# SPECIALIZED HIGH SCHOOLS
# STUDENT HANDBOOK

## 2012-2013

The Bronx High School of Science

The Brooklyn Latin School

Brooklyn Technical High School

High School for Mathematics, Science and Engineering at the City College

High School of American Studies at Lehman College

Queens High School for the Sciences at York College

Staten Island Technical High School

Stuyvesant High School

Fiorello H. LaGuardia High School of Music & Art and Performing Arts

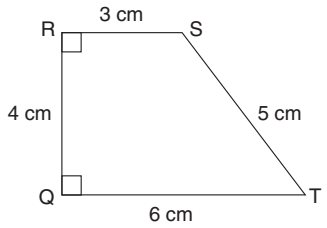
This section includes arithmetic, algebra, probability, statistics, and geometry problems. The technical terms and general concepts in these test questions can be found in the New York State Education Department **Mathematics Resource Guide with Core Curriculum**. Most problems involve application of topics covered in the **Core Curriculum**; however, since the **Core Curriculum** is just an outline, not all details of a topic are provided. Consequently, some aspects of a question may not be mentioned. As one of the purposes of this test is to identify students who will benefit from an education at a Specialized High School, the SHSAT contains many questions that require using mathematical ability to respond creatively to novel situations. The NYSED Mathematics Resource Guide with Core Curriculum can be downloaded from the New York State Education Department website: www.nysed.gov.

## Tips for Taking the Mathematics Section of the SHSAT

To improve your mathematics skills, choose a mathematics textbook and solve five to ten problems every day. Do both routine and difficult problems. Routine problems reinforce basic mathematical facts. More challenging problems help you understand mathematics concepts better. Do not give up if you cannot complete some of the problems. Skip them and move on. You may be able to solve them after you have learned more. Also, do not limit yourself to problems that test what you have learned in your mathematics class only. Go beyond what you have been taught and try new types of problems.

- You must **know the meanings of technical terms** such as "parallel" and "perpendicular" that are appropriate to your grade level, as well as the customary symbols that represent those terms. You also need to **know various formulas** such as those for the perimeter and area of different figures. You can find these technical terms, symbols, and formulas in your mathematics textbook. These terms, symbols, and formulas will **NOT** be given in the test booklet. Practice using them until you know them by heart.
- Read each problem carefully and work out the answer on scrap paper or in your test booklet. **Do not calculate on your answer sheet.**
- Most problems should be done by **working out the answer.** This is more efficient than trying out the options to see which one fits the question. The only exception is when you are explicitly asked to look at the options, as in, "Which of the following is an odd number?"
- If the question is a word problem, it often is helpful to **express it as an equation.** When you obtain an answer, look at the choices listed. If your answer is included among the choices, mark it. If it is not, reread the question and solve it again.
- The incorrect choices are often answers that people get if they misread the question or make common computational errors. For this reason, it is unwise to solve a problem in your head while looking at the possible choices. It is too easy to be attracted to a wrong choice.
- If your answer is not among the answer choices, write your answer in a different form. For example, $10(x + 2)$ is equivalent to $10x + 20$.
- You may draw figures or diagrams for questions that do not have them.
- Some questions ask you to combine a series of simple steps. Take **one step at a time,** using what you know and what the question tells you to do.
- The sample tests in this handbook are Grade 8 forms. If you are taking the Grade 9 test, work the problems on pages 109-111 as well. These problems cover topics that are introduced in the Core Curriculum for Grade 8.

## EXAMPLE 6




What is the area of trapezoid QRST?

**A.** 2 sq cm
**B.** 18 sq cm
**C.** 24 sq cm
**D.** 72 sq cm
**E.** 360 sq cm

▶ **IN EXAMPLE 6,** use the formula for the area of a trapezoid:

$$\text{Area} = \frac{1}{2} \cdot \text{height} \cdot (\text{sum of the bases})$$

From the figure, we know that the height of QRST is 4 cm and that one base is 6 cm, while the other base is 3 cm.

Thus: $A = \frac{1}{2}(4)(3 + 6) = \frac{1}{2}(4)(9) = 18$ sq cm

## EXAMPLE 7

Kendra traveled on a train for 8 hours and 12 minutes at an average speed of 110 kilometers per hour. How far did she travel?

**F.** 120 km
**G.** 170 km
**H.** 891 km
**J.** 892 km
**K.** 902 km

▶ **IN EXAMPLE 7,** first convert 12 minutes into a fraction of an hour and add that to the 8 hours:

$$\frac{12}{60} = \frac{1}{5} \text{ hour} + 8 \text{ hours}$$

So Kendra's total travel time was $8\frac{1}{5}$ hours. Multiply her travel time by 110 kilometers per hour to calculate the distance she traveled:

$$8\frac{1}{5} \cdot 110 = \frac{41}{5} \cdot 110 = 902 \text{ km}$$

## EXAMPLE 8

The length of the border between the United States and Canada is approximately $2.5 \times 10^6$ meters. What is this length in kilometers?

**A.** 250 km
**B.** 2,500 km
**C.** 25,000 km
**D.** 2,500,000 km
**E.** 2,500,000,000 km

▶ **IN EXAMPLE 8,** start by converting $2.5 \times 10^6$ from scientific notation to standard form:

$$2.5 \times 10^6 = 2{,}500{,}000 \text{ meters}$$

To change from meters to kilometers, divide by 1,000:

$$2{,}500{,}000 \div 1{,}000 = 2{,}500 \text{ km}$$

## EXAMPLE 9

If the mean of 6, 8, 10, and $x$ is 8, what is $x$?

**F.** 4
**G.** 8
**H.** 12
**J.** 16
**K.** 32

▶ **IN EXAMPLE 9,** set up an equation to calculate the mean and solve for $x$:

$$\frac{6 + 8 + 10 + x}{4} = 8$$

$$24 + x = 32$$

$$x = 8$$

### ▶ TAKING THE SAMPLE TESTS

Now you are ready to try sample test Form A. Begin by carefully reading the Directions on pages 28 and 29 and filling out side 1 of the Answer Sheet on page 30. For Form A, use side 2 of the Answer Sheet (page 31). When you are ready for Form B, use the Answer Sheet on page 69. You may tear out pages 31 and 69 to make it easier to mark your answers.

**GRADE 8**

**A**

# NEW YORK CITY PUBLIC SCHOOLS

*2012 Specialized High Schools*

# ADMISSIONS TEST

## GENERAL DIRECTIONS

### Identifying Information

Turn to Side 1 of the answer sheet. Line 1 says, "I am well enough to take this test and complete it. I understand that once I break the seal of the test booklet, I will not be eligible for a make-up test. I am a New York City resident and a Grade 8 student taking a Grade 8 test. I understand that a student who is not a New York City resident, who takes the test more than once in a given school year, or who takes the test at the wrong grade level will be disqualified from acceptance to any of the specialized high schools." Sign your name in the space following the word "signature." Do not print your name. **Notify the proctor immediately if you are ill or should not be taking this test. Do not sign the statement or begin the test. Return your answer sheet to the proctor.**

On **Line 2**, print the name and borough of the school where you are now enrolled. On **Line 3**, print today's date, using the numbers of the month, the day, and the year. On **Line 4**, print your birth date with the number of the month first, then the number of the day, then the last two digits of the year. For example, a birth date of March 1, 1998, would be 3-1-98.

In **Grid 5**, print the letters of your first name, or as many as will fit, in the boxes. Write your name exactly as you did on the application. If you have a middle initial, print it in the box labeled "MI." Then print your last name, or as much as will fit, in the boxes provided. Below each box, fill in the circle that contains the same letter as the box. If there is a space in your name, or a hyphen, fill in the circle under the appropriate blank or hyphen.

Make **dark marks** that **completely fill the circles.** If you change a mark, be sure to erase the first mark completely.

**Grid 6** is for your choice of specialized high schools. If Grid 6 is not marked correctly, your admission to a specialized high school will be affected because your admission is based on the score you attain and the order in which you rank your school preferences. The school choices indicated on your answer sheet are final. Therefore, carefully copy the order in which you ranked the schools on your admission ticket onto Grid 6.

**Fill in one and only one circle for each school for which you wish to be considered.** You may make as few as one or as many as eight choices. To increase your chances of being assigned to one of the specialized high schools, you are encouraged to make more than one choice. You **must** fill in a first choice school. Do not fill in a school more than once. Do not fill in the same school for each choice. Fill in only one circle in a row and only one circle in a column.

In **Grid 7**, fill in the circle that identifies your sex.

**Grid 8** is labeled "TEST BOOKLET LETTER AND NUMBER." In the boxes, copy the letter and numbers shown in the upper-right corner of your test booklet. Below each box, fill in the circle containing the same letter or number as the box.

For **Grid 9:**

1. Print the name of the school where you are now enrolled in the space at the top of the grid.
2. In the boxes marked "SCHOOL CODE," print the six-digit code that identifies your school and fill in the circle under the corresponding number or letter for each digit of the school code. (You can find your school code on your admission ticket. If it is not there, you or the proctor should look in the Feeder School List under the borough in which your school is located to find the code for your school.)
3. If you attend a private or parochial school, fill in the circle marked "P".
4. Under "BOROUGH OF SCHOOL," fill in the circle for the borough in which your school is located.
5. Under "TYPE OF SCHOOL," fill in the circle next to "NYC Public" if you attend a public school; fill in the circle next to "Private or Parochial" if you attend a private or parochial school.

**DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO**

**TURN YOUR BOOKLET OVER TO THE BACK COVER**

**Grid 10** is labeled "STUDENT ID NUMBER." All SHSAT test-takers should write their student ID number in Grid 10. The student ID number is found on your admission ticket. In the boxes, print your nine-digit student ID number. Below each box, fill in the circle containing the same number as in the box.

**Grid 11** asks for your date of birth. Print the first three letters of the month in the first box, the number of the day in the next box, and the last two digits of the year in the last box. Then fill in the corresponding circles.

Now review this page to make sure you have completed all lines and grids correctly. Review each column to see that the filled-in circles correspond to the letters or numbers in the boxes above them.

Turn your answer sheet to Side 2. Print your test booklet letter and numbers; your name, first name **first**; and your home address and phone number in the spaces provided.

## Marking Your Answers

Be sure to mark all your answers in the row of answer circles corresponding to the question number printed in the test booklet. Use a Number 2 pencil. If you change an answer, be sure to erase it completely. **You may write in your test booklet to solve verbal or mathematics problems, but your answers must be recorded on the answer sheet in order to be counted.** Be careful to avoid making any stray pencil marks on your answer sheet.

Each question has only one correct answer. If you mark more than one circle in any answer row, that question will be scored as incorrect. Select the **best** answer for each question. Your score is determined by the number of questions you answered correctly. **It is to your advantage to answer every question, even though you may not be certain which choice is correct.** See the example of correct and incorrect answer marks at the top of the next column.

**SAMPLE ANSWER MARKS**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Ⓐ | Ⓑ | Ⓒ | Ⓓ | ● | RIGHT |
| 2 | Ⓕ | Ⓖ | Ⓗ | Ⓙ | Ⓚ | WRONG |
| 3 | Ⓐ | Ⓑ | Ⓒ | Ⓓ | Ⓔ | WRONG |
| 4 | Ⓕ | Ⓖ | Ⓗ | Ⓙ | Ⓚ | WRONG |
| 5 | Ⓐ | Ⓑ | ● | ● | Ⓔ | WRONG |

## Planning Your Time

You have 150 minutes to complete the entire test. How you allot the time between the Verbal and Mathematics sections is up to you. **If you begin with the Verbal section, you may go on to the Mathematics section as soon as you are ready. Likewise, if you begin with the Mathematics section, you may go on to the Verbal section as soon as you are ready.** It is recommended that you do not spend more than 75 minutes on either section. If you complete the test before the allotted time (150 minutes) is over, you may go back to review questions in either section.

Work as rapidly as you can without making mistakes. Don't spend too much time on a difficult question. Return to it later if you have time.

Students must remain for the entire test session.

## Example 1

**DIRECTIONS:** Solve the problem. Find the **best** answer among the answer choices given.

**E1.** If four ice cream cones cost $2.00, how much will three ice cream cones cost?

**A.** $0.50
**B.** $1.00
**C.** $1.25
**D.** $1.50
**E.** $1.75

**EXAMPLE ANSWER**

| | | | | | |
|---|---|---|---|---|---|
| E1. | Ⓐ | Ⓑ | Ⓒ | ● | Ⓔ |

**DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO**

# 2012 NEW YORK CITY PUBLIC SCHOOLS

SPECIALIZED HIGH SCHOOLS ADMISSIONS TEST

**GRADE 8**

USE A PENCIL ONLY

SIDE 1

**8**

**1. STUDENT STATEMENT:** I am well enough to take this test and complete it. I understand that once I break the seal of the test booklet, I will not be eligible for a make-up test. I am a New York City resident and a Grade 8 student taking a Grade 8 test. I understand that a student who is not a New York City resident, who takes the test more than once in a given school year, or who takes the test at the wrong grade level will be disqualified from acceptance to any of the specialized high schools.

**Signature (full name, first name first):** _____

**2. SCHOOL WHERE YOU ARE NOW ENROLLED:** _____

**Name of School** **Borough**

**3. TODAY'S DATE:** _____ **Month** **Day** **Year**

**4. DATE OF BIRTH:** _____ **Month** **Day** **Year**

CAREFULLY RECORD YOUR NAME, SCHOOL CHOICE, SEX, TEST BOOKLET LETTER AND NUMBER, INFORMATION ABOUT THE SCHOOL WHERE YOU ARE NOW ENROLLED, STUDENT ID NUMBER, AND DATE OF BIRTH IN THE GRIDS BELOW. USE A PENCIL ONLY. INCORRECT MARKS MAY DELAY THE SCORING OF YOUR ANSWER SHEET.

**5. FIRST NAME (please print)** | **MI** | **LAST NAME (surname) (please print)**

**6. CHOICES OF SPECIALIZED HIGH SCHOOLS**

Indicate your school choice in order of preference.

- Fill in only one school for each choice.
- You **must** fill in a first choice school.
- Fill in only one circle in a row and only one circle in a column.

