

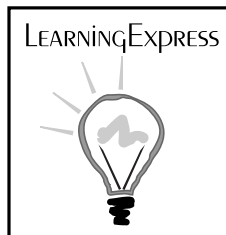
**501**

**Quantitative Comparison  
Questions**



# 501

## **Quantitative Comparison Questions**



**NEW YORK**

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# Introduction

**Welcome to 501 Quantitative Comparison Questions!** This book is designed to help you prepare for a specialized math section of a select few of the most important assessment exams. By completing the exercises in this book, you will also increase your math knowledge and refine your logic and analytical skills.

Key academic aptitude tests produced by the Educational Testing Service (ETS) for the College Board—the Preliminary Scholastic Aptitude Test/National Merit Scholarship Qualifying Test (PSAT/NMSQT) exam, the Scholastic Aptitude Test (SAT) assessment, and the Graduate Records Examination (GRE) test—include a quantitative comparison section within the math portion of the exam, so for college-bound students and many graduate students, mastering this question type is essential for getting into their school of choice.

What makes this book different than other math practice books? It's simple—this math practice book contains only questions that ask you which column contains the item of greater value, if the values are the same, or if the value cannot be determined by the information given. Gaining familiarity with this specialized question type is a proven technique for increasing test scores.

## 501 Quantitative Comparison Questions

In order to solve a quantitative comparison problem, you must first compare the quantities in the two columns and then decide whether:

- one quantity is greater than the other
- the two quantities are equal
- the relationship cannot be determined from the information given

On the PSAT exam, SAT assessment, or GRE test, your answer always should be:

- **a** if the value in Column A is greater
- **b** if the value in Column B is greater
- **c** if the two values are equal, or
- **d** if the relationship cannot be determined from the information given in the question

## Math Topics

The book is divided into four content sections. Math topics included in this volume are arithmetic, algebra, geometry, and data analysis. These categories are further divided to include the following concepts:

### **Arithmetic**

- Absolute Value
- Decimals
- Exponents and Square Roots
- Fractions
- Integers
- Ordering and the Real Number Line
- Percent
- Ratio

### **Algebra**

- Applications
- Coordinate Geometry
- Inequalities
- Operations with Algebraic Expressions
- Rules of Exponents

## 501 Quantitative Comparison Questions

- Solving Linear Equations
- Solving Quadratic Equations in One Variable
- Translating Words into Algebraic Expressions

### **Geometry**

- Circles
- Lines and Angles
- Polygons
- Quadrilaterals
- Three-Dimensional Figures
- Triangles

### **Data Analysis**

- Counting
- Sequences
- Data Representation and Interpretation
- Frequency Distributions
- Measures of Central Tendency
- Measures of Dispersion
- Probability

## **A Note about the PSAT/NMSQT Exam**

On the PSAT/NMSQT exam, there are two 25-minute math sections, for a total of 40 questions. Of these questions, 12 are quantitative comparisons. This math section requires a basic knowledge of arithmetic, algebra, and geometry, so practicing with this book is ideal, as you will improve your PSAT/NMSQT exam score and start getting familiar with the SAT exam that you will encounter in the next school year.

## **A Note about the SAT Assessment**

On the SAT exam, there are two 30-minute math sections, for a total of 60 questions. Of these questions, 30 are quantitative comparison questions. *(There is also a 15-minute section of 5-choice math questions.)* Math concepts tested include arithmetic, algebra, geometry, and other topics, such as logical reasoning, probability, and counting. This book focuses on each of

## 501 Quantitative Comparison Questions

these areas of math so that you can get the targeted practice necessary to ace the quantitative comparison sections in the SAT exam.

In addition, each SAT exam contains a 30-minute experimental verbal or math section, used for equating, that does not count toward your score, so there may be 15 more quantitative comparisons on your exam (though you will only be scored for 30 of the potential 45 questions). Since you don't know which section is experimental, it's best to be prepared to answer many of these question types. You are allowed to use a calculator to answer math questions on the exam, if you wish.

### A Note about the GRE Test

You will be given 45 minutes to complete the 28 quantitative comparison questions on the computer-based GRE test. However, there are 60 quantitative comparison questions on the paper-based exam. Overall, the *percentage* of questions on the GRE test that are quantitative comparison are the same for both versions of the test: approximately 30% of both tests are quantitative comparison questions. The content areas included in the quantitative sections of the test are arithmetic, algebra, geometry, and data analysis. These are math concepts usually studied in high school, and this book specifically targets these areas. Calculators are not permitted.

### Questions, Questions, Questions

You have just read about the math topics covered in this book. To mimic a real test environment, math concepts are mixed within each section. For example, in the arithmetic section, you may find a question or two on exponents, then three questions on square roots, followed by three questions involving decimals and fractions. Then the next question is about square roots. This way, you are preparing for any type of arithmetic question that you could encounter on the real exam. This helps you to be prepared for whatever questions the College Board/ETS throws your way. Each chapter begins with an information and instruction overview describing the mathematical concepts covered in that particular section. Then you are presented with a variety of problems awaiting your solutions.

If you are practicing for the PSAT assessment or SAT exam, you should have a calculator on hand as you work through some of the chapters,

## 501 Quantitative Comparison Questions

because calculators are allowed in the testing center. Even if you don't use it to arrive at solutions, it's a good idea to use it to check your calculations. This goes for everyone—even GRE test-takers. If you have difficulty factoring numbers, a multiplication chart may help you. And if you are unfamiliar with prime numbers, use a list of them so you won't waste time trying to factor numbers that can't be factored. Don't forget to keep lots of scrap paper on hand for working out complex problems.

### Practice Makes Perfect

Because this book is designed for many levels of test takers, you may find that some of the more advanced questions are beyond your ability. If you are using this book to study for the PSAT assessment or SAT exam, there is a chance that you may get a few of the toughest questions wrong. Don't worry! If you are getting most of the questions correct, you are probably in good shape for your test. However, if you are studying for the GRE test, the full range of questions presented is appropriate for your level.

The questions in this book can help you prepare for your test in many ways. First, completing these practice exercises will make you familiar with the question format. Quantitative comparisons usually involve less reading, take less time to answer, and require less computation than regular 5-choice questions. Remember, there are only four choices from which to select the correct answer: A, B, C, and D. If the quantity in column A is larger, you will select the letter A on your answer grid. If column B contains the greater quantity, then you will select B. Select the answer C if the two quantities are equal, and the letter D if you cannot determine which is larger from the choices and information given. When you take the test, be careful not to mark an "E" on the answer sheet because it is never the correct choice.

Second, quantitative comparison practice will get you thinking of values in terms of equalities, inequalities, and estimation. Likewise, you will get accustomed to knowing how to logically assess whether or not you have enough information in the question to assign value. However, it is not always necessary to find the *exact* value of the two quantities, and often, it is important not to waste time doing so. Remember, you have a limited amount of time to arrive at correct answers, so it is important to use estimating, rounding, and the elimination of irrelevant information to determine the relationship between the information in Column A and the information in Column B.

## **501 Quantitative Comparison Questions**

Third, in the test-taking environment, it can be difficult to switch gears from regular math questions to quantitative comparisons; completing the exercises in this book will make these mental gymnastics more comfortable as you grow familiar with the question format. Also, your performance on these questions will help you assess your overall math skill level. Because the quantitative comparison questions assess a wide variety of math topics, these exercises will help you pinpoint the areas of math for which you need further study.

Finally, each question is fully explained at the end of each chapter. The answer keys give you not only the right answer, but also an explanation of why the answer is correct. In other words, for every problem, there is a complete explanation of the solution. If you find yourself getting stuck solving a problem, you can look at the answer explanation and use it as a personal tutor.

You have already taken an important step toward improving your math skills and your score. You have shown your commitment by purchasing this book. Now all you need to do is to complete each exercise, study the answer explanations, and watch your math skills increase. You can even work in pencil and do the exercises again to reinforce what you have learned. Good luck!

**Tip Sheet**

- ✓ **Not exactly.** It is not always necessary to find the exact value of the two quantities, and often, it is important not to waste time doing so. Use estimating, rounding, and the elimination of excess information to determine the relationship and avoid wasting time.
- ✓ **Look alike.** Attempt to make the two columns look as similar as possible. For example, make sure all units are equal. This is also true if one of the answer choices is a fraction or a decimal. If this is the case, then make the other answer into an improper fraction or a decimal, in order to make the choices look the most similar.
- ✓ **It's not necessarily nice to share.** Eliminate any information the columns share. This will leave you with an easier comparison. For example, you are given the two quantities  $5(x + 1)$  and  $3(x + 1)$ , with the proviso that  $x$  is greater than 0. In this case, you would select the first quantity because, since you know that  $x$  is a positive quantity, you can eliminate the  $(x + 1)$  from both. That leaves you to decide which is greater, 5 or 3. This has become a very easy problem by eliminating the information that the two quantities shared.
- ✓ **Plug it in.** Assign values for unknowns or variables. If you can do this quickly, many comparisons will become straightforward. Plug in numbers for variables whenever they are given. Always remember to simplify the equation or expression as much as possible before you plug in a value.
- ✓ **Sticky situations.** Try not to get stuck doing complicated computations. If you feel yourself doing a lot of computations, stop and try another method. There is often more than one way to solve a problem. Try to pick the easier one.
- ✓ **No assumptions necessary.** Make no assumptions about the information listed in the columns. If the question asks you to make assumptions, then choose D. For example, if one of the answer choices is  $x^2$ , you cannot assume that the answer is a positive root. Remember that  $x^2$  will have two roots, one positive and one negative. Many times the test-maker will try to trick you into assuming that the answer to such a problem is known. Do not let the test fool you. Be aware of the possibility of multiple answers.
- ✓ **A parenthetical aside.** If one or both of the expressions being compared have parentheses, be sure to remove the parentheses by completing the calculations before proceeding. This is a simple technique that can make

## 501 Quantitative Comparison Questions

a large difference in the similarity of the two quantities. For example, if you move the parentheses from the two quantities  $(x - 2)(x - 2)$  and  $x^2 - 4x + 4$  by squaring  $(x - 2)$ , you can clearly see that they are equal.

- ✓ **Let's play Operation™.** Sometimes the best way to solve the question is to perform an operation on both columns. This is especially useful when working with fractions. Often, on finding a LCD and multiplying that number in both columns helps to make the comparison easier. Just keep in mind that, like working in an equation, the operation performed must be exactly the same in each column.
- ✓ **Timing is everything.** Use your time wisely. Try to solve each problem, or be close to a solution, after one minute. It is not necessary to complete every problem on the test unless you want to be the next math genius honored by the Educational Testing Service. It is best just to focus on the problems you know how to do. It is a good idea to practice timing yourself as you solve the practice problems. See how close you can get to a solution in one minute per problem.



## 501 Quantitative Comparison Questions

### Multiplication Table

×	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

## 501 Quantitative Comparison Questions

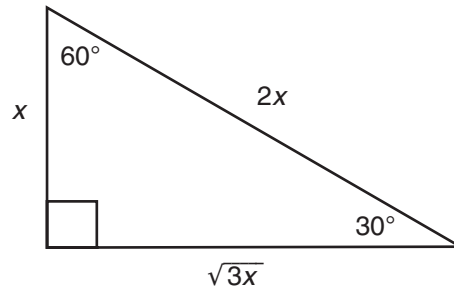
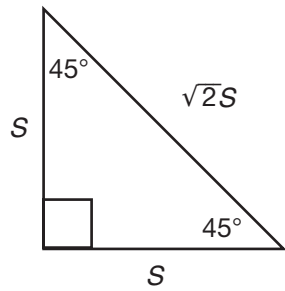
### Commonly Used Prime Numbers

2	3	5	7	11	13	17	19	23	29
31	37	41	43	47	53	59	61	67	71
73	79	83	89	97	101	103	107	109	113
127	131	137	139	149	151	157	163	167	173
179	181	191	193	197	199	211	223	227	229
233	239	241	251	257	263	269	271	277	281
283	293	307	311	313	317	331	337	347	349
353	359	367	373	379	383	389	397	401	409
419	421	431	433	439	443	449	457	461	463
467	479	487	491	499	503	509	521	523	541
547	557	563	569	571	577	587	593	599	601
607	613	617	619	631	641	643	647	653	659
661	673	677	683	691	701	709	719	727	733
739	743	751	757	761	769	773	787	797	809
811	821	823	827	829	839	853	857	859	863
877	881	883	887	907	911	919	929	937	941
947	953	967	971	977	983	991	997	1009	1013

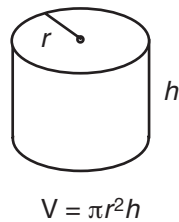
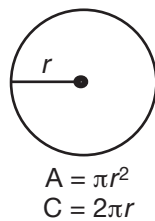
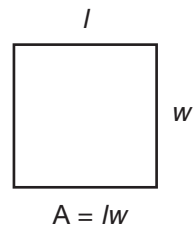
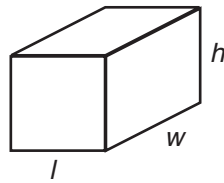
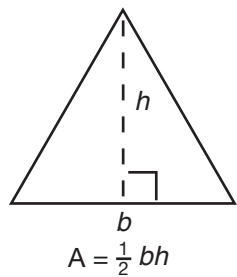
## 501 Quantitative Comparison Questions

### Reference Sheet

- The sum of the interior angles of a triangle is  $180^\circ$ .
- The measure of a straight angle is  $180^\circ$ .
- There are 360 degrees of arc in a circle.



Special Right Triangles





**501**

**Quantitative Comparison  
Questions**



# 1

## Arithmetic

**In this chapter,** the following math concepts will be the subject of the 125 arithmetic-based quantitative comparison questions:

- Absolute Value
- Decimals
- Exponents and Square Roots
- Fractions
- Integers
- Ordering and the Real Number Line
- Percent
- Ratio

Some important guidelines:

**Numbers:** All numbers used are real numbers.

**Figures:** Figures that accompany questions are intended to provide information useful in answering the questions. Unless otherwise indicated, positions of points, angles, regions, etc. are in the order shown; angle measures are positive; lines shown as straight are straight; and figures lie in a plane.

## 501 Quantitative Comparison Questions

Unless a note states that a figure is drawn to scale, you should NOT solve these problems by estimating or by measurement, but by using your knowledge of mathematics.

**Common Information:** In a question, information concerning one or both of the quantities to be compared is centered above the two columns. A symbol that appears in both columns represents the same thing in Column A as it does in Column B.

**Directions:** Each of the following questions consists of two quantities, one in Column A and one in Column B. Compare the two quantities and choose:

- a. if the quantity in Column A is greater
- b. if the quantity in Column B is greater
- c. if the two quantities are equal
- d. if the relationship cannot be determined from the information given

### Examples:

Column A

Column B

1.  $\frac{1}{5}$  of 25

$\frac{5}{2}$  of 2

The answer is **c**. The quantities are the same:  $\frac{1}{5} \times 25 = 5$ , and  $\frac{5}{2} \times 2 = 5$ .

2.  $a + 5$

$a + 7$

The answer is **b**. Regardless of the value of  $a$ , adding 7 will always result in a higher number than adding 5.



## 501 Quantitative Comparison Questions

### Questions

Column A	Column B
1. the number of even integers between 1 and 13	the number of even integers between 2 and 14
2. $\sqrt{0.16}$	$\sqrt{0.0016}$
3. Amy, Megan, and Sharon divided a batch of cookies among themselves. Amy took 30% of the cookies and Sharon took 40% of the cookies. Amy ate $\frac{1}{3}$ of the cookies she took and Sharon ate $\frac{1}{4}$ of the cookies she took. number of cookies Amy ate	number of cookies Sharon ate
4. $p - 8$	$p + 8$
5. $31x$	$35x$
6. $a^2$ <span style="margin-left: 100px;"><math>a &lt; 0</math></span>	$a^3$
7. $wx$ <span style="margin-left: 100px;"><math>w &lt; x &lt; y &lt; z</math></span>	$yz$
8. the percent increase from 10 cm to 14 cm	the percent increase from 54 cm to 58 cm
9. $\frac{1}{25}$	$\frac{.016}{4}$
10. $\sqrt{8} + \sqrt{13}$	$\sqrt{19} + \sqrt{9}$
11. $5 + \sqrt{32}$	$\sqrt{23} + 4$
12. Marvin sells candy bars at a rate of 3 bars for \$4. at this rate, the cost of $x$ candy bars	$x$ dollars
13. $(x + 2)^2$	$(x - 2)^2$
14. $8.7 \times 368$	$9 \times 368$
15. $18 - \frac{4}{5} + \frac{1}{2}$	$18 - \frac{1}{2} + \frac{4}{5}$
16. $\frac{1}{20}$ of 800	5% of 800

### 501 Quantitative Comparison Questions

Column A	Column B
<b>17.</b> $n < 0$ $7n$	$4n$
<b>18.</b> $p^2$	$-p^2$
<b>19.</b> $(85 - 93)(22 - 8)$	$(42 - 95)(11 - 17)$
<b>20.</b> $x \geq 0$ $x^2$	$x^3$
<b>21.</b> $5 \times (3 + 1) \div 2$	$5 \times 3 + 1 \div 2$
<b>22.</b> There are 150 people in a movie theater. 75 of the people are men, 60 are women, and the remainder are children. percent of people in the theater that are children	10%
<b>23.</b> .75%	.0075
<b>24.</b> The ratio of dogs to cats in a pet store is 5:3. There are 96 dogs and cats in the store. the number of dogs in the pet store	65
<b>25.</b> 45% of 104	43
<b>26.</b> $a$ , $b$ , and $c$ are integers greater than 1 and $(c^b)^5 = c^{5+a}$ $a$	$b$
<b>27.</b> $16.5 \times 10^3$	$1.65 \times 10^4$
<b>28.</b> $\frac{3}{4}$ of $\frac{8}{11}$	$\frac{6}{11}$
<b>29.</b> $x < 0 < y$ $-x^3y$	0
<b>30.</b> $a$ and $b$ are integers. $ab = 30$ . $a + b$	32
<b>31.</b> $0 < x < 1$ $\frac{1}{x}$	$\frac{1}{x^2}$
<b>32.</b> $\sqrt[4]{.0001}$	$\sqrt{.01}$

# 501 Quantitative Comparison Questions

Column A	Column B
<b>33.</b> $.123 \times 10^{-3}$	$12.3 \times 10^{-6}$
<b>34.</b> $\frac{x}{5}$ and $\frac{x}{6}$ are positive integers. the remainder when $x$ is divided by 2	1
<b>35.</b> 5.1	5.014
<b>36.</b> $x > 20$  4	  $24 - x$
<b>37.</b> the average rate of speed needed to drive 350 km in 5 hrs	the average rate of speed needed to drive 780 km in 12 hrs
<b>38.</b> hours in a year	seconds in a day
<b>39.</b> $28^2 + 42^2$	$(28 + 42)^2$
<b>40.</b> $7 \times 9 \times 12 \times 3$	$12 \times 3 \times 9 \times 7$
<b>41.</b> $n > 0$  $n(n - 1)$	  $n^2$
<b>42.</b> $a > b$  30% of $a$	  50% of $b$
<b>43.</b> 1	$\frac{4}{7} + \frac{7}{13}$
<b>44.</b> $\frac{5}{6}$ of 12	$\frac{1}{6}$ of 60
<b>45.</b> $\frac{1}{x} + 3y$	$7y + \frac{1}{x}$
<b>46.</b> $(n^2)^4$	$(n^4)^2$
<b>47.</b> $n > 1$ and $n$ is an integer.  $\frac{3}{n}$	  $n$
<b>48.</b> $0 < y < x$ . $x$ and $y$ are odd integers. remainder when $xy$ is divided by 2	$\frac{x}{y}$
<b>49.</b> $x > 0$  $5\sqrt{3x}$	  $3\sqrt{5x}$

# 501 Quantitative Comparison Questions

Column A	Column B
<b>50.</b> $x > 0$ $4x$	$\frac{x}{5}$
<b>51.</b> $-1 < x < 1$ $3x - 5$	$2x$
<b>52.</b> $x^2 + 1$	$x + 1$
<b>53.</b> $0 < x < y$ $\frac{x}{x}$	$\frac{x}{y}$
<b>54.</b> 70% of the students enrolled in a chemistry class passed the final exam. the ratio of those who failed to those who passed	$\frac{3}{5}$
<b>55.</b> $(84 + 12)(15 + 91)$	$(74 + 22)(20 + 86)$
<b>56.</b> 75% of 30	30% of 75
<b>57.</b> $.6^3$	$.6^{\frac{1}{3}}$
<b>58.</b> $x$ is an integer remainder when $4x$ is divided by 2	0
<b>59.</b> 2	$\sqrt{5}$
<b>60.</b> $\sqrt{17} + \sqrt{5}$	$\sqrt{22}$
<b>61.</b> $\frac{a}{b} = \frac{4}{5}$ and $\frac{b}{c} = \frac{9}{7}$ $\frac{a}{c}$	1
<b>62.</b> $\frac{3}{4}\%$	.75
<b>63.</b> $x$ and $y$ are prime numbers and $x + y = 12$ . $xy$	38
<b>64.</b> $0 < a < b$ $(a + b)(a + b)$	$(b - a)(b - a)$
<b>65.</b> $\sqrt{10} + \sqrt{10}$	7

## 501 Quantitative Comparison Questions

Column A	Column B
<b>66.</b> number of years from 1625 to 1812	number of years from 1631 to 1809
<b>67.</b> $\sqrt{63}$	$3\sqrt{7}$
<b>68.</b> $76 \times 14 + 14 \times 26$	$(76 + 26)14$
<b>69.</b> $p < 0$ $5p$	$9p$
<b>70.</b> $57 < 8k < 67$ 8	$k$
<b>71.</b> $243 \times 96$	$231 \times 93$
<b>72.</b> The Spartans played a total of 48 games and had a win to loss ratio of 7 to 5, and no game ended in a tie. number of wins	28
<b>73.</b> $0 < x < 5$ $x - 5$	$5 - x$
<b>74.</b> $\frac{3}{4} + \frac{1}{9} + \frac{5}{8}$	$\frac{1}{9} + \frac{5}{8} + \frac{1}{2}$
<b>75.</b> Joel swims laps 50% faster than Sue. number of laps Sue swims in 80 minutes	number of laps Joel swims in 60 minutes
<b>76.</b> $(26 - 31)(296 + 134)$	$(31 - 26)(296 + 134)$
<b>77.</b> $\frac{3}{5}$ of 80	40% of 80
<b>78.</b> $x < 0$ and $y < 0$ $ x  +  y $	$x + y$
<b>79.</b> $7(3x + 1)$	$12(3x + 1)$
<b>80.</b> $4\sqrt{2}$	$\sqrt{35}$
<b>81.</b> Dan runs $d$ miles in 30 minutes. Wendy runs $w$ miles in 1 hour. number of miles Dan runs in 1 hour	number of miles Wendy runs in 1 hour

# 501 Quantitative Comparison Questions

Column A	Column B
<b>82.</b> $r^6 = 64$ 32	$r^5$
<b>83.</b> $m > 1$ $\sqrt{m^{12}}$	$(m^2)^5$
<b>84.</b> $x > 0$ and $y > 0$ . $x$ is 40 percent of $y$ . $y$	$3x$
<b>85.</b> An appliance store sold 120 refrigerators last year. This year they sold 20 percent more. number of refrigerators sold this year	145
<b>86.</b> $956 + 274 + 189$	$200 + 275 + 970$
<b>87.</b> sum of integers from 1 to 100	1,000
<b>88.</b> $-1 < a < b < 0$ $a + b$	$a - b$
<b>89.</b> Lisa drove 117 miles between 8:15 A.M. and 10:30 A.M. without stopping. 60	Lisa's average speed in miles per hour
<b>90.</b> the product of the integers from $-21$ to $-73$	the product of the integers from $-45$ to $-72$
<b>91.</b> John plans to drive a total of 350 miles. He has completed $\frac{2}{5}$ of his trip in 2.5 hours. 60	John's average speed in miles per hour
<b>92.</b> the sum of the integers from $-10$ to 5	the sum of the integers from $-5$ to 10
<b>93.</b> the number of distinct prime factors of $12^2$	the number of distinct prime factors of $50^3$
<b>94.</b> $683 \times .05$	$683 \times .1$

# 501 Quantitative Comparison Questions

Column A	Column B
<b>95.</b> $ -83 $	$ 83 $
<b>96.</b> $45r$ $r < 0$	$\frac{45}{r}$
<b>97.</b> $-11 + (-4)$	$-11 - 4$
<b>98.</b> $5^9$	$25^4$
<b>99.</b> $\frac{1}{2} \times \frac{3}{4} \times \frac{7}{9}$	$\frac{3}{2} \times \frac{7}{9} \times \frac{1}{4}$
<b>100.</b> $2 + 8^2 - 6 - 10$	$(2 + 8)^2 - 6 - 10$
<b>101.</b> $7\sqrt{x}$ $x > 0$	$\sqrt{3x}$
<b>102.</b> $\frac{1}{3}$ of $x$	35% of $x$
<b>103.</b> $\frac{1}{3}x + \frac{1}{3}x + \frac{1}{3}x = 9$ $x$	9
<b>104.</b> $b^{(a+1)}$ $a > 1$ and $b > 1$	$b^a$
<b>105.</b> $\frac{-xy}{x}$ $x > y > 0$	$\frac{xy}{x}$
<b>106.</b> $1 - \frac{1}{30}$	$\frac{9}{10} + \frac{11}{100}$
<b>107.</b> $(t^6)^2$	$t^8 t^4$
<b>108.</b> the number of primes between 40 and 50	the number of primes between 1 and 6
<b>109.</b> $\sqrt{x} + \sqrt{y}$ $x > 0$ and $y > 0$	$\sqrt{x+y}$
<b>110.</b> Kendra is driving at a steady rate of 56 miles per hour. number of minutes it will take Kendra to drive 42 miles	45 minutes
<b>111.</b> $\{x,y\}$ represents the remainder when $x$ is divided by $y$ . $\{5^6, 10\}$	$\{10^4, 5\}$

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Column A	Column B
<b>112.</b> $x, y, z,$ and $m$ are positive integers. $x = \frac{2}{5}m$ and $y = \frac{5}{3}m$ and $z = \frac{9}{10}y$ $x$	$z$
<b>113.</b> $\sqrt{\frac{15}{2}}$	$\frac{3}{\sqrt{3}}$
<b>114.</b> $b < 0$ $5b$	$b^4$
<b>115.</b> $-(x - y) = x - y$ $x$	$y$
<b>116.</b> the product of the integers from $-5$ to $6$	the product of the integers $-8$ to $1$
<b>117.</b> $(-21)^{12}$	$(-31)^{13}$
<b>118.</b> $(m^3)^6$	$\sqrt{m^{36}}$
<b>119.</b> $\frac{5x-35}{5}$	$x - 7$
<b>120.</b> the number of primes that are divisible by $7$	the number of primes that are divisible by $11$
<b>121.</b> $.16$	$.0989$
<b>122.</b> $4.25 \times 10^5$	$42,500,000 \div 10^2$
<b>123.</b> $ x - 8 $	$ 8 - x $
<b>124.</b> The sophomore class used $60$ packages of cheese to make pizzas. Each pizza used $\frac{2}{3}$ a package of cheese. number of pizzas they made	$100$
<b>125.</b> $x = \frac{1}{4}$ and $y = \frac{1}{5}$ $\frac{x}{y}$	$\frac{y}{x}$



**Answer Explanations**

The following explanations show one way in which each problem can be solved. You may have another method for solving these problems.

1. a. There are 6 even integers between 1 and 13. They are 2, 4, 6, 8, 10, and 12. There are 5 even integers between 2 and 14. They are 4, 6, 8, 10, and 12.
2. a. The square root of 0.16 is 0.4. The square root of 0.0016 is 0.04.
3. c. Amy took 30% of the cookies and ate  $\frac{1}{3}$  of those, which is 10% of the original number of cookies. Sharon took 40% of the cookies and ate  $\frac{1}{4}$  of those, which is also 10% of the original number of cookies. Since both women ate 10% of the original number of cookies, they ate the same amount.
4. b. 8 more than any number ( $p + 8$ ) is more than 8 less than that number ( $p - 8$ ).
5. d. The relationship cannot be determined. If the value of  $x$  is 0, then both quantities are 0. If the value of  $x$  is positive, then  $35x$  is greater than  $31x$ . If the value of  $x$  is negative, then  $31x$  is greater than  $35x$ .
6. a. Since  $a$  is a negative number ( $a < 0$ ),  $a^2$  is a positive number because a negative times a negative is a positive;  $a^3$  is a negative number because three negatives multiply to a negative answer. A positive is always greater than a negative, so quantity A is greater than quantity B.
7. d. The relationship cannot be determined. If  $w = -10$ ,  $x = -9$ ,  $y = 1$ , and  $z = 2$ , then  $wx = 90$  and  $yz = 2$ , so quantity A is greater. If  $w = 0$ ,  $x = 1$ ,  $y = 2$ , and  $z = 3$ , then  $wx = 0$  and  $yz = 6$ , so quantity B is greater. Either quantity can be greater, depending on the choice of variables.
8. a. Both quantities increased by 4, but quantity A increased 4 from 10, or 40%, and quantity B increased 4 from 54, or 7.4%. 40% is greater than 7.4%.

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9. a. Change  $\frac{1}{25}$  to a decimal by dividing 1 by 25 to get .04. Change  $\frac{.016}{4}$  to a decimal by dividing .016 by 4 to get .004. .04 is greater than .004.
10. b. Compare  $\sqrt{8}$  to  $\sqrt{9}$  and find that  $\sqrt{9}$  is greater and comes from quantity B. Compare  $\sqrt{13}$  to  $\sqrt{19}$  and find that  $\sqrt{19}$  is greater and comes from quantity B. Since both parts of quantity B are greater than the parts of quantity A, quantity B is greater.
11. a. Compare 5 to 4 and find that 5 is greater and comes from quantity A. Compare  $\sqrt{32}$  to  $\sqrt{23}$  and find that  $\sqrt{32}$  is greater and comes from quantity A. Since both parts of quantity A are greater than the parts of quantity B, quantity A is greater.
12. a. Each candy bar costs more than \$1 (divide \$4 by 3). Therefore, the cost of  $x$  candy bars is more than  $x$  dollars.
13. d. The relationship cannot be determined. If 0 is substituted for  $x$ , both quantities are 4. If 6 is substituted for  $x$ , quantity A is 64  $[(6 + 2)^2 = 64]$  and quantity B is 16  $[(6 - 2)^2 = 16]$ . In the first example, the quantities are equal and in the second example, quantity A is greater. The relationship cannot be determined.
14. b. Both quantities contain the number 368. In quantity B, 368 is being multiplied by a larger number, making quantity B greater than quantity A.
15. b. Consider there to be an equal sign between the two columns. Subtract 18 from both sides, leaving  $-\frac{4}{5} + \frac{1}{2} = -\frac{1}{2} + \frac{4}{5}$ . Since  $\frac{4}{5}$  is larger than  $\frac{1}{2}$ , the left side of the equation (quantity A) is negative and the right side (quantity B) is positive. A positive number is always greater than a negative number, so quantity B is greater.
16. c.  $\frac{1}{20}$  and 5% are the same thing. Therefore, the two quantities are equal.
17. b.  $n$  is a negative number. Try a couple of negative numbers to see the pattern. Substitute in  $-2$ ;  $(7)(-2) = -14$  and  $(4)(-2) = -8$ , quantity B is greater. Substitute in  $-.5$ ;  $(7)(-.5) = -3.5$  and  $(4)(-.5) = -2$ . Again, quantity B is greater.

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- 18. a.** Any number squared is positive. Therefore,  $p^2$  is positive and  $(-p)^2$  is negative. A positive number is always greater than a negative number. Quantity A is greater.
- 19. b.** Both sets of parentheses in quantity B are negative. Two negatives multiplied yield a positive answer. Quantity A has one negative set of parentheses and one positive. A negative multiplied by a positive yields a negative answer. Since quantity B is always positive and quantity A is always negative, quantity A is greater.
- 20. d.** The relationship cannot be determined. If  $x < 1$ , for example .5, then quantity A is larger. If  $x = 1$ , then both quantities are equal (both 1). If  $x > 1$ , for example 3, then quantity B is larger.
- 21. b.** Use the order of operations to simplify.

$$5 \times (3 + 1) \div 2 =$$

$$5 \times 4 \div 2 =$$

$$20 \div 2 =$$

$$10 = \text{quantity A}$$

$$5 \times 3 + 1 \div 2 =$$

$$15 + .5 =$$

$$15.5 = \text{quantity B}$$

- 22. c.** There are 15 children out of 150 people;  $\frac{15}{150} = 0.10 = 10\%$ . The percentage of people in the theater that are children is 10%.
- 23. c.** Change .75% to a decimal by moving the decimal point two places to the left.  $.75\% = 0.0075$ .
- 24. b.** Use the equation  $5x + 3x = 96$  and solve for  $x$ .

$$5x + 3x = 96$$

$$8x = 96$$

$$\frac{8x}{8} = \frac{96}{8}$$

$$x = 12$$

$5x$  of the animals are dogs. Since  $x = 12$ ,  $5x = 60$ . There are 60 dogs, which is less than quantity B.

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- 25. a.** Notice that 45% of 104 would be more than 45% of 100. Since 45% of 100 is 45, quantity A is greater than 45 which is greater than quantity B.

- 26. a.** Simplify the exponents on the left-hand side of the equation by multiplying. Then, since the bases are the same ( $c$ ), the exponents can be set equal to each other:

$$(c^b)^5 = c^{5+a}$$

$$c^{5b} = c^{5+a}$$

$$5b = 5 + a$$

Isolate  $a$  by subtracting 5 on both sides of the equation.

$$5b - 5 = 5 + a - 5$$

$$5b - 5 = a$$

The variables must be integers greater than 1 (so the smallest possible value is 2). When 2 is substituted in for  $b$ ,  $a$  is equal to 5. As the value of  $b$  gets larger, so does the value of  $a$ . Quantity A is always greater than quantity B.

