Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

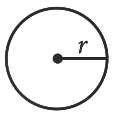
DIRECTIONS

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.

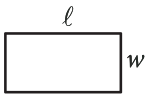
NOTES

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.

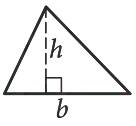
REFERENCE



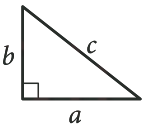
$A = \pi r^2$
$C = 2\pi r$



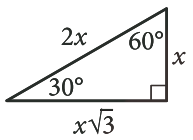
$A = \ell w$

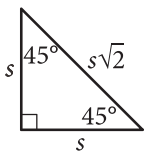


$A = \frac{1}{2}bh$

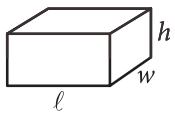


$c^2 = a^2 + b^2$

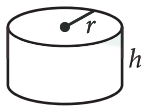




Special Right Triangles

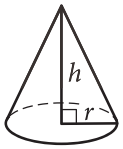


$V = \ell wh$

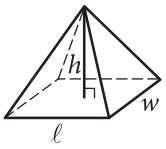


$V = \pi r^2 h$

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



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



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

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.

1

$$ax = 5$$

In the equation above, a is a constant. For which of the following values of a will the equation have no solution?

A) 0

B) 1

C) 5

D) 10

2

If $3(3x+5) = 2x - 8$, what is the value of x?

A) $-\frac{23}{7}$

B) $-\frac{15}{7}$

C) $-\frac{13}{7}$

D) $\frac{7}{11}$

3

x	$h(x)$
2	1
4	7
6	13
8	19

For the linear function h, the table above shows several values of x and their corresponding values of $h(x)$. Which of the following defines h?

A) $h(x) = 2x - 3$

B) $h(x) = 3x - 5$

C) $h(x) = 4x - 7$

D) $h(x) = 4x - 9$

4

Terrence's car contains 8 gallons of fuel. He plans to drive the car m miles using the fuel currently in the car. If the car can drive 20 miles per gallon of fuel, which inequality gives the possible values of m?

A) $m \leq (8)(20)$

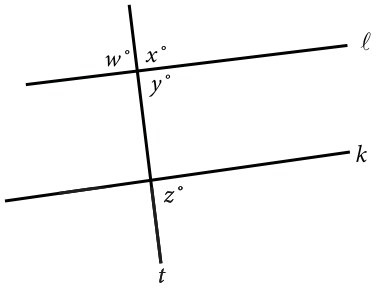
B) $m \geq (8)(20)$

C) $8 \leq 20m$

D) $8 \geq 20m$

CONTINUE

5



Note: Figure not drawn to scale.

In the figure above, line t intersects lines ℓ and k. Which of the following statements, if true, would imply that lines ℓ and k are parallel?

A) $w = y$

B) $w = z$

C) $x = z$

D) $x + y = 180$

6

Blood volume, V_B, in a human can be determined using the equation $V_B = \frac{V_P}{1-H}$, where V_P is the plasma volume and H is the hematocrit (the fraction of blood volume that is red blood cells). Which of the following correctly expresses the hematocrit in terms of the blood volume and the plasma volume?

A) $H = 1 - \frac{V_P}{V_B}$

B) $H = \frac{V_B}{V_P}$

C) $H = 1 + \frac{V_B}{V_P}$

D) $H = V_B - V_P$

7

$$\frac{2(x+1)}{x+5} = 1 - \frac{1}{x+5}$$

What is the solution to the equation above?

A) 0

B) 2

C) 3

D) 5

CONTINUE

8

$$2x^2 - 2 = 2x + 3$$

Which of the following is a solution to the equation above?

A) 2

B) $1 - \sqrt{11}$

C) $\frac{1}{2} + \sqrt{11}$

D) $\frac{1 + \sqrt{11}}{2}$

9

$$2x^3 + 11x^2 + 5x$$

Which of the following is NOT a factor of the polynomial above?

