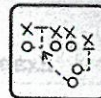


Game Plan

Mathematics



Quickly Preview the Test Section, but Skip the Directions

As you get started, take a few seconds to preview the Mathematics Test. It's 99.99% certain that you're going to find everything in place and just as you expected. But a quick overview will guarantee against any unanticipated changes. Do NOT, however, read the directions. Remind yourself of your pacing plan and then get to work.

Answer the Question That Is Being Asked

Read the Question Carefully

Some problems are fairly simple, but others are more complex, particularly practical word problems and more difficult geometry problems. The more complex the question, the easier it is to misread and set off down the wrong track. If the question is very long, then underline the key part of the question.

Example:

If Mark traveled 20 miles in 3 hours and Lester traveled twice as far in half the time, what was Lester's average speed?

- A. $3\frac{1}{3}$ miles per hour
- B. $6\frac{2}{3}$ miles per hour
- C. 12 miles per hour
- D. 26 miles per hour
- E. $26\frac{2}{3}$ miles per hour

The stem states that Lester traveled twice as far as Mark in half the time, or 40 miles in 1.5 hours.

Therefore, Lester's average speed was $\frac{40 \text{ miles}}{1.5 \text{ hours}} = 26.66\bar{6} = 26\frac{2}{3}$ miles per hour, (E).

Pay Attention to Units

Some items require you to convert units (e.g., feet to inches or hours to minutes). The item stem will tell you what units to use, and if the test-writer senses any possible confusion, the units for the answer choices will be emphasized—underlined or in bold face or capitalized. When you see a word emphasized with any of those signals, circle it and put a star beside it. It is very important.

Example:

A certain copy machine produces 13 copies every 10 seconds. If the machine operates without interruption, how many copies will it produce in an hour? *

- F. 780
- G. 4,200
- H. 4,680
- J. 4,800
- K. 5,160

Create an expression that, after cancellation of like units, gives the number of copies produced in an hour:

$\frac{13 \text{ copies}}{10 \text{ seconds}} \cdot \frac{60 \text{ seconds}}{1 \text{ minute}} \cdot \frac{60 \text{ minutes}}{1 \text{ hour}} = 4,680 \text{ copies/hour}$. Therefore, the copy machine produces 4,680 copies in an hour, (H).

Pay Attention to Thought-Reversers

A thought-reverser is any word, such as “not,” “except,” or “but,” that turns a question inside out. As shown, below, make sure that you mark the thought-reverser so that it is staring you in the face as you work the problem.

Example:

How many integers in the set of integers from 1 to 144, inclusive, are NOT a square of an integer? *

- A. 0
- B. 2
- C. 12
- D. 132
- E. 144

Since 1 is the square of 1, and 144 is the square of 12, there are a total of 12 integers in the set of integers from 1 to 144, inclusive, that are a square of an integer ($1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2, 8^2, 9^2, 10^2, 11^2, 12^2$). Therefore, there are a total of $144 - 12 = 132$ integers in the set that are NOT a square of an integer, (D).

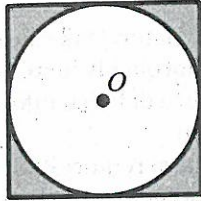
Use the Answer Choices

In the Math: Multiple-Choice Lesson, you will learn some very powerful test-taking strategies that use the answers. For now, there are two procedural points to consider.

Eliminate Answer Choices That Cannot Be Correct

Sometimes, the array of answers will include choices that, taken at face value, seem to be plausible, but when examined more carefully, must be incorrect.

Example:



In the figure above, a circle with center O and a radius of 2 is inscribed in a square. What is the area of the shaded portion of the figure?

- F. $2 - \pi$
- G. $4 - 2\pi$
- H. $16 - 2\pi$
- J. $16 - 4\pi$
- K. $16 - 6\pi$

The shaded area is equal to the area of the square minus the area of the circle. Since the radius of the circle is 2, the side of the square is 4 and its area is $4 \cdot 4 = 16$. The area of the circle is $\pi(2)^2 = 4\pi$. Therefore, the shaded area is $16 - 4\pi$, (J). Notice that without even solving the item, you can eliminate answer choices. Take a closer look at (F), (G), and (K). Since π is approximately 3.14, (F), (G), and (K) are negative. Area, however, cannot be a negative number, so (F), (G), and (K) must be wrong, and you can eliminate them without doing any other work. Now, if you had to, you can make an educated guess from the remaining choices and the odds of guessing correctly are 50 percent. (Note that even if you are unable to eliminate answer choices, you still must guess, even if randomly, since the ACT test does not penalize for wrong answers.)

Use the Answer Choices to Check Your Math

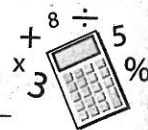
While the ACT test does not test “donkey math,” some items do require a calculation or two. One of the fundamental rules of math in school is “check your work.” On the ACT test, however, this is a real time-suck. Let’s say that you do a calculation (with or without your calculator) and the result is \$23.10. If one of the choices is \$23.10, pick it, mark your answer sheet, and move on to the next item. Do NOT check your arithmetic. The possibility that you did the arithmetic, made a mistake, and still got a number like 23.10 is just too remote to consider. On the other hand, if you do not find a choice that matches your calculation, then you’d better check both your set-up of the problem and your arithmetic to find the error. In this way, the answer choices function as a feedback loop on the accuracy of your manipulations.