- 27. c.** Multiplying by  $10^3$  moves the decimal in 16.5 three places to the right to get 16,500 (quantity A). Multiplying by  $10^4$  moves the decimal in 1.65 four places to the right to get 16,500 (quantity B).
- 28. c.** “Of” means multiply. Multiply the fractions in quantity A;  
 $\frac{3}{4} \times \frac{8}{11} = \frac{24}{44} = \frac{6}{11}$ . Quantity A is equal to quantity B.
- 29. a.** The value of  $x$  is negative.  $x^3$  is also negative because three negatives multiply to a negative answer. The negative in front of  $-x^3y$  negates the negative of  $x^3$ , making the quantity positive. The value of  $y$  doesn't matter because it is positive, making it greater than quantity B.
- 30. b.** The possible integer factor pairs of 30 are (1,30), (2,15), (3,10), and (5,6). Of these factor pairs, (1,30) has the largest sum;  $1 + 30 = 31$ . 31 is not larger than 32, so quantity B is greater.
- 31. b.**  $x$  is a positive number less than 1. The easiest way to see this solution is to try different numbers for  $x$ . If  $x = 0.5$ , then  $\frac{1}{x} = \frac{1}{0.5} = 1 \div 0.5 = 2$  and  $\frac{1}{x^2} = \frac{1}{(0.5)^2} = \frac{1}{0.25} = 4$ . Quantity B is always greater than quantity A.

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- 32. c.**  $\sqrt[4]{.0001} = .1$  and  $\sqrt{.01} = .1$ ; the two quantities are equal.
- 33. a.** In quantity A, multiplying by  $10^{-3}$  moves the decimal 3 places to the left to yield 0.000123. In quantity B, multiplying by  $10^{-6}$  moves the decimal to the left 6 places to yield 0.0000123.  $0.000123 > 0.0000123$ .
- 34. b.** In order for  $\frac{x}{5}$  and  $\frac{x}{6}$  to be integers,  $x$  must be evenly divisible by 5 and 6. If a number is divisible by 6, it is even. An even number does not have a remainder when divided by 2. Quantity A is 0 which is less than quantity B.
- 35. a.** Add two zeros to the end of quantity A to compare it to quantity B.  $5.100 > 5.014$ .
- 36. a.** If  $x$  was 20, then quantity B would be 4. Since  $x$  is greater than 20, quantity B is less than 4 and less than quantity A.
- 37. a.** Use this formula: rate  $\times$  time = distance. If  $5r = 350$ , then  $r = 70$  (quantity A). If  $12r = 780$ , then  $r = 65$  (quantity B).
- 38. b.** To find the number of hours in a year multiply 24 hours by 365 days to get 8,760 hours. To find the number of seconds in a day, multiply 60 seconds by 60 minutes by 24 hours to get 86,400 seconds.
- 39. b.** Multiply  $(28 + 42)^2$  out using FOIL.
- $$\begin{aligned}(28 + 42)^2 &= (28 + 42)(28 + 42) \\ &= (28)^2 + (28)(42) + (42)(28) + (42)^2\end{aligned}$$
- Since  $(28 + 42)^2$  has the two middle terms in addition to  $(28)^2$  and  $(42)^2$ , it is greater than quantity A.
- 40. c.** Multiplication is commutative (order doesn't matter). Quantity A and quantity B are the same, just in a different order. Therefore, they are equal.
- 41. b.** Distribute the  $n$  in quantity A to get  $n^2 - n$ . Next, subtract  $n^2$  from both quantities. Quantity A becomes  $-n$  and quantity B becomes 0. Since  $n$  is positive,  $-n$  is negative. Any negative number is less than 0; therefore, quantity B is greater.

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- 42. d.** The relationship cannot be determined;  $a$  is greater than  $b$ . If  $a$  is 200 and  $b$  is 100, 30% of 200 is 60 and 50% of 100 is 50, making quantity A greater. If  $a$  is 120 and  $b$  is 118, 30% of 120 is 36 and 50% of 118 is 59, making quantity B greater.
- 43. b.** Both fractions in quantity B are greater than  $\frac{1}{2}$ . When they are added together, they will make more than 1 whole.
- 44. c.** “Of” means multiply;  $\frac{5}{6} \times 12 = 10$  and  $\frac{1}{6} \times 60 = 10$ .
- 45. d.** The relationship cannot be determined. Subtract  $\frac{1}{x}$  from both quantities. Now compare  $3y$  and  $7y$ . If  $y$  is negative,  $3y$  is greater. If  $y$  is positive,  $7y$  is greater.
- 46. c.**  $(n^2)^4 = n^8$  and  $(n^4)^2 = n^8$ . The quantities are equal.
- 47. b.** The first integer that  $n$  can be is 2. Since  $\frac{3}{2} = 1.5$ , quantity B is greater. Quickly plugging in other integers shows that this is always true.
- 48. b.** The product of two odd numbers is odd. The remainder when an odd number is divided by 2 is always 1. Therefore, quantity A is always 1. Since  $x$  is larger than  $y$ ,  $\frac{x}{y}$  is always greater than 1 because  $y$  always goes into  $x$  more than one time.
- 49. a.** Square both quantities to compare without the square roots:  $(5\sqrt{3x})^2 = 25(3x) = 75x$ ;  $(3\sqrt{5x})^2 = 9(5x) = 45x$ . Since  $x$  is positive,  $75x$  is always greater than  $45x$ .
- 50. a.** Try a number less than 1 such as 0.5 for  $x$ ;  $4(0.5) = 2$  and  $\frac{0.5}{5} = .1$ . In this case, quantity A is greater. Try a number greater than 1 such as 20.  $4(20) = 80$  and  $\frac{20}{5} = 4$ . Whenever a positive number is multiplied by 4, it will be greater than if that positive number was divided by 5.
- 51. b.** Subtract  $2x$  from both quantities. Quantity A is now  $x - 5$  and quantity B is now 0. Add 5 to both quantities. A is now  $x$  and B is now 5.  $x$  is defined as between  $-1$  and  $1$ . Therefore, it is less than 5.

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- 52. d.** The relationship cannot be determined. If  $x = 0.5$ , quantity A is  $(0.5)^2 + 1 = .25 + 1 = 1.25$  and quantity B is  $0.5 + 1 = 1.5$ . When  $x = 0.5$ , quantity B is greater. If  $x = 6$ , quantity A is  $6^2 + 1 = 36 + 1 = 37$  and quantity B is  $6 + 1 = 7$ . Quantity A is greater when  $x = 6$ .
- 53. a.**  $\frac{x}{x}$  always equals 1. Since  $x < y$  and  $x$  is positive,  $\frac{x}{y} < 1$ .
- 54. b.** If 70% of students passed, 30% of students failed. Therefore, the ratio of failed to passed is 30 to 70, which simplifies to  $\frac{3}{7}$ .  $\frac{3}{5} > \frac{3}{7}$ .
- 55. c.** Add the numbers inside the parentheses.  $(84 + 12)(15 + 91) = (96)(106)$  and  $(74 + 22)(20 + 86) = (96)(106)$ .
- 56. c.** "Of" means multiply;  $75\%$  of  $30 = .75 \times 30 = 22.5$  and  $30\%$  of  $75 = .30 \times 75 = 22.5$ .
- 57. a.** Since the bases are equal, just compare the exponents to compare the expressions.  $3 > \frac{1}{3}$ .
- 58. c.**  $4x$  is an even number because any multiple of 4 is even. The remainder when an even number is divided by 2 is 0.
- 59. b.**  $\sqrt{4} = 2$ , so  $\sqrt{5} > 2$ .
- 60. a.**  $\sqrt{17} > 4$  and  $\sqrt{5} > 2$ , therefore,  $\sqrt{17} + \sqrt{5} > 6$ . Since  $\sqrt{25} = 5$ ,  $\sqrt{22} < 5$ . Quantity A is greater.
- 61. a.**  $\frac{a}{b} \times \frac{b}{c} = \frac{a}{c}$  and  $\frac{4}{5} \times \frac{9}{7} = \frac{36}{35}$ ;  $\frac{36}{35} > 1$ .
- 62. b.**  $\frac{3}{4}\% = 0.75\% = .0075$ ;  $\frac{3}{4}$  as a decimal is 0.75. To change 0.75% to a decimal, move the decimal point two places to the left.  $.0075 < .75$ .
- 63. b.** The only pair of numbers that adds to 12 and is prime is 7 and 5. Therefore,  $x$  and  $y$  are 5 and 7;  $xy = (5)(7) = 35$ .  $35 < 38$ .
- 64. a.** For any positive numbers  $a$  and  $b$ ,  $a + b > b - a$ . Therefore,  $(a + b)(a + b) > (b - a)(b - a)$ .
- 65. b.** Combine the terms of quantity A;  $\sqrt{10} + \sqrt{10} = 2\sqrt{10}$ . To get rid of the square root, square both quantities (A and B);  $(2\sqrt{10})^2 = 4(10) = 40$  and  $7^2 = 49$ .  $40 < 49$ .

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- 66. a.** Notice that quantity A starts earlier and ends later. Therefore, it is a longer period of time. You do not need to do the subtraction.
- 67. c.** Square both quantities to get rid of the square roots;  $(\sqrt{63})^2 = 63$  and  $(3\sqrt{7})^2 = 9(7) = 63$ . The two quantities are the same.
- 68. c.** Use the distributive property to multiply quantity B out.  $(76 + 26)14 = 76 \times 14 + 26 \times 14$ . Quantity B is equivalent to quantity A.
- 69. a.** Any positive number multiplied by 9 is greater than that same number multiplied by 5. When the number is negative, multiplying by 9 yields a number that is “more negative” or less than that negative multiplied by 5.
- 70. d.** The relationship cannot be determined. Solve the inequality for  $k$  by dividing both sides by 8;  $\frac{57}{8} < \frac{8k}{8} < \frac{67}{8}$ .  $7.125 < k < 8.375$ . It cannot be determined whether  $k$  is less than, greater than, or equal to 8.
- 71. a.** Both numbers in quantity A are greater than the corresponding number in quantity B;  $243 > 231$  and  $96 > 93$ . Therefore, the product for quantity A is greater than the product for quantity B.
- 72. c.** Use the equation  $7x + 5x = 48$  and solve for  $x$ . First, combine like terms on the left-hand side of the equation;  $12x = 48$ . Divide both sides by 12 to solve for  $x$ ;  $\frac{12x}{12} = \frac{48}{12}$ .  $x = 4$ . The wins are  $7x$  or 28.
- 73. b.**  $x$  is between 0 and 5. Since  $x$  is less than 5,  $x - 5$  must be negative. Since  $x$  is less than 5,  $5 - x$  must be positive. Any positive number is greater than any negative number.
- 74. a.** Subtract  $\frac{1}{9}$  and  $\frac{5}{8}$  from both quantities. Quantity A is then just  $\frac{3}{4}$  and quantity B is just  $\frac{1}{2}$ . Quantity A is greater than quantity B.
- 75. b.** Use the formula distance = rate  $\times$  time. Let Joel’s rate be 1.5 and Sue’s rate be 1. In 80 minutes, Sue’s distance is  $1(80) = d$  or  $80 = d$ . In 60 minutes, Joel’s distance is  $1.5(60) = d$  or  $90 = d$ .



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- 76. b.**  $(26 - 31)$  is negative and therefore, when multiplied by a positive  $(296 + 134)$  it yields a negative answer. Both parentheses in quantity B are positive, so quantity B is positive. Any positive number is greater than any negative number.
- 77. a.** 40% is equivalent to  $\frac{40}{100} = \frac{2}{5}$ ;  $\frac{3}{5}$  of 80 is greater than  $\frac{2}{5}$  of 80.
- 78. a.** Both  $x$  and  $y$  are negative. Therefore, the sum of  $x$  and  $y$  is negative (quantity B). The absolute value of  $x$  and  $y$  are both positive, so their sum is positive (quantity A). Any positive number is greater than any negative number.
- 79. d.** The relationship cannot be determined. If  $x = -2$ , then quantity A is  $7(3(-2) + 1) = 7(-6 + 1) = 7(-5) = -35$  and quantity B is  $12(3(-2) + 1) = 12(-6 + 1) = 12(-5) = -60$ . In this case, quantity A is greater. If  $x = 2$ , then quantity A is  $7(3(2) + 1) = 7(6 + 1) = 7(7) = 49$  and quantity B is  $12(3(2) + 1) = 12(6 + 1) = 12(7) = 84$ . In this case, quantity B is greater.
- 80. b.** Square both quantities to get rid of the square roots;  $(4\sqrt{2})^2 = (16)(2) = 32$  and  $(\sqrt{35})^2 = 35$ .  $32 < 35$ . Quantity B is greater.
- 81. d.** The relationship cannot be determined. There is not enough information to determine an answer.
- 82. c.**  $2^6 = 64$ ; therefore,  $r = 2$ .  $2^5 = 32$ . Both quantities are equal to 32.
- 83. b.**  $\sqrt{m^{12}} = m^6$  and  $(m^2)^5 = m^{10}$ ; since  $m$  is greater than 1, quantity B is greater than quantity A.
- 84. b.** “ $x$  is 40 percent of  $y$ ” translates into the equation  $x = .4y$ . Substitute  $.4y$  for  $x$  in quantity B;  $3(.4y) = 1.2y$ .  $y < 1.2y$ . Quantity B is greater.
- 85. b.** Find 20% of 120 by multiplying 120 by .20 to get 24 more refrigerators sold. Add 24 to the number of refrigerators sold last year to get the number sold this year;  $120 + 24 = 144$ ; 144 refrigerators were sold this year.
- 86. b.** Compare each number in quantity A to a different number in quantity B;  $956 < 970$ ,  $274 < 275$ , and  $189 < 200$ . Since each of the numbers in quantity A is less than the corresponding number in quantity B, quantity B is greater.

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- 87. a.** Pair the largest number with the smallest number (1 and 100) from the list of integers and add them together (101). Take the second largest pair (2 and 99) and add them together (101). The sum of the third largest pair (3 and 98) is also 101. There are 50 pairs whose sum is 101. To find the sum of the integers, multiply 101 by 50 to get a sum of 5,050, which is larger than quantity B.
- 88. b.** Subtract  $a$  from both quantities. Quantity A is then  $b$  and quantity B is  $-b$ . Since  $b$  is negative,  $-b$  is positive and therefore greater than  $b$ .
- 89. a.** Use the formula distance = rate  $\times$  time. Lisa's distance is 117 miles and her time is 2.25 hours;  $117 = 2.25r$ . Divide both sides by 2.25;  $\frac{117}{2.25} = \frac{2.25r}{2.25}$ , so  $52 = r$ . The rate is 52 miles per hour.
- 90. b.** All the numbers involved in the problem are negative. There is an odd number of numbers for quantity A and an even number of numbers for quantity B. When multiplying an odd number of negatives, you get a negative answer. When multiplying an even number of negatives, you get a positive answer. Any positive number is greater than any negative number.
- 91. a.** Find the number of miles that John has driven by finding  $\frac{2}{5}$  of 350;  $\frac{2}{5} \times 350 = 140$ . 140 miles have been driven in 2.5 hours. To find the average speed, use the formula distance = rate  $\times$  time. The distance is 140 and the time is 2.5.  $140 = 2.5r$ . Solve for  $r$  by dividing both sides of the equation by 2.5;  $\frac{140}{2.5} = \frac{2.5r}{2.5}$ , so  $r = 56$  mph.
- 92. b.** Quantity A and quantity B both contain the integers from  $-5$  to 5. So the only comparison that must be done is outside of those numbers. The additional numbers that quantity A has are all negative, which brings the sum down. The additional numbers that quantity B has are all positive, which brings the sum up. Quantity B is therefore greater.
- 93. c.** Create a factor tree to help visualize the factors of  $12^2$  and  $50^3$ . The only distinct prime factors of  $12^3$  are 3 and 2. The only distinct prime factors of  $50^3$  are 5 and 2. Since they both have 2 distinct prime factors, the quantities are equal.
- 94. b.**  $683 \times .05 = 34.15$  and  $683 \times .1 = 68.3$

### 501 Quantitative Comparison Questions

- 95. c.**  $|-83| = 83$  and  $|83| = 83$
- 96. d.** The relationship cannot be determined. If  $r = -0.1$ ,  $45(-0.1) = -4.5$  and  $\frac{45}{-0.1} = -450$ . In this example, quantity A is greater. If  $r = -5$ ,  $45(-5) = -225$  and  $\frac{45}{-5} = -9$ . In this example, quantity B is greater.
- 97. c.**  $-11 + (-4) = -11 - 4 = -15$
- 98. a.** In order to compare the two quantities, the bases must be the same. 25 can be written as  $5^2$ . Therefore,  $25^4 = (5^2)^4 = 5^8$ . Compare the exponents of quantities A and B.  $9 > 8$ . Quantity A is greater.
- 99. c.** To multiply fractions, simply multiply across the numerators and denominators. The numbers in the numerators in quantity A and quantity B are the same (1, 3, 7), just in a different order. The quantities in the denominators are also the same (2, 4, 9), just in a different order. When multiplied out, both quantities are  $\frac{21}{72}$ .
- 100. b.** Follow the order of operations. Quantity A is  $2 + 8^2 - 6 - 10 = 2 + 64 - 6 - 10 = 50$ . Quantity B is  $(2 + 8)^2 - 6 - 10 = 10^2 - 6 - 10 = 100 - 6 - 10 = 84$ .
- 101. a.** Square both quantities to get rid of the square roots;  $(7\sqrt{x})^2 = 49x$  and  $(\sqrt{3x})^2 = 3x$ . Since  $x$  is positive,  $49x > 3x$ . Quantity A is greater than quantity B.
- 102. d.** The relationship cannot be determined. When  $x$  is positive, quantity B is greater. When  $x$  is negative, quantity A is greater.
- 103. c.**  $\frac{1}{3}x + \frac{1}{3}x + \frac{1}{3}x = 1x$ ; therefore,  $x = 9$ . The quantities are equal.
- 104. a.** Since the bases are the same ( $b$ ) and  $b > 1$ , the exponents can be compared.  $a + 1 > a$  since  $a$  is positive.
- 105. b.** Simplify both fractions by canceling the  $x$ 's. The fractions then become just  $-y$  and  $y$ .  $y$  is positive, so  $-y$  is negative. Any positive number is greater than any negative number.

## 501 Quantitative Comparison Questions

- 106. b.** Quantity A is less than 1 and quantity B is greater than 1. This is easily seen by the fact that  $\frac{1}{30}$  is being taken from 1, which brings the value below 1 for quantity A. For quantity B, create a common denominator of 100;  $\frac{90}{100} + \frac{11}{100} = \frac{101}{100}$ . This fraction is greater than 1.
- 107. c.** Use rules of exponents to simplify quantities.  $(t^6)^2 = t^{12}$  and  $t^8 t^4 = t^{12}$ . The quantities are equal.
- 108. c.** The primes between 40 and 50 are 41, 43, and 47. The primes between 1 and 6 are 2, 3, and 5. Each quantity equals 3.
- 109. a.** Square both quantities to get rid of some of the square roots.
- $$(\sqrt{x} + \sqrt{y})^2 = (\sqrt{x} + \sqrt{y})(\sqrt{x} + \sqrt{y}) = x + 2\sqrt{xy} + y$$
- $$(\sqrt{x + y})^2 = x + y$$
- Since quantity A has the extra term  $2\sqrt{xy}$ , which is positive, it is greater.
- 110. c.** Use the formula distance = rate  $\times$  time. Kendra's rate is 56 and her distance is 42;  $42 = 56t$ . Solve the equation by dividing by 56;  $\frac{42}{56} = \frac{56t}{56}$ ;  $t = .75$  hr; .75 hours is equivalent to 45 minutes.
- 111. a.** Any power of 5 ends in 5. When it is divided by 10, there will be a remainder of 5. Therefore, quantity A is 5. Any power of 10 ends in 0. When it is divided by 5, there will be a remainder of 0.
- 112. b.** Compare  $x$  and  $z$  in terms of  $m$ ;  $x = \frac{2}{5}m$ ;  $z$  can be rewritten in terms of  $m$  by substituting  $\frac{5}{3}m$  for  $y$ ;  $z = \frac{9}{10}(\frac{5}{3}m) = \frac{3}{2}m$ .  $\frac{2}{5} < \frac{3}{2}$ , therefore, quantity B is greater.
- 113. a.** Get rid of the square roots by squaring both fractions;  $(\sqrt{\frac{15}{2}})^2 = \frac{15}{2} = 3.75$  and  $(\sqrt{\frac{3}{3}})^2 = \frac{9}{3} = 3$ .
- 114. b.**  $b$  is negative, so 5 times a negative is a negative. Quantity A is negative. A negative multiplied by itself 4 times is a positive. Quantity B is positive. Any positive number is greater than any negative number.

## 501 Quantitative Comparison Questions

- 115. c.** Simplify the equation by distributing the negative.

$$-(x - y) = x - y$$

$$-x + y = x - y$$

Next, add  $x$  to both sides. Then add  $y$  to both sides.

$$-x + x + y = x + x - y$$

$$y + y = 2x - y + y$$

$$2y = 2x$$

Divide both sides by 2.

$$\frac{2y}{2} = \frac{2x}{2}$$

$$y = x$$

- 116. c.** Zero is included in both lists. Zero multiplied by anything yields a zero. Both products are zero.
- 117. a.** Quantity A is positive because a negative number to an even power yields a positive answer. Quantity B is negative because a negative number to an odd power yields a negative answer. Any positive number is greater than any negative number.
- 118. c.** Use the rules of exponents to simplify the quantities;  $(m^3)^6 = m^{18}$ ;  $\sqrt{m^{36}} = m^{18}$ . Both quantities are equivalent to  $m^{18}$ .
- 119. c.** Divide both terms in the numerator of quantity A by 5. This yields  $x - 7$ , which is equivalent to quantity B.
- 120. c.** The only prime divisible by 7 is 7. It is the same for 11—the only prime divisible by 11 is 11. If any other number was divisible by 7 or 11, it would not be prime.
- 121. a.** Add zeros on to the end of quantity A to make it easier to compare to quantity B;  $.16 = .1600$ ;  $.1600 > .0989$ .
- 122. c.** When multiplying by  $10^5$ , move the decimal 5 places to the right to get 425,000. When dividing by  $10^2$ , move the decimal 2 places to the left to get 425,000. The values in A and B are the same.

### 501 Quantitative Comparison Questions

- 123. c.** The absolute value of opposites is the same number. For example,  $|5| = 5$  and  $|-5| = 5$ ;  $x - 8$  is the opposite of  $8 - x$ . This can be shown by multiplying either expression by  $-1$ . The result is the remaining expression;  $-1(x - 8) = -x + 8 = 8 - x$ . Therefore, the two values are equal.

- 124. b.** Divide the number of packages of cheese by the amount used per pizza to find the number of pizzas made;  $60 \div \frac{2}{3} = \frac{60}{1} \times \frac{3}{2} = 90$ . They made 90 pizzas. Quantity B is greater.

- 125. a.** Set up the complex fractions and then divide. Quantity A is

$$\frac{x}{y} = \frac{\frac{1}{4}}{\frac{1}{5}} = \frac{1}{4} \div \frac{1}{5} = \frac{1}{4} \times \frac{5}{1} = \frac{5}{4}, \text{ so Quantity A is } \frac{5}{4}; \text{ Quantity B is}$$

$$\frac{y}{x} = \frac{\frac{1}{5}}{\frac{1}{4}} = \frac{1}{5} \div \frac{1}{4} = \frac{1}{5} \times \frac{4}{1} = \frac{4}{5}, \text{ so Quantity B is } \frac{4}{5}.$$

Since quantity A is greater than 1 and quantity B is less than 1, quantity A is greater.

# 2

## Algebra

**In this chapter,** the following math concepts will be the subject of the 125 algebra-based quantitative comparison questions:

- Applications
- Coordinate Geometry
- Inequalities
- Operations with Algebraic Expressions
- Rules of Exponents
- Solving Linear Equations
- Solving Quadratic Equations in One Variable
- Translating Words into Algebraic Expressions

Some important guidelines:

**Numbers:** All numbers used are real numbers.

**Figures:** Figures that accompany questions are intended to provide information useful in answering the questions. Unless otherwise indicated, positions of points, angles, regions, etc. are in the order shown; angle measures are positive; lines shown as straight are straight; and figures lie in a plane.

## 501 Quantitative Comparison Questions

Unless a note states that a figure is drawn to scale, you should NOT solve these problems by estimating or by measurement, but by using your knowledge of mathematics.

**Common Information:** In a question, information concerning one or both of the quantities to be compared is centered above the two columns. A symbol that appears in both columns represents the same thing in Column A as it does in Column B.

**Directions:** Each of the following questions consists of two quantities, one in Column A and one in Column B. Compare the two quantities and choose:

- a. if the quantity in Column A is greater
- b. if the quantity in Column B is greater
- c. if the two quantities are equal
- d. if the relationship cannot be determined from the information given.

### Examples

Column A

Column B

1.  $x + 5 = 9$

4

$x$

The correct answer is **c**. Subtract 5 on both sides of the equation.  $x + 5 - 5 = 9 - 5$ . Simplifying this gives a solution of  $x = 4$ . The columns are equal.

2.  $a < 0$

$a^2$

$a^3$

The correct answer is **a**. Since  $a$  is less than zero, it represents a negative number. A negative number raised to an even numbered power will be a positive result, but a negative number raised to an odd numbered power will be a negative result. Column A is larger.



## 501 Quantitative Comparison Questions

### Questions

Column A	Column B
<b>126.</b> $1^{17} + 2^3$	25
<b>127.</b> $a$ is a positive integer. $\frac{1}{a^7}$	$\frac{1}{a^{10}}$
<b>128.</b> $(a^4)^2$	$a^8$
<b>129.</b> $3^3$	9
<b>130.</b> $a$ is an integer. $a^2 a^3$	$a^6$
<b>131.</b> $(\frac{3}{4})^2 - (\frac{1}{4})^2$	$(\frac{1}{2})^2$
<b>132.</b> $4^x = 64$ $x$	4
<b>133.</b> $2^{12} = 8^x$ 3	$x$
<b>134.</b> $a < 0$ $a^2$	$a^9$
<b>135.</b> $y = 5^x$ $x$ is a positive integer. $5^{x+1}$	$5y$
<b>136.</b> $x > 0$ $(2x + 4)(x + 1)$	$2x^2 + 5x + 4$
<b>137.</b> $x^2 - 4x - 21 = 0$ sum of the roots	product of the roots
<b>138.</b> The prom committee orders an arch for the entrance to the dance floor. The arch follows the equation $y = 2x - .1x^2$ where $y$ is the height of the arch, in feet. maximum arch height	10 feet

# 501 Quantitative Comparison Questions

Column A	Column B
<b>139.</b> $x < 0$ $x(x + 7)$	$x^2 + 7$
<b>140.</b> $x > 0$ $(x + 3)^2$	$x^2 + 9$
<b>141.</b> $y = x^2 + 6x + 9$ minimum $y$ value of the function	9
<b>142.</b> $y = 4x^2 + 4x - 8$ smaller root	-2
<b>143.</b> $y = -x^2 + 6x$ larger root	6
<b>144.</b> $9x^2 = 6x - 1$ $x$	1
<b>145.</b> $(x + 5)(x - 5)$	$x^2 + 10x - 25$
<b>146.</b> $xy < 0$ $(x + y)^2$	$x^2 + y^2$
<b>147.</b> $2(x + 3) + 6 = 4x$ 6	$x$
<b>148.</b> Julie is 5 years older than Ravi. Three years ago, Julie was twice as old as Ravi. Ravi's age now	5
<b>149.</b> The sum of 3 consecutive integers is 37 more than the largest integer. the middle integer	19
<b>150.</b> The sale price for a snowboard is \$63.00. This price reflects a 30% discount. the original price of the snowboard	\$90.00

## 501 Quantitative Comparison Questions

Column A	Column B
<p><b>151.</b> The ratio of rabbits to squirrels is 2:3. There are a total of 225 rabbits and squirrels. the number of squirrels</p>	90
<p><b>152.</b> To mail an envelope first class costs \$0.34 for the first ounce, plus \$0.17 for each additional ounce. The cost to mail an envelope was \$1.53. 8 ounces</p>	weight of the envelope
<p><b>153.</b> Carlos has 14 coins in his pocket, consisting of quarters and nickels only. The monetary value of these coins is \$2.30. the number of quarters</p>	the number of nickels
<p><b>154.</b> The drama club collected \$907.50 from the sale of tickets. Adult tickets cost \$5.00 and student tickets cost \$2.50. They sold 63 more student tickets than adult. the number of student tickets</p>	163
<p><b>155.</b> There are 146 athletes and 8 coaches taking a trip to a competition. They travel in buses that seat 48 people. the number of buses needed</p>	4
<p><b>156.</b> Monique had 68 points correct out of a total of 85 points on her math test. Monique's percentage grade</p>	68%
<p><b>157.</b> A bus leaves the station traveling at a constant speed of 45 miles per hour. A second bus leaves the same station heading in the same direction one hour later traveling at a constant speed of 50 miles per hour. 8 hours</p>	The number of hours after first bus left that the buses will pass each other
<p><b>158.</b> <math>\frac{8+2x}{x} = 50</math> <math>x</math></p>	$\frac{1}{6}$
<p><b>159.</b> <math>5x + 3 = 18</math> <math>x</math></p>	3

# 501 Quantitative Comparison Questions

	Column A	Column B
<b>160.</b>	$x + 4 = -14$	
	-10	$x$
<b>161.</b>	$4(x - 2) = 8$	
	4	$x$
<b>162.</b>	$p + q = 16$ $3p + 2q = 44$	
	$p$	$q$
<b>163.</b>	$2a + 2b = 20$ $4a + 2b = 14$	
	$b$	13
<b>164.</b>	$\frac{1}{6}x + 6 = 12$	
	15	$x$
<b>165.</b>	$c + 4d = 11$ $6c - 2d = 40$	
	$c$	$d$
<b>166.</b>	$9c + 12 = d$	
	$\frac{d-12}{9}$	$c$
<b>167.</b>	$\frac{a}{b} < 0$	
	$ab$	0
<b>168.</b>	$a = 2; b = 6; c = 4$	
	$c + b \div a$	7
<b>169.</b>	$3x - (4 + x)$	$2x - 4$
<b>170.</b>	$b < 0$	
	$(-2b)^2$	$-2b^2$
<b>171.</b>	$a < 0$	
	$2a^2$	$a^3$
<b>172.</b>	$abc > 0$	
	$b + c$	0

# 501 Quantitative Comparison Questions

Column A	Column B
<b>173.</b> $x \neq 0$ $(\sqrt{x^4})(\sqrt{16})$	$8x^2$
<b>174.</b> $a \geq 0$ $\sqrt{(a+4)^2}$	$a+4$
<b>175.</b> $a \neq 0$ $a+b^2$	$(a+b)^2 - 2ab$
<b>176.</b> $x > 5$ five less than $x$	$5-x$
<b>177.</b> twice the sum of 14 and $b$ , divided by 2	$b+14$
<b>178.</b> the product of $a$ and $b$	$ ab $
<b>179.</b> one third of a variable $x$ , divided by four	$\frac{x}{12}$
<b>180.</b> $x > 1$ the square root of $x$ , raised to the fourth power	$x^3$
<b>181.</b> Let $d$ = number of dimes. Let $p$ = number of pennies. $0.10d + 0.01p$	$10d + p$
<b>182.</b> $x > y > 4$ four divided by the product of $x$ and $y$	$\frac{xy}{4}$
<b>183.</b> the cost of a \$50.00 sweater, on sale for 20% off	\$30.00
<b>184.</b> the cost of a \$28.00 basketball, including 6% sales tax	$28 + .6(28)$

# 501 Quantitative Comparison Questions

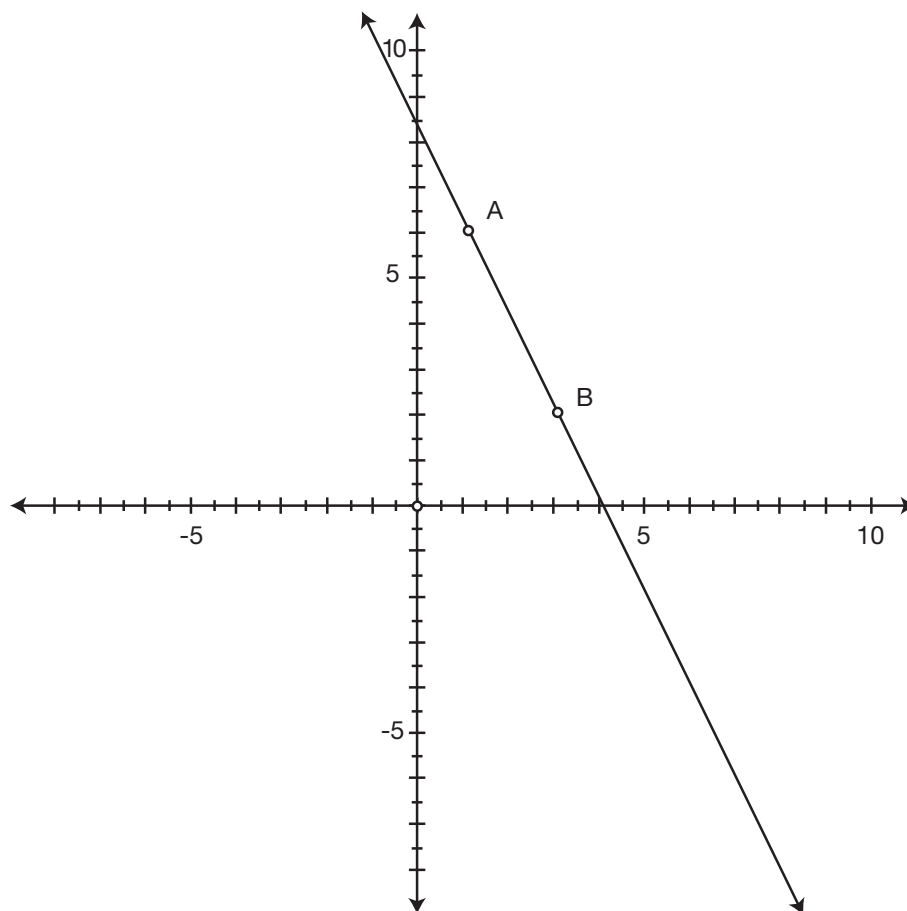
Column A	Column B
<b>185.</b> $x$ is a positive odd integer. the product of two consecutive positive odd integers	$x(x + 2)$
<b>186.</b> $3b + 3 > 18$ $b$	$5$
<b>187.</b> $2(5 - x) < 70$ $-30$	$x$
<b>188.</b> $0 < a < b$ $\frac{1}{a}$	$\frac{1}{b}$
<b>189.</b> $b + 7 < -5$ $b$	$-2$
<b>190.</b> $x < 5 ; y < z$ $x + y$	$z + 5$
<b>191.</b> $\frac{1}{2}x - \frac{1}{3}x \geq 4$ $x$	$20$
<b>192.</b> $a > b > 0$ $\frac{1}{a}$	$\frac{1}{b}$

# 501 Quantitative Comparison Questions

Column A

Column B

Use the following figure to answer questions 193–194.



