

## Advanced Algebra

1. If the average of three numbers is  $V$ . If one of the numbers is  $Z$  and another is  $Y$ , what is the remaining number?

- A.  $ZY - V$
- B.  $Z/V - 3 - Y$
- C.  $Z/3 - V - Y$
- D.  $3V - Z - Y$
- E.  $V - Z - Y$

2. Two cyclists start biking from a trail's start 3 hours apart. The second cyclist travels at 10 miles per hour and starts 3 hours after the first cyclist who is traveling at 6 miles per hour. How much time will pass before the second cyclist catches up with the first from the time the second cyclist started biking?

- A. 2 hours
- B.  $4 \frac{1}{2}$  hours
- C.  $5 \frac{3}{4}$  hours
- D. 6 hours
- E.  $7 \frac{1}{2}$  hours

3. Jim can fill a pool carrying buckets of water in 30 minutes. Sue can do the same job in 45 minutes. Tony can do the same job in  $1\frac{1}{2}$  hours. How quickly can all three fill the pool together?

- A. 12 minutes
- B. 15 minutes
- C. 21 minutes
- D. 23 minutes
- E. 28 minutes

4. Mary is reviewing her algebra quiz. She has determined that one of her solutions is incorrect. Which one is it?

- A.  $2x + 5(x-1) = 9, x = 2$
- B.  $p - 3(p-5) = 10, p = 2.5$
- C.  $4y + 3y = 28, y = 4$
- D.  $5w + 6w - 3w = 64, w = 8$
- E.  $t - 2t - 3t = 32, t = 8$

5. What simple interest rate will Susan need to secure to make \$2,500 in interest on a \$10,000 principal over 5 years?

A. 4%

B. 5%

C. 6%

D. 7%

E. 8%

6. Which of the following is not a rational number?

A. -4

B.  $\frac{1}{5}$

C. 0.8333333...

D. 0.45

E.

7. A study reported that in a random sampling of 100 women over the age of 35 showed that 8 of the women were married 2 or more times. Based on the study results, how many women in a group of 5,000 women over the age of 35 would likely be married 2 or more times?

- A. 55
- B. 150
- C. 200
- D. 400
- E. 600

8. John is traveling to a meeting that is 28 miles away. He needs to be there in 30 minutes. How fast does he need to go to make it to the meeting on time?

- A. 25 mph
- B. 37 mph
- C. 41 mph
- D. 49 mph
- E. 56 mph

9. If Steven can mix 20 drinks in 5 minutes, Sue can mix 20 drinks in 10 minutes, and Jack can mix 20 drinks in 15 minutes, how much time will it take all 3 of them working together to mix the 20 drinks?

- A. 2 minutes and 44 seconds
- B. 2 minutes and 58 seconds
- C. 3 minutes and 10 seconds
- D. 3 minutes and 26 seconds
- E. 4 minutes and 15 seconds

10. If Sam can do a job in 4 days that Lisa can do in 6 days and Tom can do in 2 days, how long would the job take if Sam, Lisa, and Tom worked together to complete it?

- A. 0.8 days
- B. 1.09 days
- C. 1.23 days
- D. 1.65 days
- E. 1.97 days

11. Jim has 5 pieces of string. He needs to choose the piece that will be able to go around his 36-inch waist. His belt broke, and his pants are falling down. The piece needs to be at least 4 inches longer than his waist so he can tie a knot in it, but it cannot be more than 6 inches longer so that the ends will not show from under his shirt. Which of the following pieces of string will work the best?

- A. 3 feet
- B.  $3\frac{3}{4}$  feet
- C.  $3\frac{1}{2}$  feet
- D.  $3\frac{1}{4}$  feet
- E.  $2\frac{1}{2}$  feet

12. The last week of a month a car dealership sold 12 cars. A new sales promotion came out the first week of the next month and the sold 19 cars that week. What was the percent increase in sales from the last week of the previous month compared to the first week of the next month?

- A. 58%
- B. 119%
- C. 158%
- D. 175%
- E. 200%

13. If two planes leave the same airport at 1:00 PM, how many miles apart will they be at 3:00 PM if one travels directly north at 150 mph and the other travels directly west at 200 mph?

- A. 50 miles
- B. 100 miles
- C. 500 miles
- D. 700 miles
- E. 1,000 miles

14. During a 4-day festival, the number of visitors tripled each day. If the festival opened on a Thursday with 345 visitors, what was the attendance on that Sunday?

- A. 345
- B. 1,035
- C. 1,725
- D. 3,105
- E. 9,315

## Answers & Explanation

1. D: The average of the three numbers may be written as  $(Z+Y+x)/3=V$ , where  $x$  represents the value of the third number. Solving for  $x$  will give the value of the remaining number. Multiplying both sides of the equation by 3 gives  $Z + Y + x = 3V$ . Subtraction of  $Z$  and  $Y$ , from both sides of the equation gives  $x = 3V - Z - Y$ . The value of the remaining number is  $3V - Z - Y$ .

2. B: The intersection of the graphs of the equations,  $y = 6x$  and  $y = 10x - 30$ , represents the time ( $x$ ) and distance ( $y$ ), where the second cyclist catches up with the first cyclist. The point of intersection is  $(7\frac{1}{2}, 45)$ . Thus, after  $7\frac{1}{2}$  hours from the time the first cyclist starts and  $4\frac{1}{2}$  hours from the time the second cyclist starts, the second cyclist catches up with the first cyclist.

3. B: The amount of time it takes the three of them to fill the pool may be represented by the equation,  $1/30+1/45+1/90=1/t$ , where  $t$  represents the number of minutes. Solving for  $t$  gives  $t = 15$ . Thus, after 15 minutes, the three of them will fill the pool, when working together.

4. E: The correct solution is  $t = -8$ . When adding  $t$  to  $-5t$ , it looks like she forgot to include the negative sign on  $4t$ , which gave an incorrect solution of positive 8.

5. B: Simple interest is represented by the formula,  $I = Prt$ , where  $I$  represents the interest amount,  $P$  represents the principal,  $r$  represents the interest rate, and  $t$  represents the time. Substituting 2,500 for  $I$ , 10,000 for  $P$ , and 5 for  $t$ , gives the equation,  $2,500 = 10,000(r)(5)$ . Thus,  $r = 0.05$ , or 5%.

6. E:  $\sqrt{2}$  has a decimal expansion that does not terminate or repeat (1.414213562...). Thus, it is an irrational number.

7. D: The following proportion may be used to solve the problem:  $\frac{8}{100} = \frac{x}{5000}$ . Solving for  $x$  gives  $x = 400$ . Thus, 400 women, out of the random sample of 5,000, will likely have been married 2 or more times.

8. E: The following equation may be used to find the speed at which he needs to travel:  $\frac{28}{x} = \frac{1}{2}$ . Thus,  $x = 56$ . He needs to travel 56 mph, in order to make it to the meeting on time.

9. A: The amount of time it takes the three of them to mix the 20 drinks may be represented by the equation,  $\frac{1}{5} + \frac{1}{10} + \frac{1}{15} = \frac{1}{t}$ , where  $t$  represents the number of minutes. Solving for  $t$  gives  $t = \frac{30}{11}$ , which equals 2.73 minutes. There are 60 seconds in a minute, so multiply 60 by 2.73 minutes to get 163.8 seconds. Divide that by 60, and it comes to approximately 2 minutes and 44 seconds.

10. B: The amount of time it will take the three of them to finish the job, when working together, may be modeled by the equation,  $\frac{1}{4} + \frac{1}{6} + \frac{1}{2} = \frac{1}{t}$ , where  $t$  represents the number of days. Solving for  $t$  gives  $t = \frac{12}{11}$ , or 1.09. Thus, it will take the three of them 1.09 days to finish the job.

11. C: The inequality,  $40 \leq x \leq 42$ , represents his situation. A length of  $3 \frac{1}{2}$  feet equals 42 inches, which satisfies the inequality.

12. A: The percent increase may be represented as  $(19-12)/12$ , which equals 0.583?. Thus, the percent of increase was approximately 58%.

13. C: The Pythagorean Theorem may be used to solve the problem. The vertical distance of the plane traveling north, after 2 hours, is 300 miles. The horizontal distance of the plane traveling west, after 2 hours, is 400 miles. Thus, the following equation represents the distance between the planes, at 3 P.M.:  $300^2+400^2=c^2$ . Solving for  $c$  gives  $\sqrt{250,000}=c$ , or  $c = 500$ . After 2 hours, the planes are 500 miles apart.

14. E: The problem represents a geometric sequence, with a common ratio of 3. Thus, the problem may be modeled with the equation,  $a_4=345 \cdot 3^{4-1}$ , where  $a_4=9,315$ . The problem may also be solved by writing the sequence, 345, 1035, 3105, 9315, and identifying the value of the fourth term as the number in attendance for Sunday, or the fourth day.