Don’t Go Calculator Crazy

Just because you are allowed to use a calculator on the test does not mean that you should try to solve every problem with your calculator. In fact, for most problems, the calculator is the less efficient method of arriving at a solution. Assume, for example, that you have to do the following arithmetic to get your answer: $\left(\frac{2}{3}\right)\left(\frac{7}{4}\right)\left(\frac{1}{6}\right)$.

Since this problem involves single digit multiplication, it’s going to be easier to do the arithmetic with a pencil than with a calculator: $\left(\frac{2}{3}\right)\left(\frac{7}{4}\right)\left(\frac{1}{6}\right) = \frac{2 \cdot 7 \cdot 1}{3 \cdot 4 \cdot 6} = \frac{14}{72} = \frac{7}{36}$. By all means, use the calculator since it will be a definite advantage, but don’t automatically assume that every problem requires its use.

60 questions in 60 mins.



Calculator Exercise

This exercise is designed to illustrate when and when not to use your calculator. Make sure that the calculator you bring to the ACT, PLAN, or EXPLORE test is one with which you are thoroughly familiar. (The calculator requirements are the same for the ACT, PLAN, and EXPLORE tests. For more detailed information on calculator usage, including specific models that are prohibited on all three tests, go to <http://www.actstudent.org/faq/answers/calculator.html>.) Although no item requires the use of a calculator, a calculator may be helpful to answer some items. The calculator may be useful for any item that involves complex arithmetic computations, but it cannot take the place of understanding how to set up a mathematical item. The degree to which you can use your calculator will depend on its features. Answers are on page 688.

DIRECTIONS: Label each of the items that follow according to one of the following categories.

- Category 1: A calculator would be very useful (saves valuable test time).
 Category 2: A calculator might or might not be useful.
 Category 3: A calculator would be counterproductive (wastes valuable test time).

1. What is the average of 8.5, 7.8, and 7.7?

- A. 8.3
- B. 8.2
- C. 8.1
- D. 8.0
- E. 7.9

2. If $0 < x < 1$, which of the following is the largest?

- F. x
- G. $2x$
- H. x^2
- J. x^3
- K. $x+1$

3. If 4.5 pounds of chocolate cost \$10, how many pounds of chocolate can be purchased for \$12?

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

4. What is the value of $\frac{8}{9} - \frac{7}{8}$?

- F. $\frac{1}{72}$
- G. $\frac{15}{72}$
- H. $\frac{1}{7}$
- J. $\frac{1}{8}$
- K. $\frac{15}{7}$

5. Which of the following fractions is the largest?

- A. $\frac{111}{221}$
- B. $\frac{75}{151}$
- C. $\frac{333}{998}$
- D. $\frac{113}{225}$
- E. $\frac{101}{301}$

6. Dr. Leo's new office is 2.8 yards by 4 yards. She plans to run a decorative border around the perimeter of the office. How many yards of wallpaper border should she purchase?

- F. 8
- G. 13.2
- H. 13.6
- J. 14.2
- K. 16.7

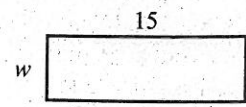
7. What is the value of $\frac{2}{3} - \frac{5}{8}$?

- A. 1
- B. $\frac{15}{16}$
- C. $\frac{3}{24}$
- D. $\frac{1}{24}$
- E. $\frac{1}{100}$

8. If $3x + y = 33$ and $x + y = 17$, then what is the value of x ?

- F. 8
- G. 12
- H. 16
- J. 24
- K. 33

9. If the perimeter of the rectangle below is 40, what is its area?



- A. 5
- B. 15
- C. 25
- D. 45
- E. 75

10. If the price of a book increases from \$10.00 to \$12.50, what is the percent increase in price?

- F. 2.5%
- G. 12.5%
- H. 25%
- J. 33%
- K. 50%

LESSON

The items in this section accompany the in-class review of the skills and concepts tested by the ACT Mathematics Test. You will work through the items with your instructor in class. Use any available space in this section for scratch work. Answers are on page 688.

DIRECTIONS: Solve each item and choose the correct answer choice. Calculator use is permitted; however, some items are best solved without the use of a calculator.

NOTE: All of the following should be assumed, unless otherwise stated.

1. Illustrative figures are NOT necessarily drawn to scale.
2. The word *average* indicates arithmetic mean.
3. The word *line* indicates a straight line.
4. Geometric figures lie in a plane.

Item-Types

Arithmetic

1. If the price of fertilizer has been decreased from 3 pounds for \$2 to 5 pounds for \$2, how many more pounds of fertilizer can be purchased for \$10 than could have been purchased before?
 - A. 2
 - B. 8
 - C. 10
 - D. 12
 - E. 15

Algebra

2. Five students formed a political club to support a candidate for local office. They project that club membership will double every three weeks. Which of the following can be used to find the number of members that the club projects to have after twelve weeks?
 - F. $5\left(\frac{2}{2^3}\right)$
 - G. $5\left(2^{\frac{3}{2}}\right)$
 - H. $5\left(2^{\frac{12}{3}}\right)$
 - J. $5\left(2^{\frac{3}{12}}\right)$
 - K. $5+5(2^4)$

3. If $\frac{2x-5}{3} = -4x$, then $x = ?$

- A. -1
- B. $-\frac{5}{14}$
- C. 0
- D. $\frac{5}{14}$
- E. 1

4. A vending machine dispenses k cups of coffee, each at a cost of c cents, every day. During a period d days long, what is the amount of money in dollars taken in by the vending machine from the sale of coffee?