**193.** the  $x$ -coordinate of point A

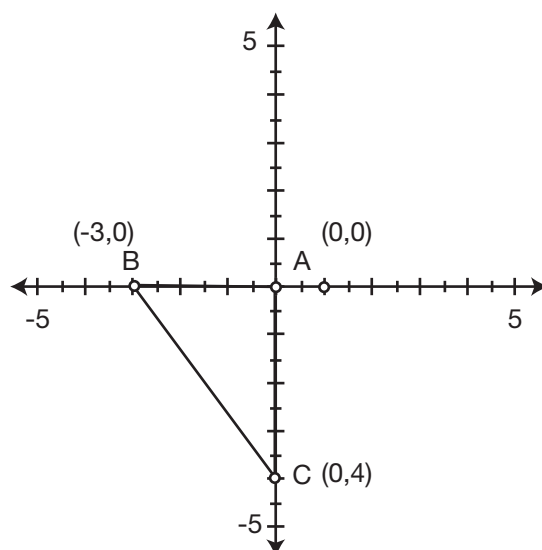
the  $x$ -coordinate of point B

**194.** 1

the slope of line AB

**501 Quantitative Comparison Questions****Column A****Column B**

Use the following figure to answer questions 195–196.

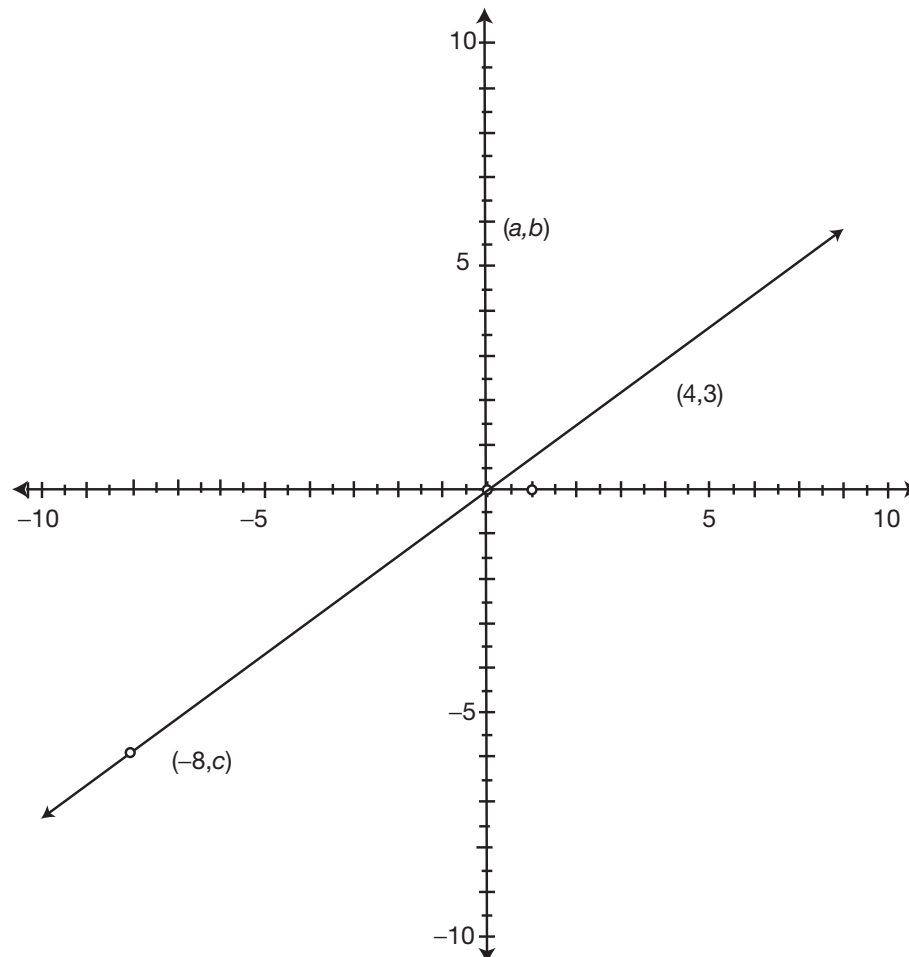


- |             |  |                          |
|-------------|--|--------------------------|
| <b>195.</b> | 5  | the length of segment BC |
| <b>196.</b> | the area of triangle ABC   | 12                       |
| <b>197.</b> | A circle with center at the origin passes through the point (0,8).   |                          |
|             | 4  | the radius of the circle |
| <b>198.</b> | the slope of the line that passes through the points (1,2) and (2,4) | 2                        |



**501 Quantitative Comparison Questions****Column A****Column B**

Use the following figure to answer questions 199–200.

**199.**  $a - b$ 

0

**200.**  $c$ 

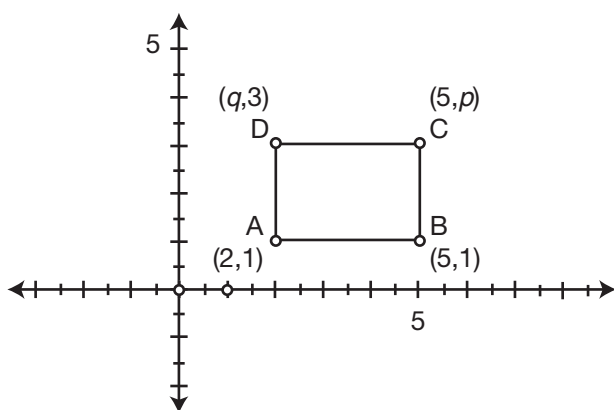
-9

# 501 Quantitative Comparison Questions

Column A

Column B

Use the following figure to answer question 201.



201.  $p - q$   $q - p$

202.  $ab < 0$   
 $b > 0$

$a$

$b$

203.  $\frac{1}{y}$   $y$

204.  $\frac{3x^2y}{4x^2y}$   $0.75$

205.  $x$  and  $y$  are positive integers.

$10y$

$10x$

206.  $(\frac{1}{2})^2$   $(\frac{1}{3})^0$

207.  $x > 1$

$2x^2$

$3x^3$

208.  $8^{x^2+x-2} = 1$

$x^2 + x - 2$

$0$

209.  $a < 0$   
 $b > 0$

$(ab)^3$

$0$

210.  $a > 1$

$a^6 \times a^2$

$(a^6)^2$

# 501 Quantitative Comparison Questions

Column A	Column B
<b>211.</b> $0 < b < 1$ $b^2$	$b^3$
<b>212.</b> $a \neq 0$ $-a^2$	$(-a)^2$
<b>213.</b> $(\frac{2}{3})^2$	$(0.667)^3$
<b>214.</b> $2 < c < d < 3$ $\frac{1}{c}$	$\frac{1}{d}$
<b>215.</b> $y = x + 8$ $x + 4$	$y - 4$
<b>216.</b> $2(x - 5) - 4 = 10$ $x$	12
<b>217.</b> $6x + 3 = -4x - 7$ $-x$	$x^2$
<b>218.</b> $11x + 3 = 42$ $11x + 3$	$11x - 3$
<b>219.</b> $\frac{4x}{3} + 4 = 2x$ $6x$	$x^2$
<b>220.</b> $x - y = 6$ $y + x = 4$ $3x$	$x\pi$
<b>221.</b> $x + y = 5$ $x - y = 1$ $x$	$y$
<b>222.</b> $c + d = 3$ $c - d = 3$ $c$	3
<b>223.</b> $y = 5x - 1$ the value of $x$ when $y = 0$	the value of $y$ when $x = 0$

# 501 Quantitative Comparison Questions

Column A	Column B
<b>224.</b> $8x - 2y = 30$ $x = \frac{3}{2}y$ $x$	$y$
<b>225.</b> $x + y = 16$ $x - y = 8$ $x^2 - y^2$	$(x + y)(x + y)$
<b>226.</b> The degree of the quadratic term of a polynomial	The degree of a cubic term of a polynomial
<b>227.</b> $3x^2 - 27 = 0$ the positive value of $x$	3
<b>228.</b> $x^2 - 3x - 10 = 0$ the negative value of $x$	-3
<b>229.</b> $-y(y - 4) = 10$ $y^2 + 10$	$4y$
<b>230.</b> $y > 2x - 1$ $2x$	$y + 1$
<b>231.</b> $4 < 2x - 2 < 8$ $x$	6
<b>232.</b> $5 < y + 1$ $y$	4
<b>233.</b> $6(x - 1) > 30$ 6	$x$
<b>234.</b> $-3x - 1 > 14$ -5	$x$
<b>235.</b> Point $(x, y)$ is located in Quadrant IV. $x$	$y$
<b>236.</b> the slope of the line $y = 2x - 3$	the slope of the line $y = \frac{1}{2}x + 3$

## 501 Quantitative Comparison Questions

Column A	Column B
<b>237.</b> Point $(x, y)$ is located in Quadrant II. the opposite of $x$	the reciprocal of $y$
<b>238.</b> The equation of line $l$ is $y = \frac{2}{3}x - 1$ . Line $m$ is perpendicular to the line $y = -\frac{3}{2}x + 1$ . the slope of line $l$	the slope of line $m$
<b>239.</b> Points $(4, c)$ and $(0, d)$ are on line $n$ . The slope of line $n$ is $\frac{3}{4}$ . $c - d$	3
<b>240.</b> $y = -2x - 3$ the y-intercept of the equation	the x-intercept of the equation
<b>241.</b> the slope of the equation $2y - 4x = 6$	the slope of the equation $-3y + 3x = 9$
<b>242.</b> the distance between the points $(0, 0)$ and $(-3, 4)$	5
<b>243.</b> the difference between 26 and the product of 4 and 3	the sum of 8 and 2
<b>244.</b> six less than nine	the square root of four
<b>245.</b> The square of a number is four. the square root of the number	4
<b>246.</b> the quotient of ten and two	the quotient of sixty-five and thirteen
<b>247.</b> One-half of $y$ is $x$ . One-half of $z$ is $y$ . $x + y + z = 35$ . $z$	15
<b>248.</b> Two cars leave the same city traveling in opposite directions. Car A is traveling at 60 miles per hour and car B is traveling at 55 miles per hour. the number of hours it takes for the cars to be 460 miles apart	4

### 501 Quantitative Comparison Questions

#### Column A

#### Column B

- 249.** The sum of two consecutive integers is 83.
- |   |   |
|---|---|
| 23 less than three times<br>the smaller integer | 16 more than two times<br>the greater integer |
|---|---|
- 250.** A vending machine has exactly \$1.15 in quarters and dimes.
- |                        |                     |
|------------------------|---------------------|
| the number of quarters | the number of dimes |
|------------------------|---------------------|

## 501 Quantitative Comparison Questions

### Answer Explanations

The following explanations show one way in which each problem can be solved. You may have another method for solving these problems.

- 126. b.** The number 1 to any power is 1;  $2^3$  is  $2 \times 2 \times 2$  which is 8;  $1 + 8 = 9$ . The quantity 25, in column B, is greater.
- 127. a.** Since the variable  $a$  is a positive integer, both choices are positive, and  $a^{10} > a^7$ . These are fractions with the same numerator. When two fractions are being compared with the same numerators, the smaller the denominator, the larger the number. Column A is greater.
- 128. c.** By the laws of exponents,  $(a^4)^2 = a^{4 \times 2} = a^8$ . This is true for any real number  $a$ . Therefore, the quantities in Column A and Column B are equal.
- 129. a.**  $3^3$  is equal to  $3 \times 3 \times 3$ , which is 27. 27 is greater than 9, so column A is greater.
- 130. d.** The answer cannot be determined. This problem involves a law of exponents that is true for any real number:  $a^2 \times a^3 = a^{2+3} = a^5$ . For most integers,  $a^6 > a^5$ . Note that this is true even for negative integers, since 6 is an even number, and 5 is an odd number. There are two exceptions, however, that would make these choices equal. They are when  $a = 0$  or  $a = 1$ .
- 131. a.** When a fraction is squared, you square both the numerator, and the denominator, so  $(\frac{3}{4})^2 = \frac{3^2}{4^2} = \frac{9}{16}$  and  $(\frac{1}{4})^2 = \frac{1}{16}$  and  $\frac{9}{16} - \frac{1}{16} = \frac{8}{16} = \frac{1}{2}$  in lowest terms. Likewise,  $(\frac{1}{2})^2 = \frac{1}{4}$ . One half is greater than one fourth.
- 132. b.** Four to the  $x$  power means that 4 is multiplied by itself " $x$ " times. By trial and error,  $4 \times 4 \times 4 = 64$ , so  $x$  is equal to 3. Choice B is greater.
- 133. b.** For exponential equations, you must first rewrite the equation to have the same bases when possible. Since  $2 \times 2 \times 2 = 8$ ,  $2^3 = 8$ . Two is the common base. Rewrite the equation as  $2^{12} = (2^3)^x$ . By the laws of exponents,  $(2^3)^x = 2^{3x}$ . The equation is now  $2^{12} = 2^{3x}$ . Since the bases are now the same, this becomes a

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simple equation to solve, by setting the exponents equal to each other:  $12 = 3x$ . Divide both sides of this equation by 3, and it becomes  $x = 4$ .

- 134. a.** When  $a$  is less than zero,  $a$  is negative. A negative number to any even power is a positive number, while a negative number to any odd power is a negative number. This is a case where even though the exponent of 2 is smaller, the quantity will be greater.
- 135. c.** Since  $y = 5^x$ , multiply each side of this equation by 5, to get  $5y = (5^1)(5^x)$ .  $(5^1)(5^x) = 5^{x+1}$ , which is the value of column A.
- 136. a.** Using the distributive property,  $(2x + 4)(x + 1) = 2x^2 + 2x + 4x + 4$ . Combine like terms, and this is equal to  $2x^2 + 6x + 4$ . Subtracting  $2x^2$  and 4 from both columns leaves  $6x$  in column A and  $5x$  in column B. Since  $x > 0$ , column A is greater.
- 137. a.** To find the roots of the equation, factor the left hand side into two binomials;  $x^2 - 4x - 21 = (x - 7)(x + 3)$ , so the equation becomes  $(x - 7)(x + 3) = 0$ . Either  $x - 7 = 0$  or  $x + 3 = 0$  to make the equation true. So  $x = 7$  or  $x = -3$ . The sum of the roots is  $7 + -3 = 4$ . The product of the roots is  $(-7)(3) = -21$ .
- 138. c.** The arch is in the shape of a parabola, and the maximum arch height (the  $y$  value) is the height at the vertex. When a quadratic is in the form  $ax^2 + bx + c$  ( $a, b, c$  are real numbers), the  $x$ -coordinate of the vertex is given by the formula  $\frac{-b}{2a} = \frac{-2}{-0.2} = 10$ . When  $x$  is 10,  $y = 2(10) - 0.1(10)^2$ . So  $y = 20 - 0.1(100) = 20 - 10 = 10$ . So the maximum arch height is 10 feet.
- 139. b.** By the distributive property,  $x(x + 7) = x^2 + 7x$  for column A. Since  $x < 0$ ,  $x$  is negative, and therefore  $7x$  is negative,  $x^2 + 7$  will be greater in this case.
- 140. a.** The quantity  $(x + 3)^2 = (x + 3)(x + 3)$ . By the distributive property, this equals  $x^2 + 3x + 3x + 9 = x^2 + 6x + 9$ . You can subtract  $x^2$  and 9 from each column and you are left with  $6x$  in column A and zero in column B. Since  $x > 0$ , column A is greater.



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- 141. b.** The given equation is a quadratic in the form  $ax^2 + bx + c$ , where  $a$ ,  $b$ , and  $c$  are real numbers. The minimum  $y$  value of the function is the  $y$  value at the vertex. The  $x$ -coordinate of the vertex is given by the formula  $\frac{-b}{2a} = \frac{-6}{2} = -3$ . When  $x = -3$ ,  $y = (-3)^2 + 6(-3) + 9 = 9 - 18 + 9 = 0$ . Column B is greater.
- 142. c.** To find the roots of this equation, first factor out the common factor of 4;  $4x^2 + 4x - 8 = 4(x^2 + x - 2)$ . Next, factor this into two binomials;  $4(x^2 + x - 2) = 4(x + 2)(x - 1)$ . The roots are the values of  $x$  that make the  $y$  value equal to zero. The equation will equal zero when  $x = -2$  or  $x = 1$ . The smaller root is  $-2$ .
- 143. c.** To find the roots of this equation, factor out the common factor of  $-x$ . The equation becomes  $y = -x(x - 6)$ . The roots are the values of  $x$  that make the  $y$  value equal to zero. The equation will equal zero when  $x = 0$  or  $x = 6$ . The larger root is 6.
- 144. b.** To find the values of  $x$ , move all terms to the left side so that it is a quadratic equation set equal to zero. Subtracting  $6x$  and  $-1$  from both sides makes the equation  $9x^2 - 6x + 1 = 0$ . Factor this quadratic into two binomials;  $9x^2 - 6x + 1 = (3x - 1)(3x - 1)$ . Now the equation is  $(3x - 1)(3x - 1) = 0$ . This will be true when  $3x - 1 = 0$ ; add one to both sides to give  $3x = 1$ ; divide both sides by 3 and  $x = \frac{1}{3}$ .
- 145. d.** The answer cannot be determined. The binomials in column A are the difference of two squares, so  $(x + 5)(x - 5) = x^2 - 5x + 5x - 25 = x^2 - 25$ . Since there is no indication as to whether  $x$  is positive or negative, the term  $10x$  in column B could be either positive or negative and the answer cannot be determined.
- 146. b.** Using the distributive property and combining like terms, column A is  $(x + y)^2 = x^2 + xy + xy + y^2 = x^2 + 2xy + y^2$ . Since  $xy < 0$ ,  $2xy$  is negative, and thus column B is greater.
- 147. c.** To solve this equation, first use the distributive property, and combine like terms, on the left hand side. The left side becomes  $2(x + 3) + 6 = 2x + 6 + 6 = 2x + 12$ . Now,  $2x + 12 = 4x$ . Subtract  $2x$  from each side, so  $12 = 2x$ . Divide both sides by 2, and  $x = 6$ .

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- 148. a.** Set up an equation and let  $x$  represent Ravi's age now. Julie's age now is represented by  $x + 5$ . Three years ago, Ravi's age was  $x - 3$  and Julie's age was  $x + 5 - 3 = x + 2$ . Three years ago, Julie was twice as old as Ravi. So  $x + 2 = 2(x - 3)$ . Use the distributive property on the right hand side to get  $x + 2 = 2x - 6$ . Add six to both sides, yielding  $x + 8 = 2x$ . Subtract  $x$  from both sides, and  $x = 8$ . Ravi's age now is 8.
- 149. c.** Set up an equation where  $x$  represents the first consecutive integer. Therefore the second consecutive integer is  $x + 1$ , and the third is  $x + 2$ . The sum of these integers is represented by  $x + x + 1 + x + 2$ . Combining like terms, the sum is represented by  $3x + 3$ . This sum is 37 more than the largest integer, so  $3x + 3 = x + 2 + 37$ . Combining like terms on the right hand side yields the equation  $3x + 3 = x + 39$ . Subtracting  $x$  from both sides yields  $2x + 3 = 39$ . Subtract 3 from both sides gives  $2x = 36$ . Divide both sides by 2, and  $x = 18$ . Now,  $x$  represents the smallest integer, so the middle integer is  $x + 1 = 19$ .
- 150. c.** \$63.00, which is the sale price, is 70% of the original price. Therefore, let  $x$  represent the original price of the snowboard. So  $0.70x = 63.00$ . Divide both sides of this equation by 0.70, and  $x = \$90.00$ .
- 151. a.** Since the ratio of rabbits to squirrels is 2:3, there are 2 rabbits for every 3 squirrels. Let  $2x$  represent the number of rabbits, and then  $3x$  represents the number of squirrels. So  $2x + 3x = 225$ . Combine like terms:  $5x = 225$ . Divide both sides by 5, and then  $x = 45$ . The number of squirrels is  $3x = 3(45) = 135$ .
- 152. c.** Let  $x$  represent the total weight in ounces. So  $x - 1$  will represent the additional ounces over the first ounce. The cost is then represented by  $0.34 + 0.17(x - 1) = 1.53$ . Use the distributive property on the left hand side to get  $0.34 + 0.17x - 0.17 = 1.53$ . Combine like terms:  $0.17 + 0.17x = 1.53$ . Subtract 0.17 from both sides:  $0.17x = 1.36$ . Divide both sides by 0.17, and  $x = 8$ . The total weight is 8 ounces.
- 153. a.** Let  $q$  represent the number of quarters. Since there are a total of 14 quarters and nickels,  $14 - q$  will represent the number of nickels. Set up an equation to represent the monetary amount:  $.25q + .05(14 - q) = 2.30$ . Use the distributive property, and

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distribute .05:  $.25q + .70 - .05q = 2.30$ . Combine like terms to get  $.20q + .70 = 2.30$ . Subtract .70 from both sides, to get  $.20q = 1.60$ . Divide both sides by .20, so  $q = 8$ . Since there are 14 coins, the number of nickels is  $14 - q = 14 - 8 = 6$ .

- 154. c.** Since there were 63 more student tickets sold than adult tickets, let  $a$  represent the number of adult tickets sold. So  $a + 63$  will represent the number of student tickets sold. The total ticket sales can be represented by  $5a + 2.5(a + 63) = 907.50$ . Use the distributive property to distribute 2.5 to the terms in parentheses:  $5a + 2.5a + 157.50 = 907.50$ . Combine like terms, to get  $7.5a + 157.50 = 907.50$ . Subtract 157.50 from both sides of the equation to get  $7.5a = 750$ . Divide both sides by 7.5, and  $a = 100$ . The number of adult tickets is therefore 100; the number of student tickets is  $100 + 63 = 163$ .
- 155. c.** The buses need to seat 146 athletes, plus 8 coaches. This is 154 people total. Three buses will hold 144 people. Four buses are needed.
- 156. a.** Monique's percentage grade is the ratio of the number correct to the total number of points on the test. This is  $\frac{68}{85} = 0.8$  and 0.8 is equal to 80%.
- 157. b.** Let  $x$  represent the number of hours after the first bus left in which they will pass. Since the second bus left one hour later, the number of hours after the second bus leaves is  $x - 1$ . The buses will pass when their distances are the same. Since the first bus is traveling 45 miles per hour,  $45x$  represents the distance the bus has gone in  $x$  hours, because  $distance = rate \times time$ . For the second bus, since it is traveling at 50 miles per hour, its distance is represented by  $50(x - 1)$ . Set up the equation to represent that the two distances are equal:  $45x = 50(x - 1)$ . Use the distributive property on the right hand side to get  $45x = 50x - 50$ . Subtract  $45x$  from both sides, and add 50 to both sides, and  $5x = 50$ . Divide both sides by 5, and  $x = 10$  hours.
- 158. c.** For this fractional equation, the best way to simplify is to multiply both sides by  $x$ . This will leave  $8 + 2x = 50x$ . Subtract  $2x$  from both sides to get  $8 = 48x$ . Divide both sides by 48, so  $x = \frac{8}{48} = \frac{1}{6}$  in simplest form.

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- 159. c.** For the given equation, subtract three from both sides to get  $5x = 15$ . Divide both sides by 5 to get  $x = 3$ .
- 160. a.** For the given equation, subtract four from both sides to get  $x = -18$ .
- 161. c.** For the given equation, first apply the distributive property, and distribute four to each term on the left. The equation now is  $4x - 8 = 8$ . Now add eight to both sides of the equation to get  $4x = 16$ . Divide both sides by 4 and  $x = 4$ .
- 162. a.** One way to solve this system of equations is to multiply each term in the first equation by 2, to get  $2p + 2q = 32$ . Line up the equations, and subtract the bottom terms from the top terms:

$$\begin{array}{r} 2p + 2q = 32 \\ -(3p + 2q = 44) \\ \hline -p = -12 \end{array}$$

Divide both sides now by  $-1$ , and  $p = 12$ . Going back to the original first equation, if  $p = 12$ , then  $12 + q = 16$ . Therefore, by subtracting twelve from both sides,  $q = 4$ .

- 163. c.** For this given system of equations, both have the term  $2b$ , so subtract the bottom terms from the top terms:

$$\begin{array}{r} 2a + 2b = 20 \\ -(4a + 2b = 14) \\ \hline -2a = 6 \end{array}$$

Divide both sides by  $-2$ , and  $a = -3$ . Going back to the original first equation, if  $a = -3$ , then  $2(-3) + 2b = 20$ , or  $-6 + 2b = 20$ . Add six to both sides of this equation to get  $2b = 26$ . Divide both sides by two, and  $b = 13$ .

- 164. b.** For the given equation, first subtract six from both sides to get  $\frac{1}{6}x = 6$ . Next, multiply both sides by the reciprocal of  $\frac{1}{6}$ , which is six. The equation now is  $x = 36$ .
- 165. a.** For the given system of equations, multiply each of the terms in the second equation by two, so that both equations have a common term of  $4d$ :

$$\begin{array}{r} c + 4d = 11 \\ 12c - 4d = 80 \\ \hline 13c = 91 \end{array}$$

Add the two equations to get  $13c = 91$ .

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Divide both sides of this resulting equation by thirteen to get  $c = 7$ . Using the original first equation and substituting in seven for  $c$ ,  $7 + 4d = 11$ . Subtract seven from both sides, and divide both sides by four, and  $d = 1$ .

- 166. c.** Since the choice in column B is  $c$ , solve the given equation for  $c$ , by subtracting twelve from both sides, and then dividing both sides by nine. The quantities are equal.
- 167. b.** It is given that  $a$  divided by  $b$  is less than zero, so by the rules of positive/negative arithmetic, either  $a$  is negative or  $b$  is negative, but not both. In this case, the term  $ab$  will be negative. Zero is larger.
- 168. c.** For the given values of  $a$ ,  $b$ , and  $c$ , column A is  $4 + 6 \div 2$ . By order of operations, first compute six divided by two, which is three. Now, four plus three is equal to seven.
- 169. c.** Use the distributive property on the expression in column A, and distribute negative one to both terms in parentheses. Now column A is  $3x - 4 - x$ . Combining like terms leaves  $2x - 4$  in column A, which is now identical to column B.
- 170. a.** It is given that  $b$  is less than zero, which means that  $b$  is a negative number. For the expression in column A, do the quantities in parentheses first. Negative two times any negative  $b$  results in a positive number. Any positive number squared is also positive. In column B, order of operations says to do the exponent first. A negative number squared is positive. Now, however, this number is multiplied by  $-2$ , which always results in a negative number. Any positive number is always greater than a negative number.
- 171. a.** It is given that  $a$  is less than zero, which means that  $a$  is a negative number. By the rules of multiplying with negative numbers, the quantity in column A is two times a negative number squared, which is positive. The quantity in column B is a negative times a negative (a positive result) which is then multiplied by another negative number. This results in a negative number.

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- 172. d.** The answer cannot be determined. It is given that the quantity  $a$  multiplied by  $b$  multiplied by  $c$  is greater than zero. This can be true if all of  $a$ ,  $b$ , and  $c$  are positive numbers, or if any two, but not all, of the three variables are negative. If all three variables were positive, then column A would be greater. If, however, both  $b$  and  $c$  were negative, then the quantity in column A would be less than zero, the value of column B.
- 173. b.** Simplify the expression in column A. The square root of  $x$  to the fourth power is  $x$  squared. Any number squared, whether positive or negative, is a positive number. Also, the square root of 16 is four. Column A is  $4x^2$ . Therefore, the quantity in column B,  $8x^2$ , is greater than  $4x^2$ .
- 174. c.** The quantity in column A becomes  $a + 4$  when simplified, since squaring and square root are inverse operations.
- 175. d.** The answer cannot be determined. Simplify the expression in column B, by first applying the distributive property to  $(a + b)^2$ , to get  $a^2 + 2ab + b^2$ . Column B is now  $a^2 + 2ab + b^2 - 2ab$ . Combining like terms results in  $a^2 + b^2$ . Since  $a$  is not equal to zero, and any number squared is positive, the quantity in column B is greater if  $a < 0$ . If  $a > 1$ , column B is also greater. If, however,  $a = 1$ , column A is equal to column B. If  $0 < a < 1$ , column A is greater.
- 176. a.** The words in column A translate in algebra to  $x - 5$ . Since it is given that  $x$  is greater than five, the quantity in column A will be a positive number. The quantity in column B will be a negative number.
- 177. c.** The words in column A translate into algebra as  $\frac{2(b + 14)}{2}$  since it is twice the sum of  $b$  and 14, then divided by 2. The twos can cancel, leaving  $b + 14$ .
- 178. d.** The answer cannot be determined. For column A, the product of  $a$  and  $b$  is  $ab$ . The expression in column B is the absolute value of  $ab$ , which is always positive, regardless of the sign of the quantity  $ab$ . Since there is no indication as to whether  $a$  or  $b$  is positive or negative, the answer cannot be determined.
- 179. c.** The words in column A translate into algebra as  $\frac{1}{3}x \div 4 = \frac{x}{3} \div \frac{4}{1} = \frac{x}{3} \times \frac{1}{4} = \frac{x}{12}$ .

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- 180. b.** The words in column A translate into algebra as  $(\sqrt{x})^4 = x^2$  since  $(\sqrt{x})^4 = (\sqrt{x})^2 (\sqrt{x})^2 = x \times x = x^2$ . Since  $x > 1$ , the quantity in Column B is greater.
- 181. b.** Since the variables  $d$  and  $p$  refer to the number of dimes and pennies respectively, they must be positive whole numbers (it's impossible to have  $-3$  dimes, or  $\frac{1}{4}$  of a penny). Regardless of what numbers the variables represent,  $\frac{1}{10}$  of any positive number plus  $\frac{1}{100}$  of another positive number will always be less than the sum of the two whole numbers. Column B will always be greater.
- 182. b.** The words in column A translate into  $4 \div xy = \frac{4}{xy}$ . Since  $x > y > 4$ , both  $x$  and  $y$  are greater than four. The quantity in column B is a number larger than one, and the quantity in column A is a number between zero and one.
- 183. a.** The cost of a \$50.00 sweater, on sale for 20% off is 80% of the \$50.00. This is  $(50.00)(.80) = \$40.00$ .
- 184. b.** The cost of a \$28.00 basketball, including 6 percent sales tax, is  $28 + .06(28)$ . The decimal in column B representing sales tax is actually equal to 60 percent, not 6 percent.
- 185. c.** Let  $x$  represent an odd integer. The next (consecutive) odd integer is thus  $x + 2$ . The product of these two integers is  $x(x + 2)$ .
- 186. a.** To solve the given inequality, first subtract three from both sides, to get  $3b > 15$ . Now, divide both sides by three, to get  $b > 5$ . Since  $b$  is greater than five, column A is greater.
- 187. b.** To solve the given inequality, first use the distributive property and distribute two to the terms in parentheses. The inequality becomes  $10 - 2x < 70$ . Subtract ten from both sides to get  $-2x < 60$ . Now, divide both sides by negative two, noting that when you divide by a negative number with an inequality, you switch the inequality symbol. The inequality thus becomes  $x > -30$ .
- 188. a.** Since it is given that  $0 < a < b$ , then  $\frac{1}{a} > \frac{1}{b}$  since, for fractions with the same numerator, the smaller the denominator, the larger the value of the fraction.

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- 189. b.** Solve the given inequality by subtracting seven from both sides of the inequality to get  $b < -12$ . Since this is true,  $-2$  is greater than any allowed value for  $b$ .
- 190. b.** The expression in column B can be written as  $5 + z$ , because of the commutative property of addition. Since it is given that  $x < 5$  and also that  $y < z$ , then the quantity in column A,  $x + y$  is less than the quantity in column B,  $z + 5$ , because of the one to one correspondence of the terms and the fact that you are adding.
- 191. a.** To solve the given inequality, first combine the like terms on the left side of the inequality, to get  $\frac{1}{6}x \geq 4$ . Now, multiply both sides by six to isolate the variable. The inequality is now  $x \geq 24$ , which is greater than the quantity in column B.
- 192. b.** It is given that  $a > b > 0$ , so both  $a$  and  $b$  are positive, and  $a$  is larger than  $b$ . For fractions with the same numerator, the smaller the denominator, the larger the value of the fraction.
- 193. b.** The  $x$ -coordinate of an ordered pair determines how far to the left or right a point is plotted on the coordinate plane. Just by looking at the drawing, point B is to the right of point A. Therefore, the  $x$ -coordinate of point B is greater.
- 194. a.** The slope of a line is the “steepness” of the graphed line. Lines that go “downhill” when read from left to right have a negative slope; lines that go “uphill” when read from left to right have a positive slope. The line in the figure is going downhill, and therefore has a negative slope.
- 195. c.** Notice that the points A, B, and C form a right triangle in the figure. To determine the length of segment BC, you count the length of segment BA and the length of segment AC. Use these lengths and the Pythagorean theorem to find the length of segment BC. The Pythagorean theorem is  $a^2 + b^2 = c^2$ , where  $a$  and  $b$  are the lengths of the legs of a right triangle. Segment BA is 3 units long, by counting. Segment AC is 4 units long. Substituting in for  $a$  and  $b$  gives  $3^2 + 4^2 = c^2$ . This is  $9 + 16 = c^2$ , or  $25 = c^2$ . Take the square root of both sides and  $c = 5$ .



