9.04 Normal Distribution - The Empirical Rule   Date _____
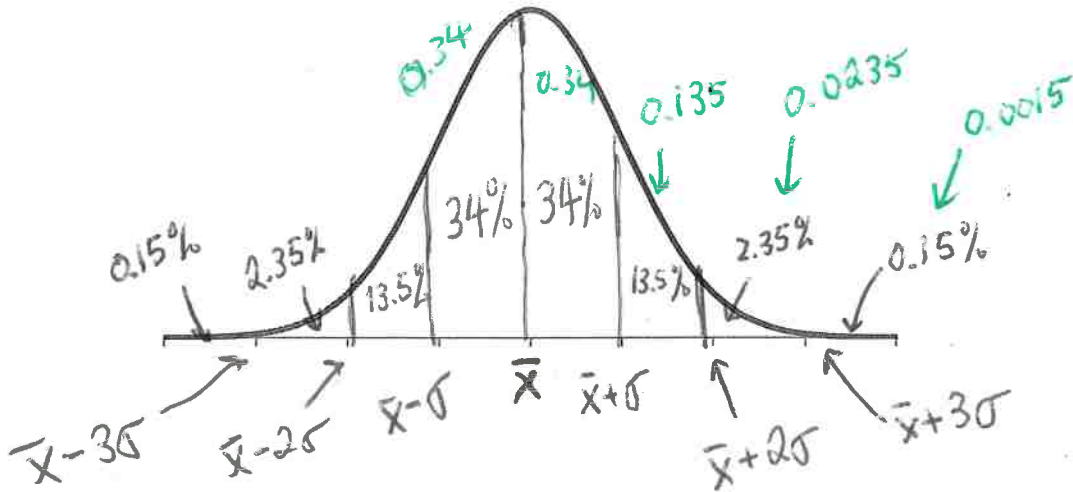
Normal Distribution is modeled by a normal (bell) curve and is symmetric about the mean.

- It is formed using the mean and standard deviation.
- The total area under the curve is _100%_ because it represents all of the probability = _100_ %
- Empirical Rule (68–95–99.7 Rule): the percent (probability) of the area under the curve for each standard deviation is shown on the graph below.
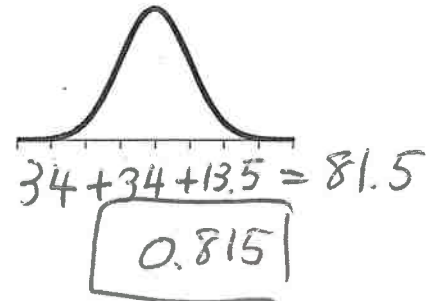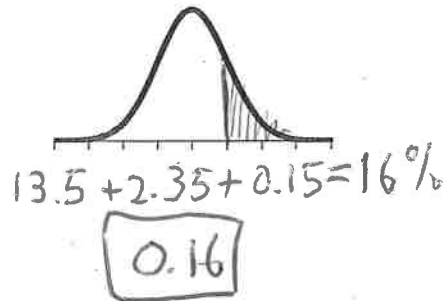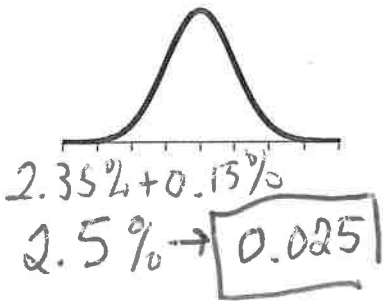

The normal distribution curve is used to find probability. It must be a normal distribution in order to use the above percentages (probabilities).

Example 1: For a normal curve, find the following probabilities of a randomly selected x-value from the distribution. If may be helpful to use a sketch.
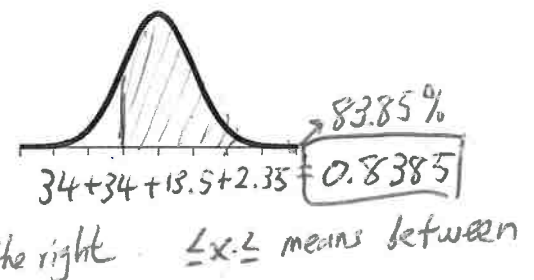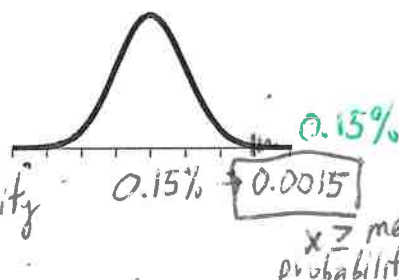
a. $P(x \le \bar{x} - 2\sigma)$