- F. $\frac{100kc}{d}$
 G. kcd
 H. $\frac{dk}{c}$
 J. $\frac{kcd}{100}$
 K. $\frac{kc}{100d}$

5. If $f(x) = 2x - 3$ and $g(x) = x^2 - 2$, then what does $f(g(2))$ equal?

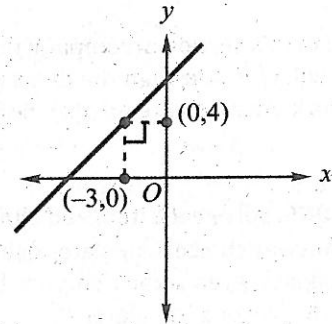
- A. -1
 B. 0
 C. 1
 D. 4
 E. 7

6. If $|x + 3| = 5$, then $x = ?$

- F. -8 or 2
 G. -2 or 8
 H. -8
 J. -2
 K. 2 or 8

Coordinate Geometry

7. In the figure below, the line has a slope of 1. What is the y -intercept of the line?



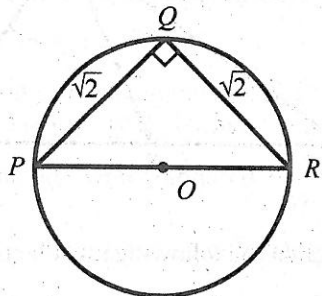
- A. -5
 B. -3
 C. 0
 D. 3
 E. 7

Geometry

8. If a circle has a radius of 1, what is its area?

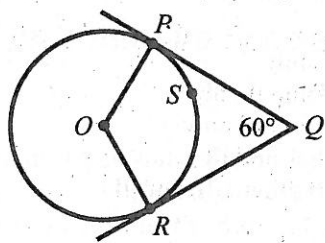
- F. $\frac{\pi}{2}$
 G. π
 H. 2π
 J. 4π
 K. π^2

9. In the figure below, $\triangle PQR$ is inscribed in a circle with center O . What is the area of the circle?



- A. $\frac{\pi}{2}$
- B. $\frac{\pi}{\sqrt{2}}$
- C. π
- D. $\pi\sqrt{2}$
- E. 2π

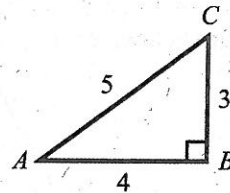
10. In the figure below, \overline{QP} is tangent to circle O at point P , and \overline{QR} is tangent to circle O at point R . What is the degree measure of the minor arc PSR ?



- F. 30
- G. 60
- H. 90
- J. 120
- K. 180

Trigonometry

11. In the figure below, $\sin A = ?$



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

Statistics and Probability

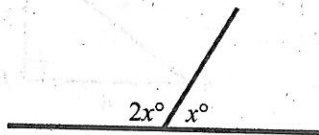
12. What is the average of 8.5, 7.8, and 7.7?

- F. 8.3
- G. 8.2
- H. 8.1
- J. 8.0
- K. 7.9

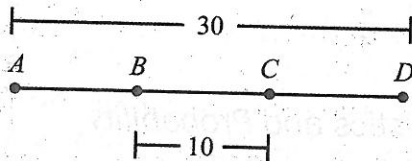
General Strategies

A Note about Figures

13. In the figure below, $x = ?$

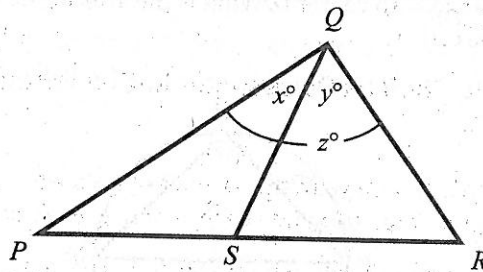


- A. 15
 B. 30
 C. 45
 D. 60
 E. 120
14. In the figure below, what is the length of $\overline{AB} + \overline{CD}$?



- F. 5
 G. 10
 H. 15
 J. 20
 K. 40

Items #15-16 refer to the following figure:



15. Which of the following must be true?

- I. $\overline{PS} < \overline{SR}$
 II. $z = 90$
 III. $x > y$

- A. I only
 B. I and II only
 C. I and III only
 D. I, II, and III
 E. Neither I, II, nor III

16. Which of the following must be true?

- I. $\overline{PR} > \overline{PS}$
 II. $z > x$
 III. $x + y = z$

- F. I only
 G. I and II only
 H. I and III only
 J. I, II, and III
 K. Neither I, II, nor III

Important Facts about the Answer Choices

Wrong Choices Correspond to Conceptual Errors

17. In a certain year, the number of girls who graduated from City High School was twice the number of boys who graduated. If $\frac{3}{4}$ of the girls and $\frac{5}{6}$ of the boys went to college immediately after graduation, what fraction of the graduates that year went to college immediately after graduation?

- A. $\frac{5}{36}$
- B. $\frac{16}{27}$
- C. $\frac{7}{9}$
- D. $\frac{29}{36}$
- E. $\frac{31}{36}$

"Signal" Words Require Special Attention

18. A jar contains black and white marbles. If there are ten marbles in the jar, then which of the following could NOT be the ratio of black to white marbles?

- F. 9:1
- G. 7:3
- H. 1:1
- J. 1:4
- K. 1:10

19. If n is a negative number, which of the following is the least in value?

- A. $-n$
- B. $n-n$
- C. $n+n$
- D. n^2
- E. n^4

20. If a machine produces 240 thingamabobs per hour, how many minutes are needed for the machine to produce 30 thingamabobs?

- F. 6
- G. 7.5
- H. 8
- J. 12
- K. 12.5

21. Of the 120 people in a room, $\frac{3}{5}$ are women. If

$\frac{2}{3}$ of the people are married, what is the maximum number of women in the room who could be unmarried?