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- 196. b.** Notice that the points A, B, and C form a right triangle in the figure. The base of this triangle is 3 units (by counting), and the height is 4 units. The formula for the area of a triangle is  $\frac{1}{2}bh$ . This is  $\frac{1}{2}(3)(4)$ , which is six units.
- 197. b.** If the circle has its center at the origin and passes through the point (0,8), then the radius of the circle is 8.
- 198. c.** The slope of a line that passes through two given points is determined by the formula  $\frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 2}{2 - 1} = \frac{2}{1} = 2$ .
- 199. b.** The point given by the coordinates  $(a,b)$  is on the  $y$ -axis, and above the  $x$ -axis. This indicates that  $a = 0$  and that  $b$  is positive. Therefore the quantity in column A is  $0 - b$ , which will be a negative number since  $b$  is greater than zero. Column B is greater.
- 200. a.** The points  $(-8,c)$  and  $(0,0)$  and  $(4,3)$  all lie on the same line. Determine the slope of this line, using the points  $(0,0)$  and  $(4,3)$ . After the slope is determined, use it to find the value of  $c$ . The slope of the line can be found by  $\frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 0}{4 - 0} = \frac{3}{4}$ . To find the value of  $c$ , use the given slope, which is  $\frac{3}{4} = \frac{c}{-8}$ . Using cross multiplication,  $4c = -24$ . Divide both sides by 4, and  $c = -6$ .
- 201. a.** Since the given figure is a rectangle, and a rectangle has right angles, then as the figure is drawn, the  $x$ -coordinate of point D equals the  $x$ -coordinate of point A. Therefore,  $q = 2$ . Similarly, the  $y$ -coordinate of point C equals the  $y$ -coordinate of point D, and  $p = 3$ . Column A will be  $3 - 2 = 1$ . Column B is  $2 - 3 = -1$ .
- 202. b.** If  $ab < 0$ , then  $a \times b$  is negative. Since  $b > 0$ ,  $b$  is a positive number. Thus,  $a$  must be a negative number to make the product negative. Therefore  $b$ , the positive value, is larger.
- 203. d.** The relationship cannot be determined. If  $y < -1$ , column A is greater. For example,  $\frac{1}{-4}$  is greater than  $-4$ . If  $0 < y < 1$ , column A is greater. For example,  $\frac{1}{\frac{1}{3}} = 3$  which is larger than  $\frac{1}{3}$ . If  $y = 1$ , then both columns simplify to 1. If  $y > 1$ , then column B is greater;  $\frac{1}{5} < 5$ .

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- 204. c.** After canceling out the factors of  $x^2y$  in column A, you are left with  $\frac{3}{4}$ , which is equal to 0.75.
- 205. d.** The relationship cannot be determined. The relationship between  $x$  and  $y$  is not stated. If  $y$  is greater than  $x$ , column A is greater. If  $x$  is greater than  $y$ , column B is greater. If  $x$  and  $y$  are equal, then the columns are equal.
- 206. b.**  $(\frac{1}{2})^2$  is equal to  $\frac{1}{4}$ , and anything to the zero power is 1. One fourth is less than 1. Column B is greater.
- 207. b.** Since  $x > 1$ , any value of  $x$  raised to the third power and multiplied by three will be larger than the same value squared and multiplied by two. For example, if  $x = 3$ , then  $2 \times 3^2 = 2 \times 9 = 18$  and  $3(3^3) = 3 \times 27 = 81$ . Column B is greater.
- 208. c.** Any base number to the zero power is equal to one, so  $x^2 + x - 2$  in column A must equal zero. Column A and column B are equal.
- 209. b.** Since  $a$  is negative and  $b$  is positive, multiplying  $a \times b$  results in a negative value. A negative value raised to an odd numbered power, like three, also results in a negative answer. Therefore, Column B is larger.
- 210. b.** Since  $a$  is greater than one, use the rules of exponents to determine the larger value. In column A, when multiplying like bases add the exponents.  $a^6 \times a^2 = a^8$ . In column B, when raising a power to another power, multiply the exponents.  $(a^6)^2 = a^{12}$ . A value greater than one raised to the twelfth power will be greater than the same value raised to the eighth. Column B is greater.
- 211. a.** Since  $b$  is between 0 and 1, the value of  $b$  could be a fraction like  $\frac{1}{4}$ ;  $(\frac{1}{4})^2 = \frac{1^2}{4^2} = \frac{1}{16}$  and  $(\frac{1}{4})^3 = \frac{1^3}{4^3} = \frac{1}{64}$ ;  $\frac{1}{16}$  is larger than  $\frac{1}{64}$ , so column A is greater.
- 212. b.**  $-a^2$  means  $a^2$  times  $-1$ , which will result in a negative number.  $(-a)^2$  equals  $(-a)(-a)$  which will give a positive result. Therefore column B is larger.
- 213. a.**  $\frac{2}{3} = 0.\overline{6}$ , which is very close in value to 0.667. Since these values are between zero and one, raising them to the third power will be smaller than raising them to the second power.

### 501 Quantitative Comparison Questions

- 214.** a. Since  $c$  and  $d$  are between 2 and 3, and  $c$  is less than  $d$ , substitute values like  $c = 2.3$  and  $d = 2.5$ .  $\frac{1}{2.3} = 0.4348$  and  $\frac{1}{2.5} = 0.4$ . 0.4348 is larger than 0.4.
- 215.** c. Since  $y = x + 8$ , substitute  $x + 8$  in for  $y$  in column B. Now column B says  $x + 8 - 4$  which simplifies to  $x + 4$ , making column A equal to column B.
- 216.** c. Multiply using the distributive property to get  $2x - 10 - 4 = 10$ . Combine like terms to get  $2x - 14 = 10$ . Add 14 to both sides;  $2x - 14 + 14 = 10 + 14$ .  $2x = 24$ . Divide both sides by 2.  $x = 12$ . Therefore, the columns are equal.
- 217.** c. In order to solve for  $x$ , add  $4x$  to both sides of the equation.  $6x + 4x + 3 = -4x + 4x - 7$ . This simplifies to  $10x + 3 = -7$ . Subtract 3 from both sides of the equation  $10x + 3 - 3 = -7 - 3$  which simplifies to  $10x = -10$ . Divide both sides by 10 and the result is  $x = -1$ . Therefore,  $-x = -(-1) = 1$  and  $x^2 = (-1)^2 = 1$ . Both columns equal 1.
- 218.** a. Since  $11x + 3 = 42$ , subtracting 3 from both sides of the equation results in  $11x = 39$ . Subtracting three again on both sides results in  $11x - 3 = 36$ . Thus, column A is larger.
- 219.** c. Multiply both sides of the equation by 3;  $3(\frac{4x}{3} + 4) = 3(2x)$ . This simplifies to  $4x + 12 = 6x$ . Subtract  $4x$  from both sides of the equation;  $4x - 4x + 12 = 6x - 4x$ , which is  $12 = 2x$ . Divide both sides by 2 to get  $x = 6$ . The columns are equal because  $6 \times 6 = 36$  and  $6^2 = 36$ .
- 220.** b. Rearrange the second equation to be  $x + y = 4$ . Combine like terms vertically to simplify to  $2x = 10$ . Divide both sides of the equation by 2 to get  $x = 5$ . Therefore  $3 \times 5 = 15$  and  $\pi$  (approximately equal to 3.14)  $\times 5$  would be greater than 15.
- 221.** a. Solving the equations for  $x$  and  $y$  by adding them together vertically to simplify to  $2x = 6$ . Dividing both sides of the equation gives  $x = 3$ . Substituting  $x = 3$  into the first equation results in  $3 + y = 5$ , so  $y = 2$ . Since  $3 > 2$ , the answer is column A.
- 222.** c. Solve for  $c$  by adding the equations together vertically to simplify to  $2c = 6$ . Dividing each side of the equation by 2 gives  $c = 3$ . The columns are equal.

### 501 Quantitative Comparison Questions

- 223. a.** Substituting  $y = 0$  gives the equation  $0 = 5x - 1$ . Adding 1 to both sides results in  $0 + 1 = 5x - 1 + 1$ , which is equal to  $1 = 5x$ . Divide both sides by 5 to get an  $x$ -value of  $\frac{1}{5}$ . Substituting  $x = 0$  gives  $y = 5(0) - 1$  which becomes  $y = 0 - 1 = -1$ . Since  $\frac{1}{5} > -1$ , column A is greater.
- 224. a.** Substitute the second equation into the first for  $x$  to get  $8(\frac{3}{2})y - 2y = 30$ ;  $8(\frac{3}{2})y$  simplifies to  $12y$  so the equation becomes  $12y - 2y = 30$ . Subtract to get  $10y = 30$  and then divide by 10 on both sides;  $\frac{10y}{10} = \frac{30}{10}$ .  $y = 3$ . Using the second equation,  $x = \frac{3}{2} \times 3 = 4.5$ . Thus,  $x$  is larger than  $y$ .
- 225. b.**  $x^2 - y^2$  is the difference between two squares and factors to  $(x - y)(x + y)$ . Since  $x + y = 16$  and  $x - y = 8$ , column A then becomes  $16 \times 8 = 128$ . Column B is  $(x + y)(x + y)$  which is  $16 \times 16 = 256$ . Column B is greater.
- 226. b.** The degree of a quadratic term is 2 and the degree of a cubic term is 3, so column B is greater.
- 227. c.** Divide each term by a factor of three to get  $x^2 - 9 = 0$ . This is the difference between two perfect squares which factors to  $(x - 3)(x + 3) = 0$ . Setting each factor equal to zero and solving results in  $x$ -values of 3 or  $-3$ . Since 3 is the positive solution for  $x$ , the columns are equal.
- 228. a.** Factoring the left side of the equation gives  $(x - 5)(x + 2) = 0$ . Setting each factor equal to zero is  $x - 5 = 0$  or  $x + 2 = 0$ , which results in a solution of 5 or  $-2$ . Since the negative result is  $-2$ , and  $-2$  is larger than  $-3$ , column A is larger.
- 229. c.** Multiplying using the distributive property on the left side gives  $-y^2 + 4y = 10$ . Adding  $y^2$  to both sides results in the equation  $4y = y^2 + 10$ . Since this equation states that  $4y$  is equal to  $y^2 + 10$ , the columns have the same value.
- 230. b.** Add 1 to both sides of the inequality;  $y + 1 > 2x - 1 + 1$ . This simplifies to  $y + 1 > 2x$ . Since the inequality states that  $y + 1$  is greater than  $2x$ , then column B is greater.

### 501 Quantitative Comparison Questions

- 231. b.** Take the compound inequality and add 2 to each section;  
 $4 + 2 < 2x - 2 + 2 < 8 + 2$ . Simplified this becomes  $6 < 2x < 10$ .  
Dividing all sections by 2 gives a result of  $3 < x < 5$ . Therefore,  
the value of  $x$  is between 3 and 5, so column B is larger.
- 232. a.** If you subtract one from both sides of the first inequality, it  
yields a result of  $4 < y$ , which means  $y$  is greater than 4. Thus,  
column A is larger.
- 233. b.** Use the distributive property on the left side of the inequality  
to get  $6x - 6 > 30$ . Add 6 to both sides of the inequality.  
 $6x - 6 + 6 > 30 + 6$ . This simplifies to  $6x > 36$ . Divide both  
sides by 6 to get a result of  $x > 6$ . Column B is larger.
- 234. a.** Add one to both sides of the inequality;  $-3x - 1 + 1 > 14 = 1$ .  
This results in  $-3x > 15$ . Divide both sides of the inequality  
by  $-3$  to get a solution of  $x > -5$ . Remember that dividing both  
sides of an inequality by a negative number changes the  
direction of the inequality symbol. Since  $x$  is less than  $-5$ , the  
answer is column A.
- 235. a.** Since point  $(x,y)$  is located in Quadrant IV, the  $x$ -values are  
positive and  $y$ -values are negative. Therefore, the  $x$ -values are  
greater than the  $y$ -values. Column A is greater.
- 236. a.** Using slope-intercept ( $y = mx + b$ ) form where  $m$  is the slope of  
the linear equation, the slope of the line in column A is 2 and  
the slope of the line in column B is  $\frac{1}{2}$ . Two is greater than  $\frac{1}{2}$ , so  
column A is greater than column B.
- 237. d.** This relationship cannot be determined. Since point  $(x,y)$  is  
located in Quadrant II,  $x$ -values are negative and  $y$ -values are  
positive. The opposite of any  $x$ -values, which are negative in  
Quadrant II, would be positive. The reciprocals of any  $y$ -values  
would also be positive and could be greater than, less than, or  
equal to any of the  $x$ -values.
- 238. c.** Using slope-intercept ( $y = mx + b$ ) form where  $m$  is the slope of  
the linear equation, the slope of line  $l$  is  $\frac{2}{3}$ . Since line  $m$  is  
perpendicular to a line that has a slope of  $-\frac{3}{2}$ , the slope of line  $m$   
is the negative reciprocal of this, or  $\frac{2}{3}$ . The slope of line  $l$  is  
equal to the slope of line  $m$ .

## 501 Quantitative Comparison Questions

- 239. c.** To find the slope of a line, calculate the change in the  $y$ -values over the change in the  $x$ -values. Therefore,  $\frac{c-d}{4-0} = \frac{3}{4}$  which simplifies to  $\frac{c-d}{4} = \frac{3}{4}$ . Since the denominators are equal, set the numerators equal to each other. Then,  $c - d = 3$ . The columns are equal.
- 240. b.** From the equation  $y = mx + b$ ,  $b$  is the  $y$ -intercept. The  $y$ -intercept for this equation is  $-3$ . The  $x$ -intercept is found by substituting zero for  $y$  and solving for  $x$ . Starting with  $0 = -2x - 3$ , then adding 3 to both sides results in  $3 = -2x$ . Dividing both sides by  $-2$  gives  $\frac{3}{-2}$  or  $-1.5 = x$ . Since  $-3 < -1.5$ , column B is greater.
- 241. a.** Converting to slope-intercept form, the first equation becomes  $2y = 4x + 6$  by adding  $4x$  to both sides. Dividing both sides by 2 gives  $\frac{2y}{2} = \frac{4x}{2} + \frac{6}{2}$  which simplifies to  $y = 2x + 3$ . The slope is 2. The second equation is  $-3y = -3x + 9$  after subtracting  $3x$  from both sides. Dividing both sides by  $-3$  to get  $y$  by itself results in  $\frac{-3y}{-3} = \frac{-3x}{-3} + \frac{9}{-3}$  which simplifies to  $y = x - 3$ . The slope of the second equation is 1. Therefore column A is greater.
- 242. c.** Using the distance formula,  $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ , the distance between  $(-3, 4)$  and  $(0, 0)$  is  $\sqrt{(-3 - 0)^2 + (4 - 0)^2}$ . This simplifies to  $\sqrt{(-3)^2 + (4)^2} = \sqrt{(9 + 16)} = \sqrt{25} = 5$ . The distance between the point  $(0, 0)$  and  $(-3, 4)$  is 5 units, so the columns are equal.
- 243. a.** “The difference between 26 and the product of 4 and 3” translates to the expression  $26 - (4 \times 3)$ , which simplifies to  $26 - 12 = 14$ . “The sum of 8 and 2” is equal to  $8 + 2 = 10$ . 14 is larger than 10.
- 244. a.** “Six less than nine” translates to  $9 - 6 = 3$ . The square root of four is 2. Column A is larger.
- 245. b.** If the square of a number is four, then the number is 2. The square root of 2 is approximately equal to 1.41, which is less than 4.
- 246. c.** The key word *quotient* tells you to divide;  $10 \div 2 = 5$  and  $65 \div 13 = 5$ . Thus, column A is equal to column B.

### 501 Quantitative Comparison Questions

- 247. a.** If one-half of  $y$  is  $x$ , let  $y = 2x$ . If one-half of  $y$  is  $z$ , let  $z = 2y$ . By substitution,  $z = 4x$ . Using the given equation  $x + y + z = 35$ , substituting gives an equation of  $x + 2x + 4x = 35$ . Combine like terms to get  $7x = 35$ , which results in  $x = 5$ . Since  $z = 4x$  then  $z = 4(5) = 20$ .
- 248. c.** Use  $\text{distance} = \text{rate} \times \text{time}$ . The distance of car A can be expressed as  $60t$  and the distance of car B can be expressed as  $55t$ . Add the two distances and set the result equal to 460 miles.  $60t + 55t = 460$ . Combine like terms.  $115t = 460$ . Divide both sides by 115;  $\frac{115t}{115} = \frac{460}{115} = 4$ ;  $t = 4$  hours. The columns are equal.
- 249. c.** Two consecutive integers are integers that are one number apart like 4 and 5 or  $-22$  and  $-23$ . Two consecutive integers whose sum is 83 are 41 and 42. Twenty-three less than three times the smaller is 100 and 16 more than two times the greater is 100. The columns are equal.
- 250. b.** The only possibilities have an odd number of quarters because the total amount ends in a 5, which is impossible to get with dimes. There can be 1 quarter and 9 dimes, or 3 quarters and 4 dimes. Five quarters is too much money. Either way, there are more dimes than quarters, so the answer is column B.





# 3

## Geometry

**In this chapter,** the following math concepts will be the subject of the 125 geometry-based quantitative comparison questions:

- Circles
- Lines and Angles
- Polygons
- Quadrilaterals
- Three-Dimensional Figures
- Triangles

Some important information:

**Numbers:** All numbers used are real numbers.

**Figures:** Figures that accompany questions are intended to provide information useful in answering the questions. Unless otherwise indicated, positions of points, angles, regions, etc. are in the order shown; angle measures are positive; lines shown as straight are straight; and figures lie in a plane. Unless a note states that a figure is drawn to scale, you should NOT solve

## 501 Quantitative Comparison Questions

these problems by estimating or by measurement, but by using your knowledge of mathematics.

**Common Information:** In a question, information concerning one or both of the quantities to be compared is centered above the two columns. A symbol that appears in both columns represents the same thing in Column A as it does in Column B.

**Directions:** Each of the following questions consists of two quantities, one in Column A and one in Column B. Compare the two quantities and choose:

- a. if the quantity in Column A is greater
- b. if the quantity in Column B is greater
- c. if the two quantities are equal
- d. if the relationship cannot be determined from the information given

### Examples:

#### Column A

#### Column B

1. the sum of the measures of two acute angles

$90^\circ$

The answer is **d**. The only thing you can infer about the acute angles in column A is that they are, by definition, each less than 90 degrees. However, depending on their measures, column A could be smaller (two 30-degree angles = 60 degrees) or larger (an 80-degree and a 45-degree angle = 125 degrees) than column B. The answer cannot be determined from the information you are given here.

2. the circumference of a circle with radius 2

the area of a circle with radius 1.5

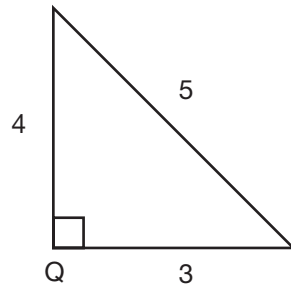
The answer is **a**. This problem is solved by substituting the values into the formulas for the circumference and area of a circle— $2\pi r$  and  $\pi r^2$ , respectively. In column A,  $2(\pi)(2) = 4\pi$ . In column B,  $\pi(1.5)^2 = 2.25\pi$ .  $4\pi$  is greater than  $2.25\pi$ , so **a** is correct.

## 501 Quantitative Comparison Questions

### Questions

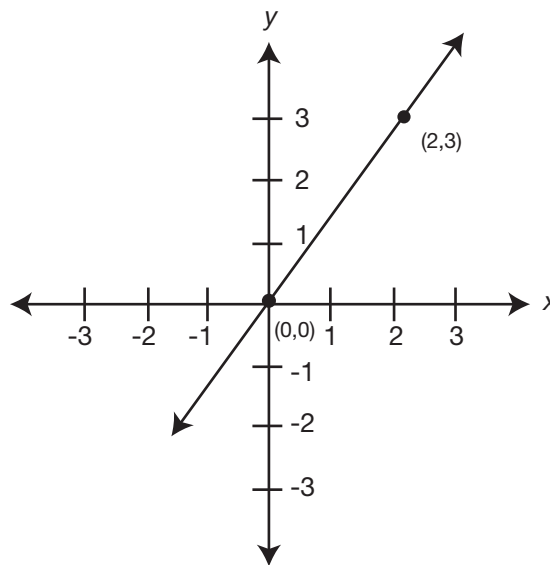
Column A

Column B



**251.** the area of  $\triangle Q$

8 sq m



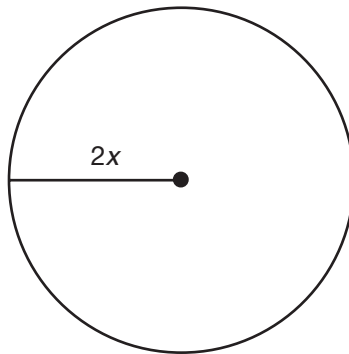
**252.** the slope of the line in the graph

$\frac{3}{2}$

# 501 Quantitative Comparison Questions

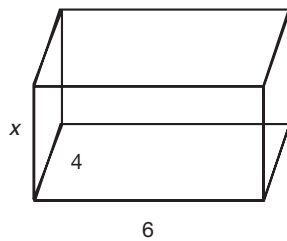
Column A

Column B

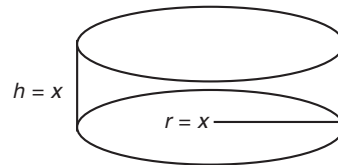


- 253.** the area of the circle in the figure

- the area of a circle with diameter  $3y$



box with length = 6,  
width = 4, height =  $x$



cylinder with radius =  $x$ , height =  $x$

- 254.** the volume of the box on the left

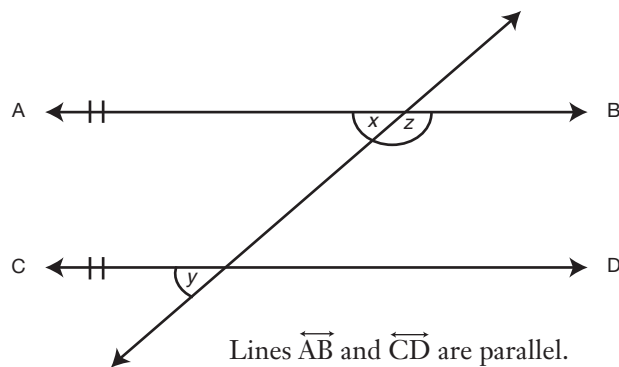
$$x \geq 3$$

- the volume of the cylinder on the right

# 501 Quantitative Comparison Questions

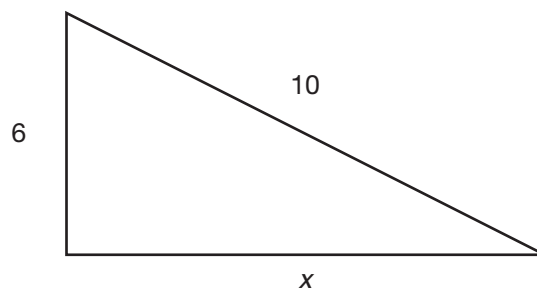
Column A

Column B



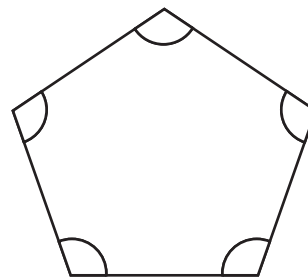
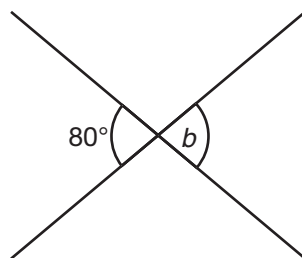
255.  $x$

$z$



256. 9

$x$



257.  $6b$

the sum of the interior angles of the polygon above

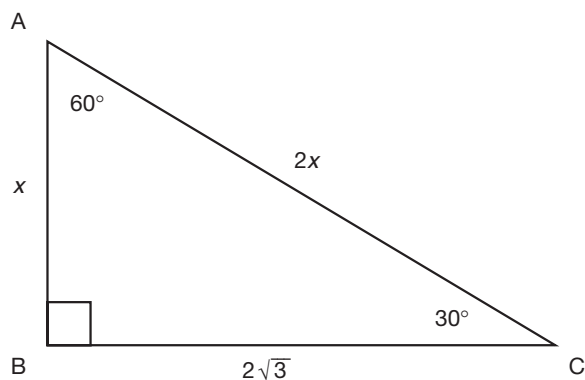
# 501 Quantitative Comparison Questions

## Column A

- 258.** the area of the largest circle that can be cut out of a square piece of paper with sides of 3.4"

## Column B

- the area of the largest circle that can be cut out of a rectangular piece of paper with length of 3.2" and a width of 5"



- 259.** AC

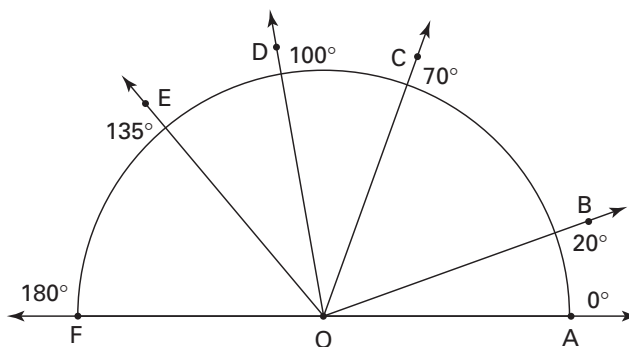
4

- 260.**  $\triangle QRS$  is an isosceles triangle with angles  $Q = 45^\circ$  and  $R = 45^\circ$  and line segments  $QS = 8$  and  $QR = x$ . Polygon DEFGH has sides  $DE = 3$  and  $GH = y$  and polygon LMNOP has sides  $LM = 1$  and  $OP = 2$ .

$x$

$y$

Use the following figure to answer questions 261–265.



- 261.** the measure of  $\angle AOD$

the measure of any right angle

- 262.** the measure of  $\angle AOB$

the measure of an acute angle

## 501 Quantitative Comparison Questions

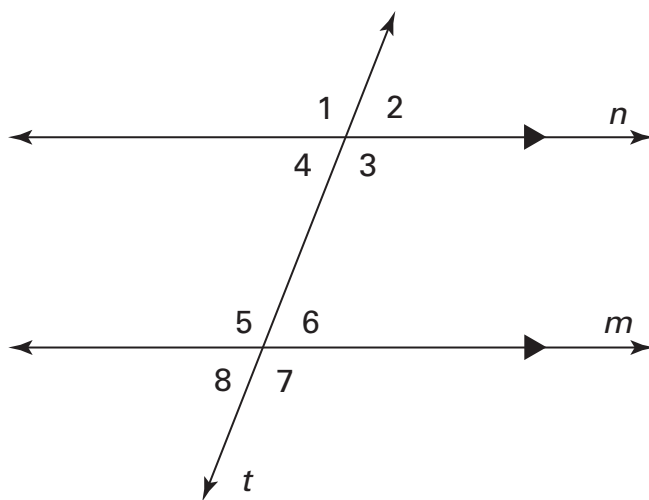
### Column A

- 263.** the measure of a reflex angle
- 264.** the measure of an angle supplementary to  $\angle BOC$
- 265.** the sum of the measures of  $\angle AOF$ ,  $\angle AOD$ , and  $\angle BOD$

### Column B

- the measure of  $\angle FOA$
- the measure of an angle supplementary to  $\angle FOE$
- the sum of the measures of the interior angles in a square

Use the following figure to answer questions 266–273.



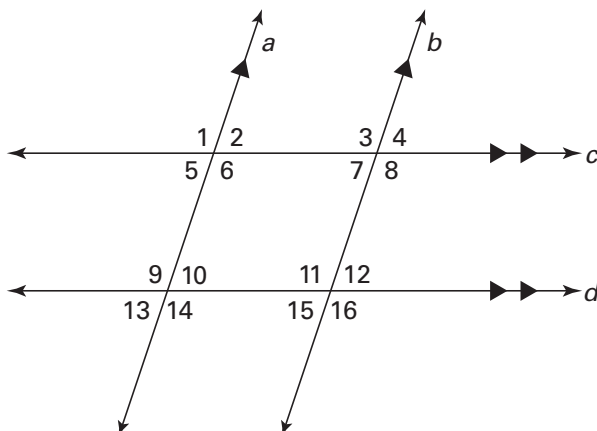
- |   |   |
|---|---|
| <b>266.</b> the measure of $\angle 1$   | the measure of $\angle 3$                 |
| <b>267.</b> the measure of $\angle 1$   | the measure of $\angle 5$                 |
| <b>268.</b> the measure of $\angle 7$   | the measure of $\angle 3$                 |
| <b>269.</b> the sum of the measures of angles 5 and 8                               | the sum of the measures of angles 2 and 3 |
| <b>270.</b> the measure of $\angle 2$   | the measure of $\angle 8$                 |
| <b>271.</b> the measure of $\angle 3$   | the measure of $\angle 6$                 |
| <b>272.</b> The measure of $\angle 1$ is $100^\circ$ .<br>$75^\circ$                | the measure of $\angle 8$                 |
| <b>273.</b> The measure of $\angle 3$ is $105^\circ$ .<br>the measure of $\angle 6$ | $77^\circ$                                |

# 501 Quantitative Comparison Questions

Column A

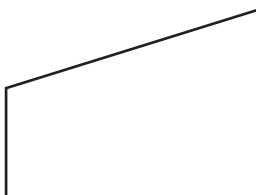
Column B

Use the following figure to answer questions 274–278.



- 274.** The measure of  $\angle 3$  is  $100^\circ$ .  
the measure of  $\angle 4$                       the measure of  $\angle 8$
- 275.** The measure of  $\angle 2$  is  $65^\circ$ .  
 $110^\circ$                       the measure of  $\angle 11$
- 276.** The measure of  $\angle 9$  is  $95^\circ$ .  
the measure of  $\angle 16$                       the measure of  $\angle 8$
- 277.** The measure of  $\angle 1$  is  $x$ .  
the measure of  $\angle 8$                        $2x$
- 278.** The sum of the measures of  $\angle 13$  and  $\angle 10$  is  $160^\circ$ .  
the measure of  $\angle 4$                       the measure of  $\angle 11$

Use the following figure to answer questions 279–280.





### 501 Quantitative Comparison Questions

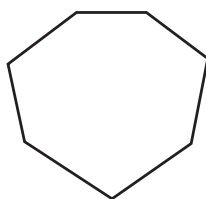
#### Column A

- 279.** the number of sides of this polygon
- 280.** the sum of the interior angles of this polygon

#### Column B

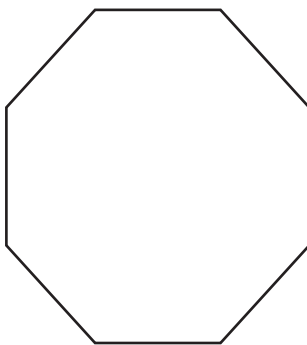
- the number of sides of a triangle
- 360

Use the following figure to answer questions 281–283.



- |  |  |
|--|--|
| <b>281.</b> the sum of the interior angles of this polygon | the sum of the exterior angles of this polygon |
| <b>282.</b> the number of sides in this polygon            | the number of sides in a heptagon              |
| <b>283.</b> the sum of the interior angles of this polygon | the sum of the interior angles of a hexagon    |

Use the following figure to answer questions 284–286.



- |  |   |
|--|---|
| <b>284.</b> the sum of the interior angles of an 8-sided polygon           | the sum of the interior angles of this figure |
| <b>285.</b> $\frac{1}{2}$ of the sum of the interior angles of this figure | the sum of the interior angles of a triangle  |

# 501 Quantitative Comparison Questions

## Column A

- 286.** the area of this polygon  
if all sides have a length of 8

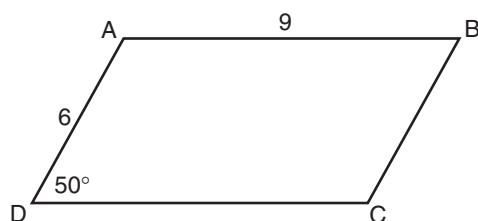
- 287.** A convex polygon has 5 sides. This polygon also has  
three right angles and two congruent angles.  
the measure of one of the congruent angles

## Column B

- the area of a convex polygon  
whose interior angles measure  
900.

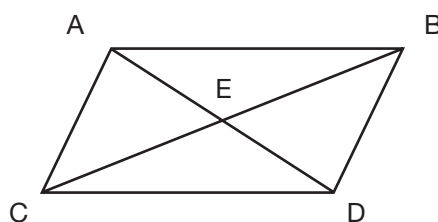
130°

Use the following figure to answer questions 288–289.



The figure is a parallelogram.

- 288.** the measure of  $\angle A$  the measure of  $\angle B$
- 289.** the length of line segment BC 6



- 290.** the length of line segment AE the length of line segment CE

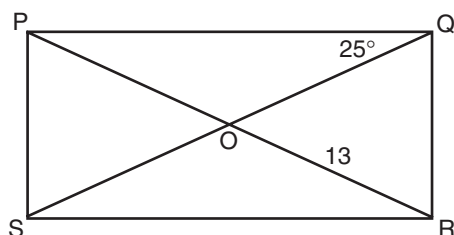
# 501 Quantitative Comparison Questions

## Column A

**291.** the length of line segment PR

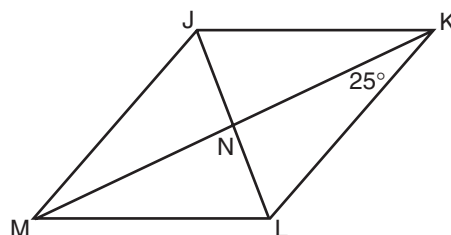
## Column B

three times the length of line segment SO



The figure is a rectangle.

Use the following figure to answer questions 292–294.



The figure is a rhombus.

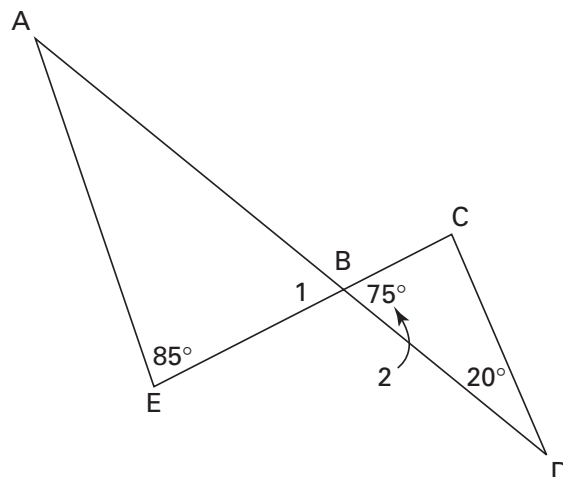
- |   |                               |
|---|-------------------------------|
| <b>292.</b> $25^\circ$                    | the measure of $\angle JKN$   |
| <b>293.</b> the measure of $\angle KNL$   | $80^\circ$                    |
| <b>294.</b> the length of line segment NK | the length of line segment JK |

# 501 Quantitative Comparison Questions

Column A

Column B

Use the following figure to answer questions 295–297.



