

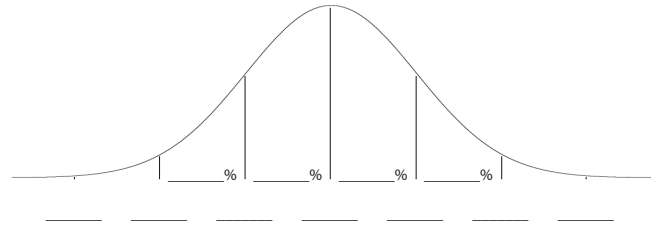
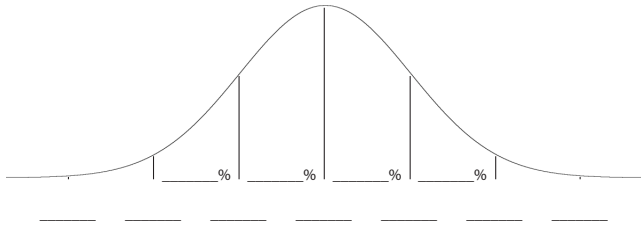
Name:

### 5-A Graphs of Normal Probability Distributions

1. In each curve, fill in the blanks for a normal distribution using the parameters provided.

a) IQ tests have a mean of  $\mu = 100$  with  $\sigma = 15$ .

b) In Alex's ant colony, the mean weight is  $\mu = 460$  mg with  $\sigma = 110$  mg.



2. Use the curves above to answer the following questions.

a) What percent of people have IQ's between 85 and 115?

b) What is the probability that a random person has an IQ between 85 and 115?

c) What is the probability that a random one of Alex's ants weighs more than 460 milligrams?

d) Approximately what percentage of Alex's ants weigh between 405 and 460 milligrams?

### 5-B Normal Probabilities

3. Convert the following raw scores into z scores using the parameters given in #1.

a) an IQ of 100

b) an IQ of 112

c) one of Alex's ants weighing 330 milligrams

4. Find the following areas under the normal curve.

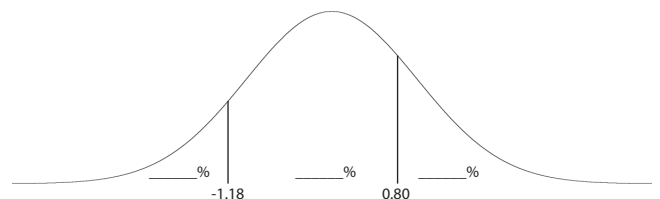
a)  $P(z < 0.00)$

b)  $P(z < 0.80)$

c)  $P(z < -1.18)$

5. A normal curve is shown at right.

a) Use the answers to #4 to fill in the blanks.



b) Add the answers to (a) to find the total area under the normal curve.

6. Calculate the following probabilities.

a)  $P(z > 0.80)$

b)  $P(z > -1.18)$

c)  $P(-1.18 \leq z \leq 0.80)$

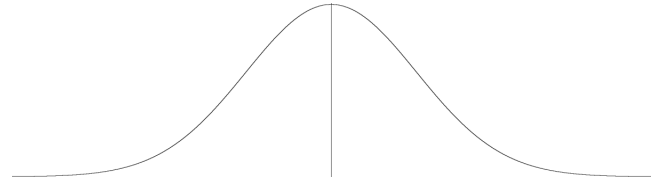
d)  $P(z > -2.09)$

e)  $P(1.25 < z < 2.40)$

f)  $P(-2.40 < z < -1.25)$

7. Given  $\mu = 100$  and  $\sigma = 15$ , do the following steps to calculate the probability that a random person will have an IQ between 105 and 126.

a) Use the z formula to calculate  $z_1$  for  $x_1 = 105$  and  $z_2$  for  $x_2 = 126$ .



b) Mark  $z_1$  and  $z_2$  on the curve.

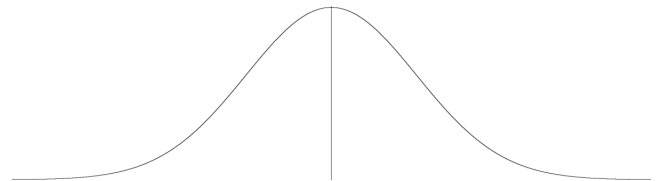
c) Use the normal table to find  $P(z < z_1)$  and  $P(z < z_2)$ .

d) Subtract to calculate  $P(z_1 < z < z_2)$ .

e) Shade the area under the curve between  $z_1$  and  $z_2$ . Make sure its size appears to be approximately the answer to (d).

f) Write an equation showing the value of  $P(105 < x < 126)$ .

8. Calculate the probability of a duck weighing between 2500 and 3000 grams, given  $\mu = 2810$  and  $\sigma = 128$ .



### 5-C Percentiles and the Normal Curve

9. Convert the following z scores into lengths, given  $\mu = 12.1$  cm and  $\sigma = 3.4$  cm.

a)  $z = 0$

b)  $z = 0.75$

c)  $z = -0.75$

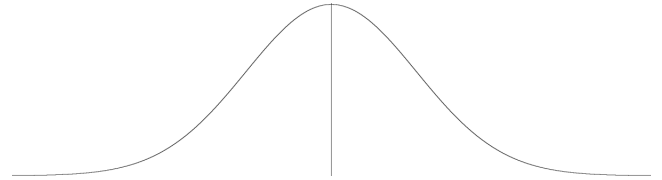
10. Find the z score needed to achieve each of the following.

a) Bottom 5%

b) Top 20%

c) 40<sup>th</sup> percentile

11. Calculate the SAT math score needed to be in the top 5%, given  $\mu = 500$  and  $\sigma = 100$ .



**5-D The Central Limit Theorem**

12. Use the formula  $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$  to calculate the standard error.

a)  $\sigma = 20, n = 4$

b)  $\sigma = 20, n = 100$

c)  $\sigma = 1.49, n = 40$

13. Use the formula  $z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$  to calculate the z score.

a)  $\mu = 50, \sigma = 20, n = 4, \bar{x} = 57$

b)  $\mu = 4.56, \sigma = 1.91, n = 30, \bar{x} = 4.31$

c) Ten people had an average IQ of 106.

14. For each scenario, circle which random sample is more likely to have the stated outcome.

a) IQ is between 105 and 126.

a single person

the average of three people

b) More than 75% of coins land on heads.

10 coins

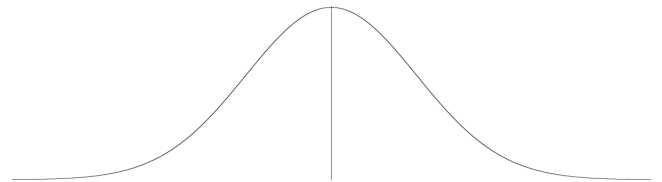
100 coins

c) Average throw distance is between 40 and 45 meters, given  $\mu = 41$ .

two throws

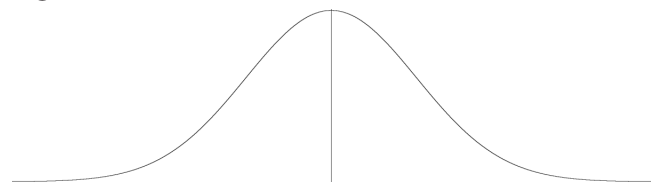
four throws

15. Given  $\mu = 100$  and  $\sigma = 15$ , calculate the probability that a group of three random people will have a mean IQ between 105 and 126.



16. Calculate the IQ score at the 95<sup>th</sup> percentile for the following.

a) individuals



b) averages of groups of nine people