$2.35\% + 0.15\%$

$2.5\% \to \boxed{0.025}$

b. $P(x \ge \bar{x} + \sigma)$

$13.5 + 2.35 + 0.15 = 16\%$

$\boxed{0.16}$

c. $P(\bar{x} - 2\sigma \le x \le \bar{x} + \sigma)$

$34 + 34 + 13.5 = 81.5$

$\boxed{0.815}$

d. $P(x \ge \bar{x})$

50% $\boxed{0.5}$ $x \le$ means probability to the left

e. $P(x \ge \bar{x} + 3\sigma)$

0.15%

$0.15\% \to \boxed{0.0015}$

$x \ge$ means probability to the right

f. $P(\bar{x} - \sigma \le x \le \bar{x} + 3\sigma)$

83.85%

$34 + 34 + 13.5 + 2.35 = \boxed{0.8385}$

$\le x \le$ means between
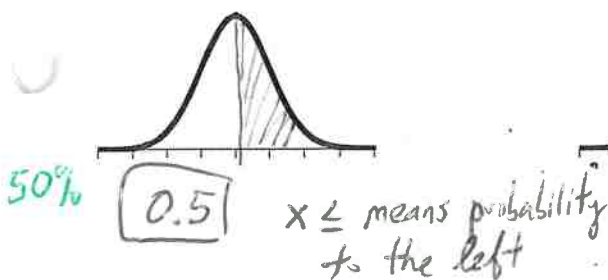
9.04 Homework – Normal Distribution & the Empirical Rule

1. Find the indicated probability for a randomly selected x-value from the distribution.
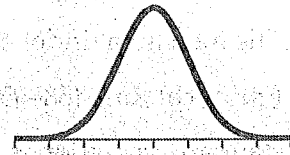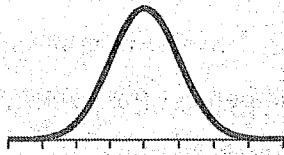   a. $P(x \leq \bar{x} + \sigma)$ b. $P(x \geq \bar{x} - 2\sigma)$ c. $P(\bar{x} - \sigma \leq x \leq \bar{x} + \sigma)$
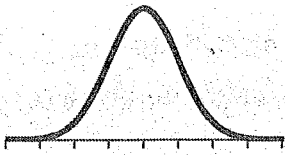
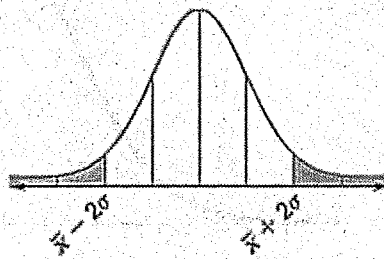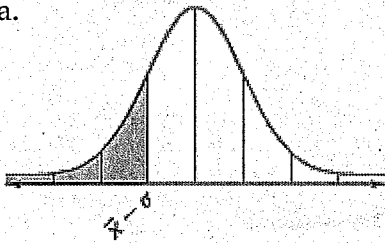2. Give the percent of the area under the normal curve represented by the shaded region.
   a.

   b.

3. A normal distribution has a mean of 25 and a standard deviation of 5. Find the probability that a randomly selected x-value from the distribution is in the given interval. Label the x-axis and the probabilities under the curve below.

   0.0015   0.0235   0.135   0.34   0.34   0.135   0.0235   0.0015

   10   15   20   25   30   35   40
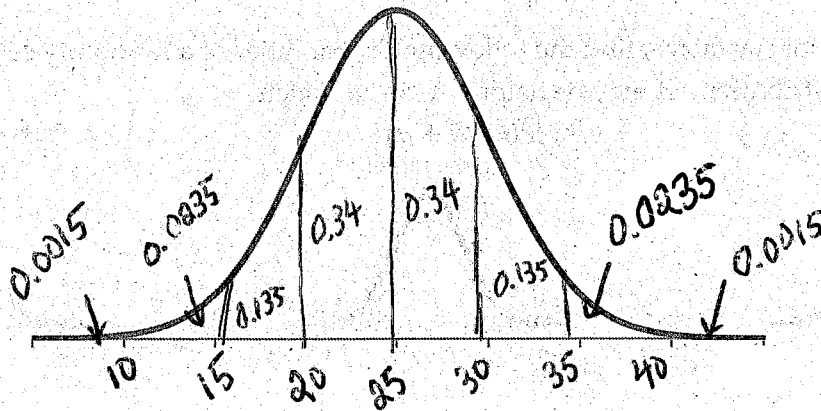
   a. Between 20 and 30

   0.68

   b. Between 10 and 25

   $0.0235 + 0.135 + 0.34 = 0.4985$

   c. Between 15 and 35

   $0.135 + 0.34 + 0.34 + 0.135$
   $= 0.95$

   d. At least 20 (20 or more)

   $0.50 + 0.34 = 0.84$

   e. At least 35 (35 or more)

   $0.0235 + 0.0015 = 0.025$

   f. At most 30 (30 or less)

   $0.50 + 0.34 = 0.84$