

# Mathematics

## Study Guide for ACCUPLACER® Placement Tests

ACCUPLACER®

CollegeBoard

- Rock Valley College uses ACCUPLACER®, an online placement test featuring a computer-based format, unlimited time and immediate scores
- ACCUPLACER® is a series of tests designed to provide information about students' academic skills in Reading, Writing, and Math QAS (Quantitative Reasoning, Algebra, and Statistics), Arithmetic or AAF (Advanced Algebra and Functions)
- Results of testing are used to determine appropriate placement into courses

This guide is also available online at: [RockValleyCollege.edu/PlacementTest](http://RockValleyCollege.edu/PlacementTest)

### To Prepare for the Placement Test:

- 1) Visit:** [RockValleyCollege.edu/PlacementTest](http://RockValleyCollege.edu/PlacementTest) for more information, study links, a copy of this study guide, free web-based interactive ACCUPLACER® study tool, and retest information.
- 2) Review** the sample questions and answers in this study guide.
- 3) Contact** the RVC Tutoring Center (815) 921-2370 to ask about the two free tutoring sessions available for any student looking for help preparing for ACCUPLACER®.

Three (3) math tests are available in the ACCUPLACER® system:

- 1) QAS (Quantitative Reasoning, Algebra, and Statistics)
- 2) Arithmetic
- 3) AAF (Advanced Algebra and Functions)

All students take the QAS test. Students scoring in the higher ranges on QAS may also be given the AAF test.

Students scoring in the lower ranges on QAS may also be given the Arithmetic test.

To prepare for the ACCUPLACER® math test(s) it would be helpful to refresh all math skills - basic math facts through the highest level of math you have learned.

**Rock Valley College**

TESTING CENTER

Rock Valley College Testing Center - Main Campus, Ground Floor, Student Center  
(815) 921-2380 • [RockValleyCollege.edu/PlacementTest](http://RockValleyCollege.edu/PlacementTest)

## ACCUPLACER® Quantitative Reasoning, Algebra, and Statistics (QAS) Sample Questions

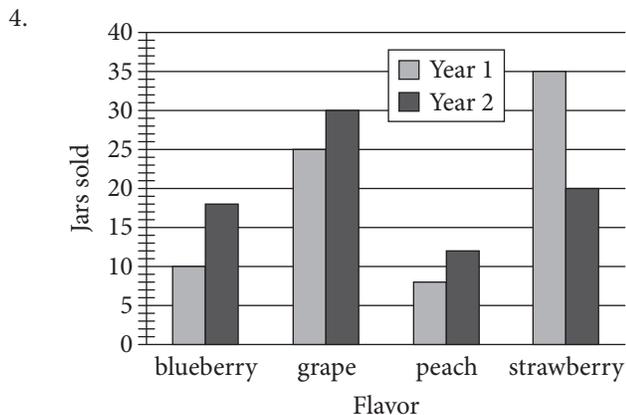
The Next-Generation Quantitative Reasoning, Algebra, and Statistics placement test is a computer adaptive assessment of test-takers' ability for selected mathematics content. Questions will focus on a range of topics including computing with rational numbers, applying ratios and proportional reasoning, creating linear expressions and equations, graphing and applying linear equations, understanding probability and set notation, and interpreting graphical displays. In addition, questions may assess a student's math ability via computational or fluency skills, conceptual understanding, or the capacity to apply mathematics presented in a context. All questions are multiple choice in format and appear discretely (stand alone) across the assessment. The following knowledge and skill categories are assessed:

- Rational numbers
- Ratio and proportional relationships
- Exponents
- Algebraic expressions
- Linear equations
- Linear applications
- Probability and sets
- Descriptive statistics
- Geometry concepts

**Sample Questions**

Choose the best answer. If necessary, use the paper you were given.

- Which of the following expressions is 5 times as much as the sum of  $r$  and  $s$ ?
  - $5 \times r + s$
  - $5 + r + s$
  - $r + s \times 5$
  - $(r + s) \times 5$
- What is the solution to the equation  $\frac{1}{2}x + \frac{3}{2}(x + 1) - \frac{1}{4} = 5$ ?
  - $\frac{5}{2}$
  - $\frac{13}{8}$
  - $\frac{15}{8}$
  - $\frac{17}{8}$
- What is the number of grams in 500 kilograms? (1 kilogram = 1,000 grams)
  - 0.5
  - 5,000
  - 50,000
  - 500,000



Robert sells four different flavors of jam at an annual farmers market. The graph above shows the number of jars of each type of jam he sold at the market during the first two years. Which flavor of jam had the greatest increase in number of jars sold from Year 1 to Year 2?

- Blueberry
- Grape
- Peach
- Strawberry

- In the  $xy$ -plane, a line crosses the  $y$ -axis at the point  $(0, 3)$  and passes through the point  $(4, 5)$ . Which of the following is an equation of the line?
  - $y = \frac{1}{2}x + 3$
  - $y = 2x + 3$
  - $y = \frac{1}{2}x - 4$
  - $y = 2x - 4$
- The amount of money  $M$ , in dollars, Paul earns can be represented by the equation  $M = 12.5h + 11$ , where  $h$  is the number of hours Paul works. Which of the following is the best interpretation of the number 11 in the equation?
  - The amount of money, in dollars, Paul earns each hour
  - The total amount of money, in dollars, Paul earns after working for  $h$  hours
  - The total amount of money, in dollars, Paul earns after working for one hour
  - The amount of money, in dollars, Paul earns in addition to an hourly wage

7.

Country	Approximate population (millions)
France	65.9
Germany	80.8
Italy	60.8
Spain	46.5
United Kingdom	64.3

The table gives the population of the 5 largest countries in the European Union in the year 2014. Which of the following is closest to the mean population of these countries?

- 80.8 million
- 64.3 million
- 63.7 million
- 60.8 million

8. Which of the following fractions is equivalent to  $\frac{-6 - (-9)}{8}$ ?

- A.  $-\frac{3}{8}$
- B.  $\frac{3}{8}$
- C.  $-\frac{15}{8}$
- D.  $\frac{15}{8}$

9. Water runs from a pump at a rate of 1.5 gallons per minute. At this rate, how long would it take to fill a tub with a 150-gallon capacity?

- A. 10 minutes
- B. 100 minutes
- C. 225 minutes
- D. 2,250 minutes

10. The volume of a right rectangular prism is found by multiplying the length of the base by the width of the base by the height of the prism. A right rectangular prism has a volume of 30 cubic inches. If the height of the prism is 6 inches, what is the area of the base of the prism?

- A. 5 square inches
- B. 24 square inches
- C. 36 square inches
- D. 180 square inches

11. Jacoby followed a recipe that requires 2 cups of water for every 3 cups of flour. If he used 8 cups of flour, how many cups of water did he use?

- A.  $2\frac{2}{3}$
- B. 4
- C.  $5\frac{1}{3}$
- D. 12

12.  $4(x + 5) + 4x + 8$

Which of the following is equivalent to the expression above?

- A.  $4(2x + 7)$
- B.  $8(x + 4)$
- C.  $5x + 17$
- D.  $8x + 13$

13. It took Khalid 90 minutes to complete 40 tasks. Which of the following is an equivalent rate?

- A. 10 tasks in 0.9 minutes
- B. 10 tasks in 2.25 minutes
- C. 10 tasks in 9 minutes
- D. 10 tasks in 22.5 minutes

14.

	Plans to vote "yes" on issue Q	Plans to vote "no" on issue Q	Total
Plans to vote "yes" on issue P	8	12	20
Plans to vote "no" on issue P	14	16	30
Total	22	28	50

The table above shows a survey of 50 registered voters in a city. Each voter was asked whether they planned to vote "yes" or "no" on two different issues. If a voter who plans to vote "yes" on issue P is randomly selected, what is the probability that voter also plans to vote "yes" on issue Q?