A) x

B) $x + 5$

C) $2x + 1$

D) $2x + 5$

10

The graph in the xy-plane of the linear function f contains the point (3 , 4). For every increase of 5 units in x, $f(x)$ increases by 3 units. Which of the following equations defines the function?

A) $f(x) = -\frac{5}{3}x + 9$

B) $f(x) = -\frac{3}{5}x + \frac{29}{5}$

C) $f(x) = \frac{3}{5}x + \frac{11}{5}$

D) $f(x) = \frac{5}{3}x - 1$

11

x	$p(x)$
−2	5
−1	0
0	−3
1	−1
2	0

The table above gives selected values of a polynomial function p. Based on the values in the table, which of the following must be a factor of p?

A) $(x-3)$

B) $(x+3)$

C) $(x-1)(x+2)$

D) $(x+1)(x-2)$

12

$$g(x)=2^x-2$$

The function g is defined by the equation above. Which of the following points in the xy-plane is an x-intercept of the graph of the equation $y=g(x)$?

A) $(-1, g(-1))$

B) $(0, g(0))$

C) $(1, g(1))$

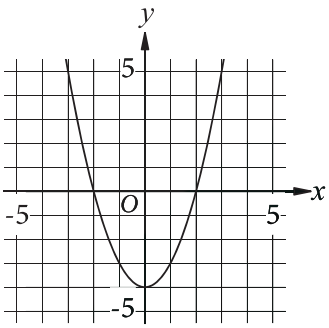
D) $(2, g(2))$

13

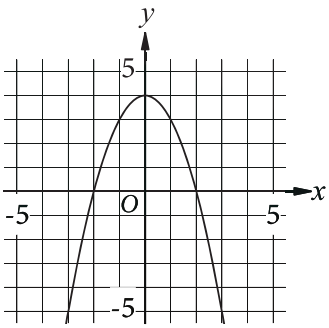
$$y = -x^2 + 4x$$

Which of the following is the graph in the xy-plane of the given equation?

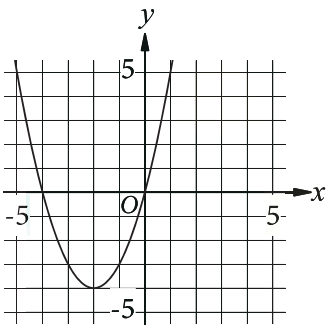
A)



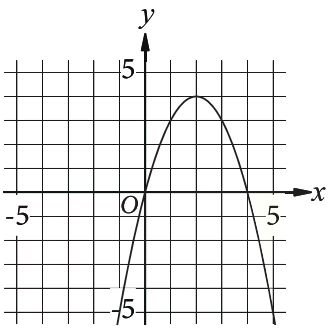
B)



C)



D)



14

$$i^2 + (-i)^2$$

In the complex number system, what is the value of the given expression? (Note: $i = \sqrt{-1}$)

A) -2

B) 0

C) 2

D) $2i$

15

The dimensions of a right rectangular prism are 4 inches by 5 inches by 6 inches. What is the surface area, in square inches, of the prism?