- A. 80
- B. 72
- C. 48
- D. 40
- E. 32

Answer the Question Being Asked

22. Three friends are playing a game in which each person simultaneously displays one of three hand signs: a clenched fist, an open palm, or two extended fingers. How many unique combinations of the signs are possible?

- F. 3
- G. 9
- H. 10
- J. 12
- K. 27

23. If $\frac{1}{3}$ of the number of girls in a school equals $\frac{1}{5}$ of the total number of students, what is the ratio of girls to boys in the school?

- A. 5:3
- B. 3:2
- C. 2:5
- D. 1:3
- E. 1:5

24. Peter walked from point P to point Q and back again, a total distance of 2 miles. If he averaged 4 miles per hour on the trip from P to Q and 5 miles per hour on the return trip, what was his average walking speed in miles per hour for the entire trip?

- F. $2\frac{2}{9}$
- G. 4
- H. $4\frac{4}{9}$
- J. $4\frac{1}{2}$
- K. 5

25. After a 20% decrease in price, the cost of an item is D dollars. What was the price of the item before the decrease?

- A. 0.75D
- B. 0.80D
- C. 1.20D
- D. 1.25D
- E. 1.5D

26. On a certain trip, a motorist drove 10 miles at 30 miles per hour, 10 miles at 40 miles per hour, and 10 miles at 50 miles per hour. What portion of her total driving time was spent driving 50 miles per hour?

- F. $1\frac{13}{51}$
- G. $\frac{5}{7}$
- H. $\frac{5}{12}$
- J. $\frac{1}{3}$
- K. $\frac{12}{47}$

27. What is the maximum number of non-overlapping sections that can be created when a circle is crossed by three straight lines?

- A. 3
- B. 4
- C. 5
- D. 6
- E. 7

28. At Glenridge High School, 20% of the students are seniors. If all of the seniors attended the school play, and 60% of all the students attended the play, what percent of the non-seniors attended the play?

- F. 20%
- G. 40%
- H. 50%
- J. 60%
- K. 100%

29. The water meter at a factory displays the reading below. What is the minimum number of cubic feet of water that the factory must use before four of the five digits on the meter are again the same?

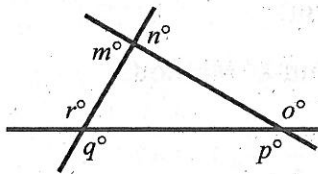
Water Usage in Cubic Feet



- A. 10,000
 B. 1,000
 C. 999
 D. 666
 E. 9
30. A telephone call from City X to City Y costs \$1.00 for the first three minutes and \$0.25 for each additional minute thereafter. What is the maximum length of time, in minutes, that a caller could talk for \$3.00?
- F. 8
 G. 10
 H. 11
 J. 12
 K. 13

“Cannot Be Determined...”

31. In the figure below, $m+n+o+p+q+r = ?$



- A. 360
 B. 540
 C. 720
 D. 900
 E. Cannot be determined from the given information

Arithmetic Review and Strategies

Simple Manipulations—Just Do It!

32. $\frac{8}{9} - \frac{7}{8} = ?$

F. $\frac{1}{72}$

G. $\frac{1}{8}$

H. $\frac{1}{7}$

J. $\frac{15}{72}$

K. $\frac{15}{7}$

33. $\sqrt{1 - \left(\frac{2}{9} + \frac{1}{36} + \frac{1}{18}\right)} = ?$

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

B. $\sqrt{\frac{2}{3}}$

C. $\frac{5}{6}$

D. 1

E. $\sqrt{3}$

Complicated Manipulations—Look for Shortcuts

Simplifying

34. $\frac{1}{2} \cdot \frac{2}{3} \cdot \frac{3}{4} \cdot \frac{4}{5} \cdot \frac{5}{6} \cdot \frac{6}{7} \cdot \frac{7}{8} = ?$

- F. $\frac{1}{56}$
- G. $\frac{1}{8}$
- H. $\frac{28}{37}$
- J. $\frac{41}{43}$
- K. $\frac{55}{56}$

Factoring

35. $86(37) - 37(85) = ?$

- A. 0
- B. 1
- C. 37
- D. 85
- E. 86

36. Which of the following is a prime factorization of 120?

- F. (2)(2)(15)
- G. (2)(3)(4)(5)
- H. (2)(2)(3)(10)
- J. (2)(2)(2)(3)(5)
- K. (2)(2)(3)(3)(5)

Approximation

37. $-4.01(3.2) + 0.2(0.4) = ?$

- A. -12.752
- B. -4.536
- C. 0.432
- D. 1.251
- E. 12.783

38. $\frac{0.2521 \cdot 8.012}{1.014}$ is approximately equal to which of the following?

