

Key

Name: _____ Date: _____ Class: _____

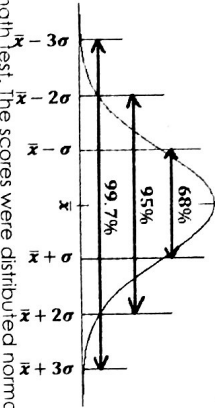
The Empirical Rule: Word problems

Definition: A probability distribution modeled by a bell-shaped curve (also called a normal curve) that is symmetric about the mean.

$$\sigma = \text{standard deviation of the data set}$$

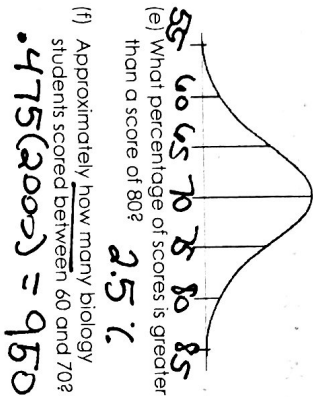
$$\mu = \text{mean of the data set}$$

- Properties of the Bell Curve
- 68% of the data lies within 1 standard deviation of the mean
 - 95% of the data lies within 2 standard deviations of the mean
 - 99.7% of the data lies within 3 standard deviations of the mean



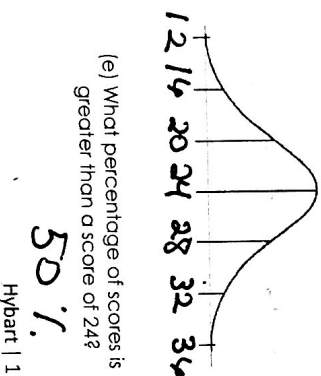
Example: At State University, 2000 freshmen took a math test. The scores were distributed normally with a mean of 70 and a standard deviation of 5. Label the mean and three standard deviations from the mean.

- (a) What percentage of scores are between scores 65 and 75? **68%**
- (b) What percentage of scores are between scores 60 and 70? **47.5%**
- (c) What percentage of scores are between scores 60 and 85? **97.35%**
- (d) What percentage of scores is less than a score of 55? **.15%**



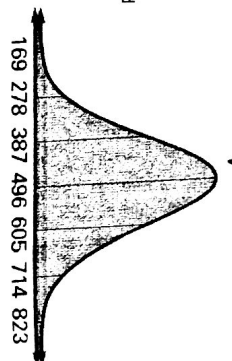
You try...
1. At Central High School, 500 juniors took the ACT last year. The scores were distributed normally with a mean of 24 and a standard deviation of 4. Label the mean and three standard deviations from the mean.

- (a) What percentage of scores are between scores 20 and 28? **68%**
- (b) What percentage of scores are between scores 16 and 32? **95%**
- (c) What percentage of scores are between scores 16 and 28? **81.5%**
- (d) What percentage of scores is less than a score of 12? **.15%**

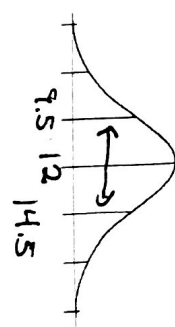


- (f) Approximately how many juniors scored between 24 and 28? **34(500) = 170 juniors**
2. The math scores for an exam for the state of Georgia are normally distributed with a mean of 496 and a standard deviation of 109.

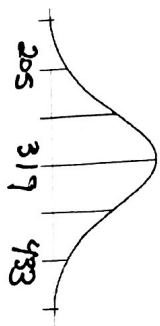
- (a) About what percent of the test-takers received scores between 387 and 605? **68%**
- (b) What percent of test-takers received scores between 496 and 714? **47.5%**



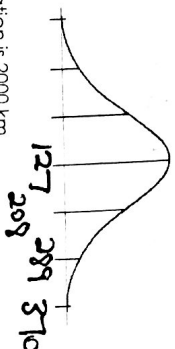
3. The data set below gives the distances, in miles, that the employees in a small office travel to work each day. Determine the range, in miles, in which 68% of the employees travel to work each day. **9.5 to 14.5 miles**
- Hint: Complete the bell curve to help answer this question. $\bar{x} = 12$ $\sigma = 2.5$
- 12, 15, 11, 8, 11, 13, 10, 16



4. A data set is bell-shaped with a mean of 319. If 95% of the data lies between 205 and 433, what is the standard deviation? **57**

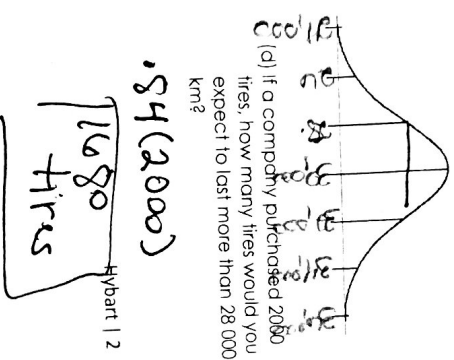


5. A data set is normally distributed with a mean of 127 and a standard deviation of 81. What percentage of data should lie between 127 and 370? **49.85%**