**School choices indicated on the answer sheet are final.**

| SCHOOLS | CHOICES: 1st choice | 2nd choice | 3rd choice | 4th choice | 5th choice | 6th choice | 7th choice | 8th choice |
|---|---|---|---|---|---|---|---|---|
| Bronx Science | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Brooklyn Latin | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Brooklyn Tech | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| HS Math, Sci., & Engineering | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| HS American Studies/Lehman | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Queens Sci./York | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Staten Island Tech | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Stuyvesant | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**7. SEX** ○ Female ○ Male

**8. TEST BOOKLET LETTER AND NUMBER**

A B C D E F G H J K L W

0 1 2 3 4 5 6 7 8 9

**9. SCHOOL WHERE YOU ARE NOW ENROLLED**

NAME OF SCHOOL

School Code: 0 0 K 0 0 0 / 0 0 M 0 0 0 / 0 0 Q 0 0 0 / 0 0 X 0 0 0 / 0 0 R 0 0 0 / 0 0 W 0 0 0

(P) Fill in for private or parochial schools only

BOROUGH OF SCHOOL

- ○ Brooklyn (K)
- ○ Manhattan (M)
- ○ Queens (Q)
- ○ Bronx (X)
- ○ Staten Island (R)
- ○ Out of NYC (W)

TYPE OF SCHOOL

- ○ NYC Public
- ○ Private or Parochial

**10. STUDENT ID NUMBER**

0 0 0 – 0 0 0 – 0 0 0 0

1 1 1 1 1 1 1 1 1 1

2 2 2 2 2 2 2 2 2 2

3 3 3 3 3 3 3 3 3 3

4 4 4 4 4 4 4 4 4 4

5 5 5 5 5 5 5 5 5 5

6 6 6 6 6 6 6 6 6 6

7 7 7 7 7 7 7 7 7 7

8 8 8 8 8 8 8 8 8 8

9 9 9 9 9 9 9 9 9 9

**11. DATE OF BIRTH**

| Month | Day | Year |
|---|---|---|
| JAN | 1 11 21 | 95 |
| FEB | 2 12 22 | 96 |
| MAR | 3 13 23 | 97 |
| APR | 4 14 24 | 98 |
| MAY | 5 15 25 | 99 |
| JUN | 6 16 26 | 00 |
| JUL | 7 17 27 | 01 |
| AUG | 8 18 28 | 02 |
| SEP | 9 19 29 | |
| OCT | 10 20 30 | |
| NOV | 31 | |
| DEC | | |

# NEW YORK CITY PUBLIC SCHOOLS

USE A PENCIL ONLY

SIDE 2

2012 SPECIALIZED HIGH SCHOOLS ADMISSIONS TEST

## GRADE 8

Test Booklet Letter  Test Booklet Number

Student's First Name (please print)  Student's Last Name (please print)

Student's Home Address  Apartment  Borough  ZIP Code  Home Telephone Number ( ) –

## PART 1 VERBAL

### SCRAMBLED PARAGRAPHS

**Paragraph 1**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

**Paragraph 2**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

**Paragraph 3**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

**Paragraph 4**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

**Paragraph 5**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

### LOGICAL REASONING

| | | | | | |
|---|---|---|---|---|---|
| 11 | A | B | C | D | E |
| 12 | F | G | H | J | K |
| 13 | A | B | C | D | E |
| 14 | F | G | H | J | K |
| 15 | A | B | C | D | E |
| 16 | F | G | H | J | K |
| 17 | A | B | C | D | E |
| 18 | F | G | H | J | K |
| 19 | A | B | C | D | E |
| 20 | F | G | H | J | K |

### READING

| | | | | | |
|---|---|---|---|---|---|
| 21 | A | B | C | D | E |
| 22 | F | G | H | J | K |
| 23 | A | B | C | D | E |
| 24 | F | G | H | J | K |
| 25 | A | B | C | D | E |
| 26 | F | G | H | J | K |
| 27 | A | B | C | D | E |
| 28 | F | G | H | J | K |
| 29 | A | B | C | D | E |
| 30 | F | G | H | J | K |
| 31 | A | B | C | D | E |
| 32 | F | G | H | J | K |
| 33 | A | B | C | D | E |
| 34 | F | G | H | J | K |
| 35 | A | B | C | D | E |
| 36 | F | G | H | J | K |
| 37 | A | B | C | D | E |
| 38 | F | G | H | J | K |
| 39 | A | B | C | D | E |
| 40 | F | G | H | J | K |
| 41 | A | B | C | D | E |
| 42 | F | G | H | J | K |
| 43 | A | B | C | D | E |
| 44 | F | G | H | J | K |
| 45 | A | B | C | D | E |
| 46 | F | G | H | J | K |
| 47 | A | B | C | D | E |
| 48 | F | G | H | J | K |
| 49 | A | B | C | D | E |
| 50 | F | G | H | J | K |

## PART 2 MATHEMATICS

### MATHEMATICS PROBLEMS

| | | | | | |
|---|---|---|---|---|---|
| 51 | A | B | C | D | E |
| 52 | F | G | H | J | K |
| 53 | A | B | C | D | E |
| 54 | F | G | H | J | K |
| 55 | A | B | C | D | E |
| 56 | F | G | H | J | K |
| 57 | A | B | C | D | E |
| 58 | F | G | H | J | K |
| 59 | A | B | C | D | E |
| 60 | F | G | H | J | K |
| 61 | A | B | C | D | E |
| 62 | F | G | H | J | K |
| 63 | A | B | C | D | E |
| 64 | F | G | H | J | K |
| 65 | A | B | C | D | E |
| 66 | F | G | H | J | K |
| 67 | A | B | C | D | E |
| 68 | F | G | H | J | K |
| 69 | A | B | C | D | E |
| 70 | F | G | H | J | K |
| 71 | A | B | C | D | E |
| 72 | F | G | H | J | K |
| 73 | A | B | C | D | E |
| 74 | F | G | H | J | K |
| 75 | A | B | C | D | E |
| 76 | F | G | H | J | K |
| 77 | A | B | C | D | E |
| 78 | F | G | H | J | K |
| 79 | A | B | C | D | E |
| 80 | F | G | H | J | K |
| 81 | A | B | C | D | E |
| 82 | F | G | H | J | K |
| 83 | A | B | C | D | E |
| 84 | F | G | H | J | K |
| 85 | A | B | C | D | E |
| 86 | F | G | H | J | K |
| 87 | A | B | C | D | E |
| 88 | F | G | H | J | K |
| 89 | A | B | C | D | E |
| 90 | F | G | H | J | K |
| 91 | A | B | C | D | E |
| 92 | F | G | H | J | K |
| 93 | A | B | C | D | E |
| 94 | F | G | H | J | K |
| 95 | A | B | C | D | E |
| 96 | F | G | H | J | K |
| 97 | A | B | C | D | E |
| 98 | F | G | H | J | K |
| 99 | A | B | C | D | E |
| 100 | F | G | H | J | K |

# PART 2 — MATHEMATICS

*Suggested Time — 75 Minutes*

50 QUESTIONS

## GENERAL INSTRUCTIONS

Solve each problem. Select the **best** answer from the choices given. Mark the letter of your answer on the answer sheet. You can do your figuring in the test booklet or on paper provided by the proctor. **DO NOT MAKE ANY MARKS ON YOUR ANSWER SHEET OTHER THAN FILLING IN YOUR ANSWER CHOICES.**

**IMPORTANT NOTES:**

(1) Formulas and definitions of mathematical terms and symbols are **not** provided.

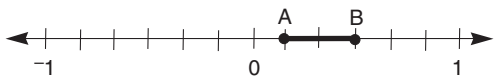
(2) Diagrams other than graphs are **not** necessarily drawn to scale. Do not assume any relationship in a diagram unless it is specifically stated or can be figured out from the information given.

(3) Assume that a diagram is in one plane unless the problem specifically states that it is not.

(4) Graphs are drawn to scale. Unless stated otherwise, you can assume relationships according to appearance. For example, (on a graph) lines that appear to be parallel can be assumed to be parallel; likewise for concurrent lines, straight lines, collinear points, right angles, etc.

(5) Reduce all fractions to lowest terms.

**51.**




On the number line above, intervals are equally spaced, and point $x$ lies in the interval AB. What are the lower and upper limits of all possible values of $x$?

**A.** $\frac{1}{6}, \frac{1}{2}$

**B.** $\frac{1}{2}, \frac{5}{6}$

**C.** $\frac{1}{6}, \frac{5}{6}$

**D.** $-\frac{5}{6}, -\frac{1}{2}$

**E.** $-\frac{2}{3}, -\frac{1}{3}$

**52.** Ms. Garcia determines math grades on the basis of 5 tests, each worth 100 points. An average of at least 80 points is needed for a grade of B. On the first 4 tests, Hilary scored 91, 72, 69, and 83. What is the lowest score she may receive on the final test and still earn a B?

**F.** 80
**G.** 82
**H.** 84
**J.** 85
**K.** 86

**53.** Three chains, each 14 feet in length, are linked end to end. Two longer chains of equal length are added to make a total length of 100 feet. What is the length of **one** of the longer chains?

**A.** 29 ft
**B.** 36 ft
**C.** 42 ft
**D.** 58 ft
**E.** 72 ft

CONTINUE ON TO THE NEXT PAGE ▶

**54.** Suppose that the age of the earth is $5.2 \times 10^9$ years, and the age of a particular artifact is $1.3 \times 10^7$ years. How many times older than the artifact is the earth?

**F.** $4.0 \times 10^{12}$
**G.** $4.0 \times 10^6$
**H.** $2.5 \times 10^6$
**J.** $2.5 \times 10^3$
**K.** $4.0 \times 10^2$

**55.** $$\frac{7 + n}{43 + n} = \frac{1}{3}$$

What is the value of $n$ in the equation above?

**A.** 9
**B.** 11
**C.** 12
**D.** 16
**E.** 25

**56.** What is the prime factorization of 1,200?

**F.** $2^2 \times 3 \times 5^2$
**G.** $2^3 \times 3 \times 5^2$
**H.** $2^4 \times 3 \times 5^2$
**J.** $2^4 \times 3^2 \times 5^2$
**K.** $2^4 \times 3^2 \times 5$

**57.** If $x = y - 7$, what is the value of $3x - 3$ in terms of $y$?

**A.** $3y - 18$
**B.** $3y - 24$
**C.** $2y - 4$
**D.** $2y - 10$
**E.** $y - 10$

**58.** Laura rode her bicycle at 15 miles per hour for 2 hours, and then at 12 miles per hour for 1 hour. What was her average speed for the entire ride?

**F.** 12 mph
**G.** 13.5 mph
**H.** 14 mph
**J.** 15 mph
**K.** 42 mph

**59.** Four friends are going to sit in a row on a bench to have their picture taken. In how many different orders can the four friends sit?

**A.** 4
**B.** 6
**C.** 8
**D.** 12
**E.** 24

**60.** For what value of $m$ is $\frac{5m - 3}{2 + m} = 4$?
(Note: $m \neq -2$.)

**F.** 14
**G.** 11
**H.** 8
**J.** 7
**K.** 5

**61.** What is the value of $4x^2 + 5x - 8$, if $x = -3$?

**A.** $-59$
**B.** $-35$
**C.** 1
**D.** 13
**E.** 43

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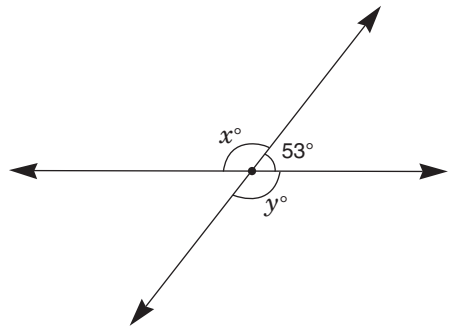
**62.** If a rectangular room is 3 times as long as it is wide, and if the width is 8 feet, how many square feet of carpet are needed to cover the floor?

**F.** 24 sq ft
**G.** 32 sq ft
**H.** 72 sq ft
**J.** 88 sq ft
**K.** 192 sq ft

**63.** Jodi's class has between 30 and 41 students. Exactly 75% of the students in her class have red book bags, and exactly $\frac{1}{6}$ of the students in her class do not have a book bag at all. How many students are in Jodi's class?

**A.** 32
**B.** 34
**C.** 36
**D.** 38
**E.** 40

**64.**




The figure above shows two intersecting lines. What is the sum of $x$ and $y$?

**F.** 53
**G.** 74
**H.** 106
**J.** 127
**K.** 254

**65.** N, M, and T are integers.
N + M is an odd number.
M + T is an odd number.

Which of the following **must** be true?

**A.** N × T is even.
**B.** N × T is odd.
**C.** N + T is odd.
**D.** N + T is even.
**E.** N − T is odd.

**66.** $\frac{4.5}{0.1} \times 0.22 =$

**F.** 0.99
**G.** 1.99
**H.** 9.9
**J.** 99
**K.** 990

**67.** $(8 - 16) \div (^{-}8 + 6)$

If the parentheses are removed from the above expression, how will the value of the expression change?

**A.** no change
**B.** increase of 3
**C.** increase of 7
**D.** increase of 12
**E.** increase of 16

**68.** If $2x + 2y - 6 = 14$, what is the value of $x$ in terms of $y$?

**F.** $10 - y$
**G.** $10 - 2y$
**H.** $8 - y$
**J.** $8 - 2y$
**K.** $4 - y$

CONTINUE ON TO THE NEXT PAGE ▶

**69.** A merry-go-round has 25 horses. Each horse is labeled consecutively with a letter from A to Y—the first horse is labeled A, the second horse is labeled B, and so on. A child walks around the merry-go-round, starting at horse A and continuing in alphabetical order, counting as she goes. She stops at the $337^{th}$ horse. What is the letter of that horse?

**A.** A
**B.** J
**C.** K
**D.** L
**E.** M

**70.** A 5-ounce bag of candies sells for \$1.50. At this rate, what would be the price of a 1-pound bag of candies? (Note: 1 lb = 16 oz.)

**F.** \$0.30
**G.** \$3.00
**H.** \$3.60
**J.** \$4.50
**K.** \$4.80

**71.** In a salsa dance class, the ratio of women to men is 3:2. What percent of the students are women?

**A.** 40%
**B.** 60%
**C.** $66\frac{2}{3}\%$
**D.** 75%
**E.** 150%

**72.** How many integers between 75 and 105 have a remainder of 2 when divided by 15?

**F.** 0
**G.** 1
**H.** 2
**J.** 3
**K.** 5

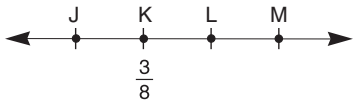
**73.** For what value of $x$ is $\frac{2(x+1)}{3} = 1$?

**A.** 0
**B.** $\frac{1}{2}$
**C.** 1
**D.** 2
**E.** $\frac{5}{2}$

**74.** A taxi company charges \$2.00 per ride plus \$0.30 for each $\frac{1}{5}$ of a mile ridden. If a taxi ride costs \$20.00, how many miles long was the ride?

**F.** $6\frac{2}{3}$ mi
**G.** 12 mi
**H.** $13\frac{1}{3}$ mi
**J.** 20 mi
**K.** 60 mi

**75.**




On the number line above, JK = $3\frac{1}{2}$, JM = $9\frac{3}{4}$, and LM = $1\frac{1}{8}$. What is the position of point L?

**A.** $5\frac{1}{8}$
**B.** $5\frac{1}{2}$
**C.** $6\frac{1}{4}$
**D.** $6\frac{5}{8}$
**E.** $8\frac{1}{4}$

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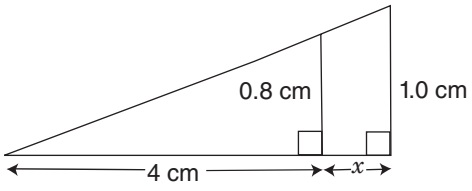
**76.** Shelby's rent is $800 per month. Since she could not pay this month's rent when due, her landlord agreed to accept 40% of the rent on the first day of the month, another 25% of the original rent on the tenth, and the rest on the twentieth. How much rent must Shelby pay on the twentieth day?

**F.** $80
**G.** $280
**H.** $300
**J.** $360
**K.** $520

**77.** If $x = -2$ and $y = 3$, what is the value of $5x - 2xy$?

**A.** $-22$
**B.** $-2$
**C.** 0
**D.** 2
**E.** 22

**78.**




In the figure above, what is the value of $x$?

**F.** 1 cm
**G.** 1.2 cm
**H.** 3.2 cm
**J.** 4 cm
**K.** 5 cm

**79.** A nation has five types of coins: sinds, dalts, lorgs, harps, and plunks. A sind is worth four lorgs. Two plunks equal five dalts. Three harps are worth one plunk. Five sinds are worth two harps. Which coin is most valuable?

**A.** sind
**B.** dalt
**C.** lorg
**D.** harp
**E.** plunk

**80.** Raoul is $x$ years old now, and Phil is 8 years older than Raoul. In 2 years, Phil will be exactly twice as old as Raoul is then. How old is Raoul now?

**F.** 3
**G.** 5
**H.** 6
**J.** 8
**K.** 10

**81.** If 1 quart of paint covers 100 square feet of wall, what is the **least** number of 1-quart cans of paint needed to completely cover two rectangular walls measuring 12 feet by 9 feet plus two additional rectangular walls measuring 10 feet by 9 feet?