- F. 0.25
- G. 0.5
- H. 1.0
- J. 1.5
- K. 2.0

39. Which of the following fractions is the largest?

- A. $\frac{111}{221}$
- B. $\frac{75}{151}$
- C. $\frac{333}{998}$
- D. $\frac{113}{225}$
- E. $\frac{101}{301}$

The "Flying-X" Method

40. If $z = \frac{x+y}{x}$, $1-z = ?$

- F. $\frac{1-x+y}{x}$
- G. $\frac{x+y-1}{x}$
- H. $\frac{1-x-y}{x}$
- J. $-\frac{y}{x}$
- K. $1-x-y$

Decimal-Fraction Equivalents

41. $0.125 \cdot 0.125 \cdot 64 = ?$
- A. 0.625
 B. 0.125
 C. 0.5
 D. 1
 E. 8
42. $\frac{0.111 \cdot 0.666}{0.166 \cdot 0.125}$ is approximately equal to which of the following?
- F. 6.8
 G. 4.3
 H. 3.6
 J. 1.6
 K. 0.9

Solving Complicated Arithmetic Application Items

43. If the senior class has 360 students, of whom $\frac{5}{12}$ are women, and the junior class has 350 students, of whom $\frac{4}{7}$ are women, how many more women are there in the junior class than in the senior class?
- A. $(360 - 350) \left(\frac{4}{7} - \frac{5}{12} \right)$
 B. $\frac{(360 - 350) \left(\frac{4}{7} - \frac{5}{12} \right)}{2}$
 C. $\left(\frac{4}{7} \cdot \frac{5}{12} \right) (360 - 350)$
 D. $\left(\frac{4}{7} \cdot 350 \right) - \left(\frac{5}{12} \cdot 360 \right)$
 E. $\left(\frac{5}{12} \cdot 360 \right) - \left(\frac{4}{7} \cdot 350 \right)$

44. If the price of candy increases from 5 pounds for \$7 to 3 pounds for \$7, how much less candy (in pounds) can be purchased for \$3.50 at the new price than at the old price?
- F. $\frac{2}{7}$
 G. 1
 H. $1\frac{17}{35}$
 J. 2
 K. $3\frac{34}{35}$

Common Arithmetic Items

Properties of Numbers

45. If n is any integer, which of the following is always an odd integer?
- A. $n - 1$
 B. $n + 1$
 C. $n + 2$
 D. $2n + 1$
 E. $2n + 2$
46. Which of the following expressions represents the product of two consecutive integers?
- F. $2n + 1$
 G. $2n + n$
 H. $2n^2$
 J. $n^2 + 1$
 K. $n^2 + n$
47. If n is any integer, which of the following expressions must be even?
- I. $2n$
 II. $2n + n$
 III. $2n \cdot n$
- A. I only
 B. II only
 C. III only
 D. I and II only
 E. I and III only

48. If n is the first number in a series of three consecutive even numbers, which of the following expressions represents the sum of the three numbers?

- F. $n+2$
- G. $n+4$
- H. $n+6$
- J. $3n+6$
- K. $6(3n)$

49. If n is an odd number, which of the following expressions represents the third odd number following n ?

- A. $n+3$
- B. $n+4$
- C. $n+6$
- D. $3n+3$
- E. $4n+4$

50. If n is any odd integer, which of the following expressions must also be odd?

- I. $n+n$
- II. $n+n+n$
- III. $n \cdot n \cdot n$

- F. I only
- G. II only
- H. III only
- J. II and III only
- K. I, II, and III

51. If n is a negative number, which of the following expressions must be positive?

- I. $2n$
- II. n^2
- III. n^5

- A. I only
- B. II only
- C. III only
- D. I and II only
- E. II and III only

52. If $0 < x < 1$, which of the following expressions is the largest?

- F. x
- G. $2x$
- H. x^2
- J. x^3
- K. $x+1$

53. If $-1 < x < 0$, which of the following expressions is the largest?

- A. -1
- B. x
- C. $2x$
- D. x^3
- E. $x-1$

Sets: Union, Intersection, and Elements

54. If set $S = \{2, 3, 4\}$ and set P is the set of all products of different elements in set S , then set $P = ?$

- F. $\{6, 8, 12\}$
- G. $\{6, 8, 18\}$
- H. $\{6, 8, 12, 24\}$
- J. $\{6, 8, 12, 18, 24\}$
- K. $\{6, 8, 12, 18, 24, 36\}$

55. If set X is the set of all integers between 1 and 24, inclusive, that are evenly divisible by 3, and set Y is the set of all integers between 1 and 24, inclusive, that are evenly divisible by 4, what is the set of all elements in both sets X and Y ?

- A. $\{12\}$
- B. $\{3, 4\}$
- C. $\{12, 24\}$
- D. $\{4, 12, 24\}$
- E. $\{3, 4, 12, 24\}$

56. If x is an element of set X , in which set X is the set of integers evenly divisible by 3 such that $6 < x < 11$, and y is an element of set Y , where set Y is the set of integers evenly divisible by 4 such that $7 < y < 12$, what is the intersection of sets X and Y ?

- F. $\{\}$
- G. $\{8\}$
- H. $\{9\}$
- J. $\{12\}$
- K. $\{8, 12\}$

57. If set S is the set of all positive odd integers and set T is the set of all positive even integers, then the union of sets S and T (the set of all elements that are in either set or both sets) is the set of:

- A. positive integers.
- B. integers.
- C. even integers.
- D. odd integers.
- E. real numbers.

58. In a certain school, each of the 72 music students must participate in the marching band, the orchestra, or both. If only music students participate, 48 students total participate in the marching band, and 54 students total participate in the orchestra, how many students participate in both programs?

