Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

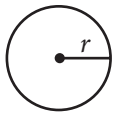
DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding bubble 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.

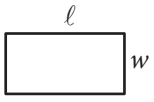
NOTES

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.

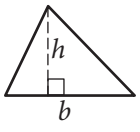
REFERENCE



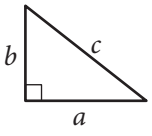
$A = \pi r^2$
$C = 2\pi r$



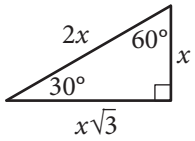
$A = \ell w$

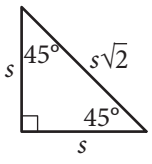


$A = \frac{1}{2}bh$

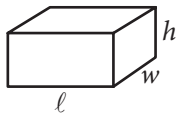


$c^2 = a^2 + b^2$

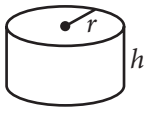




Special Right Triangles

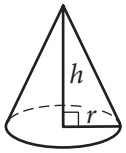


$V = \ell wh$

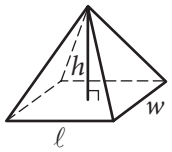


$V = \pi r^2 h$

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



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



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

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

A certain university offers courses that are either 3 credits or 4 credits per course each semester. A student registered for a total of 16 credits for the fall semester. Which equation represents the possible number of 3-credit courses, x, and 4-credit courses, y, that the student could have registered for?

A) $3x+4y=7$

B) $3x+4y=16$

C) $x+y=7$

D) $x+y=16$

2

The function f is defined by $f(x)=x+3$. What is the y-intercept of the graph of $y=f(x)$ in the xy-plane?

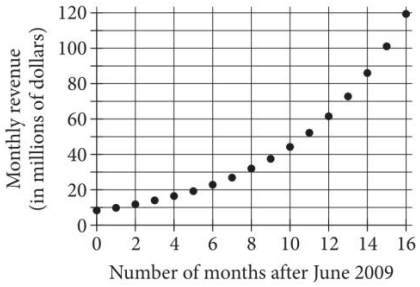
A) (0,-3)

B) (0,-1)

C) (0,1)

D) (0,3)

3



The graph shown models the monthly revenue, in millions of dollars, for a particular marketing company from June 2009 through October 2010. According to the model, which of the following is closest to this company's monthly revenue, in millions of dollars, for June 2009?

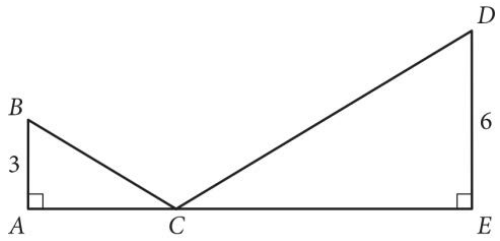
A) 8.5

B) 22.5

C) 62

D) 100

4



In the figure shown, right triangle ABC is similar to right triangle EDC, where $\angle ACB$ is congruent to $\angle ECD$ and $AE=15$. What is the length of $\overline{CE}$?

A) 4

B) 5

C) 8

D) 10

5

Which polynomial is equivalent to $(12x^4 - 5x + 18) + (6x^4 + 13x^2 + 7x - 9)$?

A) $(18x^8 + 13x^3 + 2x + 9)$

B) $(18x^8 + 8x^3 + 25x - 9)$

C) $(18x^4 + 13x^2 + 2x + 9)$

D) $(18x^4 + 8x^2 + 25x - 9)$

6

The equation $y = \frac{x + w}{z}$ relates the positive numbers w, x, y, and z. Which equation correctly expresses x in terms of w, y, and z ?

A) $x=yz-w$

B) $x=yz+w$

C) $x = \frac{z}{wy}$

D) $x = \frac{y}{zw}$

7

$g(x)=-0.038x+2.136$

The given linear function g models the annual percentage increase in the population of India x years after 1990. What is the best interpretation of $g(20)=1.376$ in this context?

A) 1.376 years after 1990, the percentage increase in the population of India was 20% over the previous year.

