.5)$

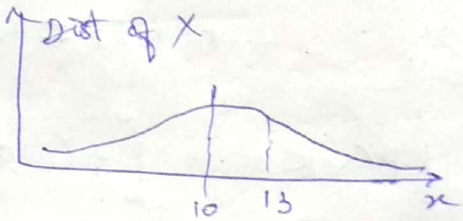
$= P(z < 0.5) - P(z < -0.5)$

$= 0.69146 - 0.30854$

$= 0.38292$

$z = \frac{x-\mu}{\sigma}$





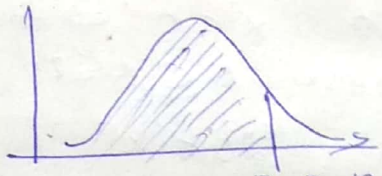
$P(X < x) = P\left[\frac{X-10}{2} < \frac{x-10}{2}\right]$

$= P\left[z < \frac{x-10}{2}\right] = 0.98$

$z = 2.05$

$z = 2(2.05) + 10$

$z = 14.1$ mA



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4) The shaft in a piston mean = 0.02508, σ = 0.0005 inch. Specification are 0.2500 ± 0.0015. Mean is equal to target is 0.2500. what proportion of shafts confirm the new specs?

Soln. $P(0.2485 < X < 0.2515)$

$= P\left[\frac{0.2485 - 0.2508}{0.0005} < z < \frac{0.2515 - 0.2508}{0.0005}\right]$

$= P(-4.6 < z < 1.4)$

$= P(z < 1.4) - P(z < -4.6)$

$= 0.91924 - 0.0000$

$= 0.91924$

5) The shaft in a piston mean = 0.02508, σ = 0.0005 inch. Specifications are 0.2500 ± 0.0015 Mean is equal to target is 0.2500. What is the propotion of shafts confirm the new specs ?.

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Soln $P(0.2485 < X < 0.2515)$

$$= P\left[\frac{0.2485 - 0.2508}{0.0005} < Z < \frac{0.2515 - 0.2508}{0.0005}\right]$$

$$= P[-4.6 < Z < 1.4)$$

$$= P(Z < 1.4) - P(Z < -4.6)$$

$$= 0.91924 - 0.0000.$$

$$= 0.91924 = 91.9\%$$

$$P(0.2485 < X < 0.2515)$$

$$= P\left[\frac{0.2485 - 0.2500}{0.0005} < Z < \frac{0.2515 - 0.2500}{0.0005}\right]$$

$$= P(-3 < Z < 3)$$

$$= P(Z < 3) - P(Z < -3)$$

$$= 0.99865 - 0.00135$$

$$= 0.99730 \simeq 99.7\%$$

The yield increased 7.8%