- F. 6
- G. 18
- H. 24
- J. 30
- K. 36

Absolute Value

59. $|-2| + 3 - |-4| = ?$

- A. -5
- B. -4
- C. -1
- D. 1
- E. 9

60. $|5| - |-5| + |-3| = ?$

- F. -8
- G. -3
- H. 3
- J. 8
- K. 13

61. $|-3| \cdot |-4| \cdot -5 = ?$

- A. -60
- B. -30
- C. -7
- D. 20
- E. 60

Complex Numbers

62. $(3+i)(4-3i) = ?$

- F. $12+3i^2$
- G. $12-3i^2$
- H. $9-5i^2$
- J. $9-5i$
- K. $15-5i$

63. $\frac{1}{2-i} = ?$

- A. -2
- B. -1
- C. $\frac{2+i}{5}$
- D. $\frac{2-i}{5}$
- E. $\frac{2+i}{3}$

Percents

64. A jar contains 24 white marbles and 48 black marbles. What percent of the marbles in the jar are black?

- F. 10%
- G. 25%
- H. $33\frac{1}{3}\%$
- J. 60%
- K. $66\frac{2}{3}\%$

65. A group of three friends shared the cost of a tape recorder. If Andy, Barbara, and Donna each paid \$12, \$30, and \$18, respectively, then Donna paid what percent of the cost of the tape recorder?

- A. 10%
- B. 30%
- C. $33\frac{1}{3}\%$
- D. 50%
- E. $66\frac{2}{3}\%$

66. Twenty students attended Professor Rodriguez's class on Monday and 25 students attended on Tuesday. The number of students who attended on Tuesday was what percent of the number of students who attended on Monday?

- F. 5%
- G. 20%
- H. 25%
- J. 80%
- K. 125%

67. If the population of a town was 20,000 in 1997 and 16,000 in 2007, what was the percent decline in the town's population?

- A. 50%
- B. 25%
- C. 20%
- D. 10%
- E. 5%

Items #68-70 refer to the following table:

CAPITOL CITY FIRES	
Year	Number of Fires
2002	100
2003	125
2004	140
2005	150
2006	135

68. The number of fires in 2002 was what percent of the number of fires in 2003?

- F. 25%
- G. $66\frac{2}{3}\%$
- H. 80%
- J. 100%
- K. 125%

69. The number of fires in 2006 was what percent of the number of fires in 2005?

- A. 90%
- B. 82%
- C. 50%
- D. 25%
- E. 10%

70. What was the percent decrease in the number of fires from 2005 to 2006?

- F. 10%
- G. 25%
- H. 50%
- J. 82%
- K. 90%

Ratios

71. A groom must divide 12 quarts of oats between two horses. If Dobbin is to receive twice as much as Pegasus, how many quarts of oats should the groom give to Dobbin?

- A. 4
- B. 6
- C. 8
- D. 9
- E. 10

72. If the ratio of John's allowance to Lucy's allowance is 3:2, and the ratio of Lucy's allowance to Bob's allowance is 3:4, what is the ratio of John's allowance to Bob's allowance?

- F. 1:6
- G. 2:5
- H. 1:2
- J. 3:4
- K. 9:8

Proportions and Direct-Inverse Variation

73. If 4.5 pounds of chocolate cost \$10, how many pounds of chocolate can be purchased for \$12?

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

74. At Star Lake Middle School, 45% of the students bought a yearbook. If 540 students bought yearbooks, how many students did not buy a yearbook?

- F. 243
- G. 540
- H. 575
- J. 660
- K. 957

75. In the equation $y = kx$, k is the constant of variation. If y is equal to 6 when $x = 2.4$, what is the constant of variation?

- A. 0.4
- B. 2.5
- C. 3.4
- D. 3.6
- E. 14.4

76. A train traveling at a constant speed, k , takes 90 minutes to go from point P to point Q , a distance of 45 miles. What is the value of k , in miles per hour?

- F. 20
- G. 30
- H. 45
- J. 60
- K. 75

77. The cost of picture framing depends on the outer perimeter of the frame. If a 15-inch-by-15-inch picture frame costs \$35 more than a 10-inch-by-10-inch picture frame, what is the cost of framing, in dollars per inch?

- A. \$3.50
- B. \$2.75
- C. \$2.25
- D. \$1.75
- E. \$1.50

78. Walking at a constant speed of 4 miles per hour, it took Jill exactly 1 hour to walk home from school. If she walked at a constant speed of 5 miles per hour, how many minutes did the trip take?

- F. 48
- G. 54
- H. 56
- J. 72
- K. 112

79. Ms. Peters drove from her home to the park at an average speed of 30 miles per hour and returned home along the same route at an average speed of 40 miles per hour. If her driving time from home to the park was 20 minutes, how many minutes did it take Ms. Peters to drive from the park to her home?

- A. 7.5
- B. 12
- C. 15
- D. 24
- E. 30

Arithmetic Strategy: "Test-the-Test"

80. Which of the following is the larger of two numbers the product of which is 600 and the sum of which is five times the difference between the two?

- F. 10
- G. 15
- H. 20
- J. 30
- K. 50

81. If $\frac{1}{3}$ of a number is 3 more than $\frac{1}{4}$ of the number, then what is the number?

- A. 18
- B. 24
- C. 30
- D. 36
- E. 48

82. If $\frac{3}{5}$ of a number is 4 more than $\frac{1}{2}$ of the number, then what is the number?

- F. 20
- G. 28
- H. 35
- J. 40
- K. 56

83. If both 16 and 9 are divided by n , the remainder is 2. What is n ?

- A. 3
- B. 4
- C. 5
- D. 6
- E. 7

84. The sum of the digits of a three-digit number is 16. If the tens digit of the number is 3 times the units digit, and the units digit is $\frac{1}{4}$ of the hundreds digit, then what is the number?