B) 1.376 years after 1990, India's population was approximately 20 times its population in 1990

C) 20 years after 1990, the percentage increase in the population of India was 1.376% over the previous year.

D) 20 years after 1990, India's population was approximately 1.376 times its population in 1990.

8

$f(x)=a(x-b)(x-c)$

For the quadratic function f shown, a, b, and c are constants. For the graph of the $y=f(x)$ in the xy-plane, the quadratic function f opens upward, and the coordinates of its vertex are both negative. Which of the following could be true?

A) $a<0, b<0, c<0$

B) $a<0, b>0, c>0$

C) $a>0, b<0, c<0$

D) $a>0, b>0, c>0$

CONTINUE

9

$$2x+6y=2$$

$$2(2x+y)=20$$

How many solutions does the given system of equations have?

A) Zero
B) Exactly one
C) Exactly two
D) Infinitely many

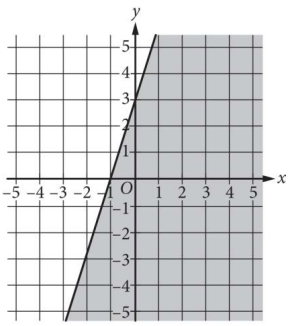
10

$$|2x+6|+4=8$$

What is the sum of the solutions to the given equation?

A) -6
B) -3
C) 0
D) 8

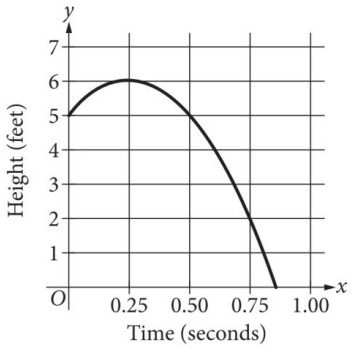
11



The shaded region shown represents the solutions to which inequality?

A) $3x - y \leq -3$
B) $3x - y \geq -3$
C) $3x + y \leq 3$
D) $3x + y \geq 3$

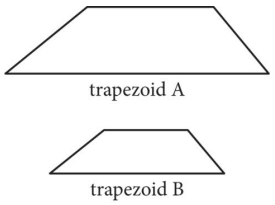
12



The graph shown models the height y, in feet, of a volleyball x seconds after it was hit by a player. Which equation represents the relationship between the height of the volleyball and the time since the volleyball was hit?

A) $y = -16x^2+5$
B) $y = -16(x - 5)^2$
C) $y = -16(x - 0.86)^2$
D) $y = -16(x - 0.25)^2+6$

13



Note: Figures not drawn to scale.

Trapezoid A and trapezoid B shown are similar. The length of each side of trapezoid A is 8 times the length of the corresponding side of trapezoid B. The area of trapezoid A is how many times as large as the area of trapezoid B?

A) 8
B) 16
C) 32
D) 64

14

The function f is defined by $f(x)=(-8)(6)^{x}-4$. What is the y-intercept of the graph of $y=f(x)$ in the xy-plane?

A) (0,-12)

B) (0,-8)

C) (0,-4)

D) (0,6)

15

Which of the following expressions is equivalent to $(\sqrt{2q}+\sqrt{2r})^{\frac{2}{3}}$, where $q>0$ and $r<0$?