**295.** the measure of  $\angle AEB$

the measure of  $\angle BCD$

**296.** the area of  $\triangle ABE$

the area of  $\triangle CBD$

**297.** the ratio of  
 $\frac{\text{the length of line segment AB}}{\text{the length of line segment DB}}$   
 to the ratio of  
 $\frac{\text{the length of line segment AE}}{\text{the length of line segment DC}}$

$\frac{3}{4}$

**298.** A flagpole stands perpendicular to the ground. At noon, the flagpole casts a shadow on the ground that is 6 feet long. At the same time, a 5 foot tall woman stands next to the flagpole and casts a shadow that is 3 feet long. The woman is also perpendicular to the ground. Assume that the triangles created in both situations are similar.

the height of the flagpole

9 feet

## 501 Quantitative Comparison Questions

### Column A

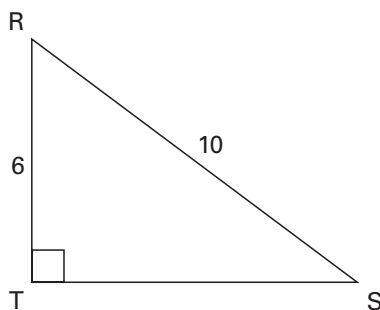
### Column B

- 299.** A surveyor is looking at two buildings from a distance, both of which stand perpendicular to the ground. He sets two telescopes up at  $45^\circ$  angles to the tops of both buildings, and both telescopes are at an elevation of 100 feet above sea level. The surveyor knows that the bases of both buildings are 100 feet above sea level and that the top of building A is 1,100 feet above sea level. The telescope pointing at building A is 250 feet away from the base of the building. The telescope pointing at building B is 300 feet away from the base of that building.

the height of building A

The height of building B

Use the following figure to answer questions 300–302.



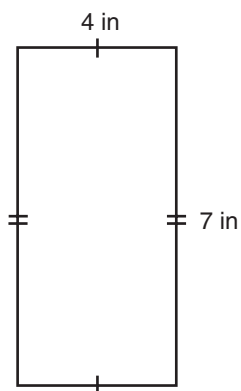
- 300.** the length of line segment TS      7
- 301.**      Recreate the diagram substituting 3 for the length of line segment RT and 4 for the line segment TS. Assume that the length of line segment RS is not given.
- 6      the length of line segment RS
- 302.** Recreate the diagram substituting 3 for the length of line segment RT and 5 for the length of line segment RS.
- 4       $b$

### 501 Quantitative Comparison Questions

Column A

Column B

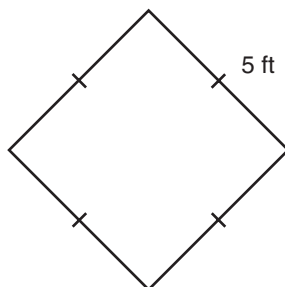
Use the following figure to answer questions 303–304.



The figure is a rectangle.

- |                      |                             |
|----------------------|-----------------------------|
| <b>303.</b> 21 in    | the perimeter of the figure |
| <b>304.</b> 28 sq in | the area of the figure      |

Use the following figure to answer questions 305–306.



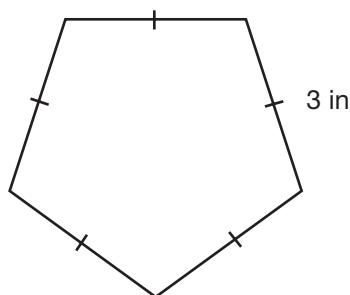
- |  |   |
|--|---|
| <b>305.</b> 10 ft  | the perimeter of the figure   |
| <b>306.</b> 25 sq ft   | the area of this square if each side is 6 in longer than indicated in the diagram |
| <b>307.</b> the perimeter of a rectangle with length 4 in and width 6 in | the perimeter of a square with sides of length 5 in each                          |
| <b>308.</b> the area of a square whose sides have a length of $3x$       | the area of a rectangle with length $2x$ and width $x$                            |

# 501 Quantitative Comparison Questions

Column A

Column B

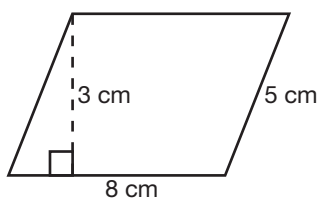
309.



13 in

the perimeter of this polygon

Use the following figure to answer questions 310–311.



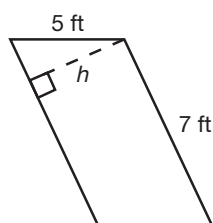
310. the base of the parallelogram in the figure

the height of the parallelogram in the figure

311. the area of the parallelogram in the figure

42 sq cm

Use the following figure to answer questions 312–313.



312. 42 sq in

the area of the triangle in the figure

313. the base of the triangle in the figure

the base of a triangle whose area is 35 sq cm and height is 10 cm

## 501 Quantitative Comparison Questions

### Column A

### Column B

- 314.** Mr. Jenkins is installing a pool in his backyard. The pool will be a rectangle with a length of 12 feet and a width of 8 feet. There will also be a 36 square foot wooden deck built adjacent to one side of the pool.
- 120 sq ft                                      the total area of the pool and deck
- 315.** Sally is mounting photographs on matting board. She has 48 square inches of matting board to work with, and a stack of five rectangular photos each measuring  $3'' \times 5''$ . Assume that she is cutting the board to fit each photo exactly, with no board wasted.
- the number of photos she can mount                                      the number of photos she does not have enough board to mount
- 316.** A standard Stop sign has 8 sides, each of which measures 10 inches in length. A special Yield sign built to be seen from a great distance is an equilateral triangle with sides of 26 inches each and three reflective circles attached to the front, each with a radius of 1.5 inches.
- the perimeter of the Stop sign                                      the perimeter of the Yield sign
- 317.** A baker has made a square sheet cake for a birthday party. At the last minute, the woman hosting the party calls to say that the cake needs to be circular in shape, and not a square. The square cake has a side 11" in length.
- the area of the largest circular cake that can be cut out of the square cake                                       $\frac{3}{4}$  the total area of the square cake

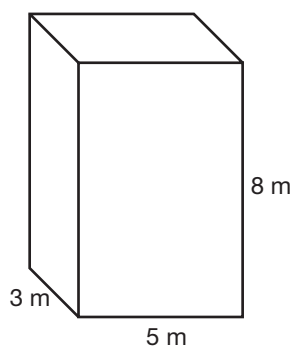


## 501 Quantitative Comparison Questions

Column A

Column B

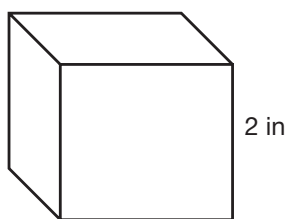
**318.**



the surface area of this  
rectangular prism

135 sq m

**319.**



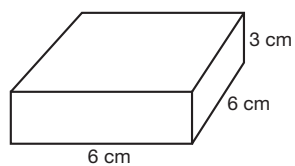
the surface area of this cube

24 sq in

**320.** the surface area of a cube  
with an edge 4" long

the surface area of a rectangular  
prism with a length of 5"

**321.**



100 cubic cm

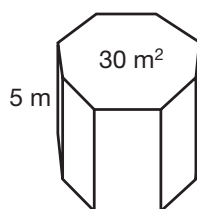
the volume of the prism in the  
diagram

# 501 Quantitative Comparison Questions

## Column A

## Column B

**322.**



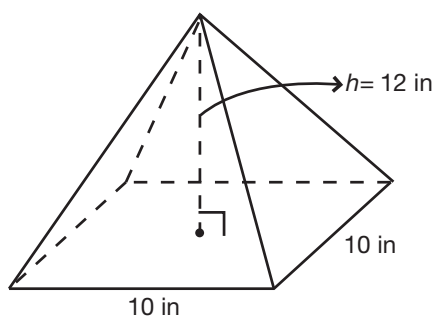
the volume of the prism in the diagram

the volume of a prism with a base of  $40 \text{ m}^2$  and height of 4 m

**323.** the volume of a cube with an edge of 4 meters

twice the volume of a cube with an edge of 2 meters

Use the following figure to answer questions 324–325.



**324.** the volume of this pyramid

1,200 cubic in

**325.** the volume of the pyramid in the diagram if the height is changed to 9 in

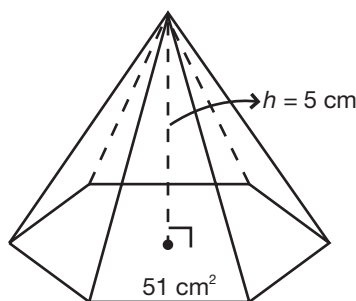
the volume of the pyramid in the diagram if the length and width are changed to 9 in each

## 501 Quantitative Comparison Questions

Column A

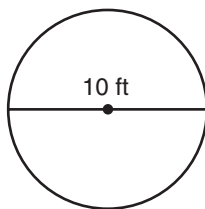
Column B

Use the following figure to answer questions 326–327.



- |  |   |
|--|---|
| <b>326.</b> the volume of the pyramid in the diagram                                     | $80 \text{ cm}^3$   |
| <b>327.</b> the volume of the pyramid in the diagram if the height is lengthened to 6 cm | the volume of a regular pyramid with area of the base = $60 \text{ cm}^2$ and height = 5 cm |
| <b>328.</b> the circumference of a circle with diameter $d = 5 \text{ cm}$               | the circumference of a circle with diameter $d = 7 \text{ cm}$                              |
| <b>329.</b> the circumference of a circle with diameter $d = 7 \text{ cm}$               | 21 cm   |
| <b>330.</b> the diameter of a circle with circumference $C = 25.12 \text{ m}$            | the radius of a circle with circumference $C = 31.4 \text{ m}$                              |

Use the following figure to answer questions 331–332.



- |   |                     |
|---|---------------------|
| <b>331.</b> the radius of the circle in the diagram | 4 ft                |
| <b>332.</b> the area of the circle in the diagram   | $15.7 \text{ ft}^2$ |

# 501 Quantitative Comparison Questions

## Column A

## Column B

333.

A circle has a radius of  $r = 4$  in.

the area of a square that  
would fit inside of the circle

the area of the circle

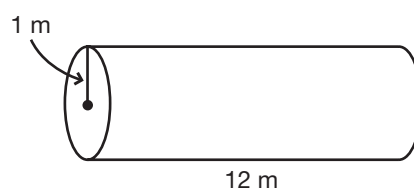
334.

A circle has a diameter of  $d = 8$  cm.

the area of the circle

the area of the largest circle that  
could be cut out of a square of  
fabric with an area of 16 sq cm

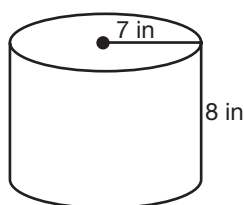
335.



the total surface area of the  
cylinder in the diagram

82 cm<sup>2</sup>

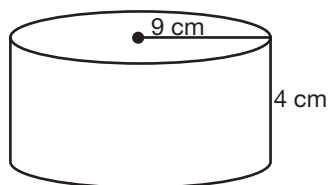
336.



the total surface area of  
this cylinder

the total surface area of a cube  
with edges  $e = 9$  cm

337.



the volume of the cylinder  
in the diagram

1,350 cm<sup>3</sup>

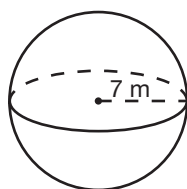
## 501 Quantitative Comparison Questions

### Column A

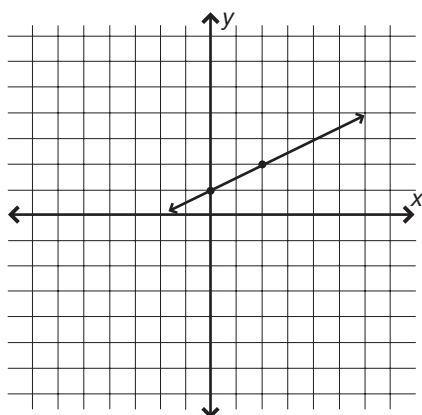
### Column B

- |   |   |
|---|---|
| <b>338.</b> the volume of a cylinder if the radius is doubled                                 | the volume of a cylinder if the height is doubled |
| <b>339.</b> A cylinder has a radius $r = 5$ cm and height $h = 10$ cm.<br>750 cm <sup>3</sup> | the volume of this cylinder                       |
| <b>340.</b> A cone has a radius $r = 5$ cm and height $h = 10$ cm.<br>the volume of the cone  | 300 cm <sup>3</sup>                               |
| <b>341.</b> A sphere has a radius of 6 cm.<br>the surface area of the sphere                  | 452.16 sq cm                                      |

Use the following figure to answer questions 342–343.



- |  |  |
|--|--|
| <b>342.</b> the surface area of this sphere              | 615 sq m                                     |
| <b>343.</b> the volume of this sphere                    | 2,000 cm <sup>3</sup>                        |
| <b>344.</b> the volume of a sphere with a radius of 2 ft | the volume of a sphere with a radius of 3 ft |
| <b>345.</b>  |  |



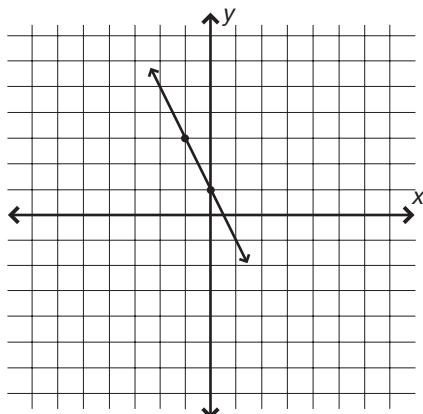
- |                                      |               |
|--------------------------------------|---------------|
| the slope of the line in the diagram | $\frac{1}{3}$ |
|--------------------------------------|---------------|

# 501 Quantitative Comparison Questions

Column A

Column B

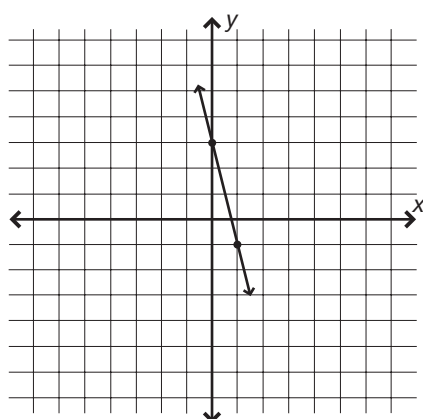
346.



the slope of the line in  
the diagram

$-\frac{1}{3}$

347.



the slope of the line in  
the diagram

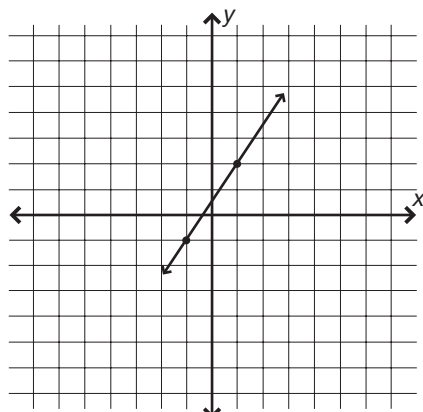
$\frac{1}{2}$

# 501 Quantitative Comparison Questions

Column A

Column B

348.



the slope of the line in  
the diagram

$\frac{2}{3}$

349. 0

the slope of the line that passes  
through the points (2,2) and (4,0)

350. A line passes through the points (0,0) and (-2,-3).

0

the slope of the line

351. 0

the slope of the line  $y = -1$

352. Tommy is standing at the base of a hill at a vertical elevation of 0 ft above sea level. He knows the hill rises along a line measured to have a slope of  $\frac{2}{5}$ . He also knows he has to walk 100 horizontal feet to get to the peak.

35 ft above sea level

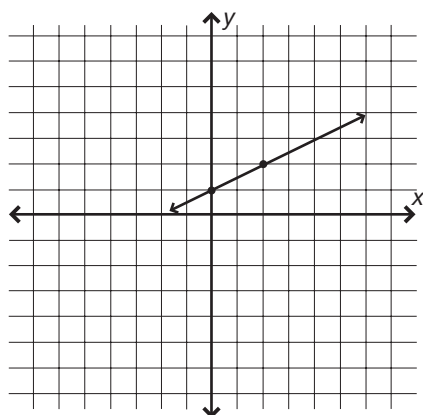
the vertical elevation of the peak  
of the hill

# 501 Quantitative Comparison Questions

Column A

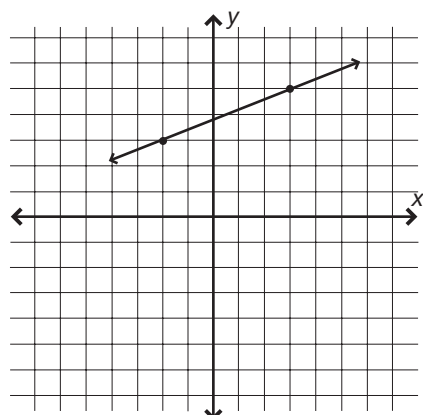
Column B

Use the following figure to answer questions 353–354.



- |  |  |
|--|--|
| <p><b>353.</b> the <math>y</math>-intercept of the line in the diagram</p> | <p>0</p>   |
| <p><b>354.</b> the <math>y</math>-intercept of the line in the diagram</p> | <p>the <math>y</math>-intercept of a line defined by the equation <math>y = -\frac{1}{2}x + 4</math></p> |

Use the following figure to answer questions 355–356.



- |  |  |
|--|--|
| <p><b>355.</b> the <math>y</math>-intercept of the line in the diagram</p> | <p>0</p>   |
| <p><b>356.</b> the <math>y</math>-intercept of the line in the diagram</p> | <p>the <math>y</math>-intercept of a line defined by the equation <math>y = x - 1</math></p> |



## 501 Quantitative Comparison Questions

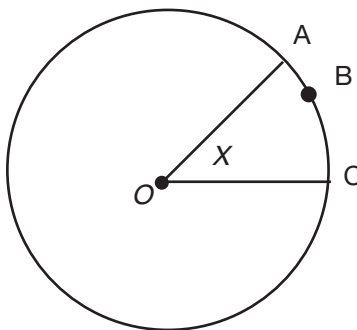
### Column A

- 357.** the  $y$ -intercept of a line defined by the equation  $y = \frac{3}{2}x - 6$
- 358.** the  $y$ -intercept of a line defined by the equation  $y = x + \frac{2}{5}$
- 359.** the  $y$ -intercept of a line defined by the equation  $2y = x + 8$
- 360.** the  $y$ -intercept of a line defined by the equation  $y = \frac{3}{2}x - 6$
- 361.** the  $y$ -intercept of a line defined by the equation  $2y + \frac{1}{2}x = 0$
- 362.** the  $y$ -intercept of a line defined by the equation  $2y = 10$

### Column B

- the  $y$ -intercept of a line defined by the equation  $y = -\frac{1}{4}x + 4$
- the  $y$ -intercept of a line defined by the equation  $y = 9x - 4$
- the  $y$ -intercept of a line defined by the equation  $y = 4x + 3$
- the  $y$ -intercept of a line defined by the equation  $6 = x - y$
- the  $y$ -intercept of a line defined by the equation  $x = 9$
- the  $y$ -intercept of a line defined by the equation  $xy = x^2 + 4x$

Use the following figure to answer questions 363–366.



$O$  is the center of the circle.

- 363.** The circumference of circle  $O$  is 20 cm. The measure of  $\angle X$  is  $45^\circ$ .  
the length of arc ABC                      2 cm

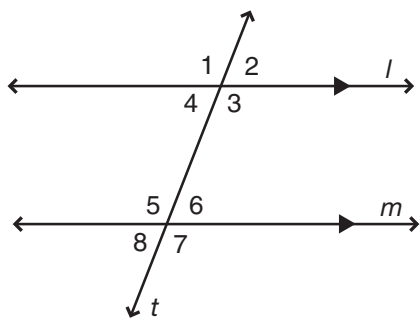
## 501 Quantitative Comparison Questions

### Column A

### Column B

- |  |   |
|--|---|
| <b>364.</b> The circumference of circle $O$ is 10 cm. The measure of $\angle X$ is $36^\circ$ .<br>the length of arc ABC | 1 cm  |
| <b>365.</b> The length of arc ABC is 2 cm. The measure of $\angle X$ is $45^\circ$ .<br>20 cm                            | the circumference of circle $O$   |
| <b>366.</b> The circumference of circle $O$ is 30 cm.<br>The length of arc ABC is 3 cm.<br><br>$35^\circ$                | the measure of $\angle x$   |
| <b>367.</b> the area of a rectangle with sides of 2 cm and 3 cm  | the area of a square with sides of 2 cm                                 |
| <b>368.</b> the sum of the interior angles of a 30-60-90 triangle  | the sum of the interior angles of an isosceles right triangle           |
| <b>369.</b> the volume of a cube with side of length 3 cm  | the volume of a cylinder with radius 2 cm and height 3 cm               |
| <b>370.</b> the hypotenuse of a right triangle with shorter sides of length 3 and 4                                      | the hypotenuse of a right triangle with shorter sides of length 6 and 8 |

Use the following figure to answer questions 371–372.



- |   |                                |
|---|--------------------------------|
| <b>371.</b> the measure of $\angle 3$   | the measure of $\angle 1$      |
| <b>372.</b> the measure of $\angle 1$   | the measure of $\angle 2$      |
| <b>373.</b> A line is represented by the equation $y = 3x + 2$ .<br>the slope of the line | the $y$ -intercept of the line |

### 501 Quantitative Comparison Questions

#### Column A

#### Column B

- 374.**  $\triangle ABC$  is a right triangle with shorter sides of 3 and 6.  
 $\triangle BCD$  is a right triangle with shorter sides of 4 and 8.  
the ratio of the lengths of  $\frac{1}{2}$   
the two triangles' hypotenuses
- 375.** A circular apple pie with a circumference of 18" is cut into 9 equal slices. The slices are all cut starting at the center of the pie out to the edge of the crust.  
the length of the arc formed 1.5"  
by the crust of one slice at its  
outer edge

## 501 Quantitative Comparison Questions

### Answer Explanations

The following explanations show one way in which each problem can be solved. You may have another method for solving these problems.

- 251. b.** The area of a triangle =  $\frac{1}{2}bh$ .  $\Delta Q$  is a right triangle, so we can substitute 3 and 4 for  $b$  and  $h$ .  $A = \frac{1}{2}(3(4)) = \frac{1}{2}(12) = 6$ . The area of  $\Delta Q$  is 6 sq m, which is less than 8 sq m, so the answer is **b**.
- 252. c.** The slope of a line is defined as  $\frac{\text{change in } y}{\text{change in } x}$ . The line in the graph crosses the origin at (0,0) and also intersects the point (2,3). This creates a rise (change in the  $y$ -value) of 3 and a run (change in the  $x$ -value) of 2, which gives a slope of  $\frac{3}{2}$ . Thus, the values in **a** and **b** are equal, so the answer is **c**.
- 253. d.** The area of a circle is defined as  $A = \pi r^2$ . The radius of the circle drawn is  $2x$ , so we can calculate the area of the circle as  $4x^2\pi$ . The area of a circle with diameter  $3y$  would be  $a = \pi r^2 = (3y)^2\pi = 9y^2\pi$ . However, since the values of  $x$  and  $y$  are not defined, it is impossible to evaluate whether quantity A ( $4x^2\pi$ ) or quantity B ( $9y^2\pi$ ) is greater. If, for instance,  $x = 5$  and  $y = 2$ , then quantity A would be greater. But if  $x = 2$  and  $y = 5$ , quantity B would be greater. So there is not enough information to evaluate the equations and the answer is **d**.
- 254. b.** The formula for the volume of a box is  $A = lwh$ . So the volume of the box at left =  $4(6)x$  or  $24x$ . The volume of a cylinder =  $\pi r^2h$ , so the volume of the cylinder at right =  $\pi x^2x$ , or  $\pi x^3$ . Substituting  $x = 3$  into both equations, the volume of the box becomes  $24(3) = 72$  and the volume of the cylinder becomes  $\pi(3)^3 = \pi(27) = 3.14(27) = 85.78$ . So long as  $x$  is greater than or equal to 3, the volume of the cylinder is greater and the answer is **b**.
- 255. d.** When two parallel lines are cut by a line segment, the resulting corresponding angles created are equal, so  $x = y$ . The sum of two complementary angles is always 180, so  $x + z = 180$ , and since  $x = y$ , it is also true that  $y + z = 180$ . However, no information is given about the relationship between  $x$  and  $z$  other than the fact that they add up to 180. Even though the

### 501 Quantitative Comparison Questions

figure makes it look like  $x > z$  is true, this cannot be taken for fact. Therefore there is not enough information to further evaluate the problem and the answer is **d**.

- 256. a.** The Pythagorean theorem states that in any right triangle,  $a^2 + b^2 = c^2$  where  $c$  is the hypotenuse of the triangle and  $a$  and  $b$  are the lengths of the other sides. Since the side labeled 10 is opposite the right angle, it is the hypotenuse of the triangle, so the Pythagorean theorem can be used by substituting 6,  $x$ , and 10 for  $a$ ,  $b$ , and  $c$ , respectively.

$$a^2 + b^2 = c^2$$

$$6^2 + x^2 = 10^2$$

$$36 + x^2 = 100$$

$$x^2 = 64$$

$$x = 8$$

$x = 8$  and therefore is less than 9, so the answer is **a**.

**Note:** If you recognize that 6, 8, 10 is a Pythagorean triple, then you know that  $x$  must be equal to 8 and you can quickly solve the problem.

- 257. b.** When two line segments intersect, the resulting vertical angles are always equal, so  $b = 80^\circ$ . Therefore,  $6b = 6(80^\circ) = 480^\circ$ . The sum of the interior angles of a polygon can be found by drawing all diagonals of the polygon from one vertex and multiplying the number of triangles formed by  $180^\circ$ . The polygon at the right can be divided into 3 triangles, so  $3(180^\circ) = 540^\circ$ .  $540^\circ > 480^\circ$ , so the answer is **b**.

- 258. a.** The area of a circle is dependent on the length of its radius, so the problem here is to determine which circle could have the largest radius. To cut a circle out of a rectangular piece of paper, you must draw a circle whose radius is no greater than any of the sides of the rectangle. This is because the radius extends equally from the center of the circle in all directions. So even though the width of the rectangle in column B is 5", its length is only 3.2", which is smaller than the sides of the square in column A (3.4"). Thus a circle with a larger radius—and, therefore, greater area—could be cut from the square in column A. So the answer is **a**.

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- 259. c.** Sketching  $\triangle ABC$  will be helpful here.  $\angle B$  must be right because the sum of angles A and C is  $90^\circ$ , and the sum of all three angles in the triangle must add up to  $180^\circ$ . The fact that this triangle has angles of  $30^\circ$ ,  $60^\circ$  and  $90^\circ$  means that it is a 30-60-90 special right triangle whose sides are  $x$ ,  $x\sqrt{3}$  and  $2x$ . (You should have the lengths of this and the other special right triangle—a 45-45-90 triangle—memorized.) Since AC is the hypotenuse of this triangle, its value can be represented by  $2x$  according to the relative lengths of the sides of this kind of special right triangle. BC measures  $2\sqrt{3}$ , and it is opposite the  $60^\circ$  angle ( $\angle A$ ), so it can be represented as the  $x\sqrt{3}$  side of the triangle. Setting  $2\sqrt{3} = x\sqrt{3}$ , and dividing both sides of the equation by  $\sqrt{3}$  yields  $x = 2$ . Plugging this value of  $x$  into  $AC = 2x$  gives line segment AC a value of  $2(2)$ , which equals 4. Thus the values of column A and column B are the same, and the answer is **c**.
- 260. d.** Though the problem tempts you to sketch the shapes and use your knowledge of isosceles triangles to determine  $x$  and your knowledge of similar polygons to determine  $y$ , there is no need. The problem does not state that polygons DEFGH and LMNOP are similar, and since there is no information indicating that their corresponding sides are in the same ratio or that corresponding angles are equal, this cannot be determined. There is not enough information to solve the problem, so the answer is **d**. When taking the test, be sure to read through the problems before spending time sketching shapes and solving equations. Determine whether or not you have enough information to solve the problem before delving into it.

**Note:** If you were told that the polygons were, in fact, similar, the problem could be solved. Line segment QR in  $\triangle QRS$  is the hypotenuse (by virtue of being opposite of  $\angle S$ , which must equal  $90^\circ$ ) and therefore has a length greater than 8. The fact that corresponding sides in similar polygons have lengths of a similar ratio could then be used to set up the ratio  $DE/GH = LM/OP$ . Substituting would yield  $\frac{3}{y} = \frac{1}{2}$ , which solves to  $y = 6$ . Since  $x > 8$ ,  $x$  must be greater than  $y$  and therefore the answer would be **a**.

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- 261. a.** The measure of  $\angle AOD$  as indicated in the diagram is  $100^\circ$ . The measure of any right angle is always  $90^\circ$ . Therefore  $\angle AOD$  is bigger and the answer is **a**.
- 262. d.** The measure of  $\angle AOB$  as indicated in the diagram is  $20^\circ$ . An acute angle is an angle with a measure less than  $90^\circ$ . Since an acute angle could be less than  $20^\circ$ , equal to  $20^\circ$  or between  $20^\circ$  and  $90^\circ$ , there is not enough information to say whether or not an acute angle would be greater than  $\angle AOB$ . Therefore, the answer is **d**.
- 263. a.** A reflex angle is defined as an angle whose measure is between  $180^\circ$  and  $360^\circ$ . The measure of  $\angle FOA$  as indicated in the diagram is  $180^\circ$  (which makes it a *straight* angle). This is smaller than a reflex angle, so the answer is **a**.
- 264. b.** Supplementary angles are angles whose measure adds up to  $180^\circ$ . The diagram does not directly indicate the measures of angles  $BOC$  and  $FOE$ , but it does give enough information to find these measures using subtraction:
- $$\begin{aligned}\angle BOC &= \angle AOC - \angle AOB \\ \angle BOC &= 70^\circ - 20^\circ \\ \angle BOC &= 50^\circ \\ \angle FOE &= \angle FOA - \angle EOA \\ \angle FOE &= 180^\circ - 135^\circ \\ \angle FOE &= 45^\circ\end{aligned}$$
- $\angle BOC = 50^\circ$ , so its supplement must equal  $180^\circ - 50^\circ$ , or  $130^\circ$ .  
 $\angle FOE = 45^\circ$ , so its supplement must equal  $180^\circ - 45^\circ$ , or  $135^\circ$ .  
The supplement to  $\angle FOE$  is larger, so the answer is **b**.
- 265. c.** The interior angles in a square are all right angles, and since there are four of them, the sum of their measures is always  $360^\circ$ .  $\angle AOF$  as indicated in the diagram measures  $180^\circ$  and  $\angle AOD$  measures  $100^\circ$ . To find the measure of  $\angle BOD$ , use subtraction:
- $$\begin{aligned}\angle BOD &= \angle AOD - \angle AOB \\ \angle BOD &= 100^\circ - 20^\circ \\ \angle BOD &= 80^\circ\end{aligned}$$

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Therefore the measures of the three angles in column A are  $180^\circ$ ,  $100^\circ$ , and  $80^\circ$ , which add up to  $360^\circ$ . This is the same as the sum in column B, so the answer is **c**.

- 266. c.** Vertical angles are congruent (equal). Vertical angles are defined as angles, formed by 2 intersecting lines, which are directly across or opposite from each other. Angles 1 and 3 are vertical and therefore congruent. The answer is **c**.
- 267. c.** When a transversal line intersects two parallel lines, the resulting corresponding angles are congruent. Corresponding angles are defined as the angles on the same side of the transversal and either both above or below the parallel lines. Angles 1 and 5 are corresponding and therefore congruent, so the answer is **c**.
- 268. c.** Angles 7 and 3 are corresponding and therefore congruent. The answer is **c**.
- 269. c.** Angles 5 and 8 are supplementary because they combine to form a straight line. The same is true of angles 2 and 3. Supplementary angles always add up to  $180^\circ$ , so the measures of both sets of angles are the same and the answer is **c**.
- 270. c.** Angles 2 and 8 are neither corresponding nor vertical. However, angles 2 and 6 are corresponding, so their measures are equal. Angles 6 and 8 are vertical, so their measures are also equal. This information can be used to determine that angles 2 and 8 are congruent because  $m\angle 2 = m\angle 6 = m\angle 8$ . In fact, angles 2 and 8 are called *alternate exterior angles*. Alternate exterior angles are always congruent, so the answer is **c**.
- 271. d** Angles 3 and 6 are *same side interior angles*. This means that they are both inside the parallel lines and on the same side of the transversal. Same side interior angles are always supplementary, so their measures add up to  $180^\circ$ . However, this relationship says nothing about the specific values of each angle, and even though the drawing makes it look like one angle might be larger than the other, no information is given that could determine the actual value of either angle. Therefore, there is not enough information to solve the problem and the answer is **d**.



