SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Fill in the blanks by standardizing the normally distributed variable.

1) Dave drives to work each morning at about the same time. His commute time is normally distributed with a mean of 42 minutes and a standard deviation of 4 minutes. The percentage of time that his commute time lies between 50 and 54 minutes is equal to the area under the standard normal curve between ___ and ___.

2) Dave drives to work each morning at about the same time. His commute time is normally distributed with a mean of 46 minutes and a standard deviation of 5 minutes. The percentage of time that his commute time exceeds 58 minutes is equal to the area under the standard normal curve that lies to the ___ of ___.

Provide an appropriate response.

3) Two random variables are normally distributed with the same mean. One has a standard deviation of 10 while the other has a standard deviation of 15. How will the graphs of the two variables differ and how will they be alike?

4) Which is larger, the area under the standard normal curve between -1 and 1, or the area under the standard normal curve between 0 and 2? Explain your reasoning.

5) Which of the variables below do you think will be roughly normally distributed?
   a. Weights of 10 year old boys
   b. Incomes of 40 year old adults
   c. The numbers that show up when you roll a balanced die
   d. The amount of coffee which a filling machine puts into "4 ounce jars"

Use a table of areas to find the specified area under the standard normal curve.

6) The area that lies between 0 and 3.01

7) The area that lies to the left of 1.13

8) The area that lies between -1.10 and -0.36

Use a table of areas for the standard normal curve to find the required z-score.

9) Find the z-score for having area 0.07 to its right under the standard normal curve, that is, find $z_{0.07}$.

10) Find the z-score for which the area under the standard normal curve to its left is 0.04
11) Determine the two z-scores that divide the area under the standard normal curve into a middle 0.874 area and two outside 0.063 areas.

**Provide an appropriate response.**

12) Suppose that you know the area under the standard normal curve to the right of -2. How could you use this to find the area under the standard normal curve to the left of 2? Explain your reasoning.

13) Suppose that you know the area under the standard normal curve between 1 and 3 and the area under the standard normal curve to the left of 3. Without further consulting a table of areas, how could you find the area under the standard normal curve to the left of 1? Explain your reasoning by using a sketch of the standard normal curve.

**Find the indicated probability or percentage for the normally distributed variable.**

14) The variable X is normally distributed. The mean is $\mu = 15.2$ and the standard deviation is $\sigma = 0.9$. Find $P(X > 16.1)$.

15) The diameters of bolts produced by a certain machine are normally distributed with a mean of 0.30 inches and a standard deviation of 0.01 inches. What percentage of bolts will have a diameter greater than 0.32 inches?

16) A bank’s loan officer rates applicants for credit. The ratings are normally distributed with a mean of 200 and a standard deviation of 50. If an applicant is randomly selected, find the probability of a rating that is between 200 and 275.

**Use the empirical rule to solve the problem.**

17) The systolic blood pressure of 18-year-old women is normally distributed with a mean of 120 mmHg and a standard deviation of 12 mmHg. What percentage of 18-year-old women have a systolic blood pressure that lies within 3 standard deviations to either side of the mean?

18) At one college, GPA's are normally distributed with a mean of 3.1 and a standard deviation of 0.4. What percentage of students at the college have a GPA between 2.7 and 3.5?

**Find the specified percentile, quartile, or decile.**

19) The annual precipitation for one city is normally distributed with a mean of 39.2 inches and a standard deviation of 2.6 inches. Find the 2nd decile.

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

20) A bank’s loan officer rates applicants for credit. The ratings are normally distributed with a mean of 200 and a standard deviation of 50. Find the 6th decile.

A) 207.8  B) 211.3  C) 212.5  D) 187.5
TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

Provide an appropriate response.

21) True or false, areas under the standard normal curve cannot be negative, whereas z-scores can be positive or negative?

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

22) Most problems involving normally distributed variables are one of two types.

Type A: Find a probability or percentage, e.g. find the probability that X lies in a specified range.

Type B: Find the observation corresponding to a given probability or percentage.

Suppose that scores on a test are normally distributed with a mean of 80 and a standard deviation of 8. Which of the following questions below are of type B?

a. Find the 80th percentile.
b. Find the cutoff for the A grade if the top 10% get an A.
c. Find the percentage scoring more than 90.
d. Find the score that separates the bottom 30% from the top 70%.
e. Find the probability that a randomly selected student will score more than 80.

You wish to approximate a binomial probability by an area under a normal curve. Use the continuity correction to determine which area under the appropriate normal curve will approximate the required probability.

23) The probability of more than 49 correct answers

24) The probability of fewer than 48 democrats

25) The probability of exactly 32 green marbles

For the binomial distribution with the given values for n and p, state whether or not it is suitable to use the normal distribution as an approximation.

26) n = 27 and p = 0.6

27) n = 19 and p = 0.8

Estimate the indicated probability by using the normal distribution as an approximation to the binomial distribution.

28) Estimate the probability of getting exactly 43 boys in 90 births.
29) A certain question on a test is answered correctly by 22% of the respondents. Estimate the probability that among the next 150 responses there will be at most 40 correct answers.

**Provide an appropriate response.**

30) Explain why a continuity correction factor is necessary when approximating the binomial distribution by the normal distribution. Refer to the terms "discrete" and "continuous", and draw a diagram to support your answer.

31) Fill in the blanks.

A fair coin is flipped 280 times. You wish to find the probability that the number of tails is greater than 160. This probability can be estimated by finding the area to the right of _____ under the normal curve with \( \mu = ____ \) and \( \sigma = ____ \).
1) Answer: 2, 3
2) Answer: right, 2.4
3) Answer: Both graphs will have the same shape (they will both be bell-shaped) and they will be centered at the same place (the common mean). The graph of the variable with the smaller standard deviation will be narrower and taller than the other graph.
4) Answer: Answers will vary. Possible answer: The area under the standard normal curve between −1 and 1 is larger. The area under the curve between 0 and 1 is common to both areas. The area under the curve between −1 and 0 is larger than the area under the curve between 1 and 2 because it is closer to the mean.
5) Answer: a and d
6) Answer: 0.4987
7) Answer: 0.8708
8) Answer: 0.2237
9) Answer: 1.48
10) Answer: −1.75
11) Answer: −1.53, 1.53
12) Answer: By symmetry, the area under the standard normal curve to the left of 2 is equal to the area under the standard normal curve to the right of −2.
13) Answer: The area under the standard normal curve to the left of 1 can be found by subtracting the area between 1 and 3 from the area to the left of 3.
14) Answer: 0.1587
15) Answer: 2.28%
16) Answer: 0.4332
17) Answer: 99.74%
18) Answer: 68.26%
19) Answer: 37.016 inches
20) Answer: C
21) Answer: TRUE
22) Answer: a, b, d
23) Answer: The area to the right of 49.5
24) Answer: The area to the left of 47.5
25) Answer: The area between 31.5 and 32.5
26) Answer: Normal approximation is suitable.
27) Answer: Normal approximation is not suitable.
28) Answer: 0.0764
29) Answer: 0.9306
30) Answer: A continuity correction factor is needed because a discrete distribution is being approximated with a continuous distribution. The binomial distribution is a discrete distribution with a probability histogram made up of bars. The probability that X takes any given whole-number value is the area of the bar above the number. In the case of X = 6, for example the probability that X = 6 is the area of the bar above 6, which runs from 5.5 to 6.5. So the area under the appropriate normal curve from 5.5 to 6.5 would approximate the area of the bar.
31) Answer: 160.5, 140, 8.37