A) $(2q+2r)^3$

B) $\sqrt[3]{2q+2r}$

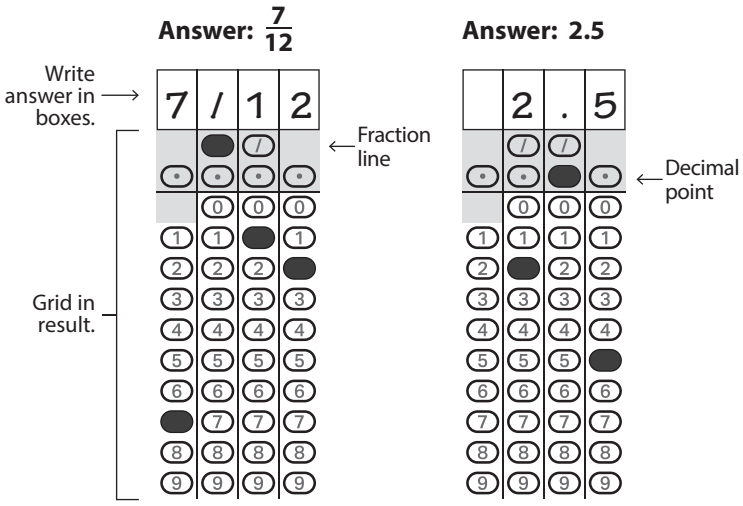
C) $\sqrt[3]{2q+2\sqrt{qr}+2r}$

D) $\sqrt[3]{2q+4\sqrt{qr}+2r}$

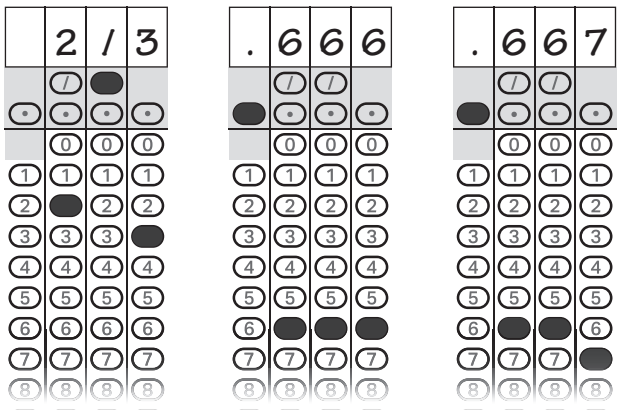
DIRECTIONS

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

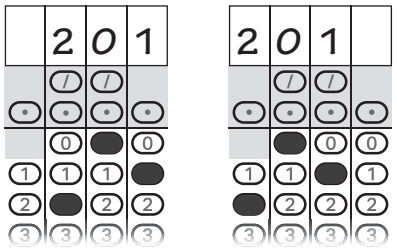
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
2. Mark no more than one bubble in any column.
3. No question has a negative answer.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

If $3x-9=6$, what is the value of $2x$?

17

$\sqrt{x^2-9}=4$

What is the positive solution to the given equation?

18

Line p is defined by $2y+4x=9$. Line r is perpendicular to line p in the xy-plane. What is the slope of line r ?

19

If $\frac{2x}{3}-2=\frac{x}{3}+1$, what is the value of $2x$?

20

Points A and B lie on a circle with radius 4 meters, and arc $\overset{\frown}{AB}$ has length meters. The length $\frac{4\pi}{5}$ of arc $\overset{\frown}{AB}$ is what fraction of the circumference of the circle?

STOP

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

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 bubble 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

1. The use of a calculator **is permitted**.
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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.

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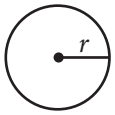
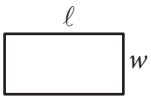
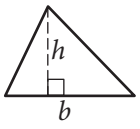


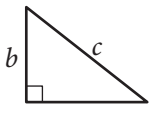
$A = \pi r^2$
$C = 2\pi r$



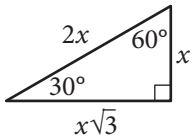
$A = \ell w$

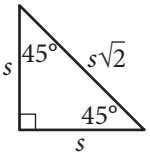


$A = \frac{1}{2}bh$

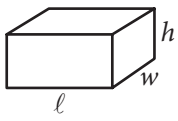


$c^2 = a^2 + b^2$

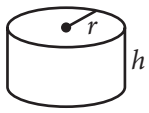




Special Right Triangles

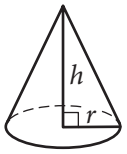


$V = \ell wh$

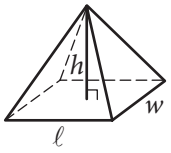


$V = \pi r^2 h$

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



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



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

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

The function f is defined by $f(x)=9x-16$. What is the value of $f(3)$?

A) -39

B) -4

C) 11

D) 27

2

$6x-7=12$

Which equation has the same solution as the given equation?