**A.** 1
**B.** 2
**C.** 3
**D.** 4
**E.** 5

**82.** If $60 \div n = 24m$, what is the value of $nm$?

**F.** 0.4
**G.** 2.5
**H.** 5.2
**J.** 36
**K.** 1,440

**83.** When positive integer $p$ is divided by 7, the remainder is 3. When $p$ is divided by 5, the remainder is 2. What is the **least** possible value of $p$?

**A.** 10
**B.** 12
**C.** 17
**D.** 38
**E.** 52

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**84.** The mean of twenty numbers is 42. If four of the twenty numbers have a mean of 50, what is the mean of the other sixteen numbers?

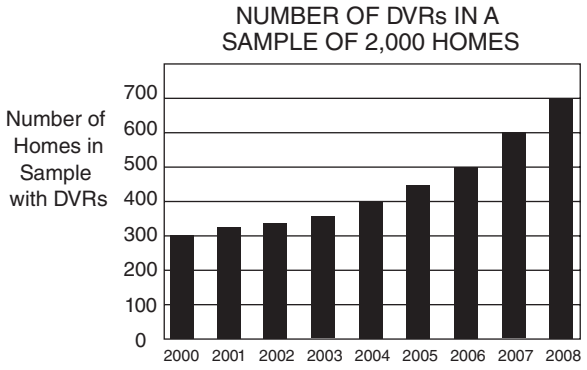
**F.** 32
**G.** 36
**H.** 40
**J.** 46
**K.** 65

**85.**
$$50 < x^2 < 65$$
$$17 < y^2 < 32$$

If $x$ and $y$ are positive integers, what is the value of $xy$?

**A.** 13
**B.** 28
**C.** 35
**D.** 40
**E.** 45

**86.**




Based on the graph above, what was the first year in which at least 25 percent of the homes in the sample of 2,000 had DVRs?

**F.** 2000
**G.** 2001
**H.** 2004
**J.** 2006
**K.** 2008

**87.** At a hotel, Jahmir exchanged 300 dollars and received 192 nobles. Based on that information, how many nobles are equal to 1 dollar? (Assume that there are no exchange fees.)

**A.** $\frac{3}{5}$
**B.** $\frac{16}{25}$
**C.** $\frac{4}{5}$
**D.** $\frac{16}{15}$
**E.** $\frac{25}{16}$

**88.** How many positive integers are between $\frac{28}{3}$ and $\frac{83}{5}$?

**F.** 6
**G.** 7
**H.** 16
**J.** 54
**K.** 55

**89.** On a number line, points K and T are 12 units apart. Point M is the midpoint of $\overline{KT}$. Point W is the midpoint of $\overline{MT}$ and is located at 5 on the number line. Which number below is a possible midpoint of $\overline{KW}$?

**A.** $-1$
**B.** $-0.5$
**C.** 0.5
**D.** 1
**E.** 4.5

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**90.**

DISTANCE AND ALTITUDE OF TWO PLANES

| | Distance of Plane from Airport at Time $t$ | Altitude of Plane at Time $t$ |
|---|---|---|
| Plane M | $(310 - 2t)$ miles | $(32{,}800 - 20t)$ feet |
| Plane N | $(3t + 235)$ miles | $(31{,}600 + 40t)$ feet |

For the mid-flight time ($t$) in minutes between 0 and 100, the altitudes of two planes and their distances from the airport are indicated in the table above. At the minute the planes are at the same distance from the airport, what is the difference between their altitudes?

**F.** 25 ft
**G.** 180 ft
**H.** 300 ft
**J.** 420 ft
**K.** 3,300 ft

**91.** $A_1A_2 + A_2A_3 + A_3A_4 + A_4A_5 + A_5A_6$

If $A_k = \frac{1}{k}$ for any positive value of $k$, and $k$ is a positive integer, what is the value of the expression above?

**A.** $\frac{1}{70}$
**B.** $\frac{1}{14}$
**C.** $\frac{5}{6}$
**D.** 1
**E.** $\frac{29}{20}$

**92.** In a certain city there are 50,000 licensed drivers. If 40,000 of the licensed drivers wear glasses and 30,000 of the licensed drivers are over 30 years old, what is the smallest possible number of licensed drivers who **both** wear glasses and are over 30?

**F.** 10,000
**G.** 20,000
**H.** 24,000
**J.** 30,000
**K.** 35,000

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

In the volume formula shown above, if $r$ is divided by 2 and $h$ is doubled, what is the ratio of the new volume to the original volume?

**A.** 1:4
**B.** 1:2
**C.** 1:1
**D.** 2:1
**E.** 4:1

**94.** If $w < 0$ and if $z > 0$, which expression **must** be positive?

**F.** $w - z^2$
**G.** $z + w^2$
**H.** $z^2 \div w$
**J.** $z - w^2$
**K.** $w + z^2$

**95.** $\frac{2x + 5}{x - 2}$

If $0 \leq x \leq 5$, how many integer values of $x$ will make the above expression an integer?

**A.** 0
**B.** 1
**C.** 2
**D.** 3
**E.** 4

**96.** On a coordinate system, the line segment joining the points (6, 8) and (12, 10) has the same midpoint as the line segment joining the points (8, 11) and ($x$, 7). What is the value of $x$?

**F.** 4
**G.** 5
**H.** 6
**J.** 9
**K.** 10

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**97.** Let GCF $(x, y)$ represent the greatest common factor of $x$ and $y$. If $p$ is a positive **even** integer less than 11, for what value of $p$ does GCF $(p^2, 81)$ have the **greatest** value?

**A.** 2
**B.** 4
**C.** 6
**D.** 8
**E.** 10

**98.** A regular dodecagon has 12 equal sides and 12 equal angles. How many degrees are in each interior angle of a regular dodecagon?

**F.** 30°
**G.** 150°
**H.** 154°
**J.** 168°
**K.** 216°

**99.** If the mean of $w$, $x$, $y$, and $z$ is 60, and the mean of $v$, $x$, $y$, and $z$ is 62, what is the value of $v - w$?

**A.** 2
**B.** 4
**C.** 6
**D.** 8
**E.** 10

**100.** A goat is tied by a 6 meter rope to the outside corner of a square shed measuring 8 meters by 8 meters. What is the area of the surrounding grass on which the goat can graze?

**F.** $6\pi$ sq m
**G.** $8\pi$ sq m
**H.** $27\pi$ sq m
**J.** $36\pi$ sq m
**K.** $48\pi$ sq m

THIS IS THE END OF THE TEST. IF TIME REMAINS, YOU MAY CHECK YOUR ANSWERS TO PART 2 AND PART 1. BE SURE THAT THERE ARE NO STRAY MARKS, PARTIALLY FILLED ANSWER CIRCLES, OR INCOMPLETE ERASURES ON YOUR ANSWER SHEET. ■

**51.** (**A**) AB lies between 0 and 1 on the number line. A is the lower limit of $x$ and B is the upper limit. The area between 0 and 1 is divided into 6 equal segments, so $A = \frac{1}{6}$ and $B = \frac{3}{6} = \frac{1}{2}$.

---

**52.** (**J**) Let $x$ represent the lowest score that Hilary can receive and earn a B, which requires an average score of 80 points. Set up the equation for the calculation of a mean of 80:

$$\frac{91 + 72 + 69 + 83 + x}{5} = 80$$

$$\begin{aligned} 91 + 72 + 69 + 83 + x &= 400 \\ 315 + x &= 400 \\ x &= 85 \end{aligned}$$

---

**53.** (**A**) When the three 14-foot chains are linked end to end, their length is $3 \times 14$ ft $= 42$ ft. Let $x$ represent the length of one of the longer chains and set up an equation:

$$\begin{aligned} 42 + 2x &= 100 \\ 2x &= 58 \\ x &= 29 \end{aligned}$$

---

**54.** (**K**) To find "how many times older," divide the age of the earth by the age of the artifact:

$$\frac{5.2 \times 10^9}{1.3 \times 10^7} = \frac{5.2}{1.3} \times \frac{10^9}{10^7}$$

$$= 4.0 \times 10^2$$

---

**55.** (**B**) The first step is to cross-multiply. Then, use the distributive property. Next, combine like terms and solve the equation:

$$\begin{aligned} 3(7 + n) &= 1(43 + n) \\ 21 + 3n &= 43 + n \\ 3n - n &= 43 - 21 \\ 2n &= 22 \\ n &= 11 \end{aligned}$$

**56.** (**H**) To get the prime factorization, divide out prime numbers until all that is left are prime numbers. One way is shown below:

$$\begin{aligned} 1{,}200 &= 2 \times 600 \\ &= 2 \times 2 \times 300 \\ &= 2 \times 2 \times 2 \times 150 \\ &= 2 \times 2 \times 2 \times 2 \times 75 \\ &= 2 \times 2 \times 2 \times 2 \times 5 \times 15 \\ &= 2 \times 2 \times 2 \times 2 \times 5 \times 3 \times 5 \\ &= 2^4 \times 3 \times 5^2 \end{aligned}$$

---

**57.** (**B**) Substitute $y - 7$ for $x$ and simplify the expression:

$$3(y - 7) - 3$$

$$3y - 21 - 3$$

$$3y - 24$$

---

**58.** (**H**) First, calculate the total distance Laura traveled:

(15 mph) × (2 hr) = 30 miles
(12 mph) × (1 hr) = 12 miles

Total distance traveled = 30 + 12 = 42 miles.
Total time traveled = 2 + 1 = 3 hours.

To calculate her average speed for the entire ride, divide total distance traveled by total time traveled:

42 ÷ 3 = 14 miles per hour

---

**59.** (**E**) Using the counting principle:

4 people can be chosen for the first position
3 people can be chosen for the second position
2 people can be chosen for the third position
1 person can be chosen for the fourth position

So, $4 \times 3 \times 2 \times 1 = 24$.

Another way to solve this problem is by writing out all the possible permutations (using the letters L, M, P, and R to represent the four people) and then count them:

| | | | |
|---|---|---|---|
| LMPR | MLPR | PLMR | RLMP |
| LMRP | MLRP | PLRM | RLPM |
| LPMR | MPLR | PMLR | RMLP |
| LPRM | MPRL | PMRL | RMPL |
| LRMP | MRLP | PRLM | RPLM |
| LRPM | MRPL | PRML | RPML |

**60.** (**G**) Begin by cross-multiplying to eliminate the fraction, then combine like terms and solve for $m$:

$$5m - 3 = 4(2 + m)$$
$$5m - 3 = 8 + 4m$$
$$m = 11$$

---

**61.** (**D**) Substitute $^-3$ into the expression wherever you see an $x$, and then simplify:

$$4x^2 + 5x - 8$$
$$4(^-3)^2 + 5(^-3) - 8$$
$$4(9) - 15 - 8$$
$$13$$

---

**62.** (**K**) The formula for the area (A) of a rectangle is length ($l$) times width ($w$): $A = l \bullet w$. The question defines the length in terms of the width: $l = 3w$. Substituting $3w$ for $l$, we get:

$$A = 3w \bullet w = 3w^2$$

Since the question states that $w = 8$:

$$3(8^2) = 3(64) = 192 \text{ sq ft}$$

---

**63.** (**C**) Since 75% is the same as $\frac{3}{4}$, we know the number of students in the class must be divisible by 4. The number of students in the class also needs to be divisible by 6, since exactly $\frac{1}{6}$ of the students do not have a book bag.

The numbers between 30 and 41 that are divisible by 4 are 32, 36, and 40. Of those three numbers, only 36 is also divisible by 6. So the answer is C, 36.

---

**64.** (**K**) The angles are formed by the intersection of two lines. The angle labeled 53° is opposite to the unlabeled angle, which by definition is also 53°. The sum of the four angles is 360°. Neither $x$ nor $y$ is being solved for, only their sum $(x + y)$.

$$x + y + 2(53) = 360$$
$$x + y = 360 - 106$$
$$x + y = 254$$

**65.** (**D**) When the sum of two integers is odd, one integer must be odd and the other must be even. The sums N + M and M + T are both odd. If M is odd, then both N and T are even. If M is even, then both N and T are odd.

Evaluate each answer option. Options A and B **may** be true, but neither **must** be true. If N and T are both even, their product will be even; if both are odd, their product will be odd. Thus, neither option **must** be true.

Regardless of whether N and T are both odd or both even, Options C and E cannot be true. In both cases, N − T and N + T would be even.

Option D will always be true, because the sum of two odd numbers is always even and the sum of two even numbers is always even.

---

**66.** (**H**) $\frac{4.5}{0.1} \times 0.22 = 45 \times 0.22 = 9.9$

---

**67.** (**D**) Begin by evaluating the problem as it is written. Following the order of operations, we first calculate the expression in the parentheses, and then perform the division:

$$(8 - 16) \div (^-8 + 6)$$
$$= (^-8) \div (^-2)$$
$$= 4$$

Now, remove the parentheses and evaluate the resulting expression. Following the order of operations, we first perform the division and then the addition:

$$8 - 16 \div {}^-8 + 6$$
$$= 8 + \frac{^-16}{^-8} + 6$$
$$= 8 + 2 + 6$$
$$= 16$$

To calculate how the value of the expression changes by removing the parentheses, subtract the first answer from the second answer:

$$16 - 4 = 12$$

The expression will change by an increase of 12.

**68.** (**F**) To find the value of $x$ in terms of $y$, solve for $x$:

$$\begin{aligned} 2x + 2y - 6 &= 14 \\ 2x + 2y &= 20 \\ x + y &= 10 \\ x &= 10 - y \end{aligned}$$

---

**69.** (**D**) First, calculate the number of complete trips around the merry-go-round the child will make. Then, determine how many horses remain in the final trip. 337 (the number she stops at) divided by 25 (the number of horses on the merry-go-round) equals 13, with a remainder of 12. Thus, the child will walk around the merry-go-round 13 complete times and stop at the $12^{th}$ horse on her next trip. The $12^{th}$ letter of the alphabet is L, so the answer is D.

---

**70.** (**K**) Since there are 16 ounces in 1 pound, the question asks how much we would pay for 16 ounces of this candy. Set up a proportion based on what is given in the problem:

$$\frac{5 \text{ oz}}{\$1.50} = \frac{16 \text{ oz}}{x}$$

Now, solve for $x$, which would be the price of 16 ounces of candy:

$$\begin{aligned} 5x &= 16(\$1.50) \\ 5x &= \$24 \\ x &= \$4.80 \end{aligned}$$

---

**71.** (**B**) A ratio of 3:2 means that in any group of

5 people, 3 are women and 2 are men.

Thus, $\frac{3}{3+2}$ or $\frac{3}{5}$ are women. $\frac{3}{5} = \frac{6}{10} = 60\%$.

---

**72.** (**H**) 75 is evenly divisible by 15, so 77 (i.e., 75 + 2) is the first integer that has a remainder of 2 when divided by 15. Add 15 to 77 (= 92) to get the next integer. Add 15 to 92 (= 107) to get the next integer. However, 107 is larger than 105, so only 2 integers (77 and 92) satisfy the conditions, and the correct answer is H.