A) 30

B) 74

C) 120

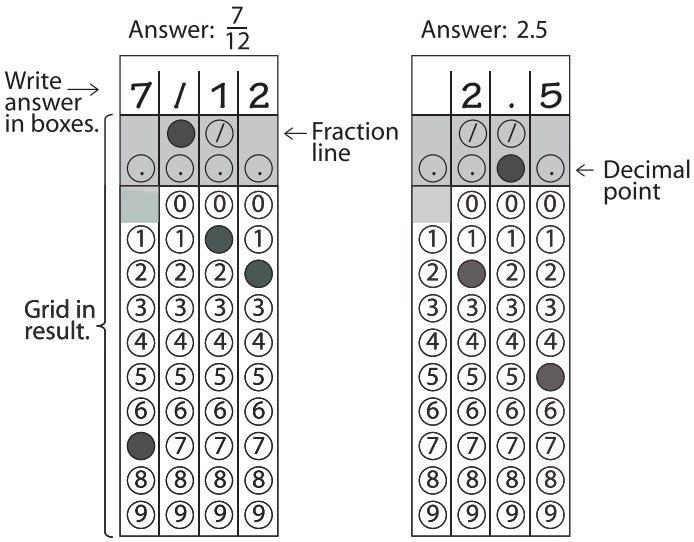
D) 148

CONTINUE

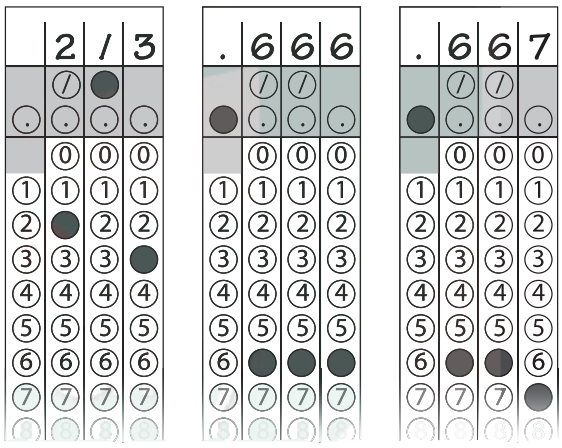
DIRECTIONS

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

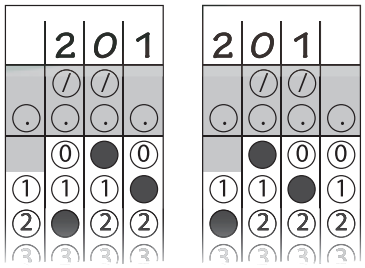
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
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.



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.

16

$$3x + y = 29$$
$$x = 2$$

If (x, y) is the solution to the given system of equations, what is the value of y?

17

A pizza parlor sells pizza slices for $3 each and calzones for $4 each. A group of friends spent $51 on pizza slices and calzones at the parlor. If they bought 6 calzones, how many pizza slices did they buy?

18

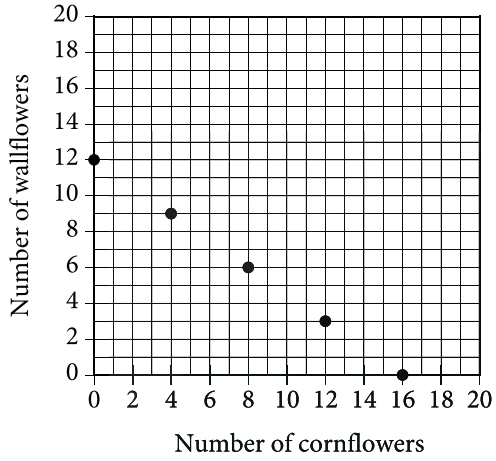
$$h(t) = -16t^2 + 48t + 72$$

If air resistance is ignored, the function h defined above models the height above ground, in feet, of a toy rocket t seconds after it is launched from the roof of building. Based on the model, what is the height above ground, in feet, of the toy rocket 1 second after launch?

CONTINUE

19

Number of cornflowers and Wallflowers at Garden Store



The points plotted in the coordinate plane above represent the possible numbers of wallflowers and cornflowers that someone can buy at the Garden the Store in order to spend exactly $24.00 total on the two types of flowers. The price of each wallflower is the same and the price of each cornflower is the same. What is the price, in dollars, of 1 cornflower? (Disregard the $ sign when gridding your answer. For example, if your answer is $9.87, grid 9.87)

20

If $\frac{\sqrt{x^5}}{\sqrt[3]{x^4}} = x^{\frac{a}{b}}$ for all positive values of x, what is the value of $\frac{a}{b}$?