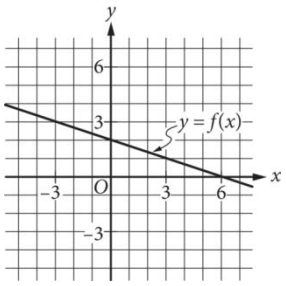
A) $6x=5$

B) $6x=6$

C) $6x=18$

D) $6x=19$

3



The graph of linear function f is shown. What is the y-intercept of the graph of f ?

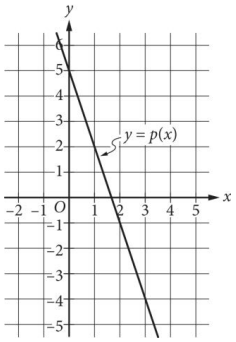
A) (0,0)

B) (0,2)

C) (0,3)

D) (0,6)

4



The graph of the linear function p is shown. Which equation defines p ?

A) $p(x) = -3x + 5$

B) $p(x) = -3x + 2$

C) $p(x) = -\frac{1}{3}x + 5$

D) $p(x) = -\frac{1}{3}x + 2$

5

Of the 50 states in the United States, 12 states are in the Midwest region. What percent of states in the United States are in the Midwest region?

A) 12%

B) 24%

C) 38%

D) 62%

Questions 6-7 refer to the following information.

$T=0.32x+0.29y$

Janice raises chickens. She uses the equation shown to estimate the total daily feed intake T, in pounds, for x male and y female chickens that are between 28 and 35 days old.

6

Using the given equation, Janice estimates that the total daily feed intake for her chickens is 90 pounds. If Janice has 100 male chickens, how many female chickens does she have?

A) 191
B) 200
C) 228
D) 245

7

Which equation estimates the total weekly feed intake W, in pounds, for x male and y female chickens that are between 28 and 35 days old?

A) $w = \frac{0.32x + 0.29y}{7}$

B) $w = \frac{0.32x}{7} + 0.29y$

C) $w = 7(0.32x) + 0.29y$

D) $w = 7(0.32x + 0.29y)$

8

The function g is defined by $g(x) = 4x^2 - 3$. For what positive value of x is $g(x)=13$?

A) 2

B) 4

C) $\frac{\sqrt{10}}{4}$

D) $\frac{\sqrt{10}}{2}$

9

In triangle ABC, the measure of angle A is $23°$ and the measure of angle B is $97°$. In triangle DEF, the measure of angle D is $23°$ and the measure of angle E is $97°$. Which of the following additional pieces of information is needed to determine whether triangle ABC is similar to triangle DEF ?

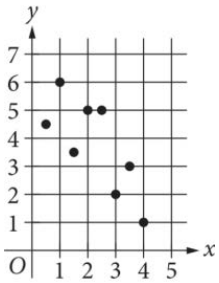
A) The measure of angle C

B) The measure of angle F

C) The measure of angle C and the measure of angle F

D) No additional information is needed.

10



Which of the following linear equations is the most appropriate model for the data shown in the scatterplot?

A) $y=6-x$

B) $y=6+x$

C) $y=-6-x$

D) $y=-6+x$

11

The current density in a wire is defined as the current, in milliamperes, flowing through the wire divided by the cross-sectional area of the wire, in square millimeters. What is the current density, in milliamperes per square millimeter, in a copper wire with a cross-sectional area of 6 square millimeters when a current of 15 milliamperes flows through the wire?

A) 0.4

B) 2.5

C) 15

D) 90

12

What is the radius of the circle in the xy-plane with equation $(x-9)^2+(y-3)=64$?

A) 64
B) 9
C) 8
D) 3

13

If $\frac{6}{x+1}=3$, what is the value of $x+1$?

A) 0.5
B) 1
C) 2
D) 3

14

Fahari kicks a ball on the ground into the air. One second after being kicked, the ball reaches its maximum height of 16 feet above the ground, and 2 seconds after being kicked, the ball is back on the ground. A quadratic function models the height $h(t)$, in feet, of the ball t seconds after Fahari kicks it. Which equation defines this relationship?