- A. 0.16
- B. 0.36
- C. 0.40
- D. 0.67

15. Which of the following values is equivalent to  $5^{-3}$ ?

- A.  $\frac{1}{15}$
- B.  $\frac{1}{125}$
- C. -15
- D. -125

16. Which of the following expressions is equivalent to  $(x^3 \cdot x^2)^5$ ?

- A.  $x^{10}$
- B.  $x^{15}$
- C.  $x^{25}$
- D.  $x^{30}$

17. The elevation at the summit of Mount Whitney is 4,418 meters above sea level. Climbers begin at a trailhead that has an elevation of 2,550 meters above sea level. What is the change in elevation, to the nearest foot, between the trailhead and the summit? (1 foot = 0.3048 meters)

- A. 569 feet
- B. 5,604 feet
- C. 6,129 feet
- D. 14,495 feet

18.  $3x - 2y = 15$   
 $x = 3$

The two lines given by the equations above intersect in the  $xy$ -plane. What is the value of the  $y$ -coordinate of the point of intersection?

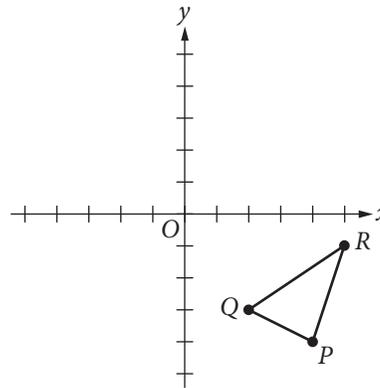
- A. -7
- B. -3
- C. 3
- D. 7

19.  $L = \{0, 20, 40, 80, 100\}$   
 $M = \{5, 10, 15, 20, 25\}$   
 $N = \{10, 20, 30, 40, 50\}$

Sets  $L$ ,  $M$ , and  $N$  are shown above. Which of the following sets represents  $L \cup (M \cap N)$  (the union of  $L$  with the intersection of sets  $M$  and  $N$ )?

- A.  $\{0, 5, 10, 15, 20, 25, 30, 40, 50, 80, 100\}$
- B.  $\{0, 10, 20, 40, 80, 100\}$
- C.  $\{20, 40\}$
- D.  $\{20\}$

20.



Triangle  $PQR$  lies in the  $xy$ -plane, and the coordinates of vertex  $Q$  are  $(2, -3)$ . Triangle  $PQR$  is rotated  $180^\circ$  clockwise about the origin and then reflected across the  $y$ -axis to produce triangle  $P'Q'R'$ , where vertex  $Q'$  corresponds to vertex  $Q$  of triangle  $PQR$ . What are the coordinates of  $Q'$ ?

- A.  $(-3, -2)$
- B.  $(3, -2)$
- C.  $(-2, 3)$
- D.  $(2, 3)$

## Rationales

- Choice D is correct.** The order of operations was used properly to write the expression. The sum of  $r$  and  $s$  in parentheses is found first, then multiplication is used to find the number that is 5 times the sum of  $r$  and  $s$ . Choice A is incorrect because this is the sum of  $s$  and 5 times as much as  $r$ . Choice B is incorrect because this is the sum of 5,  $r$ , and  $s$ . Choice C is incorrect because this is the sum of  $r$  and 5 times as much as  $s$ .
- Choice C is correct.** The equation  $\frac{1}{2}x + \frac{3}{2}(x+1) - \frac{1}{4} = 5$  can be rewritten as  $\frac{1}{2}x + \frac{3}{2}x + \frac{3}{2} - \frac{1}{4} = 5$ , which simplifies to  $2x = 5 + \frac{1}{4} - \frac{3}{2} = \frac{15}{4}$ .  
Therefore,  $x = \frac{15}{4} \div 2 = \frac{15}{8}$ . Choice A is incorrect because if  $x$  were equal to  $\frac{5}{2}$ , then  $\frac{1}{2}x + \frac{3}{2}(x+1) - \frac{1}{4}$  would equal  $\frac{1}{2}\left(\frac{5}{2}\right) + \frac{3}{2}\left(\frac{5}{2} + 1\right) - \frac{1}{4}$ , which is equal to  $\frac{25}{4}$ , not 5. Choice B is incorrect because if  $x$  were equal to  $\frac{13}{8}$ , then  $\frac{1}{2}x + \frac{3}{2}(x+1) - \frac{1}{4}$  would equal  $\frac{1}{2}\left(\frac{13}{8}\right) + \frac{3}{2}\left(\frac{13}{8} + 1\right) - \frac{1}{4}$ , which is equal to  $\frac{9}{2}$ , not 5. Choice D is incorrect because if  $x$  were equal to  $\frac{17}{8}$ , then  $\frac{1}{2}x + \frac{3}{2}(x+1) - \frac{1}{4}$  would equal  $\frac{1}{2}\left(\frac{17}{8}\right) + \frac{3}{2}\left(\frac{17}{8} + 1\right) - \frac{1}{4}$ , which is equal to  $\frac{11}{2}$ , not 5.
- Choice D is correct.** To convert from kilograms to grams, multiply  $500 \text{ kg} \times \frac{1,000 \text{ g}}{1 \text{ kg}}$ , which results in 500,000 grams. Choice A is incorrect because 0.5 is the number of kilograms in 500 grams. Choice B is incorrect because 5,000 grams is equal to 5 kilograms, not 500 kilograms. Choice C is incorrect because 50,000 grams is equal to 50 kilograms, not 500 kilograms.
- Choice A is correct.** The graph shows that he sold 10 jars of blueberry jam the first year and 18 the second year, for an increase of 8 jars. This is the largest increase of any of the flavors. Choice B is incorrect. This is the jam he sold the most of, but it is not the largest increase. Choice C is incorrect. He sold more peach jam the second year, but his sales increased by only 4, which is less than the increase for blueberry. Choice D is incorrect. He sold less strawberry jam the second year, not more.
- Choice A is correct.** An equation in the form  $y = ax + b$  has a slope of  $a$  and a  $y$ -intercept of  $b$ . The line described has a  $y$ -intercept of 3 because it crosses the  $y$ -axis at  $y = 3$  and has a slope of  $\frac{1}{2}$  because the value of  $y$  increases by 1 for every  $x$  increase of 2. Therefore, an equation of the line is  $y = \frac{1}{2}x + 3$ . Choice B is incorrect. The line described does not have a slope of 2. Choice C is incorrect. The line described does not have a  $y$ -intercept of  $-4$ . Choice D is incorrect. The line described does not have a slope of 2 or a  $y$ -intercept of  $-4$ .
- Choice D is correct.** Paul earns \$12.50 per hour, so the number of hours,  $h$ , is multiplied by 12.5. Paul earns \$11 in addition to how much he works per hour, which is why it is added to the product  $12.5h$  and is independent of how many hours Paul works. Choice A is incorrect because it is what 12.5 represents in the equation. Choice B is incorrect because it is what  $M$  stands for in the equation. Choice C is incorrect because substituting 1 into the equation gives  $12.5 + 11 = 23.5$ .

