MULTIPLE CHOICE QUESTIONS

If you have difficulty solving a multiple choice problem directly, you may be able to use another approach to eliminate incorrect answer choices and obtain the correct answer.

PROBLEM 1

The Nielsen ratings measure how many viewers watch different TV programs. There are 5000 Nielsen households, which are chosen randomly from U.S. households with televisions. Suppose the Nielsen ratings report that 9.2% of Neilson households watched a certain program. What interval is likely to contain the exact percent of all U.S. households with televisions that watched the program?

(A) 4.0% to 14.0%

(B) 7.8% to 10.6%

(C) 8.3% to 10.3%

(D) 9.2% to 9.6%

METHOD 1

SOLVE DIRECTLY Calculate the margin of error. Then use the margin of error and the percent given in the problem to find the interval.

STEP 1 **Calculate** the margin of error.

$$\text{Margin of error} = \pm\frac{1}{\sqrt{n}}$$

$$= \pm\frac{1}{\sqrt{5000}}$$

$$\approx \pm 0.014$$

$$= \pm 1.4\%$$

STEP 2 **Find** the lower bound for the interval.

Lower bound $= 9.2\% - 1.4\%$

$= 7.8\%$

STEP 3 **Find** the upper bound for the interval.

Upper bound $= 9.2\% + 1.4\%$

$= 10.6\%$

STEP 4 **Write** the interval.

The interval is 7.8% to 10.6%.

▸ The correct answer is B. (A) **(B)** (C) (D)

METHOD 2

ELIMINATE CHOICES Another method is to check the intervals given in the answer choices.

You know that 9.2% must fall exactly in the middle of the interval.

Choice A: $\frac{4.0 + 14.0}{2} = \frac{18.0}{2} = 9.0$, so 9.2% does not fall exactly in the middle of the interval. You can eliminate choice A. ✗

Choice B: $\frac{7.8 + 10.6}{2} = \frac{18.4}{2} = 9.2$, so 9.2% falls exactly in the middle of the interval.

Choice C: $\frac{8.3 + 10.3}{2} = \frac{18.6}{2} = 9.3$, so 9.2% does not fall exactly in the middle of the interval. You can eliminate choice C. ✗

Choice D: $\frac{9.2 + 9.6}{2} = \frac{18.8}{2} = 9.4$, so 9.2% does not fall exactly in the middle of the interval. You can eliminate choice D. ✗

▸ The correct answer is B. (A) **(B)** (C) (D)

At a local bank, the waiting times for an available teller are normally distributed with a mean of 10 minutes and a standard deviation of 2 minutes. What is the approximate probability that a randomly selected customer at the bank waits no more than 13 minutes for a teller?

(A) 60.7% **(B)** 82.0% **(C)** 93.3% **(D)** 98.5%

METHOD 1

SOLVE DIRECTLY Use a z-score and a standard normal table to find the desired probability.

STEP 1 **Find** the z-score for a waiting time of 13 minutes.

$$z = \frac{x - \bar{x}}{\sigma}$$

$$= \frac{13 - 10}{2}$$

$$= 1.5$$

STEP 2 **Use** the standard normal table to find $P(z \leq 1.5)$.

$$P(z \leq 1.5) = 0.9332 \approx 93.3\%$$

The probability of waiting no more than 13 minutes is about 93.3%.

▶ The correct answer is C. **(A) (B) (C) (D)**

METHOD 2

ELIMINATE CHOICES Use facts about normal distributions to eliminate incorrect answer choices.

For a randomly selected customer with a waiting time of x minutes, you know the following:

$$P(x \leq 12) = P(x \leq \bar{x} + \sigma)$$

$$= 50\% + 34\%$$

$$= 84\%$$

$$P(x \leq 14) = P(x \leq \bar{x} + 2\sigma)$$

$$= 50\% + 34\% + 13.5\%$$

$$= 97.5\%$$

It follows that $P(x \leq 13)$ is between 84% and 97.5%. Only the probability of 93.3% in answer choice C satisfies this condition.

▶ The correct answer is C. **(A) (B) (C) (D)**

PRACTICE

Explain why you can eliminate the highlighted answer choice.

1. A normal distribution has a mean of 4.06 and a standard deviation of 0.04. What is the probability that a randomly selected value from the distribution is between 4.06 and 4.14?