- F. 446
- G. 561
- H. 682
- J. 862
- K. 914

85. If the sum of five consecutive integers is 40, what is the smallest of the five integers?

- A. 4
- B. 5
- C. 6
- D. 7
- E. 8

Algebra Review and Strategies

Manipulating Algebraic Expressions

Basic Algebraic Manipulations

86. If $a^3 + b = 3 + a^3$, then $b = ?$

- F. 3^3
- G. $3\sqrt{3}$
- H. 3
- J. $\sqrt[3]{3}$
- K. $-\sqrt{3}$

87. Which of the following expressions is equivalent to $4a + 3b - (-2a - 3b)$?

- A. $2a$
- B. $12ab$
- C. $2a + 6b$
- D. $6a + 6b$
- E. $8a + 9b$

Evaluating Expressions

88. If $x = 2$, what is the value of $x^2 + 2x - 2$?

- F. -2
- G. 0
- H. 2
- J. 4
- K. 6

89. If $x = 2$, then $\frac{1}{x^2} + \frac{1}{x} - \frac{x}{2} = ?$

- A. $-\frac{3}{4}$
- B. $-\frac{1}{4}$
- C. 0
- D. $\frac{1}{4}$
- E. $\frac{1}{2}$

90. If $\frac{1}{3}x = 10$, then $\frac{1}{6}x = ?$

- F. $\frac{1}{15}$
- G. $\frac{2}{3}$
- H. 2
- J. 5
- K. 30

91. If $p = 1$, $q = 2$, and $r = 3$, what is the value of

$$\frac{(q \cdot r)(r - q)}{(q - p)(p \cdot q)}$$

- A. -3
- B. -1
- C. 0
- D. 3
- E. 6

Manipulating Expressions Involving Exponents

92. $\frac{9(x^2y^3)^6}{(3x^6y^9)^2} = ?$

- F. 1
- G. 3
- H. x^2y^3
- J. $3x^2y^3$
- K. $x^{12}y^{12}$

93. $2\left(4\frac{1}{2}\right) - 2^0 + 2^{\frac{3}{2}} + 2^{-2} = ?$

- A. $-2\sqrt{2} - \frac{1}{4}$
- B. $2\sqrt{2} - \frac{1}{4}$
- C. $2\sqrt{2}$
- D. $2\sqrt{2} + \frac{1}{4}$
- E. $2\sqrt{2} + \frac{5}{4}$

Factoring Expressions

94. Which of the following expressions is

equivalent to $\frac{x^2 - y^2}{x + y}$?

F. $x^2 - y^2$

G. $x^2 + y^2$

H. $x^2 + y$

J. $x + y^2$

K. $x - y$

95. Which of the following expressions is

equivalent to $\frac{x^2 - x - 6}{x + 2}$?

A. $x^2 - \frac{x}{2} - 3$

B. $x^2 - 2$

C. $x - 2$

D. $x - 3$

E. x

96. Which of the following is the factorization of

$6x^2 + 4x - 2$?

F. $(6x + 1)(x - 3)$

G. $(6x + 3)(x - 1)$

H. $(3x - 1)(2x - 2)$

J. $(2x + 2)(3x - 1)$

K. $(2x + 4)(3x - 2)$

Creating Algebraic Expressions

97. In a certain game, a player picks an integer between 1 and 10, adds 3 to it, multiplies the sum by 2, and subtracts 5. If x is the number picked by a player, which of the following correctly expresses the final result of the game?

A. $x + (3)(2) - 5$

B. $3x + 2 - 5$

C. $2(x + 3) - 5$

D. $2(x + 3) - 5$

E. $(2)(3)(x) - 5$

98. At 9:00 a.m., when the heat is turned on, the temperature of a room is 55°F . If the room temperature increases by $n^\circ\text{F}$ each hour, which of the following can be used to determine the number of hours needed to bring the temperature of the room to 70°F ?

F. $(55 + 70)(n)$

G. $(55 - 70)(n)$

H. $\frac{(70 - 55)}{n}$

J. $\frac{n}{(70 - 55)}$

K. $\frac{n}{(55 + 70)}$

Evaluating Sequences Involving Exponential Growth

99. In a geometric sequence of positive numbers, the fourth term is 125 and the sixth term is 3,125. What is the second term of the sequence?

A. 1

B. 5

C. 10

D. 25

E. 50

100. City University projects that a planned expansion will increase the number of enrolled students every year for the next five years by 50%. If 400 students enroll in the first year of the plan, how many students are expected to enroll in the fifth year of the plan?

F. 200
 G. 600
 H. 675
 J. 1,350
 K. 2,025

101. Jimmy's uncle deposited \$1,000 into a college fund account and promised that at the start of each year, he would deposit an amount equal to 10% of the account balance. If no other deposits or withdrawals were made and no additional interest accrued, what was the account balance after three additional annual deposits were made by Jimmy's uncle?

A. \$1,030
 B. \$1,300
 C. \$1,331
 D. \$1,500
 E. \$1,830

102. A tank with a capacity of 2,400 liters is filled with water. If a valve is opened that drains 25% of the contents of the tank every minute, what is the volume of water (in liters) that remains in the tank after 3 minutes?

F. 1,800
 G. 1,350
 H. 1,012.5
 J. 600
 K. 325.75

Solving Algebraic Equations or Inequalities with One Variable

Simple Equations

103. If $(2+3)(1+x) = 25$, then $x = ?$

A. $\frac{1}{5}$
 B. $\frac{1}{4}$
 C. 1
 D. 4
 E. 5

Simple Inequalities

104. If $2x+3 > 9$, which of the following can be the value of x ?

F. -4
 G. -3
 H. 0
 J. 3
 K. 4

Equations Involving Rational Expressions

105. If $\frac{12}{x+1} - 1 = 2$, and $x \neq -1$, then $x = ?$

A. 1
 B. 2
 C. 3
 D. 11
 E. 12

106. If $\frac{x}{x+2} = \frac{3}{4}$, and $x \neq -2$, then $x = ?$

F. 6
 G. 4
 H. 3
 J. 2
 K. 1

107. If $\frac{x}{x-2} - \frac{x+2}{2(x-2)} = 8$, and $x \neq 2$, which of the following is the complete solution set for x ?

