Quiz 3
Probability CH 10, 12
Normal Distributions CH 3

1. Spelling mistakes in a text are either "nonword errors" or "word errors." A nonword error produces a string of letters that is not a word, such as "the" typed as "teh." Word errors produce the wrong word, such as "loose" typed as "lose." Nonword errors make up 25% of all errors. A human proofreader will catch 80% of nonword errors and 50% of word errors.

| | Word Error | Nonword Error | Total |
|---|---|---|---|
| **Proofreader will Catch** | 0.375 v. | 0.20 iii. | 0.575 viii. |
| **Proofreader will NOT catch** | 0.375 vi. | 0.05 iv. | 0.425 vii. |
| **Total** | 0.75 ii. | 0.25 i. | 1 |

a) Compute the following and use your answers to complete the above table (two cells are given but the related questions may still appear below):

10 pts

i. What proportion of errors, caught or not caught, are nonword errors? 0.25 as given in problem.

ii. What proportion of errors, caught or not caught, are word errors? $1-0.25=0.75$

iii. What proportion of nonword errors will the proofreader catch? $0.8\cdot 0.25=0.20$

iv. What proportion of nonword errors will the proofreader NOT catch? $0.25-0.20=0.05$

v. What proportion of word errors will the proofreader catch? $0.5\cdot 0.75=0.375$

vi. What proportion of word errors will the proofreader NOT catch? $0.75-0.375=0.375$

vii. What proportion of errors, word or nonword, will the proofreader NOT catch? $0.375+0.05=0.425$

viii. What proportion of errors, word or nonword, will the proofreader catch? $1-0.425=0.575$

1pt b) If you select an error at random, that the proofreader caught, what is the probability that the selected error is a word error?

$P(\text{word error} \mid \text{proofreader caught}) = \dfrac{P(\text{word error and caught})}{P(\text{caught})} = \dfrac{0.375}{0.575} = 0.65$

1pt c) If you select a nonword error at random, what is the probability that the proofreader caught the error?

$P(\text{caught} \mid \text{nonword}) = \dfrac{P(\text{nonword and caught})}{P(\text{nonword})}$

$= \dfrac{0.20}{0.25} = 0.80$

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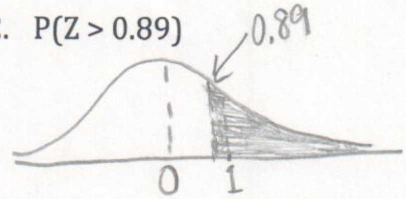
Draw a picture, label and shade it, and find the specified value.

2. P(Z > 0.89)

1pt

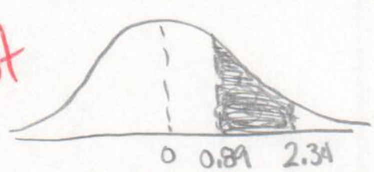



$P(Z < 0.89) = 0.8133$

$P(Z > 0.89) = 1 - 0.8133 = \boxed{0.1867}$

3. P(0.89 < Z < 2.34)

1pt

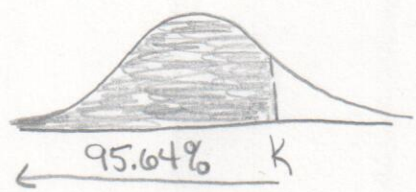



$P(Z < 2.34) = 0.9904$ $\quad P(Z < 0.89) = 0.8133$

$P(0.89 < Z < 2.34) = 0.9904 - 0.8133 = \boxed{0.1771}$

4. P(Z < k) = 0.9564

$\boxed{k = 1.71}$

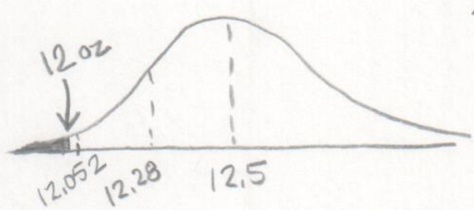



5. **Package Weights.** Suppose that the wrapper of a monster-size chocolate chip cookie lists its weight as 12 ounces. The actual weights of individual cookies naturally vary to some extent, however. Suppose that these actual weights vary according to a normal distribution with mean μ = 12.5 ounces and standard deviation σ = 0.224 ounces

a) What proportion of the cookies weigh less than the advertised 12 ounces?

1pt

$Z = \dfrac{12 - 12.5}{0.224} = -2.23$



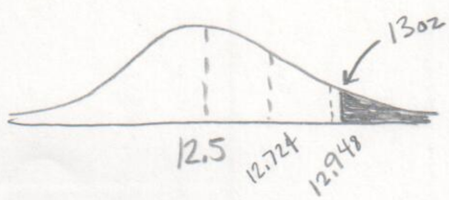

$P(Z < -2.23) = 0.0129$

$P(X < 12) = \boxed{0.0129}$

b) What proportion of the cookies weigh more than 13 ounces?

1pt

$Z = \dfrac{13 - 12.5}{0.224} = 2.23$




$P(Z > 2.23) = 1 - 0.9871 = \boxed{0.0129}$

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c) What is the weight such that only 1 cookie in 800 weighs less than that amount?

proportion $= \frac{1}{800} = 0.00125$ $z = -3.025$, -3.0 to -3.02 is ok

1pt $-3.025 = \frac{x - 12.5}{0.224}$ $(-3.025)(0.224) + 12.5 = x = \boxed{11.8 \text{ oz}}$

d) If the manufacturer wants to adjust the production process so that only 1 cookie in 800 weighs less than the advertised weight, what should the mean of the actual weights be (assuming that the standard deviation of the weights remains 0.224 ounces)?

$\mu = ?$

$\sigma = 0.224$

$X = 12$

$Z = -3.025$

$-3.025 = \frac{12 - \mu}{0.224}$

1pt

$\mu = 12 + (3.025)(0.224)$

$\boxed{\mu = 12.68 \text{ oz}}$

e) If the manufacturer wants to adjust the production process so that the mean remains at 12.5 ounces but only 1 cookie in 800 weighs less than the advertised weight, how small does the standard deviation of the weights need to be?

$\sigma = ?$

$\mu = 12.5$

$X = 12$

$Z = -3.025$

1pt

$-3.025 = \frac{12 - 12.5}{\sigma}$

$\frac{-3.025\sigma}{-3.025} = \frac{12 - 12.5}{-3.025}$

$\sigma = \frac{-.5}{-3.025} = \boxed{0.1653 \text{ oz}}$