**73.** (**B**) Solve the equation:

$$\begin{aligned} \frac{2(x+1)}{3} &= 1 \\ 2x + 2 &= 3 \\ x &= \frac{1}{2} \end{aligned}$$

---

**74.** (**G**) After the initial \$2.00 charge, the cost per mile is $\$0.30 \times 5 = \$1.50$. Let $x$ equal the number of miles ridden for a \$20 fare, and set up an equation for the total cost of the taxi ride:

$$\begin{aligned} \$2.00 + \$1.50x &= \$20.00 \\ \$1.50x &= \$18.00 \\ x &= 12 \text{ miles} \end{aligned}$$

---

**75.** (**B**) First, calculate the location of point J using the location of point K and the given length of JK:

$$\frac{3}{8} - 3\frac{1}{2} = {}^{-}3\frac{1}{8}$$

Now, use the location of point J to calculate the location of point M using the length of JM:

$${}^{-}3\frac{1}{8} + 9\frac{3}{4} = 6\frac{5}{8}$$

Finally, use the location of point M to calculate the location of point L using the length of LM:

$$6\frac{5}{8} - 1\frac{1}{8} = 5\frac{1}{2}$$

---

**76.** (**G**) Shelby paid 40% on the first day of the month and 25% on the tenth day. That means she owes a total of 35% on the twentieth day (100% − 40% − 25% = 35%).

$$\$800 \times 0.35 = \$280$$

Another way to solve this problem is to calculate what Shelby paid on each day and subtract that from the total amount due:

First day: $\$800 \times 0.40 = \$320$
Tenth day: $\$800 \times 0.25 = \$200$
Twentieth day: $\$800 - \$320 - \$200 = \$280$

---

**77.** (**D**) Substitute ${}^{-}2$ for $x$ and 3 for $y$, and simplify the expression:

$$\begin{aligned} & 5x - 2xy \\ & 5({}^{-}2) - 2({}^{-}2)(3) \\ & {}^{-}10 - ({}^{-}12) \\ & {}^{-}10 + 12 \\ & 2 \end{aligned}$$

**78.** (**F**) Because both triangles are right triangles that share a vertex, they are similar. To find $x$, set up a proportion using the two known sides of each triangle:

$$\frac{(4 + x)}{1.0} = \frac{4}{0.8}$$

$$0.8\,(4 + x) = 1.0\,(4)$$

$$4 + x = 5$$

$$x = 1$$

---

**79.** (**E**) Start by setting up an equation for each comparison mentioned in the problem:

**Equation 1:** $s = 4l$
**Equation 2:** $2p = 5d$
**Equation 3:** $3h = p$
**Equation 4:** $5s = 2h$

Now, assign a value to one variable and solve for the others:

Let $l = 1$
So, using Equation 1: $s = 4 \bullet 1 = 4$

Then, use Equation 4: $5 \bullet 4 = 2h$
$10 = h$

Then, use Equation 3: $3 \bullet 10 = p$
$30 = p$

Finally, use Equation 2: $2 \bullet 30 = 5d$
$12 = d$

Now that the values of all 5 coins are known, the coin with the greatest value is plunk (30).

---

**80.** (**H**) Raoul is now R years old, and Phil is 8 years older:

$$P = R + 8$$

Two years from now, Phil will be twice as old as Raoul:

$$(P + 2) = 2(R + 2)$$

By substitution,

$$[(R + 8) + 2] = 2\,(R + 2)$$
$$R + 10 = 2R + 4$$
$$6 = R$$

Raoul is currently 6 years old.

---

**81.** (**D**) First, calculate the area we need to paint:

2 walls each measuring 12 ft by 9 ft
$= 2 \times 12 \times 9 = 216$ sq ft

2 walls each measuring 10 ft by 9 ft
$= 2 \times 10 \times 9 = 180$ sq ft

Total area $= 216 + 180 = 396$ sq ft

1 qt covers 100 sq ft, so divide the total square feet by 100 to find the number of quarts needed:

$\frac{396}{100} = 3.96$ qt

Since we cannot buy a partial can of paint, we need to round up. The answer is 4 quarts.

---

**82.** (**G**) Rearrange the equation so that $nm$ is on one side:

$$60 = 24nm$$

$$2.5 = nm$$

---

**83.** (**C**) Find the multiples of 7 and multiples of 5, add the remainders to each multiple, and look for the first number to appear in both lists:

| | | | | | |
|---|---|---|---|---|---|
| Multiples of 7: | 7 | 14 | 21 | 28 | 35 … |
| Add 3 to each: | 10 | 17 | 24 | 31 | 38 … |

| | | | | | |
|---|---|---|---|---|---|
| Multiples of 5: | 5 | 10 | 15 | 20 | 25 … |
| Add 2 to each: | 7 | 12 | 17 | 22 | 27 … |

17 is the first number to appear in both sequences, so it is the least possible value to meet the conditions.

An alternative way to solve this problem is to test each answer option to see which one fits the criteria.

---

**84.** (**H**) The question states that the mean of 4 of the numbers is 50. To solve this problem, we can assume that the value of each of those 4 numbers is 50.

Now, let $x$ equal the mean of the other 16 numbers. Set up an equation using the mean of all 20 numbers to find the value of $x$:

$$\frac{4(50) + 16x}{20} = 42$$

$$200 + 16x = 840$$

$$16x = 640$$

$$x = 40$$

**85.** (**D**) For $x$, determine the perfect square that lies between 50 and 65. $8^2 = 64$, so $x = 8$. For $y$, find the perfect square that lies between 17 and 32. $5^2 = 25$, so $y = 5$. Then multiply $x$ and $y$:

$$8 \times 5 = 40$$

To quickly solve problems like this, it is important to know the perfect squares at least through $12^2 = 144$.

---

**86.** (**J**) Twenty-five percent of the sample of 2,000 homes is 500 homes. The first year in which at least 500 homes had DVRs was 2006, which is Option J.

---

**87.** (**B**) We know that 300 dollars = 192 nobles. To figure out how many nobles are equal to 1 dollar, divide each side of the equation by 300:

$$300 \text{ dollars} \div 300 = 192 \text{ nobles} \div 300$$

$$1 \text{ dollar} = \frac{192}{300} \text{ nobles} = \frac{16}{25} \text{ nobles}$$

---

**88.** (**G**) First, change both fractions into mixed numbers:

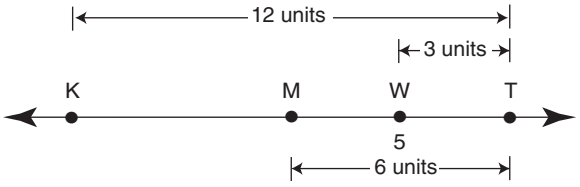
$$\frac{28}{3} = 9\frac{1}{3}$$

$$\frac{83}{5} = 16\frac{3}{5}$$

The positive integers between these mixed numbers are 10, 11, 12, 13, 14, 15, and 16. So the answer is 7.

---

**89.** (**C**) We know that KT = 12 units and M is the midpoint of $\overline{KT}$, so MT = 6 units. We know that W is the midpoint of $\overline{MT}$, so WT = 3 units.




If we assume that K is smaller than T, then K must be to the left on the number line and T must be to the right. Since we know that W is at 5 on the number line, T must be at 8 because WT = 3 units, and M must be at 2, since MW = 3 units.

Given that KT = 12, and T is at 8 on the number line, then K must be at $^-4$.

Finally, we need to find the midpoint of $\overline{KW}$:

$$\frac{^-4 + 5}{2} = \frac{1}{2} = 0.5$$

Note: The question asks for "a possible midpoint" of $\overline{KW}$ because there is no information about whether K is smaller than T, or T is smaller than K. In the explanation above, we assumed that K is smaller than T. If we assume T is smaller than K, we would get a different answer for the midpoint of $\overline{KW}$ (9.5), which is not among the answer options.

---

**90.** (**H**) First, calculate what $t$ is when the two planes are equal distances from the airport. Set the two distances equal to each other and solve for $t$:

$$310 - 2t = 3t + 235$$
$$^-5t = ^-75$$
$$t = 15$$

The question asks "what is the difference between their altitudes?" To answer this, we need to subtract the two altitudes:

$(32{,}800 - 20t) - (31{,}600 + 40t)$
$= 32{,}800 - 20t - 31{,}600 - 40t$
$= 1{,}200 - 60t$

Now, substitute the value of $t$ into the expression:

$= 1{,}200 - 60(15)$
$= 1{,}200 - 900$
$= 300$ ft

---

**91.** (**C**) Since $A_k = \frac{1}{k}$, then $A_1 = \frac{1}{1}$, $A_2 = \frac{1}{2}$, and so on.

$A_1A_2 + A_2A_3 + A_3A_4 + A_4A_5 + A_5A_6$

$= \frac{1}{1}\times\frac{1}{2} + \frac{1}{2}\times\frac{1}{3} + \frac{1}{3}\times\frac{1}{4} + \frac{1}{4}\times\frac{1}{5} + \frac{1}{5}\times\frac{1}{6}$

$= \frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30}$

$= \frac{30 + 10 + 5 + 3 + 2}{60}$

$= \frac{50}{60}$

$= \frac{5}{6}$

**92.** (**G**) There are two extreme values for the number of drivers who both wear glasses and are over age 30. (There are many more values between the extremes, but this explanation focuses on the largest and smallest.)

**Value 1:** If the 10,000 who do **not** wear glasses (50,000 − 40,000) are all 30 years old or less, that means that all 30,000 of the drivers over 30 must wear glasses.

**Value 2:** If the 10,000 who do **not** wear glasses are all over 30, that means that 20,000 of the drivers over 30 (30,000 − 10,000) must wear glasses.

Of those two values, 20,000 is smaller than 30,000, so the answer is 20,000.

---

**93.** (**B**) First, find the new volume ($V_2$) associated with the changes described in the question (dividing $r$ by 2 and doubling $h$):

$$V_2 = \frac{1}{3}\pi\left(\frac{r}{2}\right)^2(2h) = \frac{1}{3}\pi\left(\frac{r^2}{4}\right)(2h) = \frac{1}{6}\pi r^2 h$$

Now, calculate the ratio between $V_2$ and the original V:

$V_2 : V$

$$\frac{1}{6}\pi r^2 h : \frac{1}{3}\pi r^2 h$$

Cancel out the like terms:

$$\frac{1}{6} : \frac{1}{3}$$

Finally, multiply both sides by 6 to get rid of the fractions:
1:2

---

**94.** (**G**) Evaluate each option to determine which expression **must** be positive. Options F and H must be negative, and Options J and K could be either positive or negative. Only Option G **must** be positive, because the addition of a positive number ($z$) and the square of any number ($w^2$) will always be positive.

An alternate way to solve this problem is to assign values to each variable (e.g., $w = -1$ and $z = 1$), and test each answer option.

**95.** (**D**) The integer values of $x$ we need to consider are 0, 1, 2, 3, 4, and 5. Plug each of these values into the expression to see whether the result is an integer:

$x = 0$ $\quad \frac{2x+5}{x-2} = -\frac{5}{2}$, which is not an integer.

$x = 1$ $\quad \frac{2x+5}{x-2} = \frac{-7}{1} = -7$, which *is* an integer.

$x = 2$ $\quad \frac{2x+5}{x-2} = \frac{9}{0}$, which is not an integer.

$x = 3$ $\quad \frac{2x+5}{x-2} = \frac{11}{1} = 11$, which *is* an integer.

$x = 4$ $\quad \frac{2x+5}{x-2} = \frac{13}{2}$, which is not an integer.

$x = 5$ $\quad \frac{2x+5}{x-2} = \frac{15}{3} = 5$, which *is* an integer.

Thus, there are 3 integer values of $x$ (1, 3, and 5) that make the expression an integer.

---

**96.** (**K**) First, calculate the midpoint of the first line segment whose points are given:

Midpoint of $x$-value: $\frac{6+12}{2} = \frac{18}{2} = 9$

Midpoint of $y$-value: $\frac{8+10}{2} = \frac{18}{2} = 9$

So, the midpoint of the first line segment is (9, 9).

Now, use that information to find $x$. Set up the midpoint formula for the $x$-value of the second line segment using the two given points:

$$\frac{8+x}{2} = 9$$

$$8 + x = 18$$

$$x = 10$$

---

**97.** (**C**) We know that $p$ is a positive even integer less than 11, so the options for $p$ are 2, 4, 6, 8, or 10. The options for $p^2$ are then 4, 16, 36, 64, or 100.

You could check the GCF for each pair ($p^2$, 81), but there is a quicker way to solve this.

We know that $81 = 3 \times 3 \times 3 \times 3$; therefore, the correct $p^2$ option must be divisible by 3. Only $p^2 = 36$ is divisible by 3, so $p = 6$ must be the solution.

**98.** (**G**) The formula to calculate the measure of an interior angle of a polygon is $\frac{180(n-2)}{n}$, where $n$ = the number of sides of the polygon. To solve this problem, substitute $n = 12$ (the number of sides given):

$$\frac{180(12-2)}{12} = \frac{180(10)}{12} = 150^\circ$$

---

**99.** (**D**) Use the mean of $w, x, y$, and $z$ to solve for $w$:

$$\frac{w+x+y+z}{4} = 60$$

$$w + x + y + z = 240$$

$$w = 240 - x - y - z$$

Similarly, use the mean of $v, x, y$, and $z$ to solve for $v$:

$$\frac{v+x+y+z}{4} = 62$$

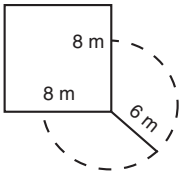
$$v + x + y + z = 248$$

$$v = 248 - x - y - z$$

Now, you can solve $v - w$:

$$\begin{aligned} v - w &= (248 - x - y - z) - (240 - x - y - z) \\ &= 248 - 240 \\ &= 8 \end{aligned}$$

**100.** (**H**) It may be helpful to draw a diagram of the shed and the grazing area.




(Notice that the lengths of the sides of the shed are not important to the solution of the problem, except to prevent the goat from walking around a corner.) The resulting grazing area is a circle with radius 6 meters, minus the area of the circle taken by the shed. The shed is square so all of its corners are right angles. Thus the grazing area is $\frac{3}{4}$ of the area of the circle. The area of a circle is $\pi r^2$.

$$\begin{aligned} \text{Grazing area} &= \frac{3}{4}\pi 6^2 \\ &= \frac{3}{4}\pi (36) \\ &= 27\pi \text{ sq m} \end{aligned}$$

## Answer Key for Sample Form A

Paragraph 1
R U Q S T

Paragraph 2
T R Q S U

Paragraph 3
U T R Q S

Paragraph 4
S U R Q T

Paragraph 5
S U T Q R

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11. B | 21. E | 31. B | 41. E | 51. A | 61. D | 71. B | 81. D | 91. C |
| 12. K | 22. G | 32. F | 42. H | 52. J | 62. K | 72. H | 82. G | 92. G |
| 13. D | 23. C | 33. C | 43. E | 53. A | 63. C | 73. B | 83. C | 93. B |
| 14. F | 24. F | 34. F | 44. F | 54. K | 64. K | 74. G | 84. H | 94. G |
| 15. E | 25. A | 35. C | 45. E | 55. B | 65. D | 75. B | 85. D | 95. D |
| 16. J | 26. K | 36. F | 46. F | 56. H | 66. H | 76. G | 86. J | 96. K |
| 17. C | 27. D | 37. B | 47. B | 57. B | 67. D | 77. D | 87. B | 97. C |
| 18. H | 28. H | 38. K | 48. G | 58. H | 68. F | 78. F | 88. G | 98. G |
| 19. A | 29. B | 39. D | 49. C | 59. E | 69. D | 79. E | 89. C | 99. D |
| 20. H | 30. J | 40. G | 50. F | 60. G | 70. K | 80. H | 90. H | 100. H |

# NEW YORK CITY PUBLIC SCHOOLS

USE A PENCIL ONLY

SIDE 2

2012 SPECIALIZED HIGH SCHOOLS ADMISSIONS TEST

## GRADE 8

Test Booklet Letter  Test Booklet Number

Student's First Name (please print)  Student's Last Name (please print)

Student's Home Address  Apartment  Borough  ZIP Code  ( ) – Home Telephone Number

## PART 1 VERBAL

### SCRAMBLED PARAGRAPHS

**Paragraph 1**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

**Paragraph 2**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

**Paragraph 3**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

**Paragraph 4**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

**Paragraph 5**

| | | | | | |
|---|---|---|---|---|---|
| The second sentence is | Q | R | S | T | U |
| The third sentence is | Q | R | S | T | U |
| The fourth sentence is | Q | R | S | T | U |
| The fifth sentence is | Q | R | S | T | U |
| The sixth sentence is | Q | R | S | T | U |