- A. $\{\}$
- B. $\{-2\}$
- C. $\{2\}$
- D. $\{4\}$
- E. $\{8\}$

Inequalities Involving Rational Expressions

108. If $\frac{3}{x-2} > \frac{1}{6}$, which of the following defines the possible values for x ?

- F. $x < 20$
- G. $x > 0$
- H. $x > 2$
- J. $0 < x < 20$
- K. $2 < x < 20$

Equations Involving Radical Expressions

109. If $\sqrt{2x+1} - 1 = 4$, then $x = ?$

- A. -5
- B. -1
- C. 1
- D. 12
- E. 24

110. Which of the following is the complete solution set for $\sqrt{3x-2} - 3 = -4$?

- F. $\{\}$
- G. $\{-1\}$
- H. $\{1\}$
- J. $\{-1, 1\}$
- K. $\{1, 2\}$

111. If $\sqrt{2x-5} = 2\sqrt{5-2x}$, then $x = ?$

- A. 1
- B. 2
- C. $\frac{5}{2}$
- D. 10
- E. 15

112. Which of the following is the complete solution set for $\sqrt{x^2+9} = 5$?

- F. $\{-4, 4\}$
- G. $\{-4\}$
- H. $\{0\}$
- J. $\{4\}$
- K. $\{\}$

Equations Involving Integer and Rational Exponents

113. If $4^{x+2} = 64$, then $x = ?$

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

114. If $8^x = 2^{x+3}$, then $x = ?$

- F. 0
- G. 1
- H. $\frac{2}{3}$
- J. 3
- K. $\frac{3}{2}$

115. If $3^{2x} = \frac{1}{81}$, then $x = ?$

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

116. If $5^3 = (\sqrt{5})^{-2x}$, then $5^x = ?$

- F. $\frac{1}{125}$
- G. $\frac{1}{25}$
- H. $\frac{1}{5}$
- J. 5
- K. 25

Equations Involving Absolute Value

117. Which of the following is the complete solution

set for $\left| \frac{2x+1}{3} \right| = 5$?

- A. $\{-8, -7\}$
- B. $\{-8, 7\}$
- C. $\{-7, 8\}$
- D. $\{7\}$
- E. $\{8\}$

118. Which of the following is the complete solution set for $|x+6| = 3x$?

- F. $\left\{-3, \frac{3}{2}\right\}$
- G. $\left\{-\frac{3}{2}, 3\right\}$
- H. $\left\{\frac{3}{2}, 3\right\}$
- J. $\{3\}$
- K. $\{\}$

Inequalities Involving Absolute Value

119. Which of the following is the complete solution set for $|2x-1| > 3$?

- A. All real numbers
- B. The null set
- C. All real numbers less than -1 or greater than 2
- D. All real numbers less than -2 or greater than 1
- E. All real numbers less than -3

120. If $|3x-6| > 9$, then which of the following must be true?

- F. $-3 < x < 2$
- G. $-2 < x < 3$
- H. $x < -3$ or $x > 2$
- J. $x < -1$ or $x > 5$
- K. $x < -1$ or $x > 9$

121. Which of the following identifies exactly those values of x that satisfy $|-2x+4| < 4$?

- A. $x > -4$
- B. $x < 4$
- C. $x > 0$
- D. $0 < x < 4$
- E. $-4 < x < 0$

Expressing and Evaluating Algebraic Functions

Function Notation

122. If $f(x) = x^2 + x$, what is the value of $f(-2)$?

- F. -8
- G. -2
- H. 2
- J. 8
- K. 12

123. If $y = f(x) = \left(\frac{6x^2 - 2^{-x}}{|x|} \right)^{\frac{1}{2}}$ for all integers and $x = -1$, what is the value of y ?

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

124. If $f(x) = x + 3$ and $g(x) = 2x - 5$, what is the value of $f(g(2))$?

- F. -2
- G. 0
- H. 2
- J. 4
- K. 10

125. If $f(x) = 3x + 2$ and $g(x) = x^2 + x$, what is the value of $g(f(-2))$?

- A. 15
- B. 12
- C. 6
- D. 3
- E. -2

126. If $f(x) = 2x^2 + x$ and $g(x) = f(f(x))$, what is the value of $g(1)$?

- F. 3
- G. 18
- H. 21
- J. 39
- K. 55

127. If $f(x) = 3x + 4$ and $g(x) = 2x - 1$, for what value of x does $f(x) = g(x)$?

- A. -5
- B. -2
- C. 0
- D. 3
- E. 7

128. If $\boxed{x} = x^2 - x$ for all integers, then $\boxed{-2} = ?$

- F. -6
- G. -2
- H. 0
- J. 4
- K. 6

129. If $\boxed{x} = x^2 - x$ for all integers, then $\boxed{3} = ?$

- A. 27
- B. 30
- C. 58
- D. 72
- E. 121

Concepts of Domain and Range

130. If $f(x) = 3x - 2$ and $-5 < x < 5$, which of the following defines the range of $f(x)$?

- F. $-17 < f(x) < 13$
- G. $-13 < f(x) < 17$
- H. $-5 < f(x) < 12$
- J. $0 < f(x) < 17$
- K. $3 < f(x) < 13$