STOP

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

CONTINUE

Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 31-38**, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

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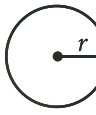
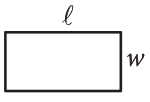
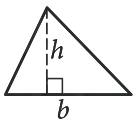


$A = \pi r^2$

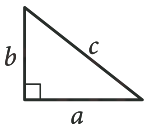
$C = 2\pi r$



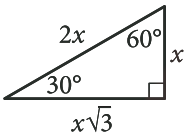
$A = \ell w$

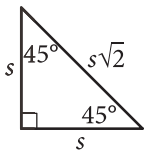


$A = \frac{1}{2}bh$

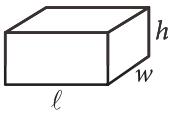


$c^2 = a^2 + b^2$

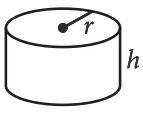




Special Right Triangles

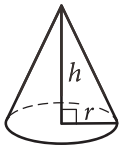


$V = \ell wh$

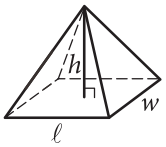


$V = \pi r^2 h$

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



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



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

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.

1

A care-sharing service charges $6 per hour to rent a car plus a $10 fee for insurance. Which of the following gives the total cost c, in dollars, of a rental that lasts t hours?

A) $c = 6t + 10$

B) $c = 6t - 10$

C) $c = 10t + 6$

D) $c = 16t$

2

If $y = x^2 + ax + a$, where a is a constant, and $y = 11$ when $x = 1$, what is the value of a?

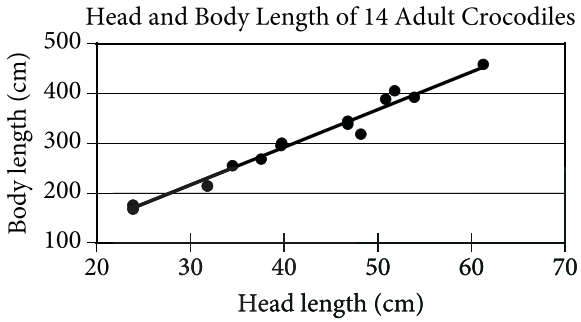
A) -5

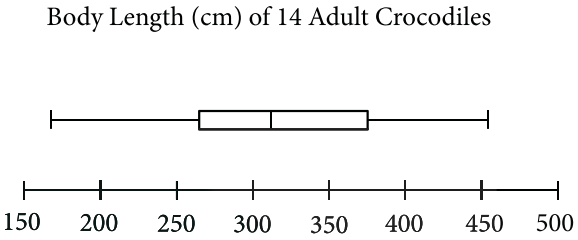
B) -2

C) 2

D) 5

Questions 3-5 refer to the following information.





The scatterplot above represents the head lengths, in centimeters (cm), and body lengths, in cm, of 14 adult crocodiles. The line of best fit for the data is also shown. The box plot above summarizes the body lengths of the 14 crocodiles.

3

For an adult crocodile with a head length of 30 cm, which of the following is closest to the body length, in cm, predicted by the line of best fit?

A) 180

B) 215

C) 250

D) 275

4

Based on the line of best fit, of the following, which is the best estimate of the increase in predicted body length, in cm, for every 10 cm increase in head length?

A) 25

B) 75

C) 125

D) 150

5

Based on the box plot, of the following, which is the best estimate of the median body length, in cm, of the 14 adult crocodiles?

A) 260

B) 300

C) 320

D) 370

6

If $5x - 7 = 13$, what is the value of $10x - 14$?

A) 4

B) 8

C) 26

D) 65

7

x	y
1	4
3	12
5	20
40	k

In the table above, the ratio of y to x for each ordered pair is constant. What is the value of k?

A) 28

B) 36

C) 80

D) 160

8

Which of the following expressions is equivalent to $2a^2(a+3)$?

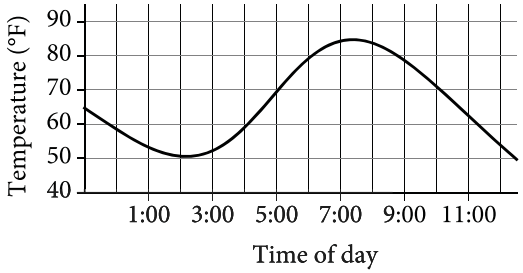
A) $5a^3$

B) $8a^5$

C) $2a^3 + 3$

D) $2a^3 + 6a^2$

9



The graph above shows the temperature in a room during a day when the thermostat malfunctioned. For which of the following two-hour periods was difference between the maximum and minimum temperatures greatest?