### LOGICAL REASONING

| | | | | | |
|---|---|---|---|---|---|
| 11 | A | B | C | D | E |
| 12 | F | G | H | J | K |
| 13 | A | B | C | D | E |
| 14 | F | G | H | J | K |
| 15 | A | B | C | D | E |
| 16 | F | G | H | J | K |
| 17 | A | B | C | D | E |
| 18 | F | G | H | J | K |
| 19 | A | B | C | D | E |
| 20 | F | G | H | J | K |

### READING

| | | | | | |
|---|---|---|---|---|---|
| 21 | A | B | C | D | E |
| 22 | F | G | H | J | K |
| 23 | A | B | C | D | E |
| 24 | F | G | H | J | K |
| 25 | A | B | C | D | E |
| 26 | F | G | H | J | K |
| 27 | A | B | C | D | E |
| 28 | F | G | H | J | K |
| 29 | A | B | C | D | E |
| 30 | F | G | H | J | K |
| 31 | A | B | C | D | E |
| 32 | F | G | H | J | K |
| 33 | A | B | C | D | E |
| 34 | F | G | H | J | K |
| 35 | A | B | C | D | E |
| 36 | F | G | H | J | K |
| 37 | A | B | C | D | E |
| 38 | F | G | H | J | K |
| 39 | A | B | C | D | E |
| 40 | F | G | H | J | K |
| 41 | A | B | C | D | E |
| 42 | F | G | H | J | K |
| 43 | A | B | C | D | E |
| 44 | F | G | H | J | K |
| 45 | A | B | C | D | E |
| 46 | F | G | H | J | K |
| 47 | A | B | C | D | E |
| 48 | F | G | H | J | K |
| 49 | A | B | C | D | E |
| 50 | F | G | H | J | K |

## PART 2 MATHEMATICS

### MATHEMATICS PROBLEMS

| | | | | | |
|---|---|---|---|---|---|
| 51 | A | B | C | D | E |
| 52 | F | G | H | J | K |
| 53 | A | B | C | D | E |
| 54 | F | G | H | J | K |
| 55 | A | B | C | D | E |
| 56 | F | G | H | J | K |
| 57 | A | B | C | D | E |
| 58 | F | G | H | J | K |
| 59 | A | B | C | D | E |
| 60 | F | G | H | J | K |
| 61 | A | B | C | D | E |
| 62 | F | G | H | J | K |
| 63 | A | B | C | D | E |
| 64 | F | G | H | J | K |
| 65 | A | B | C | D | E |
| 66 | F | G | H | J | K |
| 67 | A | B | C | D | E |
| 68 | F | G | H | J | K |
| 69 | A | B | C | D | E |
| 70 | F | G | H | J | K |
| 71 | A | B | C | D | E |
| 72 | F | G | H | J | K |
| 73 | A | B | C | D | E |
| 74 | F | G | H | J | K |
| 75 | A | B | C | D | E |
| 76 | F | G | H | J | K |
| 77 | A | B | C | D | E |
| 78 | F | G | H | J | K |
| 79 | A | B | C | D | E |
| 80 | F | G | H | J | K |
| 81 | A | B | C | D | E |
| 82 | F | G | H | J | K |
| 83 | A | B | C | D | E |
| 84 | F | G | H | J | K |
| 85 | A | B | C | D | E |
| 86 | F | G | H | J | K |
| 87 | A | B | C | D | E |
| 88 | F | G | H | J | K |
| 89 | A | B | C | D | E |
| 90 | F | G | H | J | K |
| 91 | A | B | C | D | E |
| 92 | F | G | H | J | K |
| 93 | A | B | C | D | E |
| 94 | F | G | H | J | K |
| 95 | A | B | C | D | E |
| 96 | F | G | H | J | K |
| 97 | A | B | C | D | E |
| 98 | F | G | H | J | K |
| 99 | A | B | C | D | E |
| 100 | F | G | H | J | K |

# PART 2 — MATHEMATICS

*Suggested Time — 75 Minutes*

50 QUESTIONS

## GENERAL INSTRUCTIONS

Solve each problem. Select the **best** answer from the choices given. Mark the letter of your answer on the answer sheet. You can do your figuring in the test booklet or on paper provided by the proctor. **DO NOT MAKE ANY MARKS ON YOUR ANSWER SHEET OTHER THAN FILLING IN YOUR ANSWER CHOICES.**

**IMPORTANT NOTES:**

(1) Formulas and definitions of mathematical terms and symbols are **not** provided.

(2) Diagrams other than graphs are **not** necessarily drawn to scale. Do not assume any relationship in a diagram unless it is specifically stated or can be figured out from the information given.

(3) Assume that a diagram is in one plane unless the problem specifically states that it is not.

(4) Graphs are drawn to scale. Unless stated otherwise, you can assume relationships according to appearance. For example, (on a graph) lines that appear to be parallel can be assumed to be parallel; likewise for concurrent lines, straight lines, collinear points, right angles, etc.

(5) Reduce all fractions to lowest terms.

**51.** $3.6 \div \frac{2}{3} =$

**A.** 2.4
**B.** 5.4
**C.** 6
**D.** 9
**E.** 54

**52.** $^{-}2x(3y - 4z) =$

**F.** $^{-}6xy - 8xz$
**G.** $^{-}6xy + 8xz$
**H.** $^{-}6xy - 4z$
**J.** $2xyz$
**K.** $24xyz$

**53.** Maria is now 16 years old. In 6 years, she will be twice as old as her brother is then. How old is her brother now?

**A.** 5
**B.** 6
**C.** 8
**D.** 11
**E.** 12

CONTINUE ON TO THE NEXT PAGE ▶

**54.** 6.44 + 6.46

Consider the following two methods to estimate the sum above:

Method I: Round each number to the nearest tenth, then add.

Method II: Round each number to the nearest whole number, then add.

By how much would the result of Method I be **greater** than the result of Method II?

**F.** 0
**G.** 0.1
**H.** 0.9
**J.** 1
**K.** 12.9

**55.** If M and T are odd numbers, and M is a multiple of T, which of the following **must** be true?

**A.** M + T is odd.
**B.** MT is even.
**C.** M − T is odd.
**D.** M ÷ T is even.
**E.** M ÷ T is odd.

**56.** The scale on a map is 1 inch = 10 miles. What is the distance, in inches, on the map between two towns that are $m$ miles apart?

**F.** $\frac{m}{10}$

**G.** $\frac{m}{5}$

**H.** $5m$

**J.** $10m$

**K.** $m + 10$

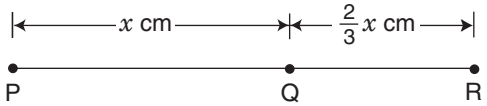
**57.** There are 1,650 registered voters in Centerville. Of these, $\frac{1}{3}$ were born between 1950 and 1979, inclusive. How many of the registered voters were born either **before** 1950 or **after** 1979?

**A.** 550
**B.** 660
**C.** 825
**D.** 990
**E.** 1,100

**58.** Tien is making 5-letter security codes using only the letters M, N, P, Q, and R. She arranges the letters in a different order for each code, using every letter exactly once within each code. How many different codes can she make?

**F.** 1
**G.** 5
**H.** 15
**J.** 120
**K.** 3,125

**59.**




Point Q is on line segment $\overline{PR}$. If PQ = 9 centimeters, how long is $\overline{PR}$?

**A.** 6 cm

**B.** 12 cm

**C.** $13\frac{1}{2}$ cm

**D.** 15 cm

**E.** 18 cm

CONTINUE ON TO THE NEXT PAGE ▶

**60.**

2004 SCHOOL DATA

| | Average Number of Students per Teacher | Number of Classroom Teachers | Spending per Student |
|---|---|---|---|
| Alaska | 17.2 | 7,800 | $10,000 |
| Colorado | 16.9 | 45,000 | $7,600 |
| Dist. of Columbia | 13.8 | 5,500 | $11,200 |
| Hawaii | 16.5 | 11,000 | $8,400 |
| Indiana | 16.9 | 60,000 | $8,000 |
| Montana | 14.4 | 10,300 | $7,600 |

Of the six locations listed above, what is the median spending per student?

**F.** $7,600
**G.** $8,000
**H.** $8,200
**J.** $8,800
**K.** $9,800

**61.** How much greater than 1.095 is the value obtained by rounding 1.095 to the nearest tenth?

**A.** 0.005
**B.** 0.5
**C.** 1.005
**D.** 1.1
**E.** 5

**62.**

MEAN ELEVATION OF CONTINENTS

| Continent | Mean Elevation |
|---|---|
| North America | 2,000 ft |
| South America | 1,800 ft |
| Europe | 980 ft |
| Asia | 3,000 ft |
| Africa | 1,900 ft |
| Oceania | 1,000 ft |
| Antarctica | 6,000 ft |

After each elevation above is rounded to the nearest thousand feet, what is the **mode** elevation?

**F.** 1,000 ft
**G.** 2,000 ft
**H.** 3,000 ft
**J.** 6,000 ft
**K.** 17,000 ft

**63.** A 24-foot-long pole is cut in half. One of these pieces is cut in half again. Finally, one of the shorter pieces is cut into thirds. Of these 5 cut pieces, what is the difference in length between the longest piece and **one** of the 3 shortest pieces?

**A.** 2 ft
**B.** 6 ft
**C.** 10 ft
**D.** 12 ft
**E.** 22 ft

**64.** 12, 10, 2, 8, $^{-}6$, 14, ____, ...

In the sequence above, each number (except the first two) is the difference between the two previous numbers. What is the seventh number in this sequence?

**F.** $^{-}20$
**G.** $^{-}8$
**H.** 4
**J.** 8
**K.** 20

**65.** What is the value of $\left|\frac{1}{16}\right| \cdot |16| + |^{-}16| + |16|$?

**A.** 1
**B.** 3
**C.** $16\frac{1}{16}$
**D.** 33
**E.** 768

**66.** The ratio of Bettina's height to her sister's height is 7:6. If Bettina is 140 centimeters tall, how much taller is Bettina than her sister?

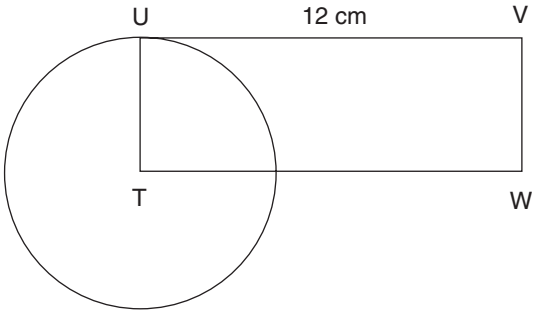
**F.** 6 cm
**G.** 10 cm
**H.** 13 cm
**J.** 20 cm
**K.** 120 cm

CONTINUE ON TO THE NEXT PAGE ▶

**67.** What is the greatest prime factor of 210?

**A.** 5
**B.** 7
**C.** 10
**D.** 21
**E.** 105

**68.**




In the diagram above, T is the center of the circle, the circumference of which is $8\pi$ centimeters. Point U is on the circle. What is the area of rectangle TUVW?

**F.** 24 sq cm
**G.** 36 sq cm
**H.** 40 sq cm
**J.** 48 sq cm
**K.** 96 sq cm

**69.** What is the greatest common factor of 459 and 567?

**A.** 3
**B.** 9
**C.** 17
**D.** 27
**E.** 51

**70.** Which statement is true?

**F.** All equilateral triangles are congruent.
**G.** All equilateral triangles are similar.
**H.** All rectangles are congruent.
**J.** All rectangles are similar.
**K.** All squares are congruent.

**71.** The sales of hot drinks are roughly a linear function of outdoor temperature. If a vendor sells 200 cups when the outdoor temperature is 70°, and 440 cups when the outdoor temperature is 50°, how many cups can the vendor expect to sell if the outdoor temperature is 55°?

**A.** 260
**B.** 380
**C.** 435
**D.** 500
**E.** 520

**72.** A certain type of bamboo blooms for 1 week once every 17 years. This type of bamboo bloomed in 1807. How many times did it bloom between 1820 and 2011, inclusive?

**F.** 5
**G.** 6
**H.** 10
**J.** 11
**K.** 12

**73.** $\dfrac{(^-1)^2 + (^-2)^3 + (^-3)^4}{(^-1)^4 + (^-2)^3 + (^-3)^2} =$

**A.** 0
**B.** 1
**C.** 5
**D.** 9
**E.** 37

**74.** Survey results indicate that between 70% and 80% of high school students have their own cell phones. If these results apply to a high school of 900 students, what is the maximum number of students who do **not** own cell phones?

**F.** 180
**G.** 270
**H.** 370
**J.** 720
**K.** 828

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**75.** If Seung is now $y$ years old and Jackson is 3 years older than Seung, what was Jackson's age 8 years ago?

**A.** $y - 11$
**B.** $y - 3$
**C.** $y - 5$
**D.** $y + 11$
**E.** $3y - 8$

**76.** On a number line, what is the midpoint of a line segment beginning at $^{-}2$ and ending at $\frac{2}{5}$?

**F.** $-\frac{7}{10}$
**G.** $-\frac{4}{5}$
**H.** $-\frac{1}{5}$
**J.** 0
**K.** $1\frac{1}{5}$

**77.** Yan has 48 coins, consisting of a mix of nickels and dimes. The total value of these 48 coins is \$3.90. How many more dimes than nickels does Yan have?

**A.** 10
**B.** 12
**C.** 18
**D.** 22
**E.** 30

**78.** If the side of a square and the diameter of a circle are equal in length, what is the ratio of the perimeter of the square to the circumference of the circle?

**F.** $\frac{1}{1}$
**G.** $\frac{\pi}{2}$
**H.** $\frac{2}{\pi}$
**J.** $\frac{\pi}{4}$
**K.** $\frac{4}{\pi}$

**79.** A used car is sold for \$5,000. The buyer pays \$400 for the down payment. What fraction of the sale price is the down payment?

**A.** 0.0125
**B.** 0.08
**C.** 0.125
**D.** 0.4
**E.** 0.8

**80.** A particular type of plastic weighs 0.035 ounces per cubic inch. What is the weight of a stack of 50 rectangular sheets of this plastic if the stack measures 5 inches by 10 inches by 20 inches?

**F.** 0.000035 oz
**G.** 0.7 oz
**H.** 3.5 oz
**J.** 35 oz
**K.** 1,750 oz

**81.** A painter needs to paint a circular region with a radius of 3 feet. The painter has only enough paint to cover 25 square feet. About how many square feet of the region **cannot** be painted?

**A.** 2.7 sq ft
**B.** 3.3 sq ft
**C.** 6.2 sq ft
**D.** 18.8 sq ft
**E.** 28.3 sq ft

**82.** Gloria receives a 15% commission on her sales. For the last three-month period, Gloria received a commission of \$12,000. What were her sales for this period?

**F.** \$13,800
**G.** \$68,000
**H.** \$80,000
**J.** \$92,000
**K.** \$800,000

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**83.**

| $x$ | $y$ |
|---|---|
| 1 | $^{-}a - \frac{b}{2}$ |
| 2 | $-\frac{b}{3}$ |
| 3 | $a - \frac{b}{4}$ |
| 4 | $2a - \frac{b}{5}$ |

Based on the table above, which of the following best represents the value of $y$ when $x = 0$?

**A.** $^{-}2a - b$

**B.** $^{-}b$

**C.** $-\frac{a}{2}$

**D.** $^{-}2a$

**E.** $-\frac{a}{2} - b$

**84.** Daquan sold $x$ hot dogs. Caitlyn and Daquan together sold $5x - 2$ hot dogs. In terms of $x$, how many hot dogs did Caitlyn sell?

**F.** $\frac{x}{5} - 2$

**G.** $5x - 1$

**H.** $6x - 2$

**J.** $4x + 2$

**K.** $4x - 2$

**85.** For house sales, a certain real estate agent charges a commission of 3% of the house price for prices less than \$200,000, and 2.5% of the house price for prices of \$200,000 or more. How many more dollars does the agent earn on a price of \$199,000 than on a price of \$201,000?