- 7. Choice C is correct.** To find the mean, find the total population of all 5 countries and divide by the total number of countries:  $65.9 + 80.8 + 60.8 + 46.5 + 64.3 = 318.3$  and  $318.3 \div 5 = 63.66$ , which rounds to 63.7. The values in the table are given in millions, so the mean population is about 63.7 million. Choice A is incorrect. It is the maximum of the values given. Choice B is incorrect. It is the median population. Choice D is incorrect. It is the middle value in the table.
- 8. Choice B is correct.** The fraction  $\frac{-6 - (-9)}{8} = \frac{-6 + 9}{8}$ , which is equivalent to  $\frac{3}{8}$ . Choices A, C, and D are incorrect because they use incorrect order of operations and/or do not take into account that subtracting  $-9$  is the same as adding 9.
- 9. Choice B is correct.** The time it would take to fill the tub can be found by dividing the number of gallons the tub can hold by the rate the water runs from the pump. This is represented by  $150 \text{ gallons} \div 1.5 \text{ gallons per minute} = 100$ . Choice A is incorrect and may be the result of dividing 150 by 15. Choice C is incorrect and may be the result of multiplying 150 by 1.5. Choice D is incorrect and may be the result of multiplying 150 by 15.
- 10. Choice A is correct.** Volume of a right rectangular prism is equal to the area of the base times the height. Since the height is known, divide the volume by height to find the area of the base. This is represented by  $30 \div 6 = 5$ . Choice B is incorrect because this is the result of subtracting 6 from 30 instead of dividing. Choice C is incorrect because this is the result of adding 6 to 30 instead of dividing. Choice D is incorrect because this is the result of multiplying 6 and 30 instead of dividing.
- 11. Choice C is correct.** The ratio of water to flour is  $\frac{2}{3}$ . Since there were 8 cups of flour used, the expression  $8 \times \frac{2}{3}$  can be used to determine the amount of water used, which is  $5\frac{1}{3}$ . Choice A is incorrect because this is the number of 3-cup "units" of flour that Jacoby used:  $8 \div 3 = 2\frac{2}{3}$ . Choice B is incorrect because this would be the amount of water necessary if 6 cups of flour were used, not 8. Choice D is incorrect because this results from using a ratio of 2 cups of flour to 3 cups of water.
- 12. Choice A is correct.** The expression  $4(x + 5) + 4x + 8$  can be expanded to  $4x + 20 + 4x + 8$ , which is equivalent to  $8x + 28$ . Since 4 can be factored from each term in this expression, it can be rewritten as  $4(2x + 7)$ . Choice B is incorrect because it expands to  $8x + 32$ , which is not equivalent to  $4(x + 5) + 4x + 8$ . Choice C is incorrect because it is equivalent to  $4 + (x + 5) + 4x + 8$  rather than  $4(x + 5) + 4x + 8$ . Choice D is incorrect because the 4 was not distributed through the expression in parentheses properly.
- 13. Choice D is correct.** Ninety minutes to complete 40 tasks is an average rate of 2.25 minutes per task ( $90 \text{ minutes} \div 40 \text{ tasks}$ ). Multiplying this rate by 10 gives the average number of tasks Khalid completed every 10 minutes ( $2.25 \times 10 = 22.5$ ). Choice A is incorrect and is most likely the result of incorrectly dividing 10 by 90. Choice B is incorrect because it is the average number of minutes it took Khalid to complete one task. Choice C is incorrect because it is equivalent to  $90 \div 10$ .
- 14. Choice C is correct.** There are 8 voters who plan to vote "yes" on both issues. There are 20 voters who plan to vote "yes" on issue P. This is represented by  $8 \div 20 = 0.4$ . Choice A is incorrect. This is the probability that a voter plans to vote "yes" on both issues. Choice B is incorrect. This is the probability that a voter plans to vote "yes" on P, given that he or she plans to vote "yes" on Q. Choice D is incorrect. This is the number of voters who plan to vote "yes" on both issues divided by the number of voters who plan to vote "yes" on P and "no" on Q.

- 15. Choice B is correct.** The expression  $5^{-3}$  can be rewritten as  $\frac{1}{5^3}$ , which is equal to  $\frac{1}{5 \times 5 \times 5} = \frac{1}{125}$ . Choices A, C, and D are incorrect because they are not equivalent to  $5^{-3}$ . Choice A is the value of  $\frac{1}{5 \times 3}$ , choice C is the value of  $5 \times (-3)$ , and choice D is the value of  $(-5)^3$ .
- 16. Choice C is correct.** Using the rules of exponents,  $(x^3 \cdot x^2)^5$  can be rewritten as  $(x^{(3+2)})^5 = (x^5)^5 = x^{5 \times 5} = x^{25}$ . Choices A, B, and D are incorrect and may be the result of not following the proper rules of exponents.
- 17. Choice C is correct.** The difference between the elevations is  $4,418 - 2,550 = 1,868$  meters. Since each meter is 0.3048 of a foot, divide the change of elevation in meters by the conversion factor to find the number of feet ( $1,868 \div 0.3048 \approx 6,129$ ). Choice A is incorrect. This is the result of multiplying by the conversion factor instead of dividing. Choice B is incorrect. This is the result of multiplying 1,868 by 3 (perhaps figuring that there are 3 feet in a yard and a meter is similar to a yard). Choice D is incorrect. This is the elevation of the summit in feet.
- 18. Choice B is correct.** Substituting 3 for  $x$  in the first equation gives  $3(3) - 2y = 15$ . This simplifies to  $9 - 2y = 15$ . Subtracting 9 from both sides of  $9 - 2y = 15$  gives  $-2y = 6$ . Finally, dividing both sides of  $-2y = 6$  by  $-2$  gives  $y = -3$ . Choice A is incorrect because  $3(3) - 2(-7)$  does not equal 15. Choice C is incorrect because  $3(3) - 2(3)$  does not equal 15. Choice D is incorrect because  $3(3) - 2(7)$  does not equal 15.
- 19. Choice B is correct.** The intersection of sets  $M$  and  $N$  is all the numbers that appear in both of the sets, so  $M \cap N = \{10, 20\}$ . The union of this and  $L$  is all the numbers that are in this set or in set  $L$ , therefore  $L \cup (M \cap N) = \{0, 10, 20, 40, 80, 100\}$ . Choice A is incorrect. This is the union of all three sets given. Choice C is incorrect. This is  $L \cap (M \cup N)$ . Choice D is incorrect. This is the intersection of all three sets.
- 20. Choice D is correct.** When triangle  $PQR$  is rotated  $180^\circ$  clockwise about the origin  $(0, 0)$ , point  $Q$  is translated from  $(2, -3)$  to  $(-2, 3)$  in the  $xy$ -plane. Then, after the triangle is reflected, or flipped, across the  $y$ -axis, point  $Q$  is translated from  $(-2, 3)$  to  $(2, 3)$ . Choice A is incorrect because it represents the location of point  $Q'$  after only a reflection across the  $y$ -axis. Choice B is incorrect and may be the result of a misunderstanding of a rotation about the origin. Choice C is incorrect because it represents the location of point  $Q'$  after only the rotation.

## ACCUPLACER® Arithmetic Sample Questions

The Next-Generation Arithmetic placement test is a computer adaptive assessment of test-takers' ability for selected mathematics content. Questions will focus on computation, order of operations, estimation and rounding, comparing and ordering values in different formats, and recognizing equivalent values across formats. In addition, questions may assess a student's math ability via computational or fluency skills, conceptual understanding, or the capacity to apply mathematics presented in a context. All questions are multiple choice in format and appear discretely (stand alone) across the assessment. The following knowledge and skill categories are assessed:

- Whole number operations
- Fraction operations
- Decimal operations
- Percent
- Number comparisons and equivalents

## Sample Questions

Choose the best answer. If necessary, use the paper you were given.

- Which of the following fractions is equal to 0.06?
  - $\frac{1}{6}$
  - $\frac{1}{60}$
  - $\frac{6}{10}$
  - $\frac{6}{100}$
- A club has 36 members. If each member donates 12 items for an auction, how many items will there be in the auction?
  - 48
  - 108
  - 422
  - 432
- What is the value of  $\frac{4}{10} + \frac{3}{100}$ ?
  - $\frac{43}{100}$
  - $\frac{43}{110}$
  - $\frac{7}{10}$
  - $\frac{7}{110}$
- A conference planner has put together 280 binders for attendees and another 31 binders for presenters. How many total binders did the planner put together for attendees and presenters?
  - 211
  - 249
  - 311
  - 590
- A store stocked 150 cans of popcorn for a weekend sale. That weekend, 72 of the cans sold. What percent of the cans of popcorn stocked were sold that weekend?
  - 2%
  - 5%
  - 48%
  - 72%
- $\frac{8}{3}$ , 2.28,  $\frac{10}{12}$ , 0.199  
 What number in the list above has the greatest value?
  - $\frac{8}{3}$
  - 2.28
  - $\frac{10}{12}$
  - 0.199
- If Manuel deposits 25% of \$130 into a savings account, what is the amount of his deposit?
  - \$5.20
  - \$25.00
  - \$32.50
  - \$97.50
- What is  $1,582 + 761$ ?
  - 1,119
  - 1,243
  - 1,343
  - 2,343
- Xiaoming is making cookies. Each batch of cookies uses 3 eggs. If Xiaoming has 20 eggs, and assuming he has enough of the other ingredients to make the cookies, what is the greatest number of batches that he can make?
  - 3
  - 6
  - 7
  - 17
- What is the value of  $3.85 + 0.004 + 0.117$ ?
  - 3.9611
  - 3.961
  - 3.971
  - 5.06
- Which of the following is equivalent to  $\frac{8}{25}$ ?
  - 0.02
  - 0.32
  - 0.825
  - 3.125
- What is the remainder when 599 is divided by 9?
  - 0
  - 5
  - 6
  - 9

