Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

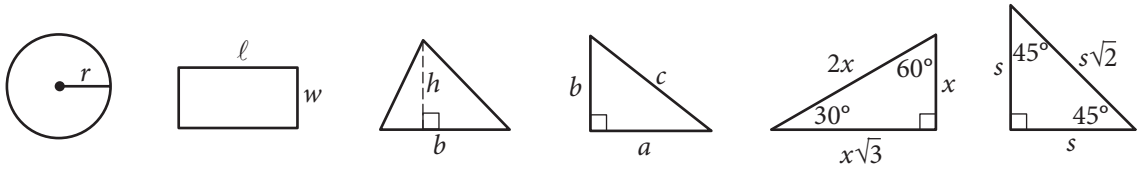
DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 16-20**, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

REFERENCE



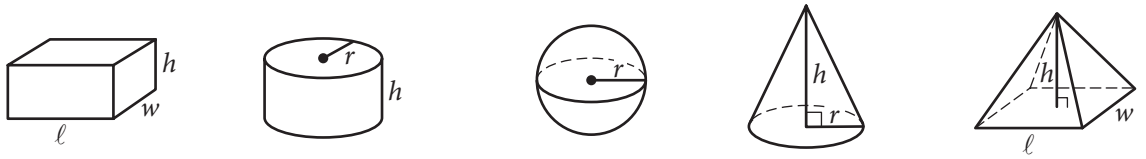
$A = \pi r^2$
$C = 2\pi r$

$A = \ell w$

$A = \frac{1}{2}bh$

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

Special Right Triangles



$V = \ell wh$

$V = \pi r^2 h$

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

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

$V = \frac{1}{3}\ell wh$

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

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CONTINUE

1

A painter will paint n walls with the same size and shape in a building using a specific brand of paint. The painter's fee can be calculated by the expression $nK\ell h$, where n is the number of walls, K is a constant with units of dollars per square foot, ℓ is the length of each wall in feet, and h is the height of each wall in feet. If the customer asks the painter to use a more expensive brand of paint, which of the factors in the expression would change?

A) h

B) ℓ

C) K

D) n

2

If $3r = 18$, what is the value of $6r + 3$?

A) 6

B) 27

C) 36

D) 39

3

Which of the following is equal to $a^{\frac{2}{3}}$, for all values of a ?

A) $\sqrt{a^{\frac{1}{3}}}$

B) $\sqrt{a^3}$

C) $\sqrt[3]{a^{\frac{1}{2}}}$

D) $\sqrt[3]{a^2}$

4

The number of states that joined the United States between 1776 and 1849 is twice the number of states that joined between 1850 and 1900. If 30 states joined the United States between 1776 and 1849 and x states joined between 1850 and 1900, which of the following equations is true?

A) $30x = 2$

B) $2x = 30$

C) $\frac{x}{2} = 30$

D) $x + 30 = 2$

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CONTINUE

5

If $\frac{5}{x} = \frac{15}{x+20}$, what is the value of $\frac{x}{5}$?

A) 10

B) 5

C) 2

D) $\frac{1}{2}$

6

$$2x - 3y = -14$$
$$3x - 2y = -6$$

If (x, y) is a solution to the system of equations above, what is the value of $x - y$?

A) -20

B) -8

C) -4

D) 8

7

x	$f(x)$
0	3
2	1
4	0
5	-2

The function f is defined by a polynomial. Some values of x and $f(x)$ are shown in the table above. Which of the following must be a factor of $f(x)$?

A) $x - 2$

B) $x - 3$

C) $x - 4$

D) $x - 5$

8

The line $y = kx + 4$, where k is a constant, is graphed in the xy-plane. If the line contains the point (c, d), where $c \neq 0$ and $d \neq 0$, what is the slope of the line in terms of c and d ?

A) $\frac{d-4}{c}$

B) $\frac{c-4}{d}$

C) $\frac{4-d}{c}$

D) $\frac{4-c}{d}$

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CONTINUE

9

$$kx - 3y = 4$$
$$4x - 5y = 7$$

In the system of equations above, k is a constant and x and y are variables. For what value of k will the system of equations have no solution?

A) $\frac{12}{5}$

B) $\frac{16}{7}$

C) $-\frac{16}{7}$

D) $-\frac{12}{5}$

10

In the xy-plane, the parabola with equation $y = (x - 11)^2$ intersects the line with equation $y = 25$ at two points, A and B. What is the length of $\overline{AB}$?

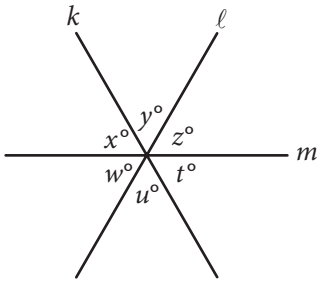
A) 10

B) 12

C) 14

D) 16

11



Note: Figure not drawn to scale.

In the figure above, lines k, ℓ, and m intersect at a point. If $x + y = u + w$, which of the following must be true?

I. $x = z$

II. $y = w$

III. $z = t$

A) I and II only

B) I and III only

C) II and III only

D) I, II, and III

12

$$y = a(x - 2)(x + 4)$$

In the quadratic equation above, a is a nonzero constant. The graph of the equation in the xy-plane is a parabola with vertex (c, d). Which of the following is equal to d ?

A) $-9a$

B) $-8a$

C) $-5a$

D) $-2a$

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CONTINUE

13

The equation $\frac{24x^2 + 25x - 47}{ax - 2} = -8x - 3 - \frac{53}{ax - 2}$ is true for all values of $x \neq \frac{2}{a}$, where a is a constant.