**A.** \$94.50
**B.** \$945
**C.** \$1,000
**D.** \$1,055
**E.** \$2,000

**86.** $r = 3m = 4n = 10p$

If $m$, $n$, and $p$ are positive integers, what is the **least** possible value of $r$?

**F.** 1
**G.** 10
**H.** 17
**J.** 60
**K.** 120

**87.** In the set of all integers from 4 to 81, inclusive, how many are multiples of 2 or 7 or both?

**A.** 34
**B.** 39
**C.** 45
**D.** 50
**E.** 55

**88.** If $\frac{3t - s}{4} = 8s$, what is the value of $s$ in terms of $t$?

**F.** $\frac{t}{2}$

**G.** $\frac{t}{3}$

**H.** $\frac{t}{4}$

**J.** $\frac{t}{7}$

**K.** $\frac{t}{11}$

**89.** Simplify the expression

$r\left[s\left(\frac{r+s}{r-s}\right)\left(\frac{r-s}{r+s}\right)\right]$, where $r \neq s$ and $r \neq {}^{-}s$.

**A.** $rs$
**B.** $s$
**C.** $rs(r + s)(r - s)$
**D.** $(r + s)(r - s)$
**E.** 1

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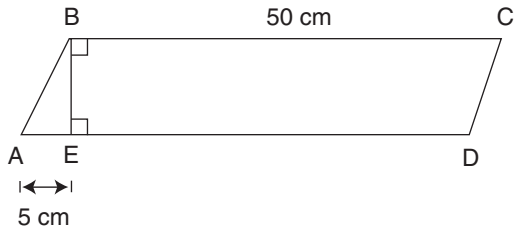
**90.** Between which two consecutive positive integers is $\sqrt{6^2 + 7^2}$?

**F.** 6 and 8
**G.** 8 and 9
**H.** 9 and 10
**J.** 12 and 14
**K.** 36 and 49

**91.**




What is the area of parallelogram ABCD if the area of triangle ABE is 25 square centimeters?

**A.** 140 sq cm
**B.** 150 sq cm
**C.** 250 sq cm
**D.** 500 sq cm
**E.** 550 sq cm

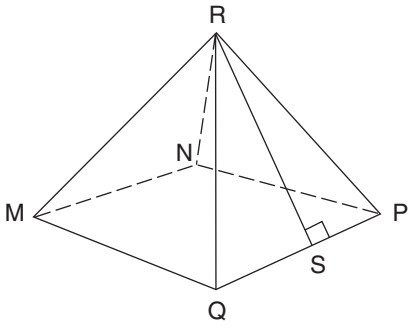
**92.** How many minutes are in 2.35 hours?

**F.** 133 min.
**G.** 138 min.
**H.** 140 min.
**J.** 141 min.
**K.** 155 min.

**93.** A group of potential voters was asked whether or not they were in favor of Proposition A and Proposition B on the ballot. Of this group, 65% were in favor of Proposition A, and 72% were in favor of Proposition B. If 3% of the total group were not in favor of either proposition, what percent were in favor of **both** propositions? (Assume that 100% of the group responded and there were no undecided voters.)

**A.** 25%
**B.** 28%
**C.** 32%
**D.** 35%
**E.** 40%

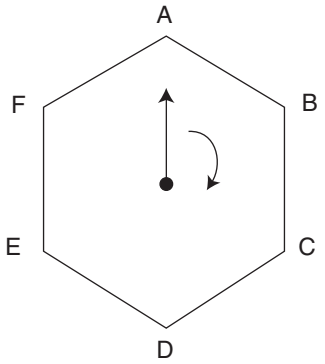
**94.**




For the pyramid above, each triangular face has the same area, and the base, MNPQ, is a square that is 8 centimeters on a side. If RS is 6 centimeters, what is the surface area of the pyramid, **excluding** the base?

**F.** 48 sq cm
**G.** 96 sq cm
**H.** 128 sq cm
**J.** 160 sq cm
**K.** 192 sq cm

**95.**




ABCDEF is a regular hexagon. The arrow in it rotates at a constant rate of 5 revolutions per minute. If the arrow points to A for the first time at 0 seconds as shown, how many **seconds** will elapse before the arrow points to B for the eleventh time?

**A.** 12 sec
**B.** 110 sec
**C.** 120 sec
**D.** 122 sec
**E.** 134 sec

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**96.** $(3m + 2n) - (2m - 3n) + k = 0$

For any value of $m$ and $n$, what is the value of $k$ in the equation above?

**F.** $^{-}m - 5n$
**G.** $^{-}m + n$
**H.** 0
**J.** 1
**K.** $m + 5n$

**97.**

| Position | Even integer |
|---|---|
| 1 | 0 |
| 2 | 2 |
| 3 | 4 |
| 4 | 6 |
| ⋮ | ⋮ |
| 500 | $x$ |

The beginning of a list of even integers is shown in the table above. What will the 500th number on the list be?

**A.** 500
**B.** 994
**C.** 996
**D.** 998
**E.** 1,000

**98.** Firefighters sprayed a 9-**inch**-thick layer of foam over a burning rectangular region 10 yards wide and 50 yards long. What volume of foam was used on the fire?

**F.** 55 cu yd
**G.** 125 cu yd
**H.** 250 cu yd
**J.** 450 cu yd
**K.** 4,500 cu yd

**99.** 5, 6, 7, 8, 9

If $\frac{x + 7}{x - 7}$ is a whole number, how many of the numbers listed above **cannot** be a value of $x$?

**A.** 0
**B.** 1
**C.** 2
**D.** 3
**E.** 4

**100.** SCORES ON BIOLOGY TEST

| Section | Lowest Score | Range |
|---|---|---|
| I | 65 | 28 |
| II | 62 | 25 |
| III | 67 | 22 |

Mr. Blake's biology class is divided into three sections. The same test was given to each section. The table above shows both the lowest score and the range of scores on this test for each section. What is the **overall** range of all scores in all three sections?

**F.** 25
**G.** 27
**H.** 28
**J.** 31
**K.** 34

THIS IS THE END OF THE TEST. IF TIME REMAINS, YOU MAY CHECK YOUR ANSWERS TO PART 2 AND PART 1. BE SURE THAT THERE ARE NO STRAY MARKS, PARTIALLY FILLED ANSWER CIRCLES, OR INCOMPLETE ERASURES ON YOUR ANSWER SHEET. ■

**51.** (**B**) Convert the mixed number 3.6 to its fractional equivalent, $3\frac{6}{10}$. Then change it to an improper fraction, which is $\frac{36}{10}$. When dividing by a fraction, multiply the dividend by the reciprocal of the divisor.

$$\left(\frac{36}{10}\right)\left(\frac{3}{2}\right) = \frac{(36)(3)}{(10)(2)} = \frac{54}{10} = 5\frac{4}{10} = 5.4$$

---

**52.** (**G**) $$\begin{aligned} {}^{-}2x(3y - 4z) &= ({}^{-}2x)(3y) - ({}^{-}2x)(4z) \\ &= {}^{-}6xy + 8xz \end{aligned}$$

---

**53.** (**A**) If Maria is 16 now, in 6 years she will be 22. Since she will then (in 6 years) be twice as old as her brother, he will be 11 (in 6 years). To find his present age, subtract 6 from 11. Thus, he is now 5 years old.

---

**54.** (**H**) Method I: 6.44 rounds to 6.4 because the digit in the hundredths place (4) is less than 5. 6.46 rounds to 6.5 because the digit in the hundredths place (6) is 5 or greater.

$$6.4 + 6.5 = 12.9$$

Method II: Both 6.44 and 6.46 round to 6 because the number in the tenths place (4) is less than 5 for each of them.

$$6 + 6 = 12$$

To calculate by how much the results from Method I are greater than the results for Method II, you subtract:

$$12.9 - 12 = 0.9$$

**55.** (**E**) In these types of questions, it is sometimes easiest to assign values to the variables to test each possibility. We know that M and T are both odd, and M is a multiple of T. So, let's assign T = 3 and M = 5 • T = 15.

Option A says "M + T is odd." 15 + 3 = 18, which is even, so A is not true.

Option B says "MT is even." 15 × 3 = 45, which is odd, so B is not true.

Option C says "M – T is odd." 15 − 3 = 12, which is even, so C is not true.

Option D says "M ÷ T is even," and Option E says "M ÷ T is odd." Because these statements are opposites, one of them must be true. 15 ÷ 3 = 5, which is odd, so E is the correct answer.

As a shortcut, because options D and E are both division with opposite results, and only one can be true, you could test only these two options to determine which is correct.

---

**56.** (**F**) To solve this, let $x$ = the number of inches between the towns on the map.

First, set up a proportion, and then solve for $x$:

$$\frac{x \text{ inches}}{m \text{ miles}} = \frac{1 \text{ inch}}{10 \text{ miles}}$$

$$\frac{x}{m} = \frac{1}{10}$$

$$x = m \bullet \frac{1}{10} = \frac{m}{10}$$

---

**57.** (**E**) We know that $\frac{1}{3}$ of the 1,650 voters were born between 1950 and 1979, inclusive; therefore, $\frac{2}{3}$ of the voters were born either before 1950 or after 1979.

$$\frac{2}{3} \times 1{,}650 = 1{,}100$$

Alternatively, you could calculate the number of voters who were born between 1950 and 1979, inclusive, and then subtract that number from the total:

$$\frac{1}{3} \times 1{,}650 = 550$$

$$1{,}650 - 550 = 1{,}100$$

**58.** (**J**) The first letter in the code could be any of the 5 letter choices. Then the second letter in the code could be any of the 4 remaining choices. The third letter of the code could be any of the 3 remaining choices, and so on. The number of different codes Tien can make is:

$$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$$

---

**59.** (**D**) The question states that PQ = 9 cm, so we know $x = 9$. We can use that information to calculate the length of QR.

$$QR = \frac{2}{3}x = \frac{2}{3} \cdot 9 = 6 \text{ centimeters}$$

Add PQ and QR to get the length of PR.

$$PQ + QR = 9 + 6 = 15 \text{ centimeters}$$

---

**60.** (**H**) First, read the column headings to find the relevant one, "Spending per Student." To calculate the median spending per student, put the values in this column in order from least to greatest:

$7,600, $7,600, $8,000, $8,400, $10,000, $11,200

The median is the number at the exact center of a set of values. Since there are an even number of values in the above set, find the middle two values and calculate the mean of those to get the median of the set:

$(\$8{,}000 + \$8{,}400) \div 2 = \$8{,}200$

---

**61.** (**A**) First, round 1.095 to the nearest tenth, resulting in a value of 1.1. The question asks how much greater this rounded number is than 1.095, so you need to subtract:

$$1.1 - 1.095 = 0.005$$

**62.** (**G**) First, round the elevation of each continent to the nearest thousand feet, and then, because the mode is the most frequently occurring value, look for the elevation that appears most often.

**After rounding:**

North America = 2,000

South America = 2,000

Europe = 1,000

Asia = 3,000

Africa = 2,000

Oceania = 1,000

Antarctica = 6,000

The elevation 2,000 is listed most frequently (3 times), so the mode is 2,000 feet.

---

**63.** (**C**) The original 24-ft board is cut in half, resulting in two 12-ft pieces.

One of those 12-ft pieces is cut in half again, resulting in two 6-ft pieces.

One of the 6-ft pieces is cut into thirds, resulting in three 2-ft pieces.

The length of the longest piece is 12 feet, and the length of one of the shortest pieces is 2 feet. The difference is 12 – 2 = 10 feet.

---

**64.** (**F**) Each number in the sequence is the difference between the two previous numbers. For example, 12 – 10 = 2, so 2 is the third term.

To find the seventh term, subtract the sixth term from the fifth term:

$$^{-}6 - 14 = {}^{-}20$$

---

**65.** (**D**) $\left|\frac{1}{16}\right| \cdot |16| + |{}^{-}16| + |16|$

$$= \left(\frac{1}{16} \cdot 16\right) + 16 + 16$$

$$= 1 + 16 + 16$$

$$= 33$$

**66.** (**J**) Bettina's height is given as 140 cm. Let her sister's height be $x$. Set up a proportion to calculate the sister's height, and solve for $x$:

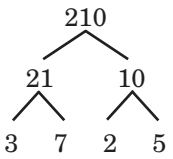
$$\frac{7}{6} = \frac{140}{x}$$
$$7x = 140(6)$$
$$7x = 840$$
$$x = 120 \text{ cm}$$

The question asks "how much taller is Bettina than her sister?" Subtract to find the answer:

$$140 - 120 = 20 \text{ cm}$$

---

**67.** (**B**) Factorize 210 into its prime factors:




The greatest prime factor is 7.

---

**68.** (**J**) Because point T is at the center of the circle and point U is on the circle, TU must be a radius ($r$) of the circle. We know the circumference of the circle is $8\pi$ cm. Therefore, we can use the formula for the circumference of a circle to calculate the length of TU.

$$\text{Circumference} = 2\pi r$$
$$8\pi \text{ cm} = 2\pi r \text{ cm}$$
$$4 \text{ cm} = r$$
$$\text{Thus, TU} = 4 \text{ cm.}$$

The formula for the area of a rectangle is length times width. The length of the rectangle (12 cm) is given in the diagram, and the width of the rectangle is TU (4 cm).

$$\text{Area} = (12 \text{ cm}) \times (4 \text{ cm}) = 48 \text{ sq cm}$$

---

**69.** (**D**) To find the greatest common factor, determine the prime factorization of each number first:

$$459 = 9 \times 51$$
$$= 3 \times 3 \times 3 \times 17$$

$$567 = 9 \times 63$$
$$= 9 \times 9 \times 7$$
$$= 3 \times 3 \times 3 \times 3 \times 7$$

Because $3 \times 3 \times 3$, or 27, is the largest number that divides evenly into both 459 and 567, 27 is their greatest common factor.

**70.** (**G**) Answer this question by evaluating each statement:

In order for two shapes to be **congruent**, they need to have the same angle measures and the same side lengths. Option F says "all equilateral triangles are congruent." All equilateral triangles have the same angle measures (60° for each angle), but the side lengths could be different (e.g., triangle A could have side lengths of 3 cm and triangle B could have side lengths of 7 cm). Thus, Option F is false.

By applying the same logic, Option H ("all rectangles are congruent") and Option K ("all squares are congruent") are also false. All rectangles and squares have the same angle measures (90° for each angle), but the side lengths could be different from one shape to the other.

Two shapes are **similar** when they have the same angle measures and the lengths of the corresponding sides of the two shapes are proportional. Option J is false because it is possible to have two rectangles whose side lengths are not proportional.

Option G ("all equilateral triangles are similar") is the only true statement. All sides of an equilateral triangle are the same length. So, the sides of two equilateral triangles would be proportional.

---

**71.** (**B**) A linear relationship (or function) means that a change in temperature is proportional to a change in the number of cups sold. So, we can start with the proportion showing the relationship between the change in the number of cups sold (440 – 200) and the change in the corresponding temperatures (50 – 70):

$$\frac{440 - 200}{50 - 70} = \frac{240}{-20} = -12$$

Thus, for every degree the temperature rises, the vendor can plan to sell 12 fewer hot drinks.

When the temperature was 50°, the vendor sold 440 hot drinks. When the temperature rises by 5° to 55°, he can expect to sell $5 \times 12 = 60$ fewer drinks than when the temperature was 50°. Subtract to find the total number of cups he can expect to sell at 55°: $440 - 60 = 380$ cups.

**72.** (**K**) The first time the bamboo blooms after 1820 is 1824 (1807 + 17). Keep adding 17 to your answer until you get to the year 2011:

1824, 1841, 1858, 1875, 1892, 1909, 1926, 1943, 1960, 1977, 1994, 2011

The answer is 12.