13. A machine is currently set to a feed rate of 5.921 inches per minute (IPM). The machinist changes this setting to 6.088 IPM. By how much did the machinist increase the feed rate?
- A. 0.167 IPM  
B. 1.167 IPM  
C. 1.833 IPM  
D. 1.967 IPM
14.  $0.075$ ,  $0.75\%$ ,  $\frac{3}{4}$
- Which of the following correctly orders the values above from least to greatest?
- A.  $0.75\%$ ,  $0.075$ ,  $\frac{3}{4}$   
B.  $0.75\%$ ,  $\frac{3}{4}$ ,  $0.075$   
C.  $\frac{3}{4}$ ,  $0.75\%$ ,  $0.075$   
D.  $0.075$ ,  $0.75\%$ ,  $\frac{3}{4}$
15. What is the value of  $2.84 \times 3.9$ ?
- A. 3.408  
B. 11.076  
C. 34.08  
D. 110.76
16. What is 0.8637 rounded to the nearest hundredth?
- A. 0.86  
B. 0.863  
C. 0.864  
D. 0.87
17. 60% of what number is equal to 30?
- A. 0.5  
B. 2  
C. 18  
D. 50
18. If  $\frac{4}{3} \div \frac{1}{6} = p$ , then the value of  $p$  is between which of the following pairs of numbers?
- A. 3 and 4  
B. 5 and 6  
C. 6 and 7  
D. 7 and 9
19. Which of the following inequalities is true?
- A.  $\frac{3}{4} < \frac{5}{7}$   
B.  $\frac{2}{3} > \frac{5}{6}$   
C.  $\frac{5}{8} > \frac{6}{10}$   
D.  $\frac{4}{5} < \frac{2}{9}$
20. Carole works at a bookstore and a restaurant. In a 28-day period, Carole worked  $\frac{1}{4}$  of the days at the bookstore and did not work  $\frac{1}{14}$  of the days. On the remaining days Carole worked at the restaurant. How many days did Carole work at the restaurant during the 28-day period?
- A. 25  
B. 19  
C. 10  
D. 9

## Rationales

- Choice D is correct.** The number 0.06 is the same as six-hundredths, which when written as a fraction is  $\frac{6}{100}$ . Choice A is incorrect because  $\frac{1}{6}$  is equivalent to one-sixth, or  $0.1\overline{6}$ . Choice B is incorrect because  $\frac{1}{60}$  is equivalent to one-sixtieth, or  $0.01\overline{6}$ . Choice C is incorrect because  $\frac{6}{10}$  is equivalent to six-tenths, or 0.6.
- Choice D is correct.** To find the total number of items, multiply the total number of members by the number of items each member will donate. This is represented by  $36 \times 12 = 432$ . Choice A is incorrect because this results from adding instead of multiplying. Choice B is incorrect because a multiplication error was made. This results from not using a placeholder zero or writing the numbers starting in the tens place when multiplying the second digit. Choice C is incorrect because a multiplication error was made. This results from making an error when carrying from the ones digit to the tens digit.
- Choice A is correct.** The expression  $\frac{4}{10} + \frac{3}{100}$  can be rewritten as  $\frac{40}{100} + \frac{3}{100}$ , which is equal to  $\frac{43}{100}$ . Choice B is incorrect because it results from combining the numerators to create a two-digit number and adding the denominators. Choice C is incorrect because it results from adding the numerators and using the denominator of the first number in the sum. Choice D is incorrect because it results from adding the numerators and denominators separately.
- Choice C is correct.** The total number of binders the planner put together for attendees and presenters is  $280 + 31 = 311$ . Adding the ones place ( $0 + 1$ ) results in the digit 1, adding the tens place ( $8 + 3$ ) results in the number 11, which should be recorded as a 1 in the tens place and a 1 carried to the hundreds place, then adding the hundreds place ( $2 + 1$ ) results in the digit 3. Choice A is incorrect. This answer results from not carrying a 1 to the hundreds place after adding the tens place. Choice B is incorrect. This answer is the result of subtracting the presenter binders from the attendee binders. However, the total number of binders will be found through addition, not subtraction. Choice D is incorrect. This answer results from incorrectly adding the numbers.
- Choice C is correct.** Divide the number of cans sold by the number of cans stocked and multiply by 100 to find the percent:  $72 \div 150 \times 100 = 48\%$ . Choice A is incorrect. This is the approximate result of dividing 150 by 72. Choice B is incorrect. This is the approximate result of dividing 72 by 15. Choice D is incorrect. This is the number of cans sold represented as a percent.
- Choice A is correct.** The fraction  $\frac{8}{3}$  is greater than 1 because the numerator is larger than the denominator. This makes it greater than choice C or choice D, which are both less than 1. The fraction  $\frac{8}{3}$  can be converted to a mixed number  $\left(2\frac{2}{3}\right)$  or decimal (approximately 2.66) by dividing 8 by 3. This makes it easier to compare choice A to the other choices. Choices B, C, and D are incorrect because  $\frac{8}{3}$  (or approximately 2.66) is greater than 2.28,  $\frac{10}{12}$ , and 0.199.

- 7. Choice C is correct.** To find 25% of \$130.00, multiply \$130.00 by 0.25, which is \$32.50. Choice A is incorrect because \$5.20 is 4% of \$130, which results from dividing \$130.00 by 25. Choice B is incorrect because \$25.00 is approximately 19% of \$130, which may be the result of misunderstanding 25% to be \$25. Choice D is incorrect because \$97.50 is 75% of \$130, which is not the amount that will go into the savings account.
- 8. Choice D is correct.**  $1,582 + 761 = 2,343$ . Choices A, B, and C are incorrect. Choice A results from adding and carrying from left to right instead of right to left. Choice B is incorrect because no numbers are carried to the next place value. Choice C is incorrect because the 1 from the hundreds place is not carried to the thousands place.
- 9. Choice B is correct.** If Xiaoming has 20 eggs, and each batch of cookies uses 3 eggs, the number of batches can be found by dividing 20 by 3. This does not divide evenly, so the number should be rounded down to 6 because Xiaoming does not have enough eggs to make 7 batches ( $7 \times 3 = 21$ ). Choice A is incorrect because 3 batches would use only 9 eggs ( $3 \times 3$  eggs). This means that Xiaoming would have 11 eggs left, which is enough to make more batches. Choice C is incorrect because 7 batches would use 21 eggs ( $3 \times 7 = 21$ ), but Xiaoming has only 20 eggs. Choice D is incorrect because 17 batches would use 51 eggs ( $17 \times 3 = 51$ ), but Xiaoming has only 20 eggs.
- 10. Choice C is correct.** Using the standard algorithm, the sum of the thousandths places ( $7 + 4$ ) is 11, so a 1 should be recorded in the thousandths place and a 1 carried to the hundredths place. The sum of the hundredths places ( $5 + 0 + 1 + 1$ ) is 7, the sum of the tenths places is 9, and the sum of the ones places is 3. This results in 3.971. Choice A is incorrect. This results from adding from left to right and recording an 11 as the result of adding the thousandths places. Choice B is incorrect. This results from not carrying the 1 from the thousandths place to the hundredths place. Choice D is incorrect. This is the sum of 3.85, 0.04, and 1.17.
- 11. Choice B is correct.** The fraction  $\frac{8}{25}$  can be written as  $\frac{32}{100}$ , which can be interpreted as thirty-two hundredths, or 0.32. Choice A is incorrect. This may be the result of dividing the numerator by 4 instead of multiplying when converting to a common denominator of 100. Choice C is incorrect. This may be the result of trying to form a number using the numerator and the denominator of the fraction. Choice D is incorrect. This is the result of 25 divided by 8.
- 12. Choice B is correct.** The result when 599 is divided by 9 is 66 with a remainder of 5. Multiplying  $9 \times 66 = 594$  and  $599 - 594 = 5$ , which is the remainder. Choice A is incorrect. This may be the result of thinking that 9 divides evenly into 599. Choice C is incorrect. This may be the result of determining that 9 goes into 599 sixty-six times and misinterpreting the meaning of this number. Choice D is incorrect because this is the divisor, not the remainder.
- 13. Choice A is correct.** The amount by which the feed rate increases is the difference between the second feed rate and the first feed rate. This is represented by  $6.088 - 5.921 = 0.167$ . Choices B, C, and D are incorrect and may be the result of errors when subtracting the two numbers given.