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- 272. b.** Angles 1 and 8 are *same side exterior angles*. This means that they are both outside the parallel lines and on the same side of the transversal. Same side exterior angles are always supplementary. Supplementary angles add up to  $180^\circ$  and the measure of  $\angle 1$  is given as  $100^\circ$ , so the measure of  $\angle 8$  must be  $180^\circ - 100^\circ = 80^\circ$ .  $80^\circ$  is greater than  $75^\circ$ , so the answer is **b**.
- 273. b.** Angles 3 and 6 are same side interior angles, which means that they are supplementary. Since the measure of  $\angle 3$  is  $105^\circ$ , the measure of  $\angle 6$  must be  $180^\circ - 105^\circ = 75^\circ$ ;  $77^\circ > 75^\circ$ , so column B is greater. The answer is **b**.
- 274. b.**  $\angle 3$  and  $\angle 4$  are supplementary angles, so the sum of their measures must add up to  $180^\circ$ . Therefore the measure of  $\angle 4 = 180^\circ - 100^\circ = 80^\circ$ ;  $\angle 3$  and  $\angle 8$  are vertical angles and therefore congruent, so the measure of  $\angle 8 = 100^\circ$ ;  $100^\circ > 80^\circ$ , so the measure of  $\angle 8$  is larger than the measure of  $\angle 4$  and the answer is **b**.
- 275. b.**  $\angle 2$  and  $\angle 11$  have no direct relationship upon first glance. However, there are two sets of parallel lines in this diagram (lines  $a$  and  $b$ , and lines  $c$  and  $d$ ) so there are many related angles to work with.  $\angle 2$  and  $\angle 3$  are same side exterior angles along transversal  $c$  and therefore are supplementary. So the measure of  $\angle 3$  is  $180^\circ - 65^\circ = 115^\circ$ . Angles 3 and 11 are corresponding angles (along transversal  $b$  and both above the parallel lines  $c$  and  $d$ ) and so are congruent. So the measure of  $\angle 11$  is also  $115^\circ$ , which is greater than column A. The answer is **b**.
- 276. c.** The measure of  $\angle 9$  is information you actually don't need to solve this problem. Some questions will provide extra information like this in an attempt to throw you off, so don't be tricked if you're sure of how to solve the problem! In this case, angles 16 and 8 are corresponding angles (both along transversal  $b$  and beneath parallel lines  $c$  and  $d$ , respectively) and so must be congruent. Therefore, the answer is **c** because their measures are the same.

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- 277. b.**  $\angle 1$  and  $\angle 8$  are alternate exterior angles (on opposite sides of transversal  $c$  and on the outside of the parallel lines  $a$  and  $b$ ), and therefore are congruent. So the measure of  $\angle 8$  is  $x$ ;  $x$  indicates the measure of an angle, so it cannot be negative. Therefore,  $2x > x$  and the answer is **b**.
- 278. b.** This problem is actually not that difficult to solve, but it does require several steps to determine the measures of both angles since there is no direct relationship between the two. First, angles 13 and 10 are vertical angles and therefore congruent. So the measure of each angle is  $\frac{1}{2}$  of their sum, or  $80^\circ$ . Next, angles 10 and 11 are same side interior angles (along transversal  $d$  and both on the inside of parallel lines  $a$  and  $b$ ) and therefore supplementary, so the measure of  $\angle 11$  must be  $180^\circ - 80^\circ = 100^\circ$ .

Now find the measure of  $\angle 4$ .  $\angle 11$  and  $\angle 7$  are same side interior angles (along transversal  $b$  and both on the inside of parallel lines  $c$  and  $d$ ) and so are supplementary. Therefore the measure of  $\angle 7 = 180^\circ - 100^\circ = 80^\circ$ ;  $\angle 7$  and  $\angle 4$  are vertical angles, and so the measure of  $\angle 4$  must also be 80.

The measure of  $\angle 11$  is greater than the measure of  $\angle 4$  because  $100^\circ > 80^\circ$ . The answer is **b**.

With some practice, you will become familiar with the relationships between the angles created by a transversal cutting two parallel lines. This will make analyzing a system of multiple parallel lines and transversals much easier, and you will be able to quickly intuit the relationship between angles like these by logically connecting different pairs of congruent and supplementary angles. Once you know the basic rules it becomes easier and easier to break down the components of a complicated system of lines and angles to solve the problem.

- 279. a.** This polygon has four sides, making it a quadrilateral. Triangles are three-sided polygons. A quadrilateral has more sides than a triangle, so the answer is **a**.

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- 280. c.** You can use the formula  $S = 180(n - 2)$  to find the sum of the angles in a convex polygon, where  $n$  represents the number of sides in the polygon. A four-sided polygon such as this one has an angle sum of  $S = 180(4 - 2) = 180(2) = 360$ , which is equal to the amount in column A, so the answer is **c**.
- 281. a.** You can use the formula  $S = 180(n - 2)$  to determine that the angle sum of this polygon is 900. The exterior sum of any convex polygon is always 360, so the answer is **a**.
- 282. c.** A heptagon is a seven-sided polygon. This polygon also has seven sides, so the values in the two choices are equal. The answer is **c**.
- 283. a.** Though the formula  $S = 180(n - 2)$  can be used to determine that the angle sum of this polygon is 900 and the angle sum of a hexagon is 720, an understanding of the nature of convex polygons provides an easier way to solve the problem. A polygon's angle sum increases as the number of sides of the polygon increases. Since this polygon has more sides (7) than a hexagon (6), the sum of its interior angle sum will be greater, so the answer is **a**.
- 284. c.** This figure is an 8-sided polygon, so the value of choices are equal. The answer is **c**.
- 285. a.** Though you can use the formula  $S = 180(n - 2)$  to determine that  $\frac{1}{2}$  of the angle sum of this polygon is 540 (the entire sum is 1,080) and the angle sum of a triangle is 180, you should more quickly be able to determine that since this is an 8-sided polygon, its angle sum will be more than double that of a 3-sided triangle. In either case, the answer is **a**.
- 286. d.** This figure is an 8-sided polygon with all sides of length 8. Though the math is a bit involved, you do have enough information to determine its area. However, while the sum of the interior angles of a convex polygon can be used to determine how many sides the figure has, the area of the second polygon cannot be calculated without more information. Therefore this problem cannot be fully solved and the answer is **d**.

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- 287. a.** The formula  $S = 180(n - 2)$  can be used to determine that the sum of the interior angles of this polygon is 540. Right angles measure  $90^\circ$  each, so subtracting the sum of the three right angles from  $540^\circ$  leaves  $270^\circ$  for the two remaining congruent angles. Congruent angles are angles with equal measures, so dividing  $\frac{270^\circ}{2}$  yields  $135^\circ$  for each angle, which is larger than the value in column B ( $130^\circ$ ). The answer, therefore, is **a**.
- 288. a.** This diagram shows a parallelogram. Opposite angles in a parallelogram are always congruent, so the measure of  $\angle B$  is equal to the measure of  $\angle D$ , which is indicated as  $50^\circ$ . Consecutive angles in a parallelogram are supplementary, so the measure of  $\angle A = 180^\circ - m\angle B$ , or  $180^\circ - 50^\circ = 130^\circ$ . Since  $130^\circ > 50^\circ$ ,  $\angle A > \angle B$ , so the answer is **a**.
- 289. c.** Opposite sides in a parallelogram are congruent, so the lengths of line segments AD and BC will be equal. The length of line segment AD is 6, so the length of BC must be 6, as well. The value in column B is also 6, so the answer is **c**.
- 290. c.** This question modifies the diagram to show line segments AC and BD, which are the diagonals of the parallelogram. Point E marks the intersection of these line segments, where they bisect each other. Line segments AE and CE are therefore the two halves of line segment AC, and have equal lengths. The answer is **c**.
- 291. b.** The figure shows a rectangle with diagonals PR and SQ that intersect at point O. The diagonals of a rectangle are congruent and bisect each other, so the length of  $\overline{PR}$  is equal to twice the length of  $\overline{SO}$  (which is one half of the diagonal  $\overline{SQ}$ ). Three times the length of  $\overline{SO}$ , however, is longer than  $\overline{PR}$ , so the answer is **b**.

Note: Line segment SO represents a length and so cannot reasonably have a negative value. Thus three times  $\overline{SO}$  cannot be a negative value, either, so three times the length of  $\overline{SO}$  will always be greater than the length of  $\overline{PR}$ .

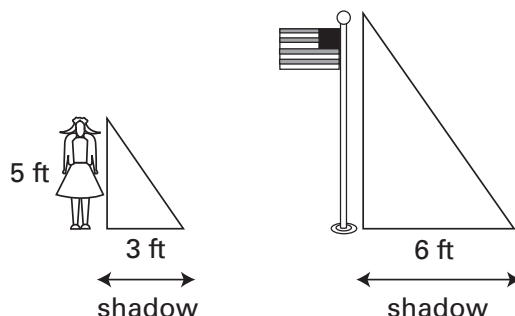
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- 292. c.** The figure shows a rhombus. The diagonals of a rhombus bisect the angles of a rhombus, so angles JKN and NKL have equal values because they comprise the two halves of the bisected  $\angle JKL$ . The measure of  $\angle NKL$  is given as  $25^\circ$ , so the values in both choices are equal. The answer, then, is **c**.
- 293. a.** The diagonals of a rhombus are perpendicular, so  $\angle KNL$  measures  $90^\circ$  because it is formed out of the intersection of the diagonals of this rhombus.  $90^\circ > 80^\circ$ , which is the value in column B, so the answer is **a**.
- 294. b.** The diagonals of a rhombus are perpendicular to each other, so angles JNK and LNK are both right angles. This means that  $\triangle JNK$  is a right triangle. Line segment JK is the hypotenuse of  $\triangle JNK$  because it is opposite the right angle. Line segment NK is also part of the same triangle, opposite one of the smaller angles of the triangle (in this case,  $\angle KJN$ , which measures  $65^\circ$ ). The hypotenuse is always the longest of the three sides of a triangle, so line segment JK is longer and the answer is **b**.
- 295. c.**  $\angle AEB$  is indicated to have a measure of  $85^\circ$ . The sum of the angles in a triangle is always  $180^\circ$ , so  $\angle BCD$  also can be determined to have a measure of  $85^\circ$  (because the other two angles in  $\triangle BCD$  add up to  $95^\circ$ ). The values of the two choices are therefore equal and the answer is **c**.
- 296. d.** There is enough information given to ascertain that the two triangles are similar according to Angle-Angle. However, no information is given to indicate the specific length of any side of either triangle. Therefore, even though triangle ABE appears larger in the diagram, the actual area of either triangle cannot be calculated. There is not enough information to solve this problem, and the answer is **d**.
- 297. a.**  $\angle 1$  and  $\angle 2$  are vertical angles, and therefore congruent, so  $\angle 1$  measures  $75^\circ$ . This can be used to determine the measure of the third angle of each triangle and consequently that triangles ABE and CBD are similar by Angle-Angle. The lengths of two corresponding sides of similar triangles are always proportionate, so the ratio in column A works out to  $\frac{1}{1}$ ;  $\frac{1}{1} > \frac{3}{4}$ ,

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so the answer is **a**. This problem is easy to solve if you know the properties of similar triangles and are able to understand the ratio described in column A.

- 298. a.** Drawing a diagram may be helpful to solving this problem.



The relationships between the flagpole and its shadow and the woman and her shadow can be depicted as right triangles because both the flagpole and the woman are perpendicular to the ground. The problem states that the triangles are similar. Similar triangles have sides of lengths proportionate to each other, so a ratio can be set up between the ratio of the flagpole's height to the length of its shadow and the woman's height to the length of her shadow as such, where  $x$  represents the height of the flagpole in feet:

$$\frac{x}{\text{length of shadow}} = \frac{\text{height of woman}}{\text{length of shadow}}$$
$$\frac{x}{6} = \frac{5}{3}$$
$$3x = 30$$
$$x = 10$$

The flagpole is 10 feet tall, which is greater than the value in column B. Therefore the answer is **a**.

- 299. b.** The problem states that both buildings are built at the same elevation and are perpendicular to the ground, and that both telescopes are level with the bases of the buildings and pointed at angles of  $45^\circ$  to the tops of the buildings. This means that similar  $45/45/90$  right triangles are created because the third angle in each triangle can only be  $45^\circ$ . A ratio can be set up to determine the height of building B based on the height of building A and the distance from the bases of the buildings to

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their respective telescopes. Note that the telescopes are 100 ft above sea level and subtract that amount from the height of the top of building A to get its actual height. Let  $b$  represent the height of building B in feet:

$$\frac{\text{height of building A}}{\text{distance to telescope A}} = \frac{b}{\text{distance to telescope B}}$$

$$\frac{1000}{250} = \frac{b}{300}$$

$$250b = 3,000,000$$

$$b = 1,200$$

The height of building B is 1,200 feet. This is more than the height of building A (1,000) so the answer is **b**.

**Note:** It is not necessary to solve for  $b$  because it is evident that  $b > 1,000$  from looking at the proportion.

- 300. a.**  $\triangle DFE$  is a right triangle and the lengths of two of its sides are indicated, so the Pythagorean theorem can be used to determine the length of the missing side. Note that in the equation  $a^2 + b^2 = c^2$ ,  $c$  represents the length of the hypotenuse of the triangle where  $a$  and  $b$  are the lengths of the other two sides:

$$a^2 + b^2 = c^2$$

$$6^2 + b^2 = 10^2$$

$$36 + b^2 = 100$$

$$b^2 = 64$$

$$b = 8$$

The length of line segment TS is 8;  $8 > 7$ , so **a** is the answer.

**Note:** If you know your Pythagorean triples, you would have recognized the 6, 8, 10 triple and have been able to solve the problem quickly without the need for any calculations.

- 301. a.** 3, 4, 5 is another Pythagorean triple, so if you recognize this you can immediately tell that the length of the hypotenuse,  $\overline{RS}$ , is 5. Otherwise, use the formula as follows:

$$a^2 + b^2 = c^2$$

$$3^2 + 4^2 = c^2$$

$$9 + 16 = c^2$$

$$25 = c^2$$

$$5 = c$$

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The length of line segment RS is 5, which is less than the value in column A. Therefore the answer is **a**.

- 302. d.** Using the Pythagorean theorem will show that the length of line segment TS is 4; 3, 4, 5 is also a Pythagorean triple that you should be familiar with. Even though the variable  $b$  is commonly used to denote one of the shorter sides of a triangle in the Pythagorean theorem, this problem does not indicate any specific value for  $b$ . As such, there is not enough information to draw a comparison between 4 and  $b$  and the answer is **d**.

- 303. b.** The figure is a rectangle. The perimeter of a rectangle can be calculated using the formula  $p = 2(l + w)$ , where  $l$  represents the length and  $w$  is the width:

$$p = 2(l + w)$$

$$p = 2(4 + 7)$$

$$p = 2(11)$$

$$p = 22$$

The perimeter is 22 in, which is greater than the value in column A. The answer is **b**.

- 304. c.** The area of a rectangle can be found using the formula  $a = lw$ , where  $l$  is the length and  $w$  is the width of the rectangle:

$$a = lw$$

$$a = 4(7)$$

$$a = 28$$

The area is 28 sq in, which is equal to the value in column A. The answer is **c**.

- 305. b.** The figure is a rhombus because it has four sides all of the same length. The perimeter of a rhombus can be calculated using the formula  $p = 4s$ , where  $s$  is the length of any one side:

$$p = 4s$$

$$p = 4(5)$$

$$p = 20$$

The perimeter of the rhombus is 20 ft, which is more than the value in column A. The answer is **b**.



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- 306. b.** The formula for calculating the area of a square is  $A = s^2$ , where  $s$  is the length of any one side. The area of the square as drawn is 25 sq ft, as follows:

$$A = s^2$$

$$A = 5^2$$

$$A = 25$$

If the square was to be redrawn with sides longer than indicated in the diagram, the area of the square would increase. Since column A represents the area of the square as indicated, the value of column B must be larger, and there is no need to calculate the area (though it does work out to 30.25 sq ft). The answer is **b**.

- 307. c.** The formula  $p = 2(l + w)$  can be used to calculate the perimeter of this rectangle as  $2(4 + 6) = 20$  in. The formula  $p = 4s$  can be used to calculate the perimeter of this square as  $4(5) = 20$  in. The values are the same, so the answer is **c**.

- 308. a.** The formula  $A = s^2$  can be used to calculate the area of this square as  $A = (3x)^2$  or  $9x^2$ . The formula  $A = lw$  can be used to calculate the area of this rectangle as  $A = 2x(x)$  or  $2x^2$ ;  $9x^2 > 2x^2$ , so the answer is **a**.

- 309. b.** The diagram indicates that the sides of this five-sided polygon are congruent, so the perimeter can be calculated using the formula  $p = ns$ , where  $n$  is the number of sides and  $s$  is the length of any one side:

$$p = ns$$

$$p = 5(3)$$

$$p = 15 \text{ in}$$

15 in > 13 in, so the answer is **b**.

- 310. a.** The base is indicated as being 8 cm, while the height is 3 cm. The base is longer, so the answer is **a**. Remember that the height of a parallelogram is always indicated by a line segment drawn at a right angle to the base. The height of a parallelogram is sometimes referred to as its *altitude*.

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- 311. b.** The area of a parallelogram can be calculated using the formula  $A = bh$ , where  $b$  is the base of the parallelogram and  $h$  is the height. In this case,  $A = 8(3) = 24$  sq cm, which is less than the value in column B. Therefore the answer is **b**.
- 312. a.** The area of a triangle is calculated using the formula  $A = \frac{1}{2}bh$ , where  $b$  is the base of the triangle and  $h$  is the height. The base of the triangle in the figure is 7 cm and the height is 6 cm, so the formula works out to  $A = \frac{1}{2}(7)(6) = \frac{1}{2}(42) = 21$ . The area of the triangle is 21 sq in, which is less than the value in column A. The answer is **a**.
- 313. c.** The figure indicates that the base of this triangle is 7 cm. To find the base of the triangle in column B, use the formula  $A = \frac{1}{2}bh$ . The problem states that the area of this triangle is 35 sq cm and the height is 10 cm, so the base can be calculated as follows:
- $$A = \frac{1}{2}bh$$
- $$35 = \frac{1}{2}b(10)$$
- $$35 = 5b$$
- $$7 = b$$
- The base of the triangle in column B is 7 cm, which is the same as the value of column A. Therefore the answer is **c**.
- 314. b.** To find the area of Mr. Jenkins' pool, use the formula  $a = lw$  to find that the area will equal  $12 \text{ ft} \times 8 \text{ ft}$ , or 96 sq ft. Added to the 36 square foot area of the deck, the total area is 132 sq ft, which is more than the value of column A. The answer is **b**.
- 315. a.** Each photo will require 15 sq in of mounting board, as determined by using the formula  $a = lw$ , where the length is 3" and the width is 5". Mounting three photos will use up  $15 \times 3$ , or 45 sq in of matting board. Sally started with 48 sq in of board, so using 45 sq in will leave her 3 sq in left over, which is not enough to mount a fourth photo. Mounting 3 of the five photos will leave her with 2 unmounted photos, so she was able to mount more photos than not and the answer is **a**.

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- 316. a.** The perimeter of a polygon is found by adding up the lengths of all its sides, or multiplying the length of one side by the number of sides if all sides are of equal length. An 8-sided Stop sign with sides of 10" length has a perimeter of  $P = ns = 8(10") = 80"$ . An equilateral triangle has three sides of equal length, so this special Yield sign has a perimeter of  $P = ns = 3(26") = 78"$ . Information regarding the reflectors attached the front of the sign is irrelevant and should be ignored, as perimeter is the measure of a shape's exterior edges.  $80" > 78"$ , so the Stop sign has a greater perimeter and the answer is **a**.
- 317. a.** This problem is not difficult in terms of the calculations required to solve it, but rather requires several steps to get to the final answer. First, to find the largest circle that can be cut from a square with sides of 11", determine the largest possible radius within the square. Since a radius extends from the center of a circle to any edge, it can be no longer than  $\frac{1}{2}$  of the length of any of the square, in this case 5.5". So the largest possible circle within this square would have a radius of 5.5" and an area calculated using the formula  $A = \pi r^2$ , where  $r$  is the radius and  $\pi = 3.14$ :

$$A = \pi r^2$$

$$A = \pi(5.5)^2$$

$$A = 30.25\pi$$

$$A = 30.25(3.14)$$

$$A = 94.99 \text{ sq in}$$

The area of the original square can be found using the formula  $A = s^2$ , where  $s$  is the length of one side of the square;  $11^2 = 121$ , so the area is 121 sq in. The value in column B, however, is  $\frac{3}{4}$  of the area of the square, and  $121 \times \frac{3}{4} = 90.75$  sq in.

$94.99 \text{ sq in} > 90.75 \text{ sq in}$ , so the area of the circle is greater than  $\frac{3}{4}$  the area of the square, and the answer is **a**.

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- 318. a.** The surface area of a rectangular prism can be calculated using the formula  $SA = 2(lw + wh + lh)$ , where  $l$ ,  $w$ , and  $h$  are the length, width and height of the prism, respectively. In this case the length is 3 m, the width is 5 m and the height is 8 m, so:

$$SA = 2(lw + wh + lh)$$

$$SA = 2(3(5) + 5(8) + 3(8))$$

$$SA = 2(15 + 40 + 24)$$

$$SA = 2(79)$$

$$SA = 158$$

The surface area of this prism is 158 sq m, which is larger than the value in column B, so the answer is **a**.

- 319. c.** The surface area of a cube can be calculated using the formula  $SA = 6e^2$ , where  $e$  is the length of one edge of the cube. In this case each edge measures 2 in long, so the formula simplifies as follows:

$$SA = 6e^2$$

$$SA = 6(2)^2$$

$$SA = 6(4)$$

$$SA = 24 \text{ sq in}$$

The values in the two choices are equal, so the answer is **c**.

- 320. d.** To calculate the surface area of a rectangular prism, the length, width, and height of the prism must be known. There is not enough information given here to solve the problem, and so the answer is **d**.

- 321. b.** The volume of a rectangular prism can be found using the formula  $V = lwh$ , where  $l$  is the length,  $w$  is the width, and  $h$  is the height. The volume of this prism, then, is calculated as follows:

$$V = lwh$$

$$V = 6(6)(3)$$

$$V = 36(3)$$

$$V = 108 \text{ cubic cm}$$

Don't forget that the volume of any container is always expressed in cubic units. The volume of this prism is 108 cm<sup>3</sup> and so the answer is **b**.

### 501 Quantitative Comparison Questions

- 322. b.** The volume of any prism is calculated using the formula  $V = Bh$ , where  $B$  is the area of the base and  $h$  is the height. The volume of the prism in the diagram, then, is  $V = Bh = 30(5) = 150 \text{ m}^3$ . The volume of the prism in column B is  $40(4) = 160 \text{ m}^3$ . Column B therefore yields a greater value and the answer is **b**.
- 323. a.** The formula used to calculate the volume of a cube is  $V = e^3$ , where  $e$  is the length of one edge;  $4^3 = 64$ , whereas  $2(2^3) = 2(8) = 16$ , so the volume of the cube in column A is greater and the answer is **a**.
- 324. b.** The volume of a pyramid is calculated using the formula  $V = \frac{1}{3}lwh$ . The length and width of this pyramid are both 10 in and the height is 12 in, so the formula simplifies to  $\frac{1}{3}(10 \times 10 \times 12) = \frac{1}{3}(1200) = 400$ . The volume of the pyramid is 400 cubic in, so the answer is **b**.
- 325. b.** The value of column A is  $V = \frac{1}{3}lwh = \frac{1}{3}(10 \times 10 \times 9) = \frac{1}{3}(900) = 300$  cubic in. The value of column B is  $V = \frac{1}{3}lwh = \frac{1}{3}(9 \times 9 \times 12) = \frac{1}{3}(972) = 324$  cubic in.  $324 > 200$ , so the answer is **b**.
- 326. a.** The area of the base of the pyramid is given in the diagram, so calculate the volume with the formula  $V = \frac{1}{3}Bh$ :
- $$V = \frac{1}{3}Bh$$
- $$V = \frac{1}{3}(51 \times 5)$$
- $$V = \frac{1}{3}(255)$$
- $$V = 85 \text{ cm}^3$$
- The value of column A is greater, so the answer is **a**.
- 327. a.** The value of column A is calculated as  $V = \frac{1}{3}Bh = \frac{1}{3}(51 \times 6) = \frac{1}{3}(306) = 102 \text{ cm}^3$ . The value of column B is calculated as  $V = \frac{1}{3}Bh = \frac{1}{3}(60 \times 5) = \frac{1}{3}(300) = 100 \text{ cm}^3$ . The answer is **a**.
- 328. b.** The circumference of a circle is calculated using the formula  $C = 2\pi r$  or  $C = \pi d$ . Thus, the greater the diameter of a circle, the greater its circumference. So the answer is **b**.

### 501 Quantitative Comparison Questions

- 329. a.** Use the formula  $C = \pi d$  to calculate the circumference of this circle, where  $\pi = 3.14$ :

$$C = \pi d$$

$$C = (3.14)7$$

$$C = 21.98 \text{ cm}$$

$21.98 \text{ cm} > 21 \text{ cm}$ , so the answer is **a**.

- 330. a.** Use the formula  $C = \pi d$  to find the diameter in column B:

$$C = \pi d$$

$$25.12 \text{ m} = \pi d$$

$$25.12 \text{ m} = 3.14d$$

$$8 \text{ m} = d$$

Now use the formula  $C = 2\pi r$  to find the radius in column B:

$$C = 2\pi r$$

$$31.4 \text{ m} = 2(3.14)r$$

$$5 \text{ m} = r$$

$8 \text{ m} > 5 \text{ m}$ , so the answer is **a**.

- 331. a.** The diagram indicates that the circle has a diameter of 10 ft. The radius is  $\frac{1}{2}$  of the length of the diameter, which in this case equals 5 ft;  $5 \text{ ft} > 4 \text{ ft}$ , so the answer is **a**.

- 332. a.** The area of the circle is calculated using the formula  $A = \pi r^2$ , where  $r$  is the radius of the circle. The radius is not given in the diagram, but can be calculated as 5 ft by dividing the diameter in half. Using the formula yields  $A = \pi r^2 = 3.14(5^2) = 3.14(25) = 78.5$ . The area of the circle is  $78.5 \text{ ft}^2$ , which is greater than the value of column B, so the answer is **a**.

- 333. b.** Any figure must be smaller than any other figure it can fit inside of. Therefore a circle is larger than a square that would fit inside of it, and the answer is **b**.

- 334. a.** Before doing any calculations, take a good look at both choices to note all of the important information provided. The largest circle that can be cut from a square of fabric has a diameter equal to the length of a side of that square. Column B refers to a circle cut out of a square of fabric with a total area of  $16 \text{ cm}^2$ . This can be used to infer that the edges of the square are 4 cm

### 501 Quantitative Comparison Questions

each, because the area of a square  $= s^2$ , where  $s$  is the length of one side of the square. The largest circle that could be cut out of that square, then, would have a diameter of 4 cm. The circle mentioned in column A has a diameter of 8 cm. Since the area of a circle increases as its diameter increases (remember,  $d = 2r$ ), the correct choice here is the circle with the largest diameter. So the answer is **a**.

- 335. b.** The surface area of a cylinder is calculated using the formula  $SA = 2\pi r^2 + 2\pi rh$ , where  $r$  is the radius of the base of the cylinder and  $h$  is the height. In this case, the radius is indicated as 1 m and the height is 12 m, so the formula simplifies as follows:

$$SA = 2\pi r^2 + 2\pi rh$$

$$SA = 2\pi 1^2 + 2\pi 1(12)$$

$$SA = 2\pi + 24\pi$$

$$SA = 2(3.14) + 24(3.14)$$

$$SA = 6.28 + 75.36$$

$$SA = 81.64 \text{ cm}^2$$

The total surface area of the cylinder is  $81.64 \text{ cm}^2$ , which is less than the value of column B, so the answer is **b**.

- 336. a.** The surface area of this cylinder is calculated as:

$$SA = 2\pi r^2 + 2\pi rh$$

$$SA = 2\pi 7^2 + 2\pi 7(8)$$

$$SA = 98\pi + 112\pi$$

$$SA = 98(3.14) + 112(3.14)$$

$$SA = 210(3.14)$$

$$SA = 659.4 \text{ cm}^2$$

The surface area of the cube in column B is calculated as

$$SA = 6e^2 = 6(9^2) = 6(81) = 486 \text{ cm}^2; 659.4 \text{ cm}^2 > 486 \text{ cm}^2, \text{ so the answer is } \mathbf{a}.$$

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- 337. b.** The volume of a cylinder is calculated using the formula  $V = \pi r^2 h$ , where  $h$  is the height of the cylinder. In this case, the radius is 9 cm and the height is 4 cm, so the formula simplifies as:

$$V = \pi r^2 h$$

$$V = \pi 9^2(4)$$

$$V = \pi 81(4)$$

$$V = 1017.36 \text{ cm}^3$$

This is less than the value of column B, so the answer is **b**.

- 338. a.** The formula for calculating the volume of a cylinder multiplies the square of the radius by the height. Doubling the radius of a cylinder will change the volume more significantly because of the squaring involved, so the answer is **a**.

- 339. b.** The volume of this cylinder is  $V = \pi r^2 h = \pi(25)(10) = 250\pi = 785 \text{ cm}^3$ ;  $785 \text{ cm}^3 > 750 \text{ cm}^3$ , so the answer is **b**.

- 340. b.** The volume of a cone is calculated using the formula  $V = \frac{1}{3}(\pi r^2 h)$ , where  $h$  is the height of the cone. In this case, the radius is 5 cm and the height is 10 cm, so the formula simplifies as:

$$V = \frac{1}{3}\pi r^2 h$$

$$V = \frac{1}{3}\pi 5^2(10)$$

$$V = \frac{1}{3}(250\pi)$$

$$V = 261.67 \text{ cm}^3$$

$300 \text{ cm}^3 > 261.67 \text{ cm}^3$ , so the answer is **b**.

- 341. c.** The surface area of a sphere is calculated using the formula  $SA = 4\pi r^2$ . Substituting yields:

$$SA = 4\pi r^2$$

$$SA = 4(3.14)(6^2)$$

$$SA = 12.56(36)$$

$$SA = 452.16 \text{ sq cm}$$

The two values are equal, so the answer is **c**.



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- 342. a.** The surface area of a sphere is calculated using the formula  $SA = 4\pi r^2$ . In this case, the formula simplifies to  $SA = 4\pi r^2 = 12.56(49) = 615.44$  sq m. This is greater than the value in column B, and so the answer is **a**.

- 343. b.** The volume of a sphere is calculated using the formula  $V = \frac{4}{3}\pi r^3$ . The formula simplifies as follows:

$$V = \frac{4}{3}\pi r^3$$

$$V = \frac{4}{3}(3.14)(7^3)$$

$$V = \frac{4}{3}(3.14)(343)$$

$$V = \frac{4}{3}(1077.02)$$

$$V = 1,436.03 \text{ cm}^3$$

The volume of this sphere is  $1,436.03 \text{ cm}^3$ , which is less than  $2,000 \text{ cm}^3$ , so the answer is **b**.

- 344. b.** As the radius of a sphere increases, so will its volume (and surface area, for that matter). The sphere in column B has the greater radius, so it will also have the greater volume. The answer is **b**.

- 345. a.** The slope of a line is defined as  $\frac{\text{the change in the } y\text{-value of the line}}{\text{the change in the } x\text{-value of the line}}$ . The line in the diagram intersects the points (0,1) and (2,2), so its slope is  $\frac{1}{2}$ ;  $\frac{1}{2} > \frac{1}{3}$ , so the answer is **a**.

- 346. b.** The slope of a line is defined as  $\frac{\text{the change in the } y\text{-value of the line}}{\text{the change in the } x\text{-value of the line}}$ . The line in the diagram intersects the points (0,1) and (-1,3), so its slope is  $-\frac{2}{1} = -2$ ;  $-\frac{1}{3} > -2$ , so the answer is **b**.

- 347. b.** The slope of a line is defined as  $\frac{\text{the change in the } y\text{-value of the line}}{\text{the change in the } x\text{-value of the line}}$ . The line in the diagram intersects the points (1,-1) and (0,3), so its slope is  $-\frac{4}{1} = -4$ ;  $-4 < \frac{1}{2}$ , so the answer is **b**.

- 348. a.** The slope of a line is defined as  $\frac{\text{the change in the } y\text{-value of the line}}{\text{the change in the } x\text{-value of the line}}$ . The line in the diagram intersects the points (-1,-1) and (1,2), so its slope is  $\frac{3}{2}$ ;  $\frac{3}{2} > \frac{2}{3}$ , so the answer is **a**.

- 349. a.** The line's slope is  $\frac{0-2}{4-2} = -1$ ;  $0 > -1$ , so the answer is **a**.

- 350. b.** The line's slope is  $\frac{-3-0}{-2-0} = \frac{3}{2}$ ;  $\frac{3}{2} > 0$ , so the answer is **b**.

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- 351. c.** The line  $y = -1$  is a horizontal line. Thus, its slope is zero and the answer is **c**.
- 352. b.** The problem gives enough information to calculate the elevation of the peak of the hill. Slope is defined as  $\frac{\text{the change in the } y\text{-value of the line}}{\text{the change in the } x\text{-value of the line}}$ . In this case, the  $y$ -value is the change in vertical distance (elevation) of the hill, while the  $x$ -value is the horizontal distance Tommy has to walk. While a diagram may be helpful to you in solving the problem, the simplest method is to set up a ratio comparing the slope and the distances Tommy has to travel, where  $y$  represents the vertical distance:
- $$\frac{2}{5} = \frac{y}{100}$$
- $$5y = 200$$
- $$y = 40 \text{ ft}$$
- The vertical elevation of the hill is 40 feet above sea level.  
 $40 \text{ ft} > 35 \text{ ft}$ , so the answer is **b**.
- 353. a.** This line intersects the  $y$ -axis at the point  $(0,1)$ , so its  $y$ -intercept is 1 and the answer is **a**.
- 354. b.** As determined in the previous problem, the  $y$ -intercept of the line in the diagram is 1. The equation in column B is in slope-intercept form, so the  $y$ -intercept is represented by the term without a variable. Thus, the  $y$ -intercept of this line is 4 and the answer is **b**.
- 355. a.** This line intersects the  $y$ -axis somewhere between the points  $(0,3)$  and  $(0,4)$ . Even though the exact value cannot be determined, it is somewhere between 3 and 4 which is clearly greater than zero. Therefore, the answer is **a**.
- 356. a.** Even though the exact  $y$ -intercept of the line in the diagram cannot be determined, it is clearly greater than zero and therefore positive. The equation in column B is in slope-intercept form, so the  $y$ -intercept is represented by the term without a variable which in this case is  $-1$ ;  $-1$  is a negative value, so the value of column A must be greater and the answer is **a**.