A quicker way to solve this is to find the first year the bamboo blooms within the given range of years (1824). Subtract that year from the final year (2011), and divide by 17 (the number of years between blooms):

$\frac{2011 - 1824}{17} = 11$ and $11 + 1 = 12$

Remember to add 1 to get 12 because both end points (1824 and 2011) need to be counted.

---

**73.** (**E**) In this kind of problem, first simplify the numerator and the denominator separately, and then reduce the fraction to lowest terms.

Numerator:
$(^{-}1)^2 + (^{-}2)^3 + (^{-}3)^4 = (1) + (^{-}8) + (81) = 74$

Denominator:
$(^{-}1)^4 + (^{-}2)^3 + (^{-}3)^2 = (1) + (^{-}8) + (9) = 2$

Now you can reduce the fraction:

$\frac{74}{2} = 37$

---

**74.** (**G**) If 70% to 80% of students own a cell phone, then 20% to 30% do **not** own a cell phone. Since we are looking for the maximum number of students who do **not** own a cell phone, calculate 30% of 900:

$900 \times 30\% = 270$ students

---

**75.** (**C**) Now:
Seung's age = $y$
Jackson's age = 3 years older than Seung = $3 + y$

Eight years ago:
Jackson's age = $(3 + y) - 8 = y - 5$

**76.** (**G**) To find the midpoint of a line segment, add the two endpoints together and then divide the sum by two:

$$\frac{\frac{2}{5} + {}^{-}2}{2} = \frac{\frac{2}{5} - \frac{10}{5}}{2} = \frac{-\frac{8}{5}}{2} = -\frac{4}{5}$$

---

**77.** (**B**) We are given the total number of coins (48). If the number of dimes is $x$, then the number of nickels is $48 - x$. A dime is represented as \$0.10, and a nickel as \$0.05. Now we can set up the problem:

$$\$0.10x + \$0.05(48 - x) = \$3.90$$

$$\$0.10x + \$2.40 - \$0.05x = \$3.90$$

$$\$0.05x = \$1.50$$

$$x = 30$$

Thus, there are 30 dimes and 18 nickels (48 – 30).

The question asks "how many more dimes than nickels?" Subtract to find the answer:

$30 - 18 = 12$

---

**78.** (**K**) Because we know that the side of the square is equal in length to the diameter of the circle, we can set the value for both the side of the square and diameter of the circle to $x$.

Perimeter of the square = 4 × side length = $4x$
Circumference of the circle = diameter × $\pi = x\pi$

Use these values to determine the ratio of the perimeter of the square to the circumference of the circle:

$$\frac{4x}{x\pi} = \frac{4}{\pi}$$

---

**79.** (**B**) To calculate the fraction, divide the down payment by the sale price:

$$\frac{\$400}{\$5{,}000} = \frac{4}{50} = \frac{8}{100} = 0.08$$

**80.** (**J**) First, calculate the volume of the stack using the formula length × width × height:

5 in. × 10 in. × 20 in. = 1,000 cubic inches

To determine the weight of the stack, multiply the number of cubic inches by the weight per cubic inch:

1,000 × 0.035 = 35 ounces

Notice that the number of sheets of plastic is given (50), but is not relevant to the solution.

---

**81.** (**B**) First, calculate the area of the circular region using the given radius of 3 feet:

Area = $\pi r^2 = (3)^2\,\pi = 9\pi = 9(3.14)$
= 28.26 square feet

Notice that $\pi$ was rounded to 3.14 because the question asks for an approximation.

Subtract the area that the paint can cover (25 sq ft) from the area of the region to get the answer:

28.26 – 25 = 3.26 = 3.3 sq ft

---

**82.** (**H**) Let $x$ = Gloria's sales for this period. Set up an equation using her commission for this period ($12,000) and the commission rate (15%):

$$\$12{,}000 = 0.15x$$

$$\frac{\$12{,}000}{0.15} = x$$

$$\$80{,}000 = x$$

**83.** (**A**) The solution to this problem requires finding the pattern. The pattern for $x$ is easy: the numbers in $x$ always change by 1. The pattern for $y$ is tougher to see. Since $y$ is a sum of two terms (an $a$ term and a negative $b$ term), we can determine the pattern for each of these terms individually, as follows:

| term | term |
|---|---|
| $^{-}a$ | $-\frac{b}{2}$ |
| 0 | $-\frac{b}{3}$ |
| $a$ | $-\frac{b}{4}$ |
| $2a$ | $-\frac{b}{5}$ |
| The $a$ term changes by adding $a$ to the previous value. | The $b$ term changes by increasing the denominator by 1. |

We want to know the value of $y$ when $x = 0$, so we need to find the value of $y$ that comes **before** the first $y$ ($^{-}a - \frac{b}{2}$) in the table. To do this, we subtract $a$ from the $a$ term and subtract 1 from the denominator of the $b$ term in the first $y$. Thus, when $x = 0$, $y = (^{-}a - a) - \frac{b}{2-1} = {}^{-}2a - b$

---

**84.** (**K**) Daquan sold $x$ hot dogs. Let $c$ represent the number of hot dogs that Caitlyn sold:

$$c + x = 5x - 2$$
$$c = 4x - 2$$

---

**85.** (**B**) For a house that sells for $199,000, the real estate agent charges a commission of 3%.

$$\$199{,}000(0.03) = \$5{,}970$$

For a house that sells for $201,000, the real estate agent charges a commission of 2.5%.

$$\$201{,}000(0.025) = \$5{,}025$$

Subtract to find how much more the agent makes on the $199,000 sale:

$$\$5{,}970 - \$5{,}025 = \$945$$

**86.** (**J**) From the given equation, $r$ must be a multiple of 3, 4, and 10. To find the least possible value of $r$, find the least common multiple of 3, 4, and 10.

All multiples of 10 must end in zero (10, 20, …), so we just need to look at the multiples of 3 and 4 that also end in zero:

Multiples of 3: 30, 60, 90, …
Mulitples of 4: 20, 40, 60, 80, …

Since 60 is the first multiple that appears in both lists above, 60 is the least common multiple of 3, 4, and 10. Thus, the least possible value of $r$ is 60.

---

**87.** (**C**) To solve this problem, find the number of multiples of 2 between 4 and 81. Then, find the number of multiples of 7 between 4 and 81:

**Multiples of 2** (4, 6, 8, …, 80):

$\frac{80-4}{2} = 38$, but we need to add 1 because both ends are counted, so $38 + 1 = 39$

**Multiples of 7** (7, 14, 21, 28, …, 77):

$\frac{81-4}{7} = 11$

Next, we need to determine how many of the multiples of 7 are even, because they will have been counted twice (once in the list of the multiples of 2 and again in the list of the multiples of 7). The multiples of 7 alternate odd and even, which means approximately half of them are odd and half are even. (Because there are 11 values, 6 must be either even or odd, and 5 must be the other.) The first and last multiple of 7 in this case are both odd, so that means 6 are odd and 5 are even (i.e., multiples of 2).

To find the total number of integers that are multiples of 2, multiples of 7, or both, add the count of the multiples of 2 and the multiples of 7, and subtract the number of integers that appear in both lists:

(multiples of 2) + (multiples of 7) – (both)
$= 39 + 11 - 5$
$= 45$

**88.** (**K**) Solve for $s$:

$$\frac{3t - s}{4} = 8s$$
$$3t - s = 32s$$
$$3t = 33s$$
$$\frac{t}{11} = s$$

---

**89.** (**A**) The values of $r$ and $s$ are not known, but the information given ($r \neq s$ and $r \neq {}^{-}s$) rules out the possibility that the denominator of either fraction could be zero, which would result in an undefined expression. Simplify the expression by canceling out $r + s$ and $r - s$. Only $rs$ remains.

---

**90.** (**H**) Complete the calculations for the quantity under the square root sign:

$$\sqrt{6^2 + 7^2}$$
$$\sqrt{36 + 49}$$
$$\sqrt{85}$$

85 falls between the squares of 9 and 10, which are 81 and 100, respectively.

$$81 < 85 < 100$$
$$9^2 < 85 < 10^2$$

---

**91.** (**D**) Use the formula for the area of a triangle to solve for BE:

$$\text{Area} = \frac{1}{2}\,(\text{base})\,(\text{height})$$
$$25 = \frac{1}{2}\,(5)\,(\text{BE})$$
$$25 = 2.5\,(\text{BE})$$
$$10 = \text{BE}$$

The area of a parallelogram is base × height. The base of ABCD is 50 cm. BE is perpendicular to AED, so the height of the parallelogram is 10 cm.

$$\text{Area} = (50\text{ cm})(10\text{ cm})$$
$$\text{Area} = 500\text{ sq cm}$$

**92.** (**J**) Since there are 60 minutes in 1 hour, multiply 2.35 by 60 to convert it to minutes:

$$2.35 \times 60 = 141 \text{ minutes}$$

---

**93.** (**E**) Because we know that 100% of the group indicated whether or not they were in favor of Proposition A, Proposition B, or both, we can add the percentages given in the question:

65% (in favor of Proposition A) + 72% (in favor of Proposition B) + 3% (in favor of neither)

$$= 140\% \text{ total}$$

The amount over 100% is the percentage of people who indicated they were in favor of both Proposition A and Proposition B and were therefore counted twice. So, the answer is $140\% - 100\% = 40\%$.

---

**94.** (**G**) For any one triangular face of the pyramid, we know the base (8 cm) and height (6 cm).

$$\text{Area of one triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$
$$= \frac{1}{2} \times (8 \text{ cm}) \times (6 \text{ cm})$$
$$= 24 \text{ sq cm}$$

All four of the triangular faces have the same area, so the total surface area of the pyramid is:

$$4 \times 24 = 96 \text{ sq cm}$$

---

**95.** (**D**) The distance from A to B is $\frac{1}{6}$ of a revolution. The arrow will point to B for the eleventh time after $10\frac{1}{6}$ revolutions. The rate of the arrow is:

$$5 \frac{\text{rev}}{\text{min}} = 5 \frac{\text{rev}}{\text{min}} \times \frac{1 \text{ min}}{60 \text{ sec}} = \frac{1 \text{ rev}}{12 \text{ sec}}$$

Use the formula for rate × time = distance. Let $x$ represent the number of seconds.

$$x \text{ sec} \left( \frac{1 \text{ rev}}{12 \text{ sec}} \right) = 10\frac{1}{6} \text{ revolutions}$$
$$\frac{x}{12} = \frac{61}{6}$$
$$x = \frac{(61)(12)}{6} = (61)(2)$$
$$= 122 \text{ sec}$$

**96.** (**F**) First, combine like terms, and then solve for $k$:

$$(3m + 2n) - (2m - 3n) + k = 0$$
$$3m + 2n - 2m + 3n + k = 0$$
$$m + 5n + k = 0$$
$$k = -m - 5n$$

---

**97.** (**D**) Each even digit in the right column is twice the position (left column) minus 2.

For example, in position 1: $2(1) - 2 = 0$

In position 2: $2(2) - 2 = 2$

In position 3: $2(3) - 2 = 4$

So, for position 500: $2(500) - 2 = 1{,}000 - 2 = 998$

---

**98.** (**G**) The answers are given in cubic yards, so the dimensions of the foam must be calculated in yards. The width and length of the rectangular region are 10 yards and 50 yards, respectively. The depth (height) of the foam over the rectangular region is 9 inches, which is $\frac{1}{4}$ yard (1 yard = 36 inches).

$$\text{Volume} = (\text{length})(\text{width})(\text{height})$$
$$= (50)(10)\frac{1}{4}$$
$$= \frac{500}{4} \text{ cu yd}$$
$$= 125 \text{ cu yd}$$

**99.** (**D**) Whole numbers are the "counting" numbers: 1, 2, 3, 4, etc. Test each value of $x$ in the given expression:

$x = 5 \quad \frac{5 + 7}{5 - 7} = \frac{12}{-2} = -6$

This **cannot** be a value of $x$ because $-6$ is not a whole number.

$x = 6 \quad \frac{6 + 7}{6 - 7} = \frac{13}{-1} = -13$

This **cannot** be a value of $x$ because $-13$ is not a whole number.

$x = 7 \quad \frac{7 + 7}{7 - 7} = \frac{14}{0} =$ undefined

This **cannot** be a value of $x$ because the expression is undefined.

$x = 8 \quad \frac{8 + 7}{8 - 7} = \frac{15}{1} = 15$

This **can** be a value of $x$ because 15 is a whole number.

$x = 9 \quad \frac{9 + 7}{9 - 7} = \frac{16}{2} = 8$

This **can** be a value of $x$ because 8 is a whole number.

The question asks how many of the listed numbers **cannot** be a value of $x$, so the answer is 3.

**100.** (**J**) The range is the difference between the highest score and the lowest score.

First, calculate the highest score for each section. Use the sum of the lowest score and the range to get the highest score.

Section I: $65 + 28 = 93$
Section II: $62 + 25 = 87$
Section III: $67 + 22 = 89$

To find the **overall** range of all the scores, take the highest of all the scores (93) and subtract the lowest of all the scores (62). The answer is 31.

## Answer Key for Sample Form B

Paragraph 1
T Q U R S

Paragraph 2
R Q T U S

Paragraph 3
S R U Q T

Paragraph 4
T R U Q S

Paragraph 5
U Q S R T

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11. C | 21. A | 31. A | 41. B | 51. B | 61. A | 71. B | 81. B | 91. D |
| 12. J | 22. G | 32. J | 42. G | 52. G | 62. G | 72. K | 82. H | 92. J |
| 13. C | 23. E | 33. C | 43. A | 53. A | 63. C | 73. E | 83. A | 93. E |
| 14. J | 24. G | 34. H | 44. H | 54. H | 64. F | 74. G | 84. K | 94. G |
| 15. B | 25. E | 35. E | 45. E | 55. E | 65. D | 75. C | 85. B | 95. D |
| 16. F | 26. H | 36. K | 46. H | 56. F | 66. J | 76. G | 86. J | 96. F |
| 17. E | 27. E | 37. D | 47. B | 57. E | 67. B | 77. B | 87. C | 97. D |
| 18. K | 28. G | 38. F | 48. F | 58. J | 68. J | 78. K | 88. K | 98. G |
| 19. E | 29. C | 39. D | 49. A | 59. D | 69. D | 79. B | 89. A | 99. D |
| 20. F | 30. F | 40. K | 50. F | 60. H | 70. G | 80. J | 90. H | 100. J |

**DIRECTIONS:** This section provides sample mathematics problems for the Grade 9 test forms. These problems are based on material included in the New York City curriculum for Grade 8. (The Grade 8 problems on sample forms A and B cover mathematics material through Grade 7.) General directions for how to answer math questions are located on pages 48 and 86. There is no sample answer sheet for this section; mark your answers directly on this page or on a separate piece of paper.

**1.** If $\frac{x}{3} = \frac{3x - 15}{4}$, what is the value of $x$?

**A.** 9

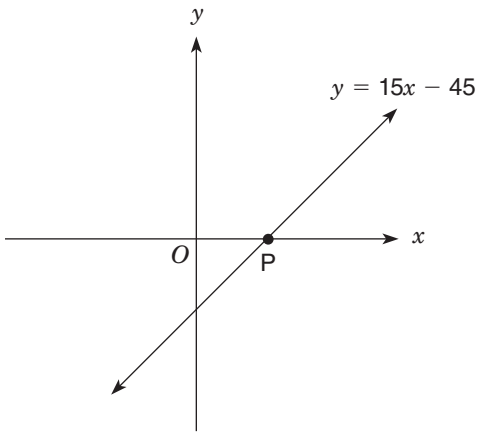
**B.** $\frac{15}{2}$

**C.** $\frac{45}{13}$

**D.** 3

**E.** $^{-}9$

**2.**



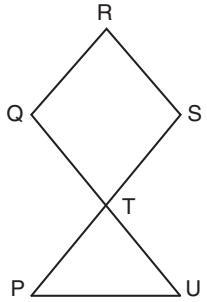

The line defined by the equation $y = 15x - 45$ intercepts the $x$-axis at point P as shown above. What are the coordinates of point P?