- 14. Choice A is correct.** To best compare the numbers, they should be put in the same format. The percent 0.75% can be converted to a decimal by dividing 0.75 by 100, which gives 0.0075. The fraction  $\frac{3}{4}$  can be converted to a decimal by dividing 3 by 4, which gives 0.75. Placing these numbers in order from least to greatest yields 0.0075, 0.075, and 0.75. Choices B, C, and D are incorrect because none of them order the numbers from least to greatest. Choice B is incorrect because  $\frac{3}{4}$  is greater than 0.075. Choice C is incorrect because  $\frac{3}{4}$  is the greatest value, not the least. Choice D is incorrect because 0.75% is less than 0.075.
- 15. Choice B is correct.** Using the standard algorithm to multiply the tenths place of 3.9 by 2.84 results in 2.556 and then multiplying the ones place of 3.9 by 2.84 results in 8.520, since each product must have three places to the right of the decimal. The sum of these two numbers is  $2.556 + 8.520 = 11.076$ . Choice A is incorrect. This results from not using a placeholder zero when multiplying the ones place. Choice C is incorrect. This results from not using a placeholder zero when multiplying the ones place and incorrectly placing the decimal point in the resulting number. Choice D is incorrect. This results from placing the decimal point to match the number of decimal places in 2.84.
- 16. Choice A is correct.** The second digit to the right of the decimal point is in the hundredths place and the third number to the right of the decimal point is in the thousandths place. The number in the hundredths place increases by 1 when the number in the thousandths place is 5 or greater. The number in the hundredths place remains the same if the number in the thousandths place is less than 5. Since the number in the thousandths place is less than 5, the number 0.8637 should be rounded down to 0.860. Choice B is incorrect. The number 0.863 is 0.8637 truncated to the thousandths place instead of rounded to the nearest hundredth. Choice C is incorrect. The number 0.864 is 0.8637 rounded to the nearest thousandths place instead of rounded to the nearest hundredth. Choice D is incorrect. The number 0.87 is 0.8637 rounded up to the nearest hundredth, but since the number in the thousandths place is less than 5, the number should be rounded down.
- 17. Choice D is correct.** Dividing 30 by 60%, which is equivalent to 0.60, gives 50. So 60% of 50 is 30. Choices A and B are incorrect because 60% was not converted into a decimal, and in choice B the division was done in the wrong order. Choice C is incorrect because 30 was multiplied by 0.60 instead of divided.
- 18. Choice D is correct.** The expression  $\frac{4}{3} \div \frac{1}{6} = \frac{4}{3} \times 6 = \frac{24}{3} = 8$ . The number 8 is between 7 and 9. Choices A, B, and C are incorrect. The quotient of the two given fractions is not between any of these pairs of numbers.

19. **Choice C is correct.** The fraction  $\frac{5}{8}$  is greater than  $\frac{6}{10}$ . When using a common denominator, this statement is equivalent to  $\frac{25}{40} > \frac{24}{40}$ . When two fractions have common denominators, the fraction with the larger numerator is the larger number. Choice A is incorrect because  $\frac{3}{4}$  is not less than  $\frac{5}{7}$ . Shown written with a common denominator, the comparison  $\frac{21}{28} < \frac{20}{28}$  is not true. Choice B is incorrect because  $\frac{2}{3}$  is not greater than  $\frac{5}{6}$ . Shown written with a common denominator, the comparison  $\frac{4}{6} > \frac{5}{6}$  is not true. Choice D is incorrect because  $\frac{4}{5}$  is not less than  $\frac{2}{9}$ . Shown written with a common denominator, the comparison  $\frac{36}{45} < \frac{10}{45}$  is not true.
20. **Choice B is correct.** Carole worked  $\frac{1}{4}$  of the 28 days at the bookstore, so she worked 7 days at the bookstore ( $28 \times \frac{1}{4}$ ). She did not work on  $\frac{1}{14}$  of the days, which equals 2 days ( $28 \times \frac{1}{14}$ ). Subtracting these amounts from 28 gives the number of days she worked at the restaurant ( $28 - 7 - 2 = 19$ ). Choice A is incorrect and may be the result of erroneously adding  $\frac{1}{4}$  and  $\frac{1}{14}$  and finding  $\frac{2}{18}$  as the days not worked at the restaurant.  $28 - (28 \times \frac{2}{18}) = 25$ . Choice C is incorrect and may be the result of adding the denominators of the fractions ( $14 + 4$ ) and using this as the number of days Carole did not work at the restaurant.  $28 - 18 = 10$ . Choice D is incorrect because it is the total number of days Carole worked at the bookstore and the days she did not work.

## ACCUPLACER® Advanced Algebra and Functions (AAF) Sample Questions

The Next-Generation Advanced Algebra and Functions placement test is a computer adaptive assessment of test-takers' ability for selected mathematics content. Questions will focus on a range of topics, including a variety of equations and functions, including linear, quadratic, rational, radical, polynomial, and exponential. Questions will also delve into some geometry and trigonometry concepts. In addition, questions may assess a student's math ability via computational or fluency skills, conceptual understanding, or the capacity to apply mathematics presented in a context. All questions are multiple choice in format and appear discretely (stand alone) across the assessment. The following knowledge and skill categories are assessed:

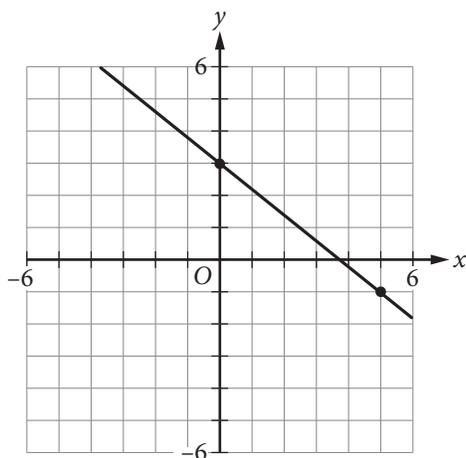
- Linear equations
- Linear applications
- Factoring
- Quadratics
- Functions
- Radical and rational equations
- Polynomial equations
- Exponential and logarithmic equations
- Geometry concepts
- Trigonometry

**Sample Questions**

Choose the best answer. If necessary, use the paper you were given.

- Function  $g$  is defined by  $g(x) = 3(x + 8)$ . What is the value of  $g(12)$ ?
  - 4
  - 20
  - 44
  - 60

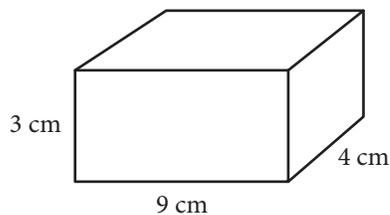
2.



Which of the following is an equation of the line that passes through the point  $(0, 0)$  and is perpendicular to the line shown above?

- $y = \frac{5}{4}x$
- $y = \frac{5}{4}x + 3$
- $y = -\frac{4}{5}x$
- $y = -\frac{4}{5}x + 3$

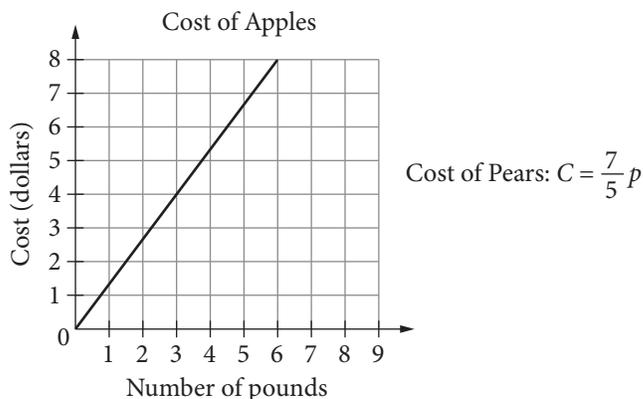
3.