6. The mean life of a tire is 30,000 km. The standard deviation is 2000 km.

- (a) 68% of all tires will have a life between **28,000** km and **32,000** km.
- (b) 95% of all tires will have a life between **24,000** km and **34,000** km.
- (c) What percent of the tires will have a life that exceeds 26,000 km? **97.5%**



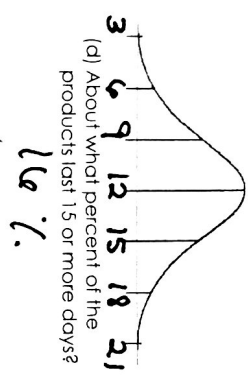
84(2000)
Hybart | 2

7. The shelf life of a particular dairy product is normally distributed with a mean of 12 days and a standard deviation of 3 days.

(a) About what percent of the products last between 9 and 15 days? **68%**

(b) About what percent of the products last between 12 and 15 days? **34%**

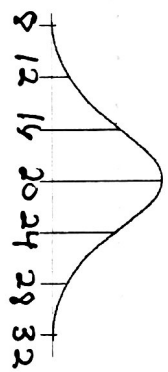
(c) About what percent of the products last 6 days or less? **2.5%**



8. A line up for tickets to a local concert had an average (mean) waiting time of 20 minutes with a standard deviation of 4 minutes.

(a) What percentage of the people in line waited for more than 28 minutes? **2.5%**

(b) If 2000 ticket buyers were in line, how many of them would expect to wait for less than 16 minutes? **16(2000) = 320 buyers**



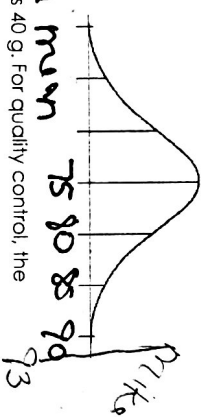
9. On a recent math test, the mean score was 75 and the standard deviation was 5. Mike made 93. Would his grade be considered an outlier if the marks were normally distributed? Explain.

yes - more than 3 standard deviations from mean

10. In an Oreo factory, the mean mass of a cookie is given as 40 g. For quality control, the standard deviation is 2 g.

(a) If 10,000 cookies were produced, how many cookies are within 2 g of the mean? **48(10,000) = 480,000 cookies**

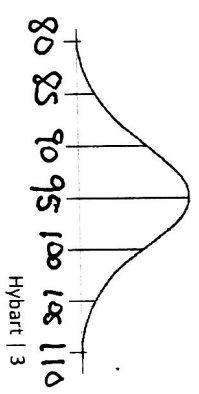
(b) Cookies are rejected if they weigh more than 44 g or less than 36 g. How many cookies would you expect to be rejected in a sample of 10,000 cookies? **34(10,000) = 340,000 cookies**



11. The speeds of cars on the highway have a mean of 95 km/h with a standard deviation of 5 km/h.

(a) What percentage of cars averaged less than 85 km/h? **2.5%**

(b) If a police car stopped cars that were going more than 105 km/h, how many cars would they stop if there were 8000 cars on the highway? **200 cars**

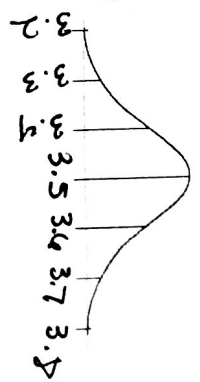


12. The Floppy Disk Company makes 3.5 inch floppy disks for disk drives that are 3.7 inches wide. The size of a manufactures disk is normally distributed with a standard deviation of 0.1 inches. The company manufactures 1000 disks every hour.

(a) What % of the disks would you expect to be greater than 3.5 inches? **50%**

(b) In one hour, how many disks would you expect to be between 3.4 inches and 3.7 inches? **815(1000) = 815,000 disks**

(c) About how many disks will be unable to fit in the disk drive (3.7 inch won't fit)? **825(1000) = 825,000 disks**



13. A bottle of fruit punch contains at least 473 ml. The machine that fills the bottles is set so that the mean volume is 477 ml. The volumes in the bottles are normally distributed.

(a) What percent of the bottles are underfilled if the standard deviation is 2 ml? **2.5%**

(b) What percent of the bottles are underfilled if the standard deviation is 4 ml? **10%**

14. A grading scale is set up for 1000 students' test scores. It is assumed that the scores are normally distributed with a mean score of 75 and a standard deviation of 15.

(a) How many students will have scores between 45 and 75? **475(1000) = 475,000 students**

(b) If 60 is the lowest passing score, how many students are expected to pass the test? **84(1000) = 84,000 students**