**F.** (45, 0)
**G.** (3, 0)
**H.** ($^{-}3$, 0)
**J.** (0, $^{-}3$)
**K.** (0, $^{-}45$)

**3.** How many different ways can a team of 2 men and 2 women be formed if there are 4 men and 5 women from which to select?

**A.** 4
**B.** 6
**C.** 16
**D.** 60
**E.** 240

**4.**




In the figure above, ∠QTS is congruent to ∠QRS. Point T lies at the intersection of line segments $\overline{QU}$ and $\overline{PS}$. Which of the following angles must also be congruent to ∠QRS?

**F.** ∠RST
**G.** ∠PTQ
**H.** ∠TUP
**J.** ∠TPU
**K.** ∠PTU

**5.** If $(4^3)(8^2) = 2^x$, what is the value of $x$?

**A.** 12
**B.** 10
**C.** 7
**D.** 6
**E.** 5

**6.** If N = $1.\overline{25}$, what is the value of N expressed as a fraction?

**F.** $\frac{5}{4}$

**G.** $\frac{124}{99}$

**H.** $\frac{113}{90}$

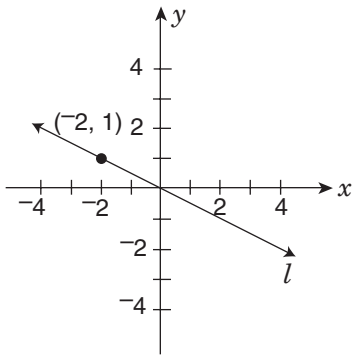
**J.** $\frac{125}{99}$

**K.** $\frac{14}{11}$

**7.** If 1 liter is approximately equal to 1.06 quarts and 32 ounces equals 1 quart, how many 20-ounce containers of soda can be **completely** filled by a 2-liter container of soda?

**A.** 2
**B.** 3
**C.** 4
**D.** 5
**E.** 6

**8.**




In the figure above, line $l$ passes through the origin. Which equation below describes line $l$?

**F.** $y = 2x$

**G.** $y = -2x$

**H.** $y = x$

**J.** $y = \frac{1}{2}x$

**K.** $y = -\frac{1}{2}x$

**9.** What is the simplified form of $\frac{6(2x^2 - 4x)}{3x}$ if $x \neq 0$?

**A.** $4x - 4$

**B.** $4x^2 - \frac{8}{3}$

**C.** $4x - 8$

**D.** $4x^2 - 8$

**E.** $4x^2 - 8x$

**10.** The translation of point P (3, 5) to P′ (5, −3) is equivalent to rotating point P by which of the following clockwise rotations about the origin?

**F.** 45°
**G.** 90°
**H.** 135°
**J.** 180°
**K.** 225°

**11.** What is the greatest integer $n$ that satisfies the inequality $5 - n \geq 3n - 4$?

**A.** 1

**B.** 2

**C.** $2\frac{1}{4}$

**D.** 3

**E.** 4

**12.** The volume of a cube is 729 cubic feet. What is the length, in **inches**, of one side of this cube?

**F.** $\frac{3}{4}$ in.

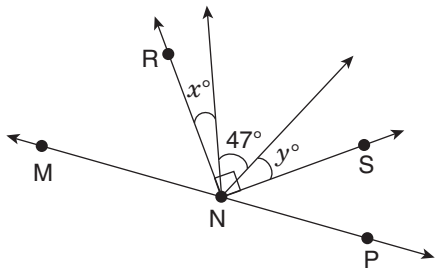
**G.** 9 in.

**H.** 108 in.

**J.** 243 in.

**K.** 2,916 in.

**13.**



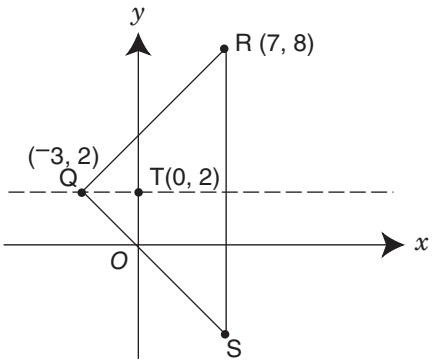

In the figure above, point N lies on straight line $\overleftrightarrow{MNP}$, and $\angle RNS$ is a right angle. What is the value of $y$ in terms of $x$?

**A.** $43 - x$
**B.** $x - 43$
**C.** $133 - x$
**D.** $x - 133$
**E.** $x$

**14.** A property is valued at \$300,000 today. If this represents a 150% increase in value over its value 10 years ago, what was the value of this property 10 years ago?

**F.** \$120,000
**G.** \$150,000
**H.** \$200,000
**J.** \$275,000
**K.** \$450,000

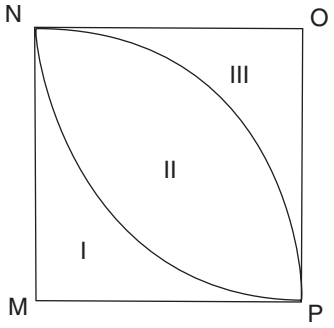
**15.**




The dashed line is the line of symmetry for triangle QRS. What are the coordinates of point S?

**A.** $(-7, -8)$
**B.** $(7, -8)$
**C.** $(7, -4)$
**D.** $(-7, -4)$
**E.** $(7, 8)$

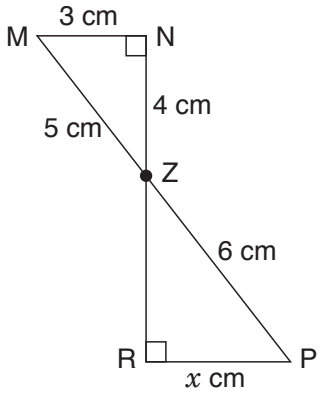
**16.**




In the figure above, MNOP is a square with sides of length 20. Each arc inside MNOP is $\frac{1}{4}$ of the circumference of a circle with either M or O as its center. What is the area of the region labeled II? Express your answer in terms of $\pi$.

**F.** $50\pi$
**G.** $100\pi$
**H.** $200\pi - 100$
**J.** $200\pi - 400$
**K.** $800\pi - 400$

**17.**




In the figure above, all lines are straight. $\overline{MP}$ and $\overline{RN}$ intersect at point Z. What is the value of $x$?

**A.** 3
**B.** $3\frac{3}{5}$
**C.** 4
**D.** $4\frac{4}{5}$
**E.** 5

**1.** (**A**) First, cross-multiply to eliminate the denominators, and then solve for $x$:

$$\begin{aligned} 4x &= 3(3x - 15) \\ 4x &= 9x - 45 \\ -5x &= -45 \\ x &= 9 \end{aligned}$$

---

**2.** (**G**) Since P is on the $x$-axis, we know its $y$-value must equal 0. Use that in the equation to solve for $x$:

$$\begin{aligned} y &= 15x - 45 \\ 0 &= 15x - 45 \\ 45 &= 15x \\ 3 &= x \end{aligned}$$

So, the coordinates for P are (3, 0).

---

**3.** (**D**) In this case, the order in which you select the people is not important, so you cannot simply use the counting principle.

To solve this problem, first calculate the number of possible combinations for each gender.

**Select 2 men from 4 men** (a, b, c, d):

ab, ac, ad, bc, bd, cd

So, there are 6 ways to select 2 men from a group of 4 men.

**Select 2 women from 5 women** (v, w, x, y, z):

vw, vx, vy, vz, wx, wy, wz, xy, xz, yz

So, there are 10 ways to select 2 women from a group of 5 women.

The selection of one gender is independent of the selection of the other. Multiply the number of possible combinations for each gender:
$6 \times 10 = 60$ different combinations.

---

**4.** (**K**) $\angle$QTS and $\angle$PTU are vertical angles, so they are congruent. Since $\angle$QRS is congruent to $\angle$QTS, then $\angle$QRS is also congruent to $\angle$PTU.

**5.** (**A**) Begin by finding a common base for each term. In this case, the common base is 2.

$$\begin{aligned} 4 &= 2^2 \\ 8 &= 2^3 \\ (4^3)(8^2) &= (2^2)^3(2^3)^2 \\ &= (2^6)(2^6) \\ &= 2^{12} \\ \text{So, } x &= 12. \end{aligned}$$

Alternatively, you could multiply the left side of the equation and then factor it:

$$(4^3)(8^2) = (4 \times 4 \times 4)(8 \times 8)$$
$$= (2 \times 2 \times 2 \times 2 \times 2 \times 2)\,(2 \times 2 \times 2 \times 2 \times 2 \times 2)$$
$$= 2^{12}$$

---

**6.** (**G**) Start with the original equation: $N = 1.\overline{25}$

Set up a second equation in which you multiply both sides of the original equation by a multiple of 10. You multiply by 10 for each digit in the repeating sequence. In this case, there are two digits, so you multiply by 10 twice, i.e., 100.

$$\begin{aligned} 100N &= 100(1.\overline{25}) \\ 100N &= 125.\overline{25} \end{aligned}$$

Now, subtract the two equations, then solve for N:

$$\begin{aligned} 100N &= 125.\overline{25} \\ -N &= -1.\overline{25} \\ \hline 99N &= 124 \end{aligned}$$

$$N = \frac{124}{99}$$

A shortcut is to recall that single-digit fractions with 9 as the denominator repeat, for example:

$\frac{1}{9} = 0.\overline{1}$, $\frac{2}{9} = 0.\overline{2}$

This can be extended to two-digit fractions with 99 as the denominator, for example:

$\frac{10}{99} = 0.\overline{10}$, $\frac{20}{99} = 0.\overline{20}$

In this case, $1.\overline{25} = 1\frac{25}{99} = \frac{124}{99}$

**7.** (**B**) Begin by converting from liters to quarts, and then from quarts to ounces. We know that 1 liter = 1.06 quarts, and 1 quart = 32 ounces, so:

1 liter = $1.06 \times 32 = 33.92$ ounces

We want to divide a 2-liter container of soda into 20-ounce containers.

2 liters = $2 \times 33.92 = 67.84$ ounces

$67.84 \div 20 = 3.392$ containers

The number 3.392 is greater than 3 but less than 4, so the answer is 3 full containers.

---

**8.** (**K**) The equation of a line is $y = mx + b$, where $m$ is the slope and $b$ is the $y$-intercept. Since the line passes through the origin, $b = 0$, so we only need to find the slope. Because we are given the point $(^{-}2, 1)$ and the origin $(0, 0)$, we can use the slope formula:

$$m = \frac{1 - 0}{^{-}2 - 0} = {}^{-}\frac{1}{2}$$

Now, substitute the values for $m$ and $b$ in the equation:

$y = mx + b$

$y = {}^{-}\frac{1}{2}x + 0$

$y = {}^{-}\frac{1}{2}x$

---

**9.** (**C**) There are many ways to simplify this expression, but one way to begin is by simplifying the polynomial in the numerator:

$$\frac{6(2x^2 - 4x)}{3x}$$

$$= \frac{12x^2 - 24x}{3x}$$

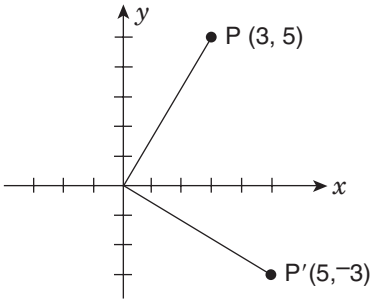
Divide the numerator and denominator by $3x$:

$= 4x - 8$

**10.** (**G**) If the coordinates of a point labeled R are $(a, b)$, then a 90° **counterclockwise** rotation about the origin would make the coordinates of point R′ $(^{-}b, a)$. A 90° **clockwise** rotation about the origin would make the coordinates of R′ $(b, {}^{-}a)$.

In the question, P is (3, 5) and P′ is $(5, {}^{-}3)$. Using the rule stated above, P′ is the image after point P is rotated 90° clockwise.

Alternatively, it may help to make a sketch of this problem. Place the two points on the coordinate grid: Point P is in the first quadrant, and point P′ is in the fourth quadrant. Draw a line from each point to the origin. The angle formed at the origin should resemble a right angle, which is option G (90°).

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**11.** (**B**) First, simplify the inequality to get $n$ on one side:

$$5 - n \geq 3n - 4$$

$$9 \geq 4n$$

$$\frac{9}{4} \geq n$$

$$2\frac{1}{4} \geq n$$

Since $n$ is less than or equal to $2\frac{1}{4}$, the greatest integer value of $n$ is 2.

**12.** (**H**) The volume of the cube is 729 cubic feet, so one side of that cube is $\sqrt[3]{729} = 9$ feet. The question asks for the length of an edge in inches.

9 feet $\times$ 12 = 108 inches

---

**13.** (**A**) Angle RNS is a right angle (90°). From the figure, we see that three smaller angles ($x°$, $y°$, and 47°) combine to make RNS:

$$x + y + 47 = 90$$
$$x + y = 43$$
$$y = 43 - x$$

---

**14.** (**F**) A common mistake on this type of problem is to treat a 150% increase as 1.5 times the original value. However, a 150% increase means adding 150% to the original value. If the original value is $x$, then $x$ + 150% of $x = x + 1.5x = 2.5x$.

The present value is 2.5 times greater than the original value:

$$\$300{,}000 = 2.5x$$
$$\$120{,}000 = x$$

---

**15.** (**C**) Because QRS is a triangle, and the dashed line is a line of symmetry, the dashed line divides the triangle exactly in half and crosses side RS at its midpoint (7, 2).

To find the $y$-coordinate of S, note that the $y$-coordinate for R is 8 and the dashed line is at $y = 2$. The vertical distance between R and the line of symmetry is 8 – 2 = 6. Subtract 6 from the $y$-value for the line of symmetry to find the $y$-coordinate of S: $2 - 6 = {}^{-}4$.

To find the $x$-coordinate of S, remember that RS must be a vertical line segment. Thus, the $x$-coordinate of S must be the same as the $x$-coordinate of R, which is 7.

So, the coordinates for S are $(7, {}^{-}4)$.

**16.** (**J**) First, recognize that O and M represent the centers of the two circles. $\overline{OP}$ and $\overline{MP}$ are each a radius for one of the circles, and are given as length 20. Use the formula for the area of a circle to find the area of one-fourth of each circle:

$$\frac{1}{4}(20^2\pi) = 100\pi$$

The areas II + III and I + II each represent $\frac{1}{4}$ of a circle. So, II + III = 100π and I + II = 100π.

The area of square MNOP (20 × 20 = 400) is equivalent to I + II + III. Use the following formula to determine the area of region II:

Area of the square = (area of quarter circle M) + (area of quarter circle O) – (overlapping area)

$$\text{I} + \text{II} + \text{III} = (\text{I} + \text{II}) + (\text{II} + \text{III}) - \text{II}$$
$$400 = (100\pi) + (100\pi) - \text{II}$$
$$400 = 200\pi - \text{II}$$
$$\text{II} = 200\pi - 400$$

---

**17.** (**B**) Each triangle is a right triangle, and the angles formed at point Z are congruent because they are vertical angles. Thus, the two triangles are similar by definition. Set up the following proportion between similar sides to find $x$:

$$\frac{5}{3} = \frac{6}{x}$$
$$5x = 18$$
$$x = \frac{18}{5} = 3\frac{3}{5}$$

## Answer Key for Grade 9 Mathematics

| | | | |
|---|---|---|---|
| 1. A | 6. G | 11. B | 16. J |
| 2. G | 7. B | 12. H | 17. B |
| 3. D | 8. K | 13. A | |
| 4. K | 9. C | 14. F | |
| 5. A | 10. G | 15. C | |

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