A) 1:00 to 3:00

B) 3:00 to 5:00

C) 5:00 to 7:00

D) 7:00 to 9:00

10

$$P(t) = 250 + 10t$$

The population of snow leopards in a certain area can be modeled by the function P defined above, where $P(t)$ is the population t years after 1990. Of the following, which is the best interpretation of the equation $P(30) = 550$?

A) The snow leopard population in this area is predicted to be 30 in the year 2020.

B) The snow leopard population in this area is predicted to be 30 in the year 2030.

C) The snow leopard population in this area is predicted to be 550 in the year 2020.

D) The snow leopard population in this area is predicted to be 550 in the year 2030.

11

In the xy-plane, which of the following changes to the graph of the equation $y = x^2 + 3$ will result in the graph of the equation $y = (x^2 + 3) - 6$?

A) A shift 6 units to the left

B) A shift 6 units to the right

C) A shift 6 units upward

D) A shift 6 units downward

12

Tanya earns $13.50 per hour at her part-time job. When she works z hours, she earns $13.50z$ dollars. Which of the following expression gives the amount, in dollars, Tanya will earn if she works $3z$ hours?

A) $3(13.50z)$

B) $3 + 13.50z$

C) $3z + 13.50z$

D) $13.50(z + 3)$

13

United States Presidents
from 1789 to 2015

Ages	Number
40–44	2
45–49	7
50–54	13
55–59	11
60–64	7
65–69	3

The table above gives the number of United States presidents from 1789 to 2015 whose age at the time they first took office is within the interval listed. Of those presidents who were at least 50 years old when they first took office, what fraction were at least 60 years old?

A) $\frac{10}{43}$

B) $\frac{10}{34}$

C) $\frac{10}{24}$

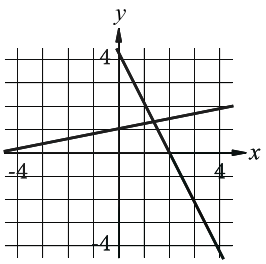
D) $\frac{25}{34}$

14

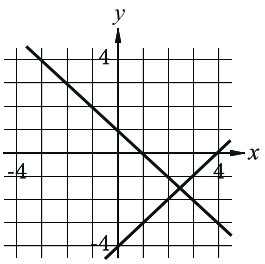
$$x + 5y = 5$$
$$2x - y = -4$$

Which of the following graphs in the xy-plane could be used to solve the system of equations above?

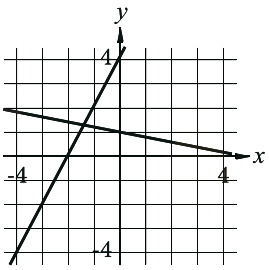
A)



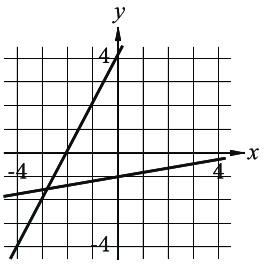
B)



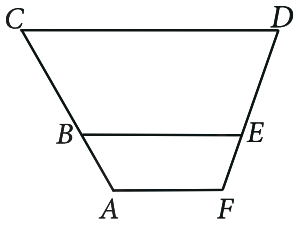
C)



D)



15



In the figure above, $\overline{AF}$, $\overline{BE}$, and $\overline{CD}$ are parallel. Points B and E lie on $\overline{AC}$ and $\overline{FD}$, respectively. If AB=9, BC=18.5, and FE=8.5, what is the length of $\overline{ED}$, to the nearest tenth?

A) 16.8

B) 17.5

C) 18.4

D) 19.6

CONTINUE

Questions 16 and 17 refer to the following information.