   (A) 0.01 **(B)** 0.475 **(C)** 0.68 **(D)** 0.99

2. If you add the same nonzero constant to each value in a data set, which statistic does not change?

   (A) Mean **(B)** Median **(C)** Mode **(D)** Range

3. Which type of function best models the data represented by the scatter plot at the right?

   (A) Linear **(B)** Quadratic

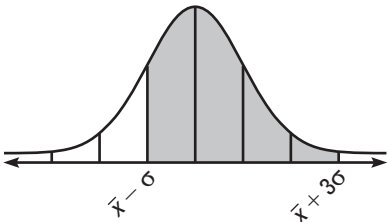   **(C)** Cubic **(D)** Exponential
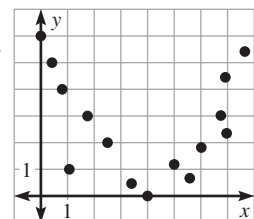
MULTIPLE CHOICE

1. Which binomial expansion includes the term $40x^2$?

  A $(x + 1)^5$ **B** $(x + 5)^5$

  C $(2x + 1)^5$ **D** $(2x + 5)^5$

2. What is the fourth term of the expansion of $(x - 2)^6$?

  A $60x^4$ **B** $-60x^4$

  C $-96x^3$ **D** $96x^3$

3. According to a survey from the National Center for Health Statistics, the heights of adult women in the United States are normally distributed with a mean of 64 inches and a standard deviation of 2.7 inches. What is the approximate probability that 4 randomly selected women are all between 58.6 inches and 66.7 inches tall?

  A 34%   **B** 44%

  C 68%   **D** 81.5%

4. What is the percent of the area under a normal curve that is represented by the shaded region?

  A 50%   **B** 81.5%

  C 83.85%   **D** 84%

5. Rachel scored an 88 on her physics test. The class average was 79.3, and the standard deviation was 7.5. What is the z-score for Rachel's test score?

  A 1.16   **B** 1.30

  C 1.45   **D** 1.60

6. You perform a binomial experiment consisting of 20 trials with a probability of success of 41%. What is the most likely number of successes?

  A 8   **B** 5

  C 4   **D** 16

7. In a nationwide poll of 1015 U.S. adults, Tom Hanks was voted America's favorite movie star. What is the approximate margin of error for the survey?

  A ±0.031%   **B** ±0.31%

  C ±3.1%   **D** ±31%

8. A normal distribution has a mean of 165 and a standard deviation of 6.7. What is the z-score of a data point measuring 192?

  A 53.28   **B** 10.43

  C 0.78   **D** 4.02

9. Complete the sentence: A(n) _____?_____ observes individuals and measures variables without controlling the individuals or their environment.

  A controlled experiment   **B** control group

  C observational study   **D** treatment group

10. A survey claims the percent of customers who favor brand X cereal over brand Y is likely between 78.01% and 45.99%. How many people were surveyed?

  A 62   **B** 10

  C 39   **D** 32

GRIDDED ANSWER

11. A normal distribution has a mean of 77 and a standard deviation of 4. What is the z-score corresponding to an x-value of 80?

12. What is the coefficient of x^3 in the expansion of $(4x - 1)^9$?

13. What is the value of the expression $_5C_3 - {_5C_2}$?

14. In a normal distribution, about what percent of the area under the related normal curve lies within 2 standard deviations of the mean?

15. What is the probability rounded to the nearest thousandth of tossing a coin 50 times and getting exactly 15 heads?

16. In a survey of adults who follow more than one sport, 30% listed football as their favorite sport. You survey 15 adults who follow more than one sport. What is the probability rounded to the nearest thousandth that fewer than 4 of them will say that football is their favorite sport?

SHORT RESPONSE

17. According to a certain poll, 51% of adults in the United States follow professional football. The margin of error is $\pm 2\%$. About how many people were surveyed? *Explain* whether you know for certain that football is followed by the majority of adults in the United States.

18. A student is conducting a survey about the Internet usage of high school students. He sends the survey by e-mail to each person in his address book, and uses only the surveys that are returned. What type of sample is this? Is the sample biased or unbiased? *Explain.*

EXTENDED RESPONSE

19. The results of a survey of the newsgathering habits of adults age 18–29 are displayed in the table.

a. How many people were surveyed?

b. Why might the conclusion, "Young adults generally don't get news from TV" be inaccurate to draw from this data?

c. Aleida decides to test the results of the poll. She decides to survey people at random from that age group. What is the probability, to the nearest tenth of a percent, that the Internet is the primary source of news for at least 3 out of the 6 people she will choose to survey?

What is your primary source of news?	
TV	32%
Internet	41%
Newspaper	12%
Radio	15%
(*margin of error* $\pm 4.47\%$)	

d. Aleida finds that 4 of 6 respondents (or 66.7%) to her poll said that the Internet was their primary source of news. She concludes that the poll was inaccurate. Why might she be wrong?

e. To the nearest tenth of a percent, what is the margin of error in Aleida's survey?