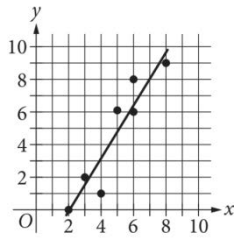
A) $h(t)=-16(t-16)^2+1$

B) $h(t)=-16(t-1)^2+16$

C) $h(t)=-16(t+1)^2-16$

D) $h(t)=-16(t+16)^2-1$

15



The scatterplot shows the relationship between two variables, x and y. A line of best fit is also shown. For how many of the data points is the actual y-value at least 1 greater than the y-value predicted by the line of best fit?

A) 1
B) 2
C) 3
D) 4

16

A 3,000-piece rectangular jigsaw puzzle has 216 edge pieces, and the rest are inside pieces. The equation $48r+216=3{,}000$ describes this situation, where r represents the number of rows that contain inside pieces. Which of the following is the best interpretation of $48r$ in this context?

A) There are $48r$ total pieces.
B) There are $48r$ pieces in each row.
C) There are $48r$ edge pieces.
D) There are $48r$ inside pieces.

17

$$y < -3x + 1$$
$$y < -\frac{1}{2}x + 1$$

Which ordered pair (x, y) is a solution to the given system of inequalities in the xy-plane?

A) $(-2,3)$
B) $(1,2)$
C) $(0,2)$
D) $(-1,1)$

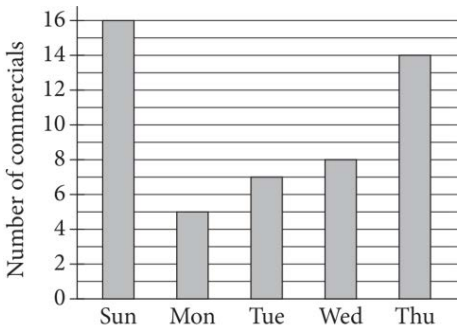
18

Opinions on the Proposal				
	For	Against	Undecided	Total
County 1	526	980	95	1,601
County 2	667	386	91	1,144
Total	1,193	1,366	186	2,745

The table shows the results of a poll that was used to determine support for a county proposal. The results are categorized by county and opinion. If one person who responded to the poll is selected at random, which of the following statements results in the greatest value?

A) The probability that the person is undecided, given that the person is from County 1
B) The probability that the person is undecided, given that the person is from County 2
C) The probability that the person is from County 1, given that the person is undecided
D) The probability that the person is from County 2, given that the person is undecided

19



The bar graph shows the number of commercials Albert saw each day that he watched television last week. For these five days, how much greater is the mean number of commercials per day than the median number of commercials per day?

A) 2

B) 3

C) 5

D) 6

20

A county school board in a certain state is proposing a start time of 7:30 a.m. for all high schools in the county. A sample of 100 high school students was selected at random from all high school students in the county. The selected students were asked whether they approved of the proposed change in the school start time, and 70 students responded that they did not approve of the proposed change. Which of the following is the largest population to which the results of the survey can be generalized?

A) The 70 students who responded that they did not approve of the proposed change

B) The 100 students who were surveyed

C) All high school students in the county

D) All high school students in the state

Questions 21-22 refer to the following information.

The bar graph shown summarizes the total number of businesses, in thousands, and the total number of tourism-related businesses, in thousands, in Iceland for each of 7 years.

21

Tourism-related businesses employed 13.5 thousand people in Iceland in 2009. Which of the following is closest to the mean number of employees per tourism-related business in Iceland in 2009?

A) 5

B) 14

C) 23

D) 58

22

In 2008, what percentage of the total businesses in Iceland were tourism-related?

A) 52%

B) 20%

C) 5%

D) 2%

23

The heat capacity of a substance is the amount of energy, in joules (J), required to raise the temperature of 1 gram (g) of the substance by 1 degree Celsius (°C). The heat capacity of water is approximately 4.2 $\frac{J}{g \cdot °C}$. Approximately how much energy, in joules, is required to raise the temperature of 1.0 g of water from 22°C to 30°C?