Club Participation in the 2014–2015 School Year

Class	Drama	Robotics	Chess	Band	Total
Juniors	21	15	10	18	64
Seniors	27	20	21	17	85
Total	48	35	31	35	149

Of all juniors and seniors who attended a particular high school during the 2014—2015 school year, 149 participated in the clubs listed in the table above. Each of the 149 students participated in only one of the four school clubs listed. The table shows the distribution of the 149 students by class and club participation.

16

The band was composed of freshmen, sophomores, juniors, and seniors. If 30% of the students in the band were juniors, how many students were in the band?

A) 49

B) 54

C) 56

D) 60

17

Of the number of juniors and seniors in the drama club, the 25% who walked to school represents $\frac{1}{8}$ of the total number of juniors and seniors who walked to school. How many juniors and seniors walked to school?

A) 96

B) 60

C) 24

D) 12

CONTINUE

18

A bag containing 10,000 beads of assorted colors is purchased from a craft store. To estimate the percent of red beads in the bag, a sample of beads is selected at random. The percent of red beads in the bag was estimated to be 15%, with an associated margin of error of 2%. If r is the actual number of red beads in the bag, which of the following is most plausible?

A) $r > 1,700$

B) $1,300 < r < 1,700$

C) $200 < r < 1,500$

D) $r < 1,300$

19

x	$f(x)$
0	c
1	$2c$
2	$3c$

For the linear function f, the table above gives some values of x and their corresponding values $f(x)$, where c is a constant. Which of the following equations defines f?

A) $f(x) = x + c$

B) $f(x) = x + 3c$

C) $f(x) = cx + c$

D) $f(x) = 3cx + 3c$

20

$$\frac{1}{x^2 + 10x + 25} = 4$$

If x is a solution to the given equation, which of the following is a possible value of $x + 5$?

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

B) $\frac{5}{2}$

C) $\frac{9}{2}$

D) $\frac{11}{2}$

21

The graph of a line in the *xy*-plane has a positive slope and intersects the *y*-axis at a point that has a negative *y*-coordinate. Which of the following could be an equation of the line?

A) $-3x+2y=-5$

B) $-3x+2y=5$

C) $3x+2y=-5$

D) $3x+2y=5$

22

$$f(x)=-500x^2+25{,}000x$$

The revenue $f(x)$, in dollars, that a company receives from sales of a product is given by the function *f* above, where *x* is the unit price, in dollars, of the product. The graph of $y=f(x)$ in the *xy*-plane intersects the *x*-axis at 0 and *a*. What does *a* represent?

A) The revenue, in dollars, when the unit price of the product is \$0

B) The unit price, in dollars, of the product that will result in maximum revenue

C) The unit price, in dollars, of the product that will result in a revenue of \$0

D) The maximum revenue, in dollars, that the company can make

23

The graph of the equation $ax+ky=6$ is a line in the *xy*-plane, where *a* and *k* are constants. If the line contains the points (−2, −6) and (0, −3), what is the value of *k*?

A) −2

B) −1

C) 2

D) 3

24

From 2005 through 20l4, the number music CDs sold in the United States declined each year by approximately 15% of the number sold the preceding year. In 2005, approximately 600 million CDs were sold in the United States. Of the following, which best models *C*, the number of millions of CDs sold in the United States, *t* years after 2005?

A) $C=600(0.15)^t$

B) $C=600(0.85)^t$

C) $C=600(1.15)^t$

D) $C=600(1.85)^t$

25

$$g(t) = -0.34(t - 5.51)^2 + 8.26$$

The function g above models the growth rate of a certain plant, in millimeters per day (mm/day), in terms of the watering time t, in minutes per day (min/day). What is the meaning of (5.51, g (5.51)) in this context?

A) The watering time of 5.51 min/day results in a plant growth rate of g (5.51) mm/day.

B) The plant growth rate of 5.51 mm/day results in a watering time of g (5.51) min/day.

C) The watering time increases by g (5.51) min/day for every 5.51 mm/day increase in growth rate.

D) The growth rate increases by g (5.51) mm/day for every 5.51 min/day increase in watering time.

26

A psychologist designed and conducted a study to determine whether playing a certain educational game increases middle school students' accuracy in adding fractions. For the study, the psychologist chose a random sample of 35 students from all of the students at one of the middle schools in a large city. The psychologist found that students who played the game showed significant improvement in accuracy when adding fractions. What is the largest group to which the results of the study can be generalized?

A) The 35 students in the sample

B) All students at the school

C) All middle school students in the city

D) All students in the city

27

A manufacturer determined that right cylindrical containers with a height that is 4 inches longer than the radius offer the optimal number of containers to be displayed on a shelf. Which of the following expresses the volume, V, in cubic inches, of such containers, where r is the radius, in inches?

A) $V = 4\pi r^3$

B) $V = \pi(2r)^3$

C) $V = \pi r^2 + 4\pi r$

D) $V = \pi r^3 + 4\pi r^2$

28

For the function f, if $f(3x) = x - 6$ for all values of x, what is the value of $f(6)$?

A) -6

B) -4

C) 0

D) 2

CONTINUE

29

In the system of equation below, a and c are constant.

$$\frac{1}{2}x+\frac{1}{3}y=\frac{1}{6}$$
$$ax+y=6$$

If the system of equation has an infinite number of solutions (x, y), what is the value of a ?

A) $-\frac{1}{2}$

B) 0

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

D) $\frac{3}{2}$

30

A researcher surveyed 200 adults selected at random from the city of Aldley and 300 adults selected at random from the suburbs of Aldley. Each person surveyed was asked whether he or she owns a car. Some of the results are shown in the partially completed table below.

	Owns car	Does not own car	Total
City of Aldley	80	120	200
Suburbs of Aldley	x	y	300

The researcher found that an adult surveyed in the suburbs of Aldley is twice as likely to own a car as an adult surveyed in the city of Aldley. Of the following, which could be the value of x?

A) 120

B) 160

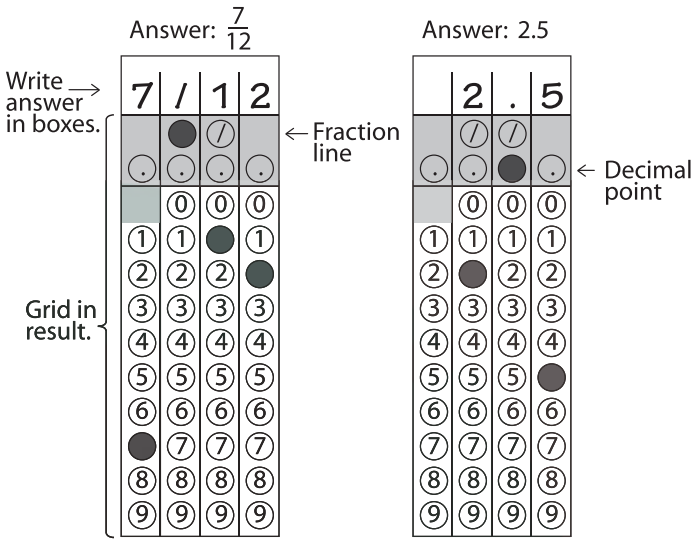
C) 210

D) 240

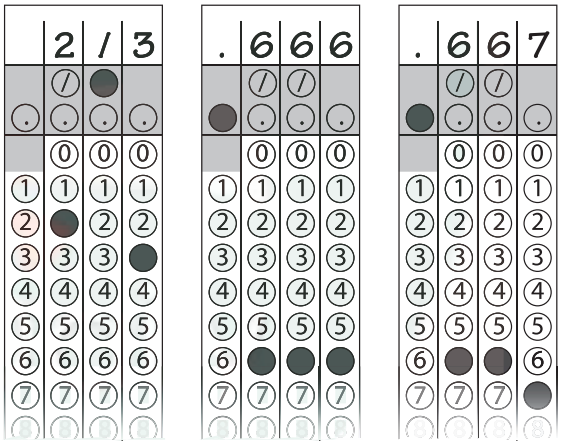
DIRECTIONS

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

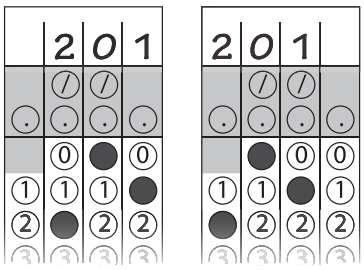
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
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.