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- 357. b.** Both equations are in slope-intercept form, so the  $y$ -intercepts can be determined from the terms without variables. The  $y$ -intercept of the line in column A is  $-6$ , and in column B it's  $4$ , so the answer is **b**.
- 358. a.** Both equations are in slope-intercept form, so the  $y$ -intercepts can be determined from the terms without variables. The  $y$ -intercept of the line in column A is  $\frac{2}{5}$ , and in column B it's  $-4$ , so the answer is **a**.
- 359. a.** The equation in column A must be put into slope-intercept form in order to determine its  $y$ -intercept. Dividing both sides of the equation by  $2$  yields the proper  $y = mx + b$  form as  $y = \frac{1}{2}x + 4$ , so the  $y$ -intercept is  $4$ . The  $y$ -intercept of the line in column B is  $3$ , so the answer is **a**.
- 360. c.** The equation in column B must be put into slope-intercept form in order to determine its  $y$ -intercept. Subtracting  $6$  from both sides and adding  $y$  to both sides yields the proper equation  $y = x - 6$ , with a  $y$ -intercept of  $-6$ . The  $y$ -intercept of the line in column A is also  $-6$  so the answer is **c**.
- 361. d.** The equation in column A must be put into slope-intercept form in order to determine its  $y$ -intercept. Simplifying yields  $y = -\frac{1}{4}x$ , so the  $y$ -intercept is  $0$ . The line in column B is a vertical line running through the point  $(9,0)$ , and so has no  $y$ -intercept. The problem has no solution and so the answer is **d**.
- 362. a.** Both equations must be put into slope-intercept form. The first equation simplifies to  $y = 5$ , which represents a horizontal line that has a  $y$ -intercept of  $5$ . The second equation simplifies by dividing both sides by  $x$ , yielding  $y = x + 4$ . The  $y$ -intercept of this line is  $4$ , so the answer is **a**.

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- 363. a.** The length of arc ABC can be determined using the formula  $length = \frac{x}{360}(C)$ , where  $x$  is the measure of the angle whose rays intersect the arc and  $C$  is the circumference of the circle. In this case, the formula is set up as follows:

$$length = \frac{x}{360}(C)$$

$$length = \frac{45}{360}(20)$$

$$length = \frac{1}{8}(20)$$

$$length = 2.5 \text{ cm}$$

2.5 cm > 2 cm, so the answer is **a**.

- 364. c.** The length of arc ABC can be determined using the formula  $length = \frac{x}{360}(C)$ , where  $x$  is the measure of the angle whose rays intersect the arc and  $C$  is the circumference of the circle. In this case, the formula is set up as follows:

$$length = \frac{x}{360}(C)$$

$$length = \frac{36}{360}(10)$$

$$length = \frac{1}{10}(10)$$

$$length = 1 \text{ cm}$$

The values in both choices are equal, so the answer is **c**.

- 365. a.** The circumference of the circle can be determined using the same formula as above but solving for  $C$ . In this case, the formula is set up as follows:

$$length = \frac{x}{360}(C)$$

$$2 = \frac{45}{360}(C)$$

$$2 = \frac{1}{8}(C)$$

$$C = 16 \text{ cm}$$

20 cm > 16 cm, so the answer is **a**.

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- 366. b.** The measure of  $\angle x$  can be determined using the same formula as above but solving for  $x$ . In this case, the formula is set up as follows:

$$\text{length} = \frac{x}{360}(C)$$

$$3 = \frac{x}{360}(30)$$

$$3 = \frac{30x}{360}$$

$$1,080 = 30x$$

$$36 = x$$

$36^\circ > 35^\circ$ , so the answer is **b**.

- 367. a.** The area of the rectangle in column A is  $2(3) = 6 \text{ cm}^2$ . The area of the square in column B is  $2^2 = 4 \text{ cm}^2$ .
- 368. c.** The sum of the interior angles of any triangle is  $180^\circ$ . The values in both choices are equal so the answer is **c**.
- 369. b.** The volume of the cube in column A is  $s^3 = 3^3 = 27 \text{ cm}^3$ . The volume of the cylinder in column B is  $\pi r^2(h) = 3.14(2^2)(3) = 3.14(4)(3) = 3.14(12) = 37.68 \text{ cm}^3$ ;  $37.68 > 27$ , so the answer is **b**.
- 370. b.** These triangles are 3, 4, 5 and 6, 8, 10 Pythagorean triples, which means that the hypotenuses are 5 and 10, respectively. The Pythagorean theorem ( $a^2 + b^2 = c^2$ ) can also be used to solve for each hypotenuse individually. Either method will find that the hypotenuse of the triangle in column B is longer. The answer is **b**.
- 371. c.** Angles 1 and 3 are vertical angles created by the intersection of two lines, and so are equal. The answer is **c**.
- 372. d.** Angles 1 and 2 are exterior angles on the outside of two parallel lines cut by a transversal, and so are supplementary. Even though  $\angle 1$  appears to be slightly larger in the diagram, there is no indication as to either angle's actual measure. All that can be determined is that the two angles add up to  $180^\circ$ , which is not enough information to solve the problem. The answer is **d**.
- 373. a.** The equation is in slope-intercept form, so the slope is the coefficient of the  $x$  term and the  $y$ -intercept is the term without a variable. In this case, the slope is 3 and the  $y$ -intercept is 2. The slope is the greater quantity, so the answer is **a**.

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- 374. a.** It may be helpful to draw a diagram of the two triangles. The triangles are similar, as the lengths of shorter sides of triangles are proportional. The shorter sides are in a ratio of 3:4 so the hypotenuses must also be in a ratio of 3:4;  $\frac{3}{4} > \frac{1}{2}$ , so the answer is **a**.
- 375. a.** The pie is a circle, so it measures  $360^\circ$  around. Since it is cut into eight equal slices, each slice forms an angle of  $40^\circ$  at the center of the pie. The formula  $length = \frac{x}{360}(C)$  can be used to determine the length of the arc of one of the slices by substituting the information given in the problem as follows:

$$length = \frac{x}{360}(C)$$

$$length = \frac{40}{360}(18)$$

$$length = \frac{1}{9}(18)$$

$$length = 2''$$

The length of the arc formed by one slice of pie is  $2''$ ;  $2'' > 1.5''$ , so the answer is **a**.

# 4

## Data Analysis

**In this chapter,** the following math concepts will be the subject of the 126 data analysis-based quantitative comparison questions:

- Counting
- Sequences
- Data Representation and Interpretation
- Frequency Distributions
- Measures of Central Tendency
- Measures of Dispersion
- Probability

Some important information:

**Numbers:** All numbers used are real numbers.

**Figures:** Figures that accompany questions are intended to provide information useful in answering the questions. Unless otherwise indicated, positions of points, angles, regions, etc. are in the order shown; angle measures are positive; lines shown as straight are straight; and figures lie in a plane. Unless a note states that a figure is drawn to scale, you should NOT solve

## 501 Quantitative Comparison Questions

these problems by estimating or by measurement, but by using your knowledge of mathematics.

**Common Information:** In a question, information concerning one or both of the quantities to be compared is centered above the two columns. A symbol that appears in both columns represents the same thing in Column A as it does in Column B.

**Directions:** Each of the following questions consists of two quantities, one in Column A and one in Column B. Compare the two quantities and choose:

- a. if the quantity in Column A is greater
- b. if the quantity in Column B is greater
- c. if the two quantities are equal
- d. if the relationship cannot be determined from the information given

### Examples:

Column A

Column B

1.  $\sqrt{3^2 + 4^2}$

$\sqrt{(3 + 4)^2}$

The correct answer is **b**. Remember to look carefully at the two columns, even if they initially appear to be the same. In this case, while the two quantities look similar, they are not equivalent. In column A,  $\sqrt{3^2 + 4^2}$  is equal to  $\sqrt{9 + 16}$ , or  $\sqrt{25}$ , which is equal to 5. In column B, be sure the work out the calculations inside the parentheses first:  $\sqrt{(3 + 4)^2} = \sqrt{7^2} = 7$ . 7 is greater than 5, so the correct answer is **b**.

2.  $m$  and  $n$  are integers.

$m^3$

$n^2$

The correct answer is **d**. The only information you are given about the two quantities is that they are integers, which tells you nothing about their respective values. Depending on what values you assign, column A could be larger than column B or vice versa, or both values could be the same. Since you cannot determine which value is greater, the answer is **d**.



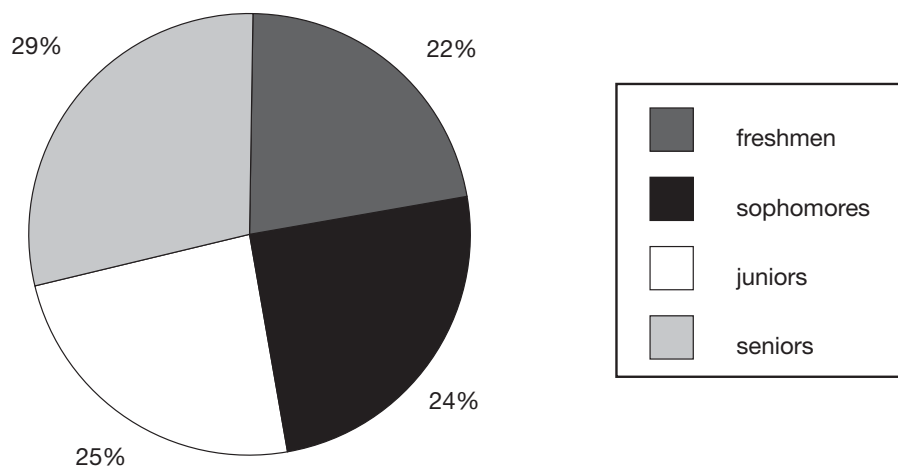
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### Questions

Column A	Column B
<b>376.</b> the average (arithmetic mean) of 6, 5, 8, 7, and 9	the average (arithmetic mean) of 11, 2, and 8
<b>377.</b> the average (arithmetic mean) of 16, 23, 30, 45, and 17	the average (arithmetic mean) of 23, 18, 17, 35, and 45
<b>378.</b> $A = \{15, 20, 20, 13\}$ the median of set A	the mode of set A
<b>379.</b> The mean of set B is 17. $B = -5, -1, 12, 29, x, y$ $x$	$y$
<b>380.</b> $C = 3, 6, 11, 12, 10, 18, x$ The mean of set C is 9. 8	$x$

Use the following figure to answer questions 381–383.

**Brown High School Student Distribution**



- 381.** number of freshmen                      22
- 382.** There are 400 students enrolled at Brown High School.  
number of seniors                      120

## 501 Quantitative Comparison Questions

### Column A

- 383.** difference between the quantity of freshmen and sophomores

### Column B

- difference between the quantity of juniors and seniors

Use the following sequence to answer questions 384 and 385.

$$.25, .5, .75, 1, 1.25, 1.5, 1.75, 2, \dots$$

- |   |      |
|---|------|
| <b>384.</b> the 53rd term of the sequence | 13   |
| <b>385.</b> the 78th term of the sequence | 19.5 |

Use the following series to answer questions 386 and 387.

$$2 + 4 + 6 + 8 + \dots + 98 + 100$$

- |   |       |
|---|-------|
| <b>386.</b> the sum of the first 23 terms of the series | 550   |
| <b>387.</b> the sum of all the terms in the series      | 2,550 |

Use the information below to answer questions 388–400.

$$\begin{aligned} D &= \{13, 22, 17, 24, x\} \\ E &= \{13, 22, 17, 24, y\} \\ x &> 0, y > 0 \end{aligned}$$

- |                                 |                                   |
|---------------------------------|-----------------------------------|
| <b>388.</b> the mean of set D   | the mean of set E                 |
| <b>389.</b> the median of set D | the median of set E               |
| <b>390.</b>                     | $x > y$                           |
| the mean of set D               | the mean of set E                 |
| <b>391.</b>                     | $x > y > 24$                      |
| the median of set D             | the median of set E               |
| <b>392.</b>                     | $x > 17 > y$                      |
| the median of set D             | the median of set E               |
| <b>393.</b>                     | The ranges of the sets are equal. |
| the median of set D             | the median of set E               |

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Column A	Column B
<b>394.</b> $x = y$ the mean of set D	the mean of set E
<b>395.</b> $x = y$ the median of set D	the median of set E
<b>396.</b> $x < y$ the mean of set D	the mean of set E
<b>397.</b> $x < y$ the range of set D	the range of set E
<b>398.</b> The means of the two sets are equal. $x$	$y$
<b>399.</b> The mean of set D is greater than the mean of set E. $x$	$y$
<b>400.</b> The modes of the two sets are equal. 12	$x$

Use the information below to answer questions 401–402.

$$F = \{28, 29, 30, 31, 32\}$$

$$G = \{10, 20, 30, 40, 50\}$$

<b>401.</b> the mean of set F	the median of set G
<b>402.</b> the standard deviation of set F	the standard deviation of set G

Use the following experiment to answer questions 402–405.

A coin is tossed 3 times.

<b>403.</b> the number of possible outcomes containing exactly 2 heads	the number of possible outcomes containing exactly 1 tail
<b>404.</b> the total number of possible outcomes	5

### 501 Quantitative Comparison Questions

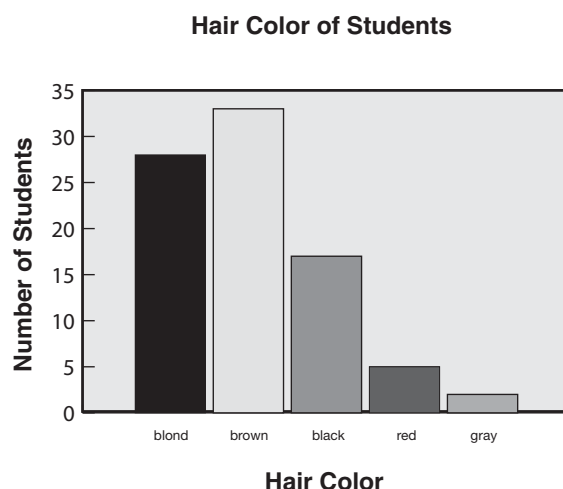
#### Column A

- 405.** the probability of tossing  
3 tails

#### Column B

$$\frac{1}{2}$$

Use the following bar graph to answer questions 406–408.



- |  |   |
|--|---|
| <b>406.</b> 12                                   | difference between the number<br>of students with brown hair and<br>those with black hair |
| <b>407.</b> percent of students with<br>red hair | percent of students with<br>gray hair   |
| <b>408.</b> total number of students<br>surveyed | 90  |

Use the following experiment to answer questions 409–411.

A number cube (die) is rolled and a coin is tossed.

- |   |   |
|---|---|
| <b>409.</b> total number of possible<br>outcomes  | 8 |
| <b>410.</b> number of outcomes in<br>which an even number is<br>rolled on the cube, and a<br>head is tossed on the coin | 3 |

## 501 Quantitative Comparison Questions

### Column A

### Column B

- 411.** number of outcomes in which a factor of 2 is rolled on the cube, and a head or a tail is tossed on the coin

5

Use the following experiment to answer questions 412–413.

A coin is tossed 14 times.

Heads occurs 8 times and tails 6 times.

The second and thirteenth tosses are heads.

- 412.** maximum number of heads that can occur in a row

8

- 413.** minimum number of heads in the first 10 tosses

4

Use the following series to answer questions 414–416.

$$-20 + -18 + -16 + \dots + 18 + 20 + 22 + 24$$

- 414.** the sum of all terms in the series

50

- 415.** the sum of the first three terms

the sum of the fourth, fifth, and sixth terms.

- 416.** the sum of the 18th, 19th, and 20th terms

the sum of the last two terms

Use the following sequence to answer questions 417–418.

$$1, 1, 2, 3, 5, 8, 13, 21, 34, \dots$$

- 417.** the 11th term in the sequence

90

- 418.** the sum of the 41st and 42nd terms of the sequence

the 43rd term of the sequence

Use the following facts to answer questions 419 and 420.

William bought 4 pairs of pants for \$80. The next day, he purchased another pair of pants. He spent an average of \$22.50 for the five pairs of pants.

## 501 Quantitative Comparison Questions

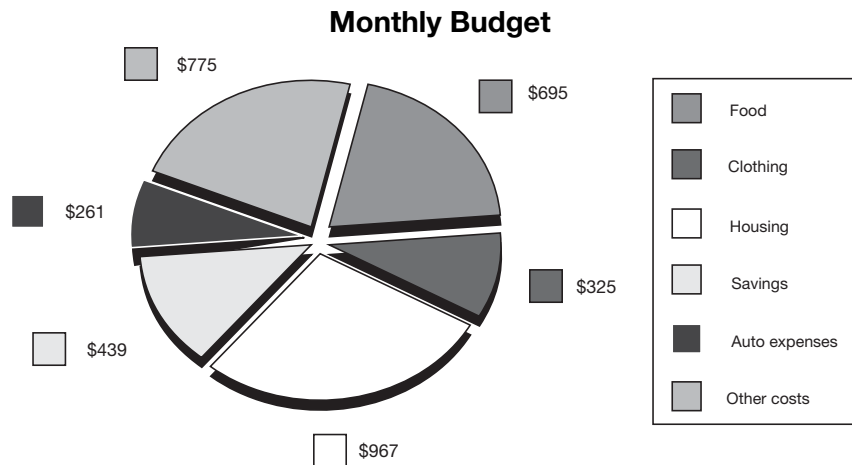
### Column A

- 419.** amount of money William spent on the fifth pair of pants
- 420.** \$30

### Column B

- average cost of each of the first four pairs of pants
- the cost of the fifth pair of pants

Use the graph below to answer question 421–423.



- |   |  |
|---|--|
| <p><b>421.</b> percent of budget spent on Housing</p> <p><b>422.</b> percent of budget not spent on Savings</p> <p><b>423.</b> percent of budget spent on Food, Auto, and Other</p> | <p>percent of budget spent on Clothing and Food</p> <p>86%</p> <p>percent of budget spent on Housing, Clothing and Savings</p> |
|---|--|

Use the following situation to answer questions 424–426.

Papa's Pizza offers any of up to 2 different toppings on their pies.  
Papa's has 8 total toppings from which to choose.

- |  |                   |
|--|-------------------|
| <p><b>424.</b> total number of possible 1 topping pizzas Papa's makes</p> <p><b>425.</b> Pepperoni is an available topping.<br/>number of possible pizzas containing pepperoni</p> | <p>8</p> <p>8</p> |
|--|-------------------|

## 501 Quantitative Comparison Questions

### Column A

### Column B

- 426.** total number of possible pizzas    12  
Papa's makes

- 427.**            The mean of five distinct positive integers is 10.  
the largest possible value            46  
of one of the integers

Use the following situation to answer questions 428 and 429.

Set H contains five positive integers such that the mean, median, mode, and range are all equal. The sum of the data is 25.

- 428.** the smallest possible number    6  
in set H
- 429.** 10    the largest possible number in  
set H

Use the following situation to answer questions 430 and 431.

Set J consists of 5 elements. The range of the numbers in set J is 0, and the sum of the numbers in set J is 40.

- 430.** highest element in set J            lowest element in set J
- 431.** mode of set J                            16

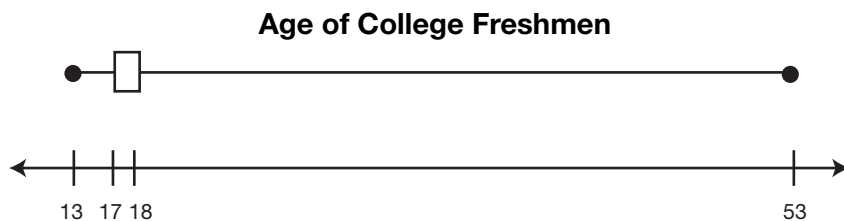
Use the following situation to answer questions 432 and 433.

$$K = \{8, x, y, 10\}$$

The mean of set K is 12, there is no mode, and  $x > y$ .

- 432.**  $x + y$                                     24
- 433.**  $2x$                                       30

Use the following box plot to answer questions 434 and 435.



### 501 Quantitative Comparison Questions

Column A	Column B
<b>434.</b> quartile 1	quartile 3
<b>435.</b> quartile 3	median
<b>436.</b> Susan has 3 pairs of pants and 4 shirts. Assume each pair of pants matches each shirt. 7	number of outfits Susan has
Use the following experiment description to answer questions 437–440. A card is drawn from a standard deck of 52 cards.	
<b>437.</b> probability of drawing a queen	probability of drawing a club
<b>438.</b> probability of drawing a jack or a spade	$\frac{17}{52}$
<b>439.</b> probability of drawing a black card	probability of drawing a heart or a face card
<b>440.</b> probability of drawing a red card with an even number on it	probability of drawing an eight or a nine

Use the following experiment description to answer questions 441 and 442.

A bag contains 6 blue marbles and 4 red marbles. Two marbles are selected at random, one after the other (the first marble is not replaced in the bag after it is drawn).

<b>441.</b> probability of drawing 2 blue marbles	probability of drawing 2 red marbles
<b>442.</b> probability of drawing a red followed by a blue marble	probability of drawing a blue followed by a red marble

Use the following experiment description to answer questions 443 and 444.

A bag contains 6 blue marbles and 8 red marbles. Two marbles are selected at random, with the first selected marble being replaced in the bag before the second marble is drawn.



### 501 Quantitative Comparison Questions

#### Column A

- 443.** probability of drawing 2 blue marbles
- 444.** probability of drawing a red followed by a blue marble

#### Column B

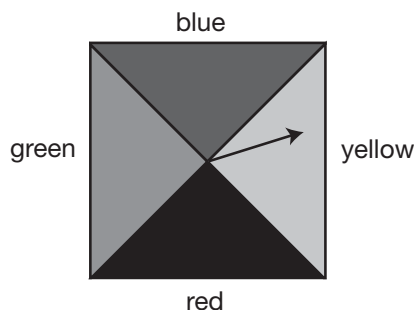
- probability of drawing 2 red marbles
- probability of drawing a blue followed by a red marble

Use the following experiment description to answer questions 445–447.

A bag contains 3 blue marbles and 2 red marbles. Two marbles are selected at random.

- |  |  |
|--|--|
| <b>445.</b> probability of selecting 2 blue marbles if the first selected marble is replaced                   | probability of selecting 2 blue marbles if the first selected marble is not replaced                   |
| <b>446.</b> probability of selecting a blue marble, then a red marble if the first selected marble is replaced | probability of selecting a blue marble, then a red marble if the first selected marble is not replaced |
| <b>447.</b> probability of selecting 2 red marbles if the first selected marble is replaced                    | probability of selecting 2 blue marbles if the first selected marble is not replaced                   |

Use the spinner below and the experiment description to answer questions 448–451.



The spinner above is spun twice, then a 6-sided number cube (die) is rolled.

- |  |    |
|--|----|
| <b>448.</b> number of outcomes                                 | 14 |
| <b>449.</b> probability of obtaining the outcome: blue, red, 4 | .1 |

## 501 Quantitative Comparison Questions

Column A	Column B
<b>450.</b> probability of obtaining the outcome: blue or red, red, even number	probability of obtaining the outcome: green, green or yellow, odd
<b>451.</b> probability of obtaining the outcome: not green, red, factor of 2	probability of obtaining the outcome: not blue, not blue, multiple of 3

Use the frequency distribution table below to answer questions 452–455.

Data Value	Frequency
0	3
1	6
2	2
3	1
4	2

<b>452.</b> mean of distribution	2.5
<b>453.</b> median of distribution	2
<b>454.</b> mode of distribution	1
<b>455.</b> range of distribution	5

Use the following set to answer questions 456–458.

For  $x = 0$ ,  $x = 1$ ,  $x = 2$ , and  $x = 3$ ,  
let set  $K = \{2x, x^2, x + 2\}$ .

<b>456.</b> 4	mode of set K
<b>457.</b> range of set K	10
<b>458.</b> median of set K	mean of set K

Use the sequence below to answer questions 459–460.

2, 4, 8, 16, 32, . . .

<b>459.</b> the tenth term of the sequence	$2^{10}$
<b>460.</b> the twentieth term of the sequence	twice the tenth term

## 501 Quantitative Comparison Questions

### Column A

### Column B

Use the sequence below to answer questions 461–462.

$64, 32, 16, 8, 4, \dots$

- |  |           |
|--|-----------|
| <b>461.</b> the seventh term of the sequence   | 0         |
| <b>462.</b> the thirtieth term of the sequence | $2^{-20}$ |

Use the situation below to answer questions 463–464.

A survey of high school seniors at Blake High School revealed that 35% play an instrument, 43% participate in sports, and 29% do neither.

- |   |     |
|---|-----|
| <b>463.</b> percent of students who play an instrument and/or participate in sports | 78% |
| <b>464.</b> percent of students who play an instrument and participate in sports    | 10% |

Use the information below to answer questions 465–466.

$$M = \{4, 6, 3, 7, x, x\}$$

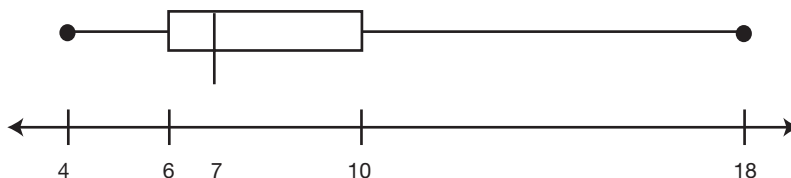
$$N = \{1, 5, 8, y\}$$

$$x > 0, y > 0$$

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| <b>465.</b><br>the mean of set M   | $x > y$<br>the mean of set N        |
| <b>466.</b><br>the median of set M | $x > y > 10$<br>the median of set N |

Use the following box plot to answer questions 467–469.

**Birthweight of Babies at Center Hospital**



### 501 Quantitative Comparison Questions

Column A	Column B
<b>467.</b> number of data elements between first quartile and median	number of data elements between third quartile and max
<b>468.</b> interquartile range	3
<b>469.</b> spread of data in third quarter	spread of data in second quarter

Use the menu for Kelly's Deli below to answer questions 470–472.

Bread	Meat	Cheese
Rye	Ham	American
Wheat	Salami	Swiss
White	Turkey	Provolone
	Roast Beef	Cheddar
	Tuna	

A sandwich from Kelly's consists of one type of bread, one meat, and one cheese.

<b>470.</b> number of possible sandwiches Kelly's makes	60
<b>471.</b> number of sandwiches that can be made on rye bread	number of sandwiches that can be made on wheat bread
<b>472.</b> number of sandwiches that can be made with roast beef	number of sandwiches that can be made with provolone cheese

Use the sequence below to answer questions 473–476.

1, 4, 9, 16, 25, . . .

<b>473.</b> the seventh term in the sequence	36
<b>474.</b> the twentieth term in the sequence	400
<b>475.</b> the difference between the 34th and 35th terms	the difference between the 10th and 13th terms
<b>476.</b> the 1000th term in the sequence	$1 \times 10^9$

### 501 Quantitative Comparison Questions

#### Column A

**477.** 50th percentile of data set W

**478.** 50th percentile of data set W

**479.** 25th percentile of data set W

#### Column B

average (arithmetic mean) of data set W

median of data set W

first quartile of data set W

Use the sets below to answer questions 480 and 481.

$$P = \{1, 2, 3, 4, 5\}$$

$$Q = \{2, 3, 6, 5\}$$

**480.** standard deviation of set P

**481.** mean of set P

**482.** 100 meters

**483.**  $3.46 \times 10^9$  miles

**484.**  $1.5 \times 10^{-6}$  millimeters

standard deviation of set Q

median of set Q

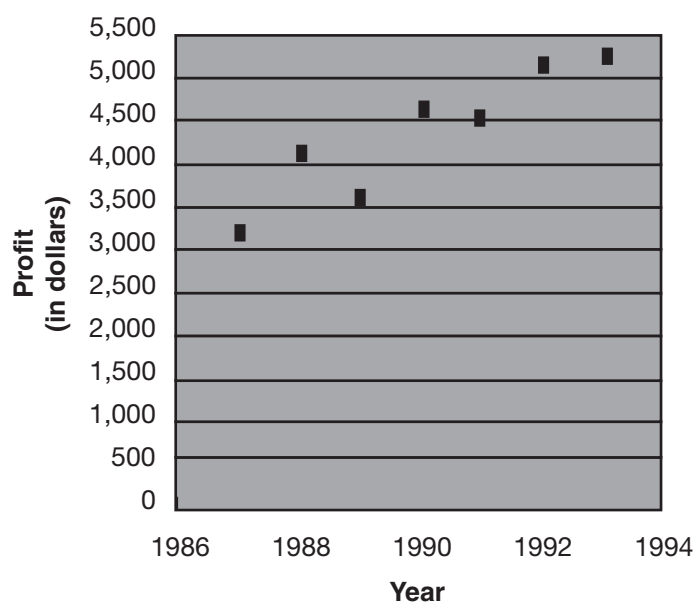
1 kilometer

$34.6 \times 10^8$  miles

.00000015 millimeters

Use the following figure to answer questions 485–487.

Profits of Company B



**501 Quantitative Comparison Questions**

Column A	Column B
<b>485.</b> profit increase from 1988 to 1990	profit increase from 1987 to 1989
<b>486.</b> profit decrease from 1990 to 1991	profit decrease from 1988 to 1989
<b>487.</b> overall profit from 1987 to 1993	\$1,500

Use the following sequence to answer questions 488–489.

1, 2, 6, 24, . . .

<b>488.</b> the fifth term of the sequence	150
<b>489.</b> the sixth term of the sequence	720

Use the following series to answer questions 490–491.

$2 + 12 + 22 + 32 + 42 + \dots + 102 + 112 + 122 + 132$

<b>490.</b> the number of terms in the sequence	13
<b>491.</b> the sum of the series	1,000
<b>492.</b> $4.23 \times 10^{-5}$	$.423 \times 10^{-4}$
<b>493.</b> 234 milliliters	2.34 liters
<b>494.</b> 45 centigrams	.45 grams
<b>495.</b> 12 square yards	36 square feet
<b>496.</b> 24 square inches	2 square feet
<b>497.</b> 1 cubic foot	$12^3$ cubic inches

**501 Quantitative Comparison Questions****Column A****Column B**

Use the frequency distribution below to answer questions 498–501.

**Ages of Women Entered in Road Race**

<b>Classes</b>	<b>Frequency</b>
15–19	3
20–24	14
25–29	17
30–34	13
35–39	10

- |             |  |  |
|-------------|--|--|
| <b>498.</b> | number of 17-year-olds entered in race | number of 27-year-olds entered in race |
| <b>499.</b> | total number of entrants               | 55                                     |
| <b>500.</b> | median age of entrant                  | 30                                     |
| <b>501.</b> | number of entrants under 30            | 28                                     |

## 501 Quantitative Comparison Questions

### Answer Explanations

The following explanations show one way in which each problem can be solved. You may have another method for solving these problems.

- 376. c.** The mean of the numbers in column A is 7:  $6 + 5 + 8 + 7 + 9 = 35$ . 35 divided by 5 = 7. The mean of the numbers in column B is also 7:  $11 + 2 + 8 = 21$ . 21 divided by 3 = 7.
- 377. b.** Of the 5 numbers in each set, 3 are the same (23, 17, and 45). The remaining 2 numbers are greater in the set in column B than in the set in column A, therefore, the mean of the set in column B is greater than the mean of the set in column A.
- 378. b.** The median of set A (the middle of the set when the numbers are put in numerical order) is 17.5: 13, 15, 20, 20. Since there is an even number of elements in the set, the average of the two middle numbers, 15 and 20 is found;  $15 + 20 = 35$ ;  $\frac{35}{2} = 17.5$ . The mode of set A (the most frequently occurring element in the set) is 20 because it occurs twice. 20 is greater than 17.5.
- 379. d.** The relationship cannot be determined. Since the mean of set B is 17, and the set has 6 elements, the sum of the elements in the set must be  $(17)(6) = 102$ . The total of the given elements is  $-5 + -1 + 12 + 29 = 35$ . Therefore,  $x$  and  $y$  must total what's left, namely,  $102 - 35 = 67$ . There is no way to know which of the two might be greater, or if the two are equal.
- 380. a.** Since the mean of set C is 9 and the set has 7 elements, the sum of the elements in the set must be  $(9)(7) = 63$ . The total of the given elements is  $3 + 6 + 11 + 12 + 10 + 18 = 60$ . Therefore,  $x$  must equal the remaining value, namely,  $63 - 60 = 3$ . 8 is greater than 3.
- 381. d.** The relationship cannot be determined. Since the number of students enrolled at Brown High School is not given for this question, it is not known whether the number of freshmen equals 22 (if there are 100 students, because 22% of 100 = 22), is more than 22 (if there are > 100 students, because 22% of > 100 is > 22) or is less than 22 (if there are < 100 students, because 22% of < 100 is < 22).



### 501 Quantitative Comparison Questions

- 382. b.** Since there are 400 students at Brown High School and 29% are seniors, 29% of 400, or  $.29 \times 400 = 116$ ;  $120 > 116$ , so the answer is **b**.
- 383. b.** The difference between the number of freshmen and sophomores is  $24\% - 22\% = 2\%$  of 400;  $.02 \times 400 = 8$  students. The difference between the number of juniors and seniors is  $29\% - 25\% = 4\%$ . 4% of 400 is 16.  $16 > 8$ .
- 384. a.** The pattern in this series (.25, .5, .75, 1, 1.25, 1.5 . . .) can also be written as  $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}, \frac{5}{4}, \frac{6}{4} \dots$ . Since each term given is equivalent to the term number (its number in the sequence) divided by 4, an  $n$ th term would be equal to  $\frac{n}{4}$ . The 53rd term is equal to  $\frac{53}{4}$ ;  $\frac{53}{4} = 13.25$ ;  $13.25 > 13$ , so the answer is **a**.
- 385. c.** Use the same equation you established in the previous problem. The 82nd term =  $\frac{82}{4} = 19.5$ . Column B is also 19.5, so the correct answer is **c**.
- 386. a.** Note that the first term is 2, the second term is 4, the third term is 6, etc. The term is equal to two times the term number. Therefore, the 23rd term is  $23 \times 2 = 46$  and the sum of the even numbers from 2 to 46 is needed to answer the question. In series questions, an easy shortcut is to rewrite the series below the original series and add vertically to get consistent sums. In this case,
- $$\begin{array}{r} 2 + 4 + 6 + \dots + 44 + 46 \\ 46 + 44 + 42 + \dots + 4 + 2 \\ \hline 48 + 48 + 48 + \dots + 48 + 48 \end{array}$$
- Since 23 terms were added, there are 23 totals of 48. Each term has been written twice, so  $23 \times 48$  is double the total needed and must be divided by two;  $23 \times (\frac{48}{2}) = 23 \times 24 = 552$ ;  $552 > 550$ , so column A is greater.
- 387. c.** Following the same procedure as in the previous question, the last term is 100, so there are  $\frac{100}{2}$ , or 50 terms in the series. The consistent sum would be 102 because the first term plus the last term =  $2 + 100 = 102$ . There would be 50 sums of 102 which would again be double the total needed;  $50 \times (\frac{102}{2}) = 50 \times 51 = 2,550$ .