The surface area of a right rectangular prism can be found by finding the sum of the area of each of the faces of the prism. What is the surface area of a right rectangular prism with length 4 centimeters (cm), width 9 cm, and height 3 cm? (Area of a rectangle is equal to length times width.)

- $75 \text{ cm}^2$
  - $108 \text{ cm}^2$
  - $120 \text{ cm}^2$
  - $150 \text{ cm}^2$
- Which of the following expressions is equivalent to  $(x + 7)(x^2 - 3x + 2)$ ?
    - $x^3 - 3x^2 + 2x + 14$
    - $x^3 + 4x^2 - 19x + 14$
    - $x^3 - 3x + 14$
    - $x^2 - 2x + 9$

5.

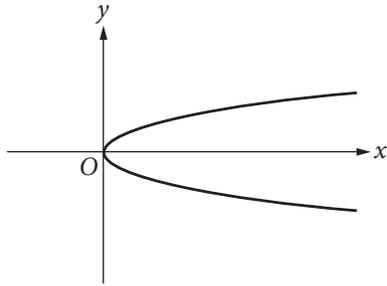


The graph above shows the cost, in dollars, of apples as a function of the number of pounds of apples purchased at a particular grocery store. The equation above defines the cost  $C$ , in dollars, for  $p$  pounds of pears at the same store. Which of the following statements accurately compares the cost per pound of apples and the cost per pound of pears at this store?

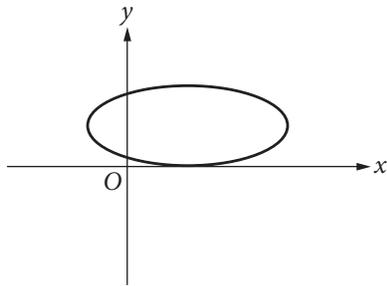
- Apples cost approximately \$0.07 less per pound than pears do.
- Apples cost approximately \$0.04 less per pound than pears do.
- Apples cost approximately \$0.73 less per pound than pears do.
- Apples cost approximately \$0.62 more per pound than pears do.

6. Which of the following is the graph of a function where  $y = f(x)$ ?

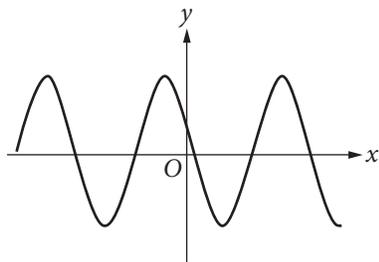
A.



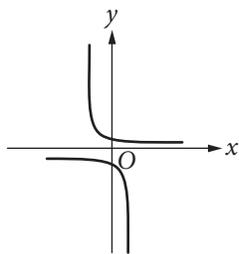
B.



C.



D.



7. Which of the following expressions is equivalent to  $3x^2 + 6x - 24$ ?

- A.  $3(x + 2)(x - 4)$
- B.  $3(x - 2)(x + 4)$
- C.  $(x + 6)(x - 12)$
- D.  $(x - 6)(x + 12)$

8. A biologist puts an initial population of 500 bacteria into a growth plate. The population is expected to double every 4 hours. Which of the following equations gives the expected number of bacteria,  $n$ , after  $x$  days? (24 hours = 1 day)

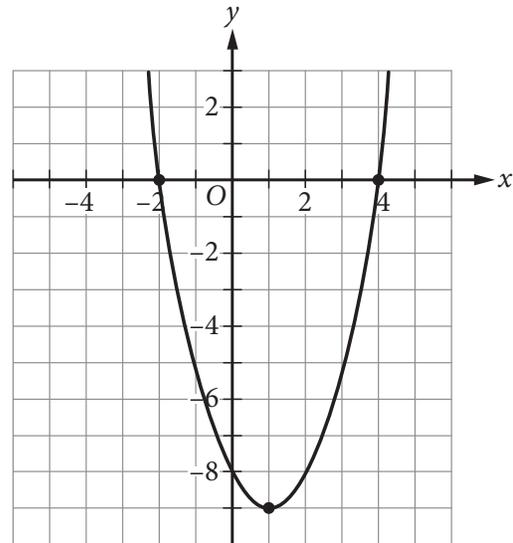
- A.  $n = 500(2)^x$
- B.  $n = 500(2)^{6x}$
- C.  $n = 500(6)^x$
- D.  $n = 500(6)^{2x}$

9.  $x^2 + 5x - 9 = 5$

Which of the following values of  $x$  satisfies the equation above?

- A. 7
- B. 3
- C. -2
- D. -7

10. The graph of  $y = f(x)$  is shown in the  $xy$ -plane below.



Which of the following equations could define  $f(x)$ ?

- A.  $f(x) = x^2 - 2x - 8$
- B.  $f(x) = -x^2 + 2x - 8$
- C.  $f(x) = (x - 2)(x + 4)$
- D.  $f(x) = -(x - 1)^2 - 9$

11. Which of the following best describes the range of  $y = -2x^4 + 7$ ?

- A.  $y \leq -2$
- B.  $y \geq 7$
- C.  $y \leq 7$
- D. All real numbers

12. For which of the following equations is  $x = 6$  the only solution?

- A.  $(6x)^2 = 0$
- B.  $(x - 6)^2 = 0$
- C.  $(x + 6)^2 = 0$
- D.  $(x - 6)(x + 6) = 0$

13. If  $f(x) = x^2 + 3x + 1$ , what is  $f(x + 2)$ ?

- A.  $x^2 + 3x + 3$
- B.  $(x + 2)^2 + 3(x + 2) + 1$
- C.  $(x + 2)(x^2 + 3x + 1)$
- D.  $x^2 + 3x + 9$

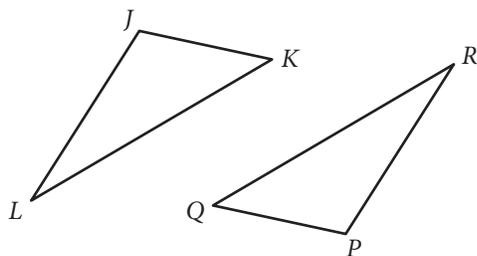
14. What, if any, is a real solution to  $\sqrt{5x + 1} + 9 = 3$ ?

- A.  $-\frac{1}{5}$
- B. 7
- C.  $\frac{143}{5}$
- D. There is no real solution.

15. If  $x \neq -2$  and  $x \neq -\frac{3}{2}$ , what is the solution to  $\frac{5}{x + 2} = \frac{x}{2x - 3}$ ?

- A. 3 and 5
- B. 2 and  $-\frac{3}{2}$
- C.  $-2$  and  $\frac{3}{2}$
- D.  $-3$  and  $-5$

16.



Triangle  $JKL$  and triangle  $PQR$  are shown above. If  $\angle J$  is congruent to  $\angle P$ , which of the following must be true in order to prove that triangles  $JKL$  and  $PQR$  are congruent?

- A.  $\angle L \cong \angle R$  and  $JL = PR$
- B.  $KL = QR$  and  $PR = JL$
- C.  $JK = PQ$  and  $KL = QR$
- D.  $\angle K \cong \angle Q$  and  $\angle L \cong \angle R$

17. In the function  $f(x) = a(x + 2)(x - 3)^b$ ,  $a$  and  $b$  are both integer constants and  $b$  is positive. If the end behavior of the graph of  $y = f(x)$  is positive for both very large negative values of  $x$  and very large positive values of  $x$ , what is true about  $a$  and  $b$ ?

- A.  $a$  is negative, and  $b$  is even.
- B.  $a$  is positive, and  $b$  is even.
- C.  $a$  is negative, and  $b$  is odd.
- D.  $a$  is positive, and  $b$  is odd.

18. Which of the following equations is equivalent to  $2^{5x} = 7$ ?

- A.  $x = \log_2\left(\frac{7}{5}\right)$
- B.  $x = \frac{\log_2 7}{5}$
- C.  $x = \frac{\log_7 2}{5}$
- D.  $x = \frac{\log_7 5}{2}$

19. If  $x > 0$  and  $y > 0$ , which of the following expressions is equivalent to  $\frac{x - y}{\sqrt{x} - \sqrt{y}}$ ?