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.

31

Pure beeswax has a density of 0.555 ounce per cubic inch. An online company sells pure beeswax at a price of $8.00 per ounce. What is the selling price, in dollars per cubic inch, for pure beeswax purchased from this company? (Disregard the $ sign when gridding your answer. For example, if your answer is $1.37, grid 1.37)

32

2, 10, 3, 7, 6

The mean of the list of numbers above is what fraction of the sum of the five numbers?

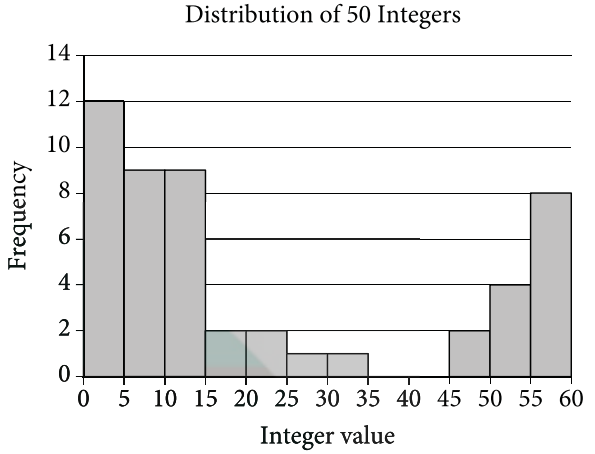
33

The equation $(x+6)^2+(y+3)^2=121$ defines a circle in the xy-plane. What is the radius of the circle?

34

A baker is gathering the ingredients required to make 15 batches of oatmeal cookies and 1 cake. The cake will require one-quarter bag of flour. The baker needs a total of more than 3 but less than 4 bags of flour. What is one possible value for the fraction of one bag of flour required for each batch of cookies?

35



The histogram summarizes the distribution of a data set composed of 50 integers. The first bar represents the number of integers that are at least 0 but less than 5. The second bar represents the number of integers that are at least 5 but less than 10, and so on. What is a possible value of the median of the data set?

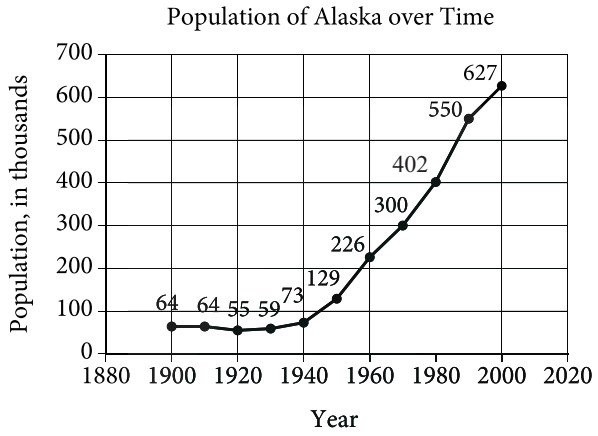
36

$$K=\frac{200v^2}{2}$$

In the equation above, the kinetic energy, K, of a 200-gram object is given in terms of its speed, v. If the equation is rewritten in the form $v=a\sqrt{K}$, where a is a positive constant, what is the value of a ?

CONTINUE

Questions 37 and 38 refer to the following information.



The line graph above shows the population, in thousands, of people living in Alaska every 10 years from 1900 to 2000.

37

What was the population of Alaska, in thousands, in 1990?

38

The ratio of the population of Alaska in 1980 to the population of Alaska in 1970 can be written as $a : 1$. What is the value of a?

STOP

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