What is the value of a ?

A) -16
B) -3
C) 3
D) 16

14

What are the solutions to $3x^2 + 12x + 6 = 0$?

A) $x = -2 \pm \sqrt{2}$

B) $x = -2 \pm \frac{\sqrt{30}}{3}$

C) $x = -6 \pm \sqrt{2}$

D) $x = -6 \pm 6\sqrt{2}$

15

$$C = \frac{5}{9}(F - 32)$$

The equation above shows how a temperature F, measured in degrees Fahrenheit, relates to a temperature C, measured in degrees Celsius. Based on the equation, which of the following must be true?

I. A temperature increase of 1 degree Fahrenheit is equivalent to a temperature increase of $\frac{5}{9}$ degree Celsius.

II. A temperature increase of 1 degree Celsius is equivalent to a temperature increase of 1.8 degrees Fahrenheit.

III. A temperature increase of $\frac{5}{9}$ degree Fahrenheit is equivalent to a temperature increase of 1 degree Celsius.

A) I only
B) II only
C) III only
D) I and II only

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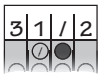
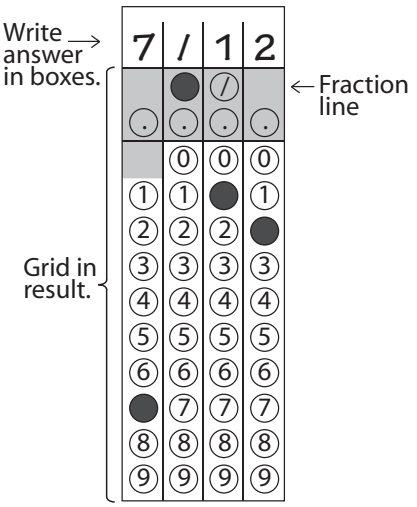
CONTINUE

DIRECTIONS

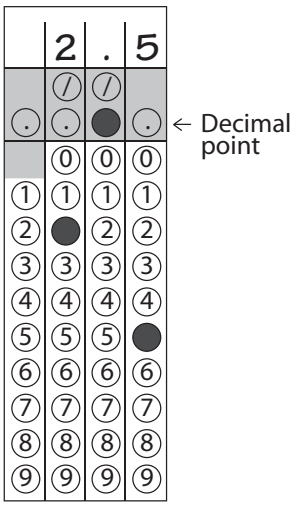
For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
4. Some problems may have more than one correct answer. In such cases, grid only one answer.
5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
6. **Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

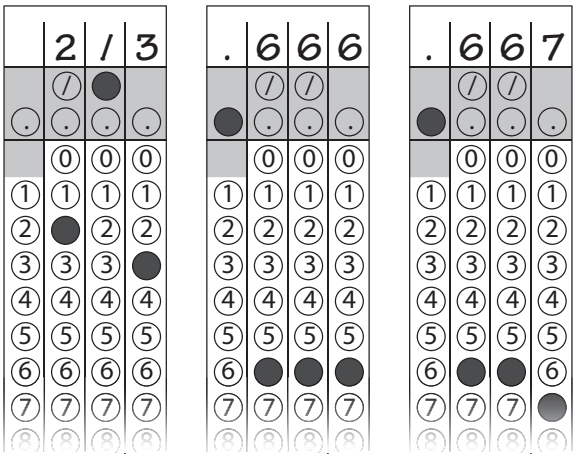
Answer: $\frac{7}{12}$



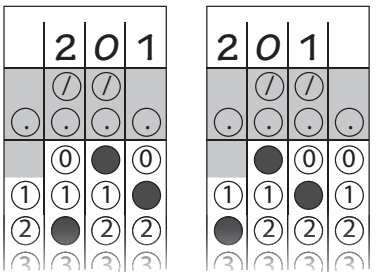
Answer: 2.5



Acceptable ways to grid $\frac{2}{3}$ are:



Answer: 201 – either position is correct



NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

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CONTINUE

16

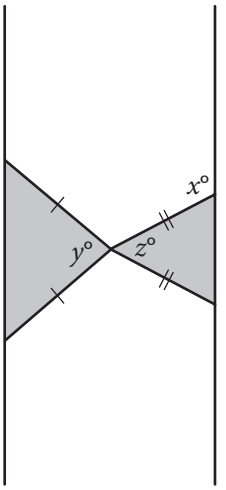
$$x^3(x^2 - 5) = -4x$$

If $x > 0$, what is one possible solution to the equation above?

17

If $\frac{7}{9}x - \frac{4}{9}x = \frac{1}{4} + \frac{5}{12}$, what is the value of x ?

18



Note: Figure not drawn to scale.

Two isosceles triangles are shown above. If $180 - z = 2y$ and $y = 75$, what is the value of x ?

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CONTINUE

19

At a lunch stand, each hamburger has 50 more calories than each order of fries. If 2 hamburgers and 3 orders of fries have a total of 1700 calories, how many calories does a hamburger have?

20

In triangle ABC, the measure of $\angle B$ is $90°$, $BC = 16$, and $AC = 20$. Triangle DEF is similar to triangle ABC, where vertices D, E, and F correspond to vertices A, B, and C, respectively, and each side of triangle DEF is $\frac{1}{3}$ the length of the corresponding side of triangle ABC. What is the value of $\sin F$?

STOP

If you finish before time is called, you may check your work on this section only. Do not turn to any other section.

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