- A.  $\frac{x - y}{\sqrt{x} - \sqrt{y}}$
- B.  $\sqrt{x - y}$
- C.  $\sqrt{x} + \sqrt{y}$
- D.  $x\sqrt{x} + y\sqrt{y}$

20. In triangle  $ABC$ , angle  $C$  is a right angle. If  $\cos A = \frac{5}{8}$ , what is the value of  $\cos B$ ?

- A.  $\frac{3}{8}$
- B.  $\frac{5}{8}$
- C.  $\frac{\sqrt{39}}{8}$
- D.  $\frac{\sqrt{89}}{8}$

## Rationales

- Choice D is correct.** The value of  $g(12)$  can be found by substituting 12 for  $x$  in the equation for  $g(x)$ . This yields  $g(12) = 3(12 + 8)$ , which is equivalent to  $3(20)$  or 60. Choice A is incorrect. This answer represents the value of  $x$  in the equation  $12 = 3(x + 8)$ . Choice B is incorrect. This answer represents the value of the expression in parentheses. Choice C is incorrect. This answer is a result of incorrectly distributing the 3 through the expression in parentheses:  $g(12) = 3(12) + 8$ .
- Choice A is correct.** The slopes of perpendicular lines are negative reciprocals of each other. The slope of the line in the graph is  $-\frac{4}{5}$ . The negative reciprocal of  $-\frac{4}{5}$  is  $\frac{5}{4}$ . A line that passes through the point  $(0, 0)$  has a  $y$ -intercept of 0. Therefore, the equation  $y = \frac{5}{4}x + 0$ , or  $y = \frac{5}{4}x$ , is correct. Choice B is incorrect because it is an equation of a line that is perpendicular to the line shown, but it does not pass through the origin. Choice C is incorrect because this equation is parallel to the line shown, not perpendicular. Choice D is incorrect because it is the equation of the line shown in the graph.
- Choice D is correct.** The surface area of the rectangular prism is the total area of each of the faces of the prism and can be written as  $2(\text{length} \times \text{width}) + 2(\text{height} \times \text{width}) + 2(\text{length} \times \text{height})$ , which is  $2(4 \text{ cm} \times 9 \text{ cm}) + 2(3 \text{ cm} \times 9 \text{ cm}) + 2(4 \text{ cm} \times 3 \text{ cm})$ , or  $150 \text{ cm}^2$ . Choice A is incorrect because it is half the surface area of the prism. Choice B is incorrect because it is the volume of the prism. Choice C is incorrect because it is 30 units less than the surface area of the prism described.
- Choice B is correct.** Using the distribution property, the given expression can be rewritten as  $x(x^2) + x(-3x) + x(2) + 7(x^2) + 7(-3x) + 7(2)$ . Further simplifying results in  $x^3 - 3x^2 + 2x + 7x^2 - 21x + 14$ . Finally, adding like terms yields  $x^3 + 4x^2 - 19x + 14$ . Choices A, C, and D are incorrect because they each result from errors made when performing the necessary distribution and adding like terms.
- Choice A is correct.** The cost per pound of apples can be determined by the slope of the graph as about \$1.33 per pound. The cost per pound of pears can be determined by the slope of the line defined by the equation  $C = \frac{7}{5}P$ . The slope of the line defined by  $C$  is  $\frac{7}{5}$ , so the cost per pound of pears is \$1.40. Therefore, the apples cost approximately \$0.07 less per pound than pears do. Choice B is incorrect. This is the result of misreading the cost per pound of apples as \$0.67 and the cost per pound of pears as \$0.71 and then finding the difference between the two values. Choice C is incorrect. This is the result of misreading the cost per pound of apples from the graph as \$0.67 and then subtracting the cost per pound of pears, \$1.40. Choice D is incorrect. This is the result of misreading the cost per pound of pears as \$0.71 and then subtracting this value from the cost per pound of apples, \$1.33.
- Choice C is correct.** A function has one output for each input. Each  $x$ -value on this graph corresponds to only one  $y$ -value. Choices A, B, and D are incorrect because each has  $x$ -values that correspond to more than one  $y$ -value.
- Choice B is correct.** The expression  $3(x - 2)(x + 4)$  can be expanded by first multiplying  $(x - 2)$  by 3 to get  $(3x - 6)$  and then multiplying  $(3x - 6)$  by  $(x + 4)$  to get  $3x^2 + 6x - 24$ . Choice A is incorrect because it is equivalent to  $3x^2 - 6x - 24$ . Choice C is incorrect because it is equivalent to  $x^2 - 6x - 72$ . Choice D is incorrect because it is equivalent to  $x^2 + 6x - 72$ .

- 8. Choice B is correct.** An exponential function can be written in the form  $y = ab^t$  where  $a$  is the initial amount,  $b$  is the growth factor, and  $t$  is the time. In the scenario described, the variable  $y$  can be substituted with  $n$ , the total number of bacteria, and the initial amount is given as 500, which yields  $n = 500b^t$ . The growth factor is 2 because the population is described as being expected to double, which gives the equation  $n = 500(2)^t$ . The population is expected to double every 4 hours, so for the time to be  $x$  days,  $x$  must be multiplied by 6 (the number of 4-hour periods in 1 day). This gives the final equation  $n = 500(2)^{6x}$ . Choices A, C, and D are incorrect. Choice A does not account for the six 4-hour periods per day, choice C uses the number of time periods per day as the growth rate, and choice D uses the number of time periods per day as the growth rate and multiplies the exponent by the actual growth rate.
- 9. Choice D is correct.** Subtracting 5 from both sides of the equation gives  $x^2 + 5x - 14 = 0$ . The left-hand side of the equation can be factored, giving  $(x + 7)(x - 2) = 0$ . Therefore, the solutions to the quadratic equation are  $x = -7$  and  $x = 2$ . Choice A is incorrect because  $7^2 + 5(7) - 9$  is not equal to 5. Choice B is incorrect because  $3^2 + 5(3) - 9$  is not equal to 5. Choice C is incorrect because  $(-2)^2 + 5(-2) - 9$  is not equal to 5.
- 10. Choice A is correct.** The graph of  $y = f(x)$  crosses the  $x$ -axis at  $x = -2$  and  $x = 4$ , crosses the  $y$ -axis at  $y = 8$ , and has its vertex at the point  $(1, -9)$ . Therefore, the ordered pairs  $(-2, 0)$ ,  $(4, 0)$ ,  $(0, -8)$ , and  $(1, -9)$  must satisfy the equation for  $f(x)$ . Furthermore, because the graph opens upward, the equation defining  $f(x)$  must have a positive leading coefficient. All of these conditions are met by the equation  $f(x) = x^2 - 2x - 8$ . Choice B is incorrect. The points  $(-2, 0)$ ,  $(4, 0)$ ,  $(0, -8)$ , and  $(1, -9)$ , which are easily identified on the graph of  $y = f(x)$ , do not all satisfy the equation  $f(x) = -x^2 + 2x - 8$ ; only  $(0, -8)$  does. Therefore  $f(x) = -x^2 + 2x - 8$  cannot define the function graphed. Furthermore, because the graph opens upward, the equation defining  $y = f(x)$  must have a positive leading coefficient, which  $f(x) = -x^2 + 2x - 8$  does not. Choice C is incorrect. The points  $(-2, 0)$ ,  $(4, 0)$ ,  $(0, -8)$ , and  $(1, -9)$ , which are easily identified on the graph of  $y = f(x)$ , do not all satisfy the equation  $f(x) = (x - 2)(x + 4)$ ; only  $(0, -8)$  does. Therefore,  $f(x) = (x - 2)(x + 4)$  cannot define the function graphed. Choice D is incorrect. Though the vertex  $(1, -9)$  does satisfy the equation  $f(x) = -(x - 1)^2 - 9$ , the points  $(-2, 0)$ ,  $(4, 0)$ , and  $(0, -8)$  do not. Therefore,  $f(x) = -(x - 1)^2 - 9$  cannot define the function graphed. Furthermore, because the graph opens upward, the equation defining  $y = f(x)$  must have a positive leading coefficient, which  $f(x) = -(x - 1)^2 - 9$  does not.
- 11. Choice C is correct.** The range of a function describes the set of all outputs,  $y$ , that satisfy the equation defining the function. In the  $xy$ -plane, the graph of  $y = -2x^4 + 7$  is a U-shaped graph that opens downward with its vertex at  $(0, 7)$ . Because the graph opens downward, the vertex indicates that the maximum value of  $y$  is 7. Therefore, the range of the function defined by  $y = -2x^4 + 7$  is the set of  $y$ -values less than or equal to 7. Choices A, B, and D are incorrect in that choice A doesn't cover the entire range, while choices B and D include values that aren't part of the range.
- 12. Choice B is correct.** The only value of  $x$  that satisfies the equation  $(x - 6)^2 = 0$  is 6. Choice A is incorrect because  $x = 0$  is the only solution to the equation  $(6x)^2 = 0$ . Choice C is incorrect because  $x = -6$  is the only solution to the equation  $(x + 6)^2 = 0$ . Choice D is incorrect because although  $x = 6$  is a solution to the equation  $(x - 6)(x + 6) = 0$ ,  $x = -6$  is another solution to the equation.
- 13. Choice B is correct.** Substituting  $x + 2$  for  $x$  in the original function gives  $f(x + 2) = (x + 2)^2 + 3(x + 2) + 1$ . Choice A is incorrect. This is  $f(x) + 2$ . Choice C is incorrect. This is  $(x + 2)f(x)$ . Choice D is incorrect. This is  $f(x) + 2^3$ .