A) 1.9
B) 8.0
C) 34
D) 92

24

$$v = (1{,}000)(1.05)^t$$

The given equation models the value of an antique dresser t years after its restoration, where $0 \le t \le 5$. Which of the following equations best models the value of the dresser m months after its restoration, where $0 \le m \le 60$?

A) $v = (\frac{1{,}000}{12})(1.05)^m$

B) $v = (1{,}000)(\frac{1.05}{12})^m$

C) $v = (1{,}000)(1.05)^{\frac{m}{12}}$

D) $v = (1{,}000)(1.05)^{12m}$

25

$$(x-5)^2 + 10(x-5) + 25 = 0$$

How many distinct real solutions does the given equation have?

A) Zero
B) Exactly one
C) Exactly two
D) Infinitely many

26

$$4x - y = 3$$

One of the two equations in a linear system is given. The system has exactly one solution. Which equation could be the other equation in the system?

A) $-4x + y = 6$
B) $4x - y = 3$
C) $4x + y = 5$
D) $4x - y = 5$

27

A drawing of an object has a scale where a length of 4 inches on the drawing represents an actual length of 9 feet. The actual length of the object is $12y$ feet. Which expression represents the length, in inches, of the object in the drawing?

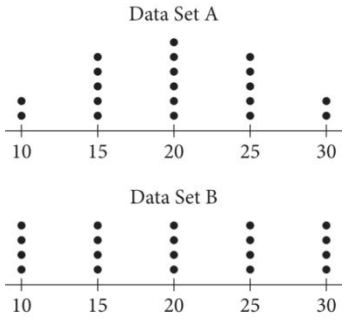
A) $\frac{4}{3}y$

B) $3y$

C) $\frac{16}{3}y$

D) $27y$

28



The dot plots shown each represent a data set. Which of the following statements best compares the means and the standard deviations of the two data sets?

A) The means are equal; the standard deviation of data set A is less than the standard deviation of data set B.

B) The means are equal; the standard deviation of data set A is greater than the standard deviation of data set B.

C) The standard deviations are equal; the mean of data set A is less than the mean of data set B.

D) The standard deviations are equal; the mean of data set A is greater than the mean of data set B.

29

The expression $0.7x$ represents the result of decreasing a positive quantity x by what percent?

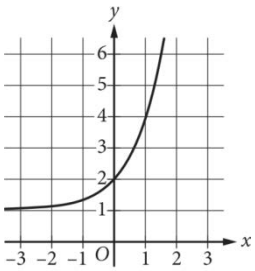
A) 70%

B) 30%

C) 7%

D) 3%

30



The graph of $y=f(x)+1$ is shown. Which equation defines the function f?

A) $f(x) = 2^x$

B) $f(x) = 3^x$

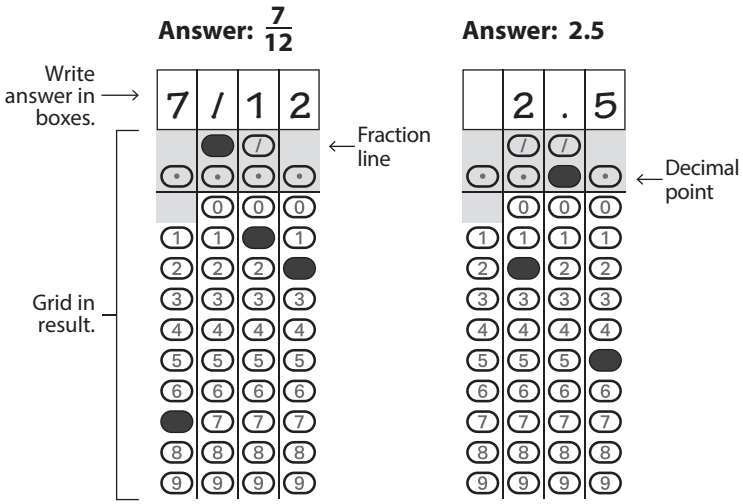
C) $f(x) = 2^x + 1$

D) