**MA 207 Empirical Rule and *z*-Scores** **Name:**_____ **Date:** _____ **Class time:** _____

1. According to one study, the distribution of HDL (good) cholesterol levels for men is approximately bell-shaped with a mean of 46 mg/dL and a standard deviation of 14 mg/dL.

   For each part below, sketch a separate bell-shaped curve (be sure to put a scale on the horizontal axis) and shade an appropriate region, then give a numerical answer to the question.

   a. What is the z-score for a HDL level of $x = 32$ mg/dL? What is the z-score for a HDL level of $x = 60$ mg/dL? What percent of subjects have HDL levels between 32 and 60?

   For 32 $z = \frac{32-46}{14} = -1$

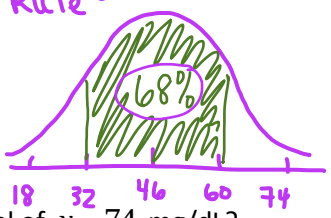
   For 60 $z = \frac{60-46}{14} = 1$

   Using Table A

   .8413
   −.1587
   .6826

   OR Using the empirical Rule

   68%

   b. What is the z-score for a HDL level of $x = 18$ mg/dL? What is the z-score for a HDL level of $x = 74$ mg/dL? What percent of subjects have HDL levels between 18 and 74?

   For 18 $z = \frac{18-46}{14} = -2$

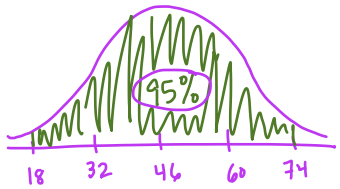
   For 74 $z = \frac{74-46}{14} = 2$

   Table A

   .9772
   −.0228
   .9544

   OR empirical rule

   95%

   c. What is the HDL levels would be considered outliers?

   $\bar{x} - 3s$ $46 - 3(14) = 4$

   $\bar{x} + 3s$ $46 + 3(14) = 88$

   A cholesterol level below 4 mg/dL or above 88 mg/dL.

   For each part below, making a sketch is optional, but you should know how to do it. What percent of subjects have HDL levels that are…

   There are many ways to find the answers.

   d. below 46? (Equivalently, in what percentile is a subject with an HDL of 46?)

   $z = 0$ 50%

   e. between 46 and 60?

   half of a. $\frac{68}{2}$ 34%

   f. below 60?

   d. + e. 84%

   g. above 60?

   100% − f. 16%

   h. below 32 or above 60? (~~combined areas~~)

   100% − a. 32%

   Using Table A

   .5000
   .8413 − .5000 = .3413

   .8413

   1 − .8413 = .1587

   OR

   .1587 + .1587 = .3174

i. below 32?

h. ÷ 2 → 16%

j. above 32?

100% − i. → 84%

* k. equal to 32?

0% The area under the curve at exactly 32 is the area of a rectangle with width 0.

l. between 18 and 46?

half of b. → 47.5%

m. above 46?

100% − d. → 50%

n. above 18?

l. + m. → 97.5%

o. below 18 or above 74?

100% − b. → 5%

p. above 74?

half of o. → 2.5%

q. below 4 or above 88?

$z = \frac{88-46}{14} = 3$ double b/c symmetric → 0.26%

r. below 4?

$z = -3$ → .0013

s. below 74?

100% − p. → 97.5%

t. between 32 and 74?

s. − i. → 81.5%

u. What is the *z*-score for a man with an HDL level of 67?

$z = \frac{67-46}{14} =$ 1.5

v. What is the HDL level of a man with a *z*-score of −1.5? Include units in your answer.

$-1.5 = \frac{x-46}{14}$ (multiply both sides by 14, then add 46 to both sides)

$x =$ 25 mg/dL

w. In what percentile is a man with HDL level of 18?

$z = \frac{18-46}{14} = -2$ Table A: .0228 → 2nd percentile or 3rd

x. What is the HDL level of a man in the 70th percentile? Include units in your answer.

Find .7000 in Table A

| z | .02 |
|---|---|
| 0.5 | ← .6985 |

$z = 0.52$

$0.52 = \frac{x-46}{14}$

$x =$ 53.28 mg/dL