- 14. Choice D is correct.** Subtracting 9 from both sides of the equation yields  $\sqrt{5x+1} = -6$ , and there are no real values of  $x$  that result in the square root of a number being negative, so the equation has no real solution. Choices A and C are incorrect due to computational errors in solving for  $x$  and not checking the solution in the original equation. Choice B is incorrect because it is the extraneous solution to the equation.
- 15. Choice A is correct.** To solve the equation for  $x$ , cross multiply to yield  $x(x+2) = 5(2x-3)$ . Simplifying both sides of the new equation results in  $x^2 + 2x = 10x - 15$ . Next, subtract  $10x$  from both sides of the equation and add 15 to both sides of the equation to yield  $x^2 - 8x + 15 = 0$ . By factoring the left-hand side, the equation can be rewritten in the form  $(x-3)(x-5) = 0$ . It follows, therefore, that  $x = 3$  and  $x = 5$ . Choices B, C, and D are possible results from mathematical errors when solving the equation for  $x$ .
- 16. Choice A is correct.** If two angles and the included side of one triangle are congruent to corresponding parts of another triangle, the triangles are congruent. Since angles  $J$  and  $L$  are congruent to angles  $P$  and  $R$ , respectively, and the side lengths between each pair of angles,  $JL$  and  $PR$ , are also equal, then it can be proven that triangles  $JKL$  and  $PQR$  are congruent. Choices B and C are incorrect because only when two sides and the included angle of one triangle are congruent to corresponding parts of another triangle can the triangles be proven to be congruent, and angles  $J$  and  $P$  are not included within the corresponding pairs of sides given. Further, side-side-angle congruence works only for right triangles, and it is not given that triangles  $JKL$  and  $PQR$  are right triangles. Choice D is incorrect because the triangles can only be proven to be similar (not congruent) if all three sets of corresponding angles are congruent.
- 17. Choice D is correct.** A polynomial function of even degree with a positive leading coefficient will have positive end behavior for both very large negative values of  $x$  and very large positive values of  $x$ . For a polynomial function in the form  $f(x) = a(x+2)(x-3)^b$  to be of even degree with a positive leading coefficient,  $a$  must be positive and  $b$  must be odd. Choice A is incorrect. If  $a$  is negative and  $b$  is even, the polynomial function will be of odd degree, with a negative leading coefficient. This results in positive end behavior for very large negative values of  $x$  and negative end behavior for very large positive values of  $x$ . Choice B is incorrect. If  $a$  is positive and  $b$  is even, the polynomial function will be of odd degree with a positive leading coefficient. This results in negative end behavior for very large negative values of  $x$  and positive end behavior for very large positive values of  $x$ . Choice C is incorrect. If  $a$  is negative and  $b$  is odd, the polynomial function will be of even degree with a negative leading coefficient. This results in negative end behavior on both sides of the function.
- 18. Choice B is correct.** By definition, if  $(b)^x = y$ , where  $b > 0$  and  $b \neq 1$ , then  $x = \log_b y$ . Therefore, the given equation  $2^{5x} = 7$  can be rewritten in the form  $\log_2 7 = 5x$ . Next, solving for  $x$  by dividing both sides of the equation by 5 yields  $\frac{\log_2 7}{5} = x$ . Choices A, C, and D are incorrect because they are the result of misapplying the identity, which states that if  $(b)^x = y$ , where  $b > 0$  and  $b \neq 1$ , then  $x = \log_b y$ .

**19. Choice C is correct.** Since  $x > 0$  and  $y > 0$ ,  $x$  can be rewritten as  $(\sqrt{x})^2$  and  $y$  can be rewritten as  $(\sqrt{y})^2$ . It follows, then, that  $\frac{x-y}{\sqrt{x}-\sqrt{y}}$  can be rewritten as  $\frac{(\sqrt{x})^2 - (\sqrt{y})^2}{\sqrt{x} - \sqrt{y}}$ .

Because the numerator is a difference of two squares, it can be factored as

$$\frac{(\sqrt{x} + \sqrt{y})(\sqrt{x} - \sqrt{y})}{(\sqrt{x} - \sqrt{y})}$$

. Finally, dividing the common factors of  $(\sqrt{x} - \sqrt{y})$  in the numerator and denominator yields  $\sqrt{x} + \sqrt{y}$ . Alternatively, if  $\frac{x-y}{\sqrt{x}-\sqrt{y}}$  is multiplied by

$$\frac{\sqrt{x} + \sqrt{y}}{\sqrt{x} + \sqrt{y}},$$

which is equal to 1, and therefore does not change the value of the original expression, the result is  $\frac{(x-y)(\sqrt{x} + \sqrt{y})}{(\sqrt{x} - \sqrt{y})(\sqrt{x} + \sqrt{y})}$ , which is equivalent to

$$\frac{x\sqrt{x} + x\sqrt{y} - y\sqrt{x} - y\sqrt{y}}{x - \sqrt{xy} + \sqrt{xy} - y}$$

. This can be rewritten as  $\frac{(x-y)(\sqrt{x} + \sqrt{y})}{(x-y)}$ , which can be

simplified to  $\sqrt{x} + \sqrt{y}$ . Choice A is incorrect and may be the result of incorrectly

combining  $\sqrt{x} - \sqrt{y}$ . Choice B is incorrect because it is equivalent to  $\frac{x-y}{\sqrt{x}-\sqrt{y}}$ . Choice

D is incorrect and may be the result of misusing the conjugate strategy. Instead of

multiplying the numerator and denominator by the quantity  $(\sqrt{x} + \sqrt{y})$ , they may have been multiplied by  $(\sqrt{x} - \sqrt{y})$  and then improperly distributed.

**20. Choice C is correct.** If triangle  $ABC$  is defined as a right triangle, where angle  $C$  is the right angle, then the cosine of angle  $A$  ( $\cos A$ ) is defined as the ratio  $\frac{\text{the length of the side adjacent to angle } A}{\text{the length of the hypotenuse}}$ . Since this ratio is defined as  $\frac{5}{8}$ , then the length of the side opposite angle  $A$ , which is also the side adjacent to angle  $B$ , can be derived from the Pythagorean theorem:  $a^2 + 5^2 = 8^2$ , where  $a$  represents the length of the side opposite angle  $A$ . Solving for  $a$  yields  $a^2 = 64 - 25 = 39$ , so  $a = \sqrt{39}$ . Then, to determine the cosine of angle  $B$ , use the same ratio in relation to angle  $B$ :  $\cos B = \frac{\text{the length of the side adjacent to angle } B}{\text{the length of the hypotenuse}} = \frac{\sqrt{39}}{8}$ . Choice A and D are incorrect and likely results from an error in finding the length of side  $\overline{CB}$ . Choice B is incorrect and is the value of  $\cos A$  and  $\sin B$ .