### 501 Quantitative Comparison Questions

- 388. d.** The answer cannot be determined. Since the value of neither  $x$  nor  $y$  is known, the means of the sets cannot be found and cannot, therefore, be compared.
- 389. d.** The answer cannot be determined. Although the question indicates that both  $x$  and  $y$  are greater than zero, and both sets D and E have 5 elements, the elements are not ordered, so the third element is not necessarily the median. For example, if  $x < 13$ , the order of the set would be  $x, 13, 17, 22, 24$  and the median would be 17. If  $17 < x < 22$ , the order of the set would be  $13, 17, x, 22, 24$  and the median would be  $x$ .
- 390. a.** Since  $x > y$ , the sum of the elements in set D  $>$  the sum of the elements in set E. When the sums are divided by 5 (the number of elements in each set), the mean of set D will be a larger number.
- 391. c.** Since  $x > y > 24$ , we know that in each of sets D and E,  $x$  and  $y$  respectively are the largest elements. Therefore, set D in numerical order is  $\{13, 17, 22, 24, x\}$  and set E in numerical order is  $\{13, 17, 22, 24, y\}$ , so in each case, the median is the middle number, 22.
- 392. a.** Since  $x > 17$ , the median of set D will be  $x, 22$ , or  $24$ , depending on how large  $x$  is. The median will therefore be one of these elements:  $x$  which is  $> 17, 22$ , or  $24$ . Since  $y < 17$ , the median of set E must be 17 because the third element will be 17; there are 2 elements less than 17, namely,  $y$  and 13.
- 393. d.** The answer cannot be determined. Choose an arbitrary value for the range, say 15. Therefore,  $x$  might be 9 since that would enable the range to be  $24 - 9 = 15$ . This would make the median of set D be 17.  $y$  might have the same value, which would make the medians equal, but  $y$  could also equal 28 because  $28 - 13 = 15$  as well. This would make the median equal 22 as the third element of the set.
- 394. c.** If  $x = y$ , then set D = set E, and it follows that the mean of set D = the mean of set E.
- 395. c.** If  $x = y$ , then set D = set E, and all statistics for the two sets would be equal, including, but not limited to, mean, median, mode, and range.

### 501 Quantitative Comparison Questions

- 396. b.** Since  $x < y$ , the sum of the elements in set D  $<$  the sum of the elements in set E. When the sums are divided by 5 (the number of elements in each set), the mean of set E will be a larger number.
- 397. d.** The answer cannot be determined. Let  $x = 5$  and  $y = 32$ . Then the range of set D  $= 24 - 5 = 19$  and the range of set E  $= 32 - 13 = 19$ . The ranges are equal, which eliminates choices **a** and **b**. Now let  $x = 12$  and  $y = 15$ . Then the range of set D  $= 24 - 12 = 12$  and the range of set E  $= 24 - 13 = 11$ . Since in both cases,  $x < y$ , the answer cannot be determined.
- 398. c.** The only way for the mean of the two sets to be equal is for the sum of the two sets to also be equal. In order for this to happen,  $x$  must equal  $y$ .
- 399. a.** Since the mean of set D  $>$  the mean of set E, the sum of the elements in set D must be  $>$  the sum of the elements in set E. Therefore, since the remaining elements are all equal, the only way to get a larger sum in set D is for  $x$  to be  $> y$ .
- 400. b.** Because the mode of the two sets are equal, there must be a mode in each set, meaning that one of the elements must repeat. This implies that  $x$  and  $y$  are equal to one of the elements already shown to be in sets D and E. Since all of these elements are  $> 12$ ,  $x$  must be  $> 12$ .
- 401. c.** The mean of set F is  $28 + 29 + 30 + 31 + 32 = 150$ ;  $\frac{150}{5} = 30$ . The median of set G, which is already in numerical order, is the middle element, 30.
- 402. b.** Standard deviation is a measure of the spread of the data from the mean. Since the mean of each set is 30, the data in set F is obviously clustered more closely to the mean than the data in set G; therefore, the standard deviation of set G  $>$  the standard deviation of set F.
- 403. c.** The number of possible outcomes containing exactly 2 heads is 3: HHT, HTH, and THH. These are the same three outcomes that contain exactly one tail.

### 501 Quantitative Comparison Questions

- 404.** a. Since there are two possible outcomes for each toss of the coin, and the coin is being tossed three times, there are  $2^3 = 8$  possible outcomes.  $8 > 5$ .
- 405.** b. Only one of the 8 possible outcomes, TTT, contains three tails so the probability of tossing three tails is  $\frac{1}{8}$ ;  $\frac{1}{8} < \frac{1}{2}$ .
- 406.** b. It appears that there are at most 17 students with black hair and 32 students with brown hair;  $32 - 17 = 15$ .  $15 > 12$ .
- 407.** a. Since more students have red hair than have gray hair, the percent of students with red hair must be higher than the percent of students with gray hair. The actual percents do not have to be determined.
- 408.** b. Even with rough approximations done with the data, rounding up, if there are about 30 blond students, 32 brown-haired students, 18 black-haired students, 4 redheads and 3 with gray hair, that total, 87, is  $< 90$ .
- 409.** a. There are 6 possible outcomes on the number cube, {1, 2, 3, 4, 5, 6}, and 2 on the coin, {H, T}. According to the counting principle for probability, there are therefore,  $6 \times 2 = 12$  possible outcomes.  $12 > 8$ .
- 410.** c. The outcomes in which an even number on the cube would be followed by a head on the coin would be: (2, H), (4, H), (6, H). There are three outcomes, so columns A and B are equivalent.
- 411.** b. The factors of 2 are 1 and 2. The outcomes that meet the condition that there is a factor of 2 on the number cube and a head or a tail on the coin are (1, H), (1, T), (2, H), (2, T). There are four outcomes, and  $5 > 4$ , so the correct answer is b.
- 412.** b. Since there are a total of 8 tosses that were heads, but the second and thirteenth are known to be two of them, there can only be a maximum of 7 heads in a row since there are more than 8 tosses between the second and thirteenth tosses. For example, the outcomes could be: H H H H H H H T T T T T H T or T H T T T T T H H H H H H H.

### 501 Quantitative Comparison Questions

- 413.** c. Since there are 8 total heads and the objective is to have a minimal quantity of them in the first ten tosses, the last four tosses would have to all be heads. This would leave  $8 - 4 = 4$  tosses left for the first ten outcomes.
- 414.** b. If the series is examined carefully, it can be noted that the first 41 terms will total zero since every nonzero number in the series, up until 22, can be paired with its opposite. Therefore, the sum of the series is simply the sum of the last two numbers, 22 and 24;  $22 + 24 = 46$ .  $50 > 46$ .
- 415.** b. The sums do not need to be found. The first three terms are smaller numbers than the following three terms; therefore, their sum will automatically be smaller than the sum of terms 4, 5, and 6.
- 416.** a. The 18th, 19th, and 20th terms are 14, 16 and 18;  $14 + 16 + 18 = 48$ . The last two terms are 22 and 24;  $22 + 24 = 46$ .  $48 > 46$ .
- 417.** b. This is the Fibonacci sequence in which each term after the first two is found by adding the previous two terms. There are nine terms provided in the sequence. The tenth term is found by adding the eighth and ninth terms:  $21 + 34 = 55$ , so the tenth term is 55. The eleventh term is found by adding the ninth and tenth terms:  $34 + 55 = 89$ . Since  $90 > 89$ , column B is greater.
- 418.** c. Since each term is found by adding the previous two terms, the 43rd term is the sum of the 41st and 42nd terms.
- 419.** a. The answer can be found with minimal calculations: Since William bought 4 pairs of pants for \$80, each pair of pants cost an average of \$20. The fifth pair of pants managed to bring his average cost per pair up to \$22.50, so it must have cost more than \$20.
- 420.** b. If the five pairs of pants averaged \$22.50 per pair, William's total cost must be  $\$22.50 \times 5 = \$112.50$ . This cost, minus the \$80 he paid for the first four pairs, leaves  $\$112.50 - \$80 = \$32.50$ .
- 421.** b. \$967 was spent on Housing.  $\$695 + \$325 = \$1,020$  was spent on Food and Clothing. Since more money was spent on Food and Clothing, this accounts for a higher percent of the budget.

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- 422. a.** The total monthly budget is  $\$775 + \$695 + \$325 + \$967 + \$439 + \$261 = \$3462$ . The percent spent on Savings is  $\frac{\$439}{\$3,462} =$  about 12%. Therefore, the amount not spent on Savings is  $100\% - 12\% = 88\%$ .  $88\% > 86\%$ .
- 423. c.** The amount of money spent on Food, Auto Expenses, and Other Costs is  $\$695 + \$261 + \$775 = \$1,731$ , which is exactly half, or 50% of the total amount of the budget,  $\$3,462$ .
- 424. c.** Since there are 8 toppings available, a one-topping pie would consist of any one of these 8 toppings. There are 8 possibilities.
- 425. c.** One 1-topping pizza would contain pepperoni. In addition, any of the remaining seven toppings could be paired with pepperoni to make seven more possible pies. Therefore, there are a total of eight possible pies with pepperoni as a topping.
- 426. a.** Papa's offers one plain pizza, 8 one-topping pizzas, and 28 two-topping pizzas. Call the available toppings A, B, C, D, E, F, G, and H. Then A can be paired with any of the remaining 7 toppings. B can be paired with any of the remaining 6 toppings starting with C because it's already been paired with A. C can be paired with D, E, F, G, or H since it's already been paired with A and B. And so on. In other words, there are  $7 + 6 + 5 + 4 + 3 + 2 + 1 = 28$  possible 2-topping pies. The total number of pies Papa's offers is  $1 + 8 + 28 = 37$ ;  $37 > 12$ .
- 427. b.** If the mean of five distinct (meaning different) positive integers is 10, the sum of these integers must be  $5 \times 10 = 50$ . For one of these integers to be as large as it can be, the remaining integers must be as small as they can be, namely, 1, 2, 3, and 4. These integers total  $1 + 2 + 3 + 4 = 10$ . So, the largest one of the integers can be is 40.
- 428. b.** Since the sum of the five elements of set H is 25, the mean is  $\frac{25}{5} = 5$ . Since the mean, median, mode, and range are all equal, they are all equal to 5. Therefore, 6 must be larger than the smallest element in set H.
- 429. a.** If 10 is the largest possible number in set H, then, since the range of the numbers in the set is also 5, the smallest number would have to be 5. Even if the set consisted of four 5's and just the one 10, the sum of the numbers would still be too high. To

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get a sum of 25 with a mode and a median of 5, at least 2 of the numbers in the set must be 5 and the remainder must add up to 15 while not violating the range requirement, which is also 5. One possibility is {2, 5, 5, 6, 7}. Another is {3, 4, 5, 5, 8}.

- 430. c.** If the range of the elements in set J is 0, then all of the elements must be the same since the range is derived by subtracting the smallest element from the largest element. Therefore the highest element in set J is equal to the lowest element in set J.
- 431. b.** Since the sum of the elements in set J is 40, and there are 5 elements, the mean of the set is 8. Also, since the range of the numbers in the set is zero, each of the numbers in the set must be 8, making 8 the mode of the set;  $16 > 8$ .
- 432. a.** Since the mean of set K is 12, the sum of the 4 elements in the set must be  $4 \times 12 = 48$ . The two given elements, 8 and 10 total 18. Therefore, the difference between the total and the given elements is  $48 - 18 = 30$ . The two remaining elements,  $x$  and  $y$  must total 30, which is greater than 24.
- 433. a.** The total of  $x$  and  $y$  must be 30, and  $x > y$ , therefore,  $x$  must be  $> 15$  and  $y$  must be  $< 15$ . Therefore,  $2x > 30$ .
- 434. b.** Quartile 1 is 17 and Quartile 3 is 18. Therefore, Quartile 1  $<$  Quartile 3.
- 435. d.** The answer cannot be determined. The median may be 17 or 18, which would make it less than, or equal to, Quartile 3.
- 436. b.** Since each pair of pants matches each shirt, Susan has  $4 \times 3 = 12$  outfits;  $12 > 7$ .
- 437. b.** There are 4 queens in a deck, so the probability of drawing a queen is  $\frac{4}{52}$ . There are 13 clubs in a deck, so the probability of drawing a club is  $\frac{13}{52}$ ;  $\frac{13}{52} > \frac{4}{52}$ .
- 438. b.** There are 4 jacks and 13 spades, but one of these is the jack of spades which cannot be counted twice. Therefore, there are  $4 + 13 - 1 = 16$  cards that are jacks or spades (or both). The probability of drawing one of these cards is  $\frac{16}{52}$ ;  $\frac{16}{52} < \frac{17}{52}$ .

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- 439. a.** There are 26 black cards (13 spades and 13 clubs) so the probability of drawing one of these cards is  $\frac{26}{52}$ . There are 13 hearts and 12 face cards, but three of these face cards are hearts: the jack, queen and king of hearts. These cards cannot be counted twice, therefore, there are  $13 + 12 - 3 = 22$  cards that are hearts or face cards (or both). The probability of drawing one of these cards is  $\frac{22}{52}$ ;  $\frac{26}{52} > \frac{22}{52}$ .
- 440. a.** There are 10 red cards with even numbers on them: the 2, 4, 6, 8, and 10 of hearts and of diamonds. The probability of drawing one of these cards is  $\frac{10}{52}$ . There are 4 eights and 4 nines, so a total of 8 cards that are eights or nines, and the probability of drawing one of these cards is  $\frac{8}{52}$ ;  $\frac{10}{52} > \frac{8}{52}$ .
- 441. a.** The probability of drawing 2 blue marbles comes from multiplying the probability of drawing the first blue marble by the probability of drawing the second. The probability of drawing the first blue marble is  $\frac{6}{10}$  because there are 6 blue marbles out of the 10 total marbles in the bag. The probability of drawing the second blue marble is  $\frac{5}{9}$  because having drawn the first blue marble, there are 5 blue marbles left out of a total of 9 marbles remaining in the bag (since the experiment is conducted without replacing the first selected marble in the bag);  $\frac{6}{10} \times \frac{5}{9} = \frac{30}{90}$ .
- The probability of drawing 2 red marbles comes from multiplying the probability of drawing the first red marble by the probability of drawing the second. The probability of drawing the first red marble is  $\frac{4}{10}$  because there are 4 red marbles out of the 10 total marbles in the bag. The probability of drawing the second red marble is  $\frac{3}{9}$  because having drawn the first red marble, there are 3 red marbles left out of a total of 9 marbles remaining in the bag;  $\frac{4}{10} \times \frac{3}{9} = \frac{12}{90}$ ;  $\frac{30}{90} > \frac{12}{90}$ .
- 442. c.** The probability of drawing a red followed by a blue marble is  $\frac{4}{10} \times \frac{6}{9} = \frac{24}{90}$ . The probability of drawing a blue followed by a red marble is  $\frac{6}{10} \times \frac{4}{9} = \frac{24}{90}$ .



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- 443. b.** In this case, the original selected marble is replaced in the bag before the second marble is drawn, keeping the denominators of the multiplied fractions the same. The probability of drawing 2 blue marbles is  $\frac{6}{14} \times \frac{6}{14} = \frac{36}{196}$ . The probability of drawing 2 red marbles is  $\frac{8}{14} \times \frac{8}{14} = \frac{64}{196}$ ;  $\frac{64}{196} > \frac{36}{196}$ .
- 444. c.** The probability of drawing a red, followed by a blue marble is  $\frac{8}{14} \times \frac{6}{14} = \frac{48}{196}$ . The probability of drawing a blue, followed by a red marble is  $\frac{6}{14} \times \frac{8}{14} = \frac{48}{196}$ .
- 445. a.** The probability of selecting 2 blue marbles if the first selected marble is replaced is  $\frac{3}{5} \times \frac{3}{5} = \frac{9}{25}$  (or .36). The probability of selecting 2 blue marbles if the first selected marble is not replaced is  $\frac{3}{5} \times \frac{2}{4} = \frac{6}{20}$  (or .30);  $.36 > .30$ .
- 446. b.** The probability of selecting a blue, then a red marble if the first selected marble is replaced is  $\frac{3}{5} \times \frac{2}{5} = \frac{6}{25}$  (or .24). The probability of selecting a blue, then a red marble if the first selected marble is not replaced is  $\frac{3}{5} \times \frac{2}{4} = \frac{6}{20}$  (or .30);  $.30 > .24$ .
- 447. b.** The probability of selecting 2 red marbles if the first selected marble is replaced is  $\frac{2}{5} \times \frac{2}{5} = \frac{4}{25}$  (or .16). The probability of selecting 2 blue marbles if the first selected marble is not replaced is  $\frac{3}{5} \times \frac{2}{4} = \frac{6}{20}$  (or .30);  $.30 > .16$ .
- 448. a.** Each spin of the spinner has 4 possible outcomes, and the number cube has 6 possible outcomes. Therefore the experiment has  $4 \times 4 \times 6 = 96$  possible outcomes;  $96 > 14$ .
- 449. b.** There is only one outcome (blue, red, 4) out of the possible 96 outcomes. The probability of obtaining this outcome is  $\frac{1}{96}$ ;  $.1 = \frac{1}{10}$ ;  $\frac{1}{10} > \frac{1}{96}$ .
- 450. c.** There are 6 outcomes that meet the condition (blue or red, red, even number): (blue, red, 2), (blue, red, 4), (blue, red, 6), (red, red, 2), (red, red, 4), (red, red, 6). The probability of obtaining one of these outcomes is  $\frac{6}{96}$ . Similarly, there are 6 outcomes that meet the condition (green, green or yellow, odd): (green, green, 1), (green, green, 3), (green, green, 5), (green, yellow, 1), (green, yellow, 3), (green, yellow, 5). The probability of obtaining one of these outcomes is also  $\frac{6}{96}$ .

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- 451. b.** There are 6 outcomes that meet the condition (not green, red, factor of 2). This number can also be found by multiplying the number of ways to achieve this outcome: There are 3 outcomes that meet the condition “not green,” 1 outcome that meets the condition “red,” and 2 outcomes (1 and 2) that meet the condition “factor of 2.”  $3 \times 1 \times 2 = 6$ . The probability of obtaining one of these 6 outcomes is  $\frac{6}{96}$ . Likewise, for the outcome (not blue, not blue, multiple of 3) there are 3 outcomes that meet the condition “not blue” and 2 (3 and 6) that meet the condition “multiple of 3.”  $3 \times 3 \times 2 = 18$ . The probability of obtaining one of these outcomes is  $\frac{18}{96}$ ;  $\frac{18}{96} > \frac{6}{96}$ .
- 452. b.** To find the mean of a set of data displayed in a frequency table, the sum of the data must be found by multiplying each data value by its frequency (the number of times it occurs) and adding the products: 0 occurs 3 times ( $3 \times 0 = 0$ ), 1 occurs 6 times ( $6 \times 1 = 6$ ), 2 occurs 2 times ( $2 \times 2 = 4$ ), 3 occurs 1 time ( $1 \times 3 = 3$ ), and 4 occurs 2 times ( $2 \times 4 = 8$ ). The sum is:  $0 + 6 + 4 + 3 + 8 = 21$ . There are  $3 + 6 + 2 + 1 + 2 = 14$  pieces of data displayed in the table (the sum of the frequencies).  $\frac{21}{14} = 1.5$ ;  $2.5 > 1.5$ .
- 453. b.** Since there are 14 data items (an even number) in the frequency table, the median will be the average of the middle two, namely the seventh and the eighth pieces. The table contains the data in numerical order, so the first three elements are zeros and the next six are ones. Therefore, the seventh and eighth pieces of data will both be 1 and the median will be 1.
- 454. c.** The mode of a data set is the element that occurs most frequently, which is easy to spot in a frequency table. In this case, there are 6 occurrences of the data value 1, making it the mode.
- 455. b.** The range of the distribution is the difference between the largest and the smallest piece of data. In this case, the smallest data value is zero and the largest is 4;  $4 - 0 = 4$ ;  $5 > 4$ .

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- 456. c.** To answer any of questions 456–458, set K must be determined by substituting the corresponding values for  $x$  into each of the expressions given for set K:

$$\text{when } x = 0, 2x = 2 \times 0 = 0, x^2 = 0^2 = 0, x + 2 = 0 + 2 = 2;$$

$$\text{when } x = 1, 2x = 2 \times 1 = 2, x^2 = 1^2 = 1, x + 2 = 1 + 2 = 3;$$

$$\text{when } x = 2, 2x = 2 \times 2 = 4, x^2 = 2^2 = 4, x + 2 = 2 + 2 = 4;$$

$$\text{when } x = 3, 2x = 2 \times 3 = 6, x^2 = 3^2 = 9, x + 2 = 3 + 2 = 5.$$

Set K, therefore, is 0, 0, 2, 2, 1, 3, 4, 4, 4, 6, 9, 5. The mode is the value that occurs the most, 4.

- 457. b.** The range of set K is the difference between the largest and smallest values in set K. The largest value in set K is 9, the smallest is 0.  $9 - 0 = 9$ ;  $10 > 9$ .
- 458. a.** The median of set K is the middle number when the set is put in numerical order: 0, 0, 1, 2, 2, 3, 4, 4, 4, 5, 6, 9. The median is the average (arithmetic mean) of the sixth and seventh data values, namely 3 and 4;  $\frac{(3+4)}{2} = 3.5$ . The mean is the sum of the data divided by 12:  $0 + 0 + 1 + 2 + 2 + 3 + 4 + 4 + 4 + 5 + 6 + 9 = 40$ ;  $\frac{40}{12} = 3.3\bar{3}$ ;  $3.5 > 3.3\bar{3}$ .
- 459. c.** Each term of the sequence is a power of 2. The first term is  $2^1$ , the second term is  $2^2$ , the third term is  $2^3$ , etc. Therefore, the 10th term of the sequence would be  $2^{10}$ .
- 460. a.** The 20th term of the sequence is  $2^{20}$ . The 10th term of the sequence is  $2^{10}$ . Twice the tenth term is  $2 \times 2^{10}$ , which equals  $2^{11}$ . Since  $2^{20} > 2^{11}$ ,  $2^{20} >$  twice the tenth term.
- 461. a.** Each term in this sequence is also a power of 2, beginning with 64 which equals  $2^6$ . Since the first term =  $2^6$ , the second =  $2^5$ , the third =  $2^4$ , the fourth =  $2^3$  and so on, each term is equal to 2 raised to the  $7-n$  power, where  $n$  = the term number (in other words, the power of 2, plus the term number = 7). Therefore, the seventh term of the sequence is  $2^{7-7} = 2^0 = 1$ ;  $1 > 0$ .
- 462. b.** The thirtieth term of the sequence is  $2^{7-30} = 2^{-23}$ ;  $2^{-20} > 2^{-23}$ .
- 463. b.** If 29% of seniors neither play an instrument, nor participate in sports, this leaves 71% who must participate in one or both of the activities;  $78\% > 71\%$ .

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- 464. b.** 71% of seniors must participate in one or both of the activities. 43% participate in sports and 35% play an instrument, but  $43\% + 35\% = 78\%$  which is too high because those seniors who participate in both activities have been counted twice.  $78\% - 71\% = 7\%$ . Therefore, 7% of students participate in both activities;  $10\% > 7\%$ .
- 465. a.** The sum of the elements given in set M is  $4 + 6 + 3 + 7 = 20$ .  $\frac{20}{4} = 5$  meaning that the four given elements have an average of 5 before the value of  $2x$  is added to the sum. The sum of the elements in set N is  $1 + 5 + 8 = 14$ ;  $\frac{14}{3} = 4.667$  meaning that the three given elements have an average of 4.667 before the value of  $y$  is added to the sum. Since  $x > y$ , 2 larger numbers will be added to the sum of set M than will be added to the sum of set N. This will keep the mean of set M  $>$  the mean of set N.
- 466. c.** Since both  $x$  and  $y$  are  $> 10$ , the elements of set M can be ordered as follows:  $M = \{3, 4, 6, 7, x, x\}$  which makes the median the average of the third and fourth terms;  $6 + 7 = 13$ ;  $\frac{13}{2} = 6.5$ . Likewise, set N in order =  $1, 5, 8, y$  which makes the median the average of the second and third terms;  $5 + 8 = 13$ ;  $\frac{13}{2} = 6.5$ .
- 467. c.** Because quartiles divide the data into four quarters such that there are the same number of pieces of data in each quarter, the quantity of data between the first quartile and the median, and the quantity of data between the third quartile and the max must be equal.
- 468. a.** The interquartile range is the difference between the first and the third quartiles; in this case 6 and 10;  $10 - 6 = 4$ ;  $4 > 3$ .
- 469. a.** The data in the third quarter are spread between the values 7 and 10. The data in the second quarter are spread between the values 6 and 7. Therefore the data in the third quarter have a larger spread than the data in the second quarter.
- 470. c.** Kelly's offers 3 types of bread, 5 types of meat, and 4 types of cheese. Therefore, Kelly's can make any of  $3 \times 5 \times 4 = 60$  types of sandwiches.

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- 471. c.** Fixing the type of bread means Kelly's can use 1 type of bread, any of the 5 meats and any of the 4 cheeses on the sandwich.  
 $5 \times 4 = 20$  types of sandwiches that can be made on wheat or rye bread.
- 472. b.** If a sandwich must contain roast beef, it can be made on any of 3 types of bread and with any of 4 types of cheese;  $3 \times 4 = 12$  types of roast beef sandwich. If a sandwich must contain provolone cheese, it can be made on any of 3 types of bread with any of 5 types of meat;  $3 \times 5 = 15$  types of provolone cheese sandwich;  $15 > 12$ .
- 473. a.** This sequence contains all the perfect squares of the positive integers. The first term  $= 1 \times 1$ . The second term  $= 2 \times 2$ . The third term  $= 3 \times 3$  and so on. The seventh term, therefore, is  $7 \times 7 = 49$ ;  $49 > 36$ .
- 474. c.** The twentieth term of the sequence is  $20 \times 20 = 400$ .
- 475. c.** The 34th term is  $34 \times 34 = 1,156$ . The 35th term is  $35 \times 35 = 1,225$ ;  $1,225 - 1,156 = 69$ . The 10th term is  $10 \times 10 = 100$ . The 13th term is  $13 \times 13 = 169$ ;  $169 - 100 = 69$ .
- 476. b.** The 1,000th term is  $1,000 \times 1,000 = 1,000,000 = 1 \times 10^6$ .  
 $1 \times 10^9 > 1 \times 10^6$  since  $10^9 > 10^6$ .
- 477. d.** The answer cannot be determined. The fiftieth percentile of a data set is the same as the median of the set. The median of a set of data may be greater than, less than, or equal to the mean of the set. For example, in the data set 2, 3, 4, the median, or fiftieth percentile, is 3. The mean is also 3. In the data set 1, 5, 8, 9, the median, or fiftieth percentile is the average of 5 and 8.  $5 + 8 = 13$ ;  $\frac{13}{2} = 6.5$ . The mean is the sum, 23, divided by 4;  $\frac{23}{4} = 5.75$ , so the median is greater.
- 478. c.** The median of a data set is always equal to the fiftieth percentile.
- 479. c.** The 25th percentile is, by definition, the same as the first quartile.
- 480. b.** The standard deviation of set P can be found by finding the mean of set P, then finding the square of the distance each element of the set is from the mean. Finding the sum of these

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squares, dividing by the number of elements in the set, then finding the square root of this quantity. For set P:  $1 + 2 + 3 + 4 + 5 = 15$ ;  $\frac{15}{5} = 3$ , which is the mean;  $1 - 3 = -2$ ;  $-2 \times -2 = 4$ ;  $2 - 3 = -1$ ;  $-1 \times -1 = 1$ ;  $3 - 3 = 0$ ;  $0 \times 0 = 0$ ;  $4 - 3 = 1$ ;  $1 \times 1 = 1$ ;  $5 - 3 = 2$ ;  $2 \times 2 = 4$ . The sum of these square differences is  $4 + 1 + 0 + 1 + 4 = 10$ ;  $\frac{10}{5} = 2$ . The standard deviation is  $\sqrt{2}$ .

For set Q:  $2 + 3 + 6 + 5 = 16$ ;  $\frac{16}{4} = 4$ , which is the mean;  $2 - 4 = -2$ ;  $-2 \times -2 = 4$ ;  $3 - 4 = -1$ ;  $-1 \times -1 = 1$ ;  $6 - 4 = 2$ ;  $2 \times 2 = 4$ ;  $5 - 4 = 1$ ;  $1 \times 1 = 1$ . The sum of these square differences is  $1 + 4 + 4 + 1 = 10$ ;  $\frac{10}{4} = 2.5$ . The standard deviation is  $\sqrt{2.5}$ ;  $\sqrt{2.5} > \sqrt{2}$ .

- 481. b.** The mean of set P is 3. The median of set Q is the average of the second and third elements, 3 and 5;  $3 + 5 = 8$ ;  $\frac{8}{2} = 4$ ;  $4 > 3$ .
- 482. b.** 1 kilometer is equal to 1,000 meters.
- 483. c.** Using scientific notation,  $3.46 \times 10^9$  means the decimal point in 3.46 would be moved 9 places to the right (since the exponent on 10 is a positive 9). This would yield 3,460,000,000. Likewise, in  $34.6 \times 10^8$ , the decimal point in 34.6 would be moved 8 places to the right to yield 3,460,000,000 as well.
- 484. a.**  $1.5 \times 10^{-6}$  means the decimal point would move 6 places to the left (since the exponent on the 10 is a negative 6) to yield .0000015;  $.0000015 > .00000015$ .
- 485. a.** The profit in 1988 was approximately \$4,100. In 1990, the profit was approximately \$4,800. The profit increase was, therefore, about \$700. The profit in 1987 was approximately \$3,250. In 1989, the profit was approximately \$3,600. The profit increase was, therefore, about \$350.  $\$700 > \$350$ .
- 486. b.** The profit in 1990 was approximately \$4,800. In 1991, the profit was approximately \$4,600. The profit decrease was, therefore, about \$200. The profit in 1988 was approximately \$4,100. In 1989, the profit was approximately \$3,600. The profit decrease was, therefore, about \$500.  $\$500 > \$200$ .
- 487. a.** The profit in 1987 was approximately \$3,250. In 1993, the profit was approximately \$5,250. The profit increase was, therefore, about \$2,000.  $\$2,000 > \$1,500$ .

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- 488. b.** Each term in the sequence, beginning with the second, is found by multiplying the previous term by increasing integers. So, the first term, 1, times 2 = 2, the second term. The second term, 2, times 3 = 6, the third term. The third term, 6, times 4 = 24, the fourth term. The fifth term is therefore, the fourth term, 24, times 5 = 120.  $150 > 120$ .
- 489. c.** The sixth term is the fifth term, 120, times 6 = 720.
- 490. a.** The number of each term in the sequence can be determined by examining its tens and hundreds places. The first term is 2, so there is a zero in the 10s place. The second term is 12 and there is a 1 in the 10s place. The seventh term is 62 . . . there is a 6 in the 10s place. In other words, the 10s place is always one less than the term number. Note that the eleventh term should therefore be 102 and the twelfth term should be 112. The last term, 132, must be the fourteenth term.
- 491. b.** Rewriting the series in backward order beneath the original series, then adding vertically, gives 14 consistent sums of 134. This is double the total desired since every term has been written twice;  $134 \times 14 = 1,876$ ;  $\frac{1,876}{2} = 938$ ;  $1,000 > 938$ .
- 492. c.**  $4.23 \times 10^{-5}$  means the decimal point must move 5 decimal places to the left yielding .0000423;  $.423 \times 10^{-4}$  means the decimal point must move 4 decimal places to the left yielding .0000423 as well.
- 493. b.** A milliliter is  $\frac{1}{1,000}$  of a liter. Therefore, 234 milliliters, divided by 1,000, = .234 liters;  $2.34 > .234$
- 494. c.** A centigram is  $\frac{1}{100}$  of a gram. 45 centigrams, divided by 100, is .45 grams.
- 495. a.** Each square yard measures 3 feet long by 3 feet wide and so, is 9 square feet. 12 square yards would be equal to  $12 \times 9 = 108$  square feet;  $108 > 36$ .
- 496. b.** One square foot measures 12 inches long by 12 inches wide and is equivalent to 144 square inches; 2 square feet is equal to  $2 \times 144 = 288$  square inches;  $288 \text{ square inches} > 24 \text{ square inches}$ .

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- 497. c.** 1 cubic foot measures 12 inches in height, width, and length and is equivalent therefore to  $12^3$  cubic inches.
- 498. d.** The answer cannot be determined. Since the data in this frequency table is organized into classes of uniform width, the original data values cannot be determined. In the class of 15–19 year olds, for example, there are 3 women who may be 15, 16, and 19, or who may all be 17. There is no way to know. There are more women in the 25–29 age range than in the 15–19 age range, but there is no way to know whether any or all of them are of any one specific age within the range.
- 499. a.** The total number of entrants is the total of the frequency column;  $3 + 14 + 17 + 13 + 10 = 57$ ;  $57 > 55$ .
- 500. b.** The median age of an entrant cannot be determined exactly; however, since there are 57 entrants, the median age would be the 29th age when the data were in numerical order, as they are arranged, vertically, in the table. Adding frequencies vertically until arriving at the class that would contain the 29th data value:  $3 + 14 = 17$ ;  $17 + 17 = 34$  which is  $> 29$ . This means that the 29th data value is in the third class, between 25 and 29; 30 is larger than every number in this class so the answer is **b**.
- 501. a.** To find the number of women under 30, add together the three age groups that are listed first in the table (15–19, 20–24, and 25–29):  $3 + 14 + 17 = 34$ ; 34 is greater than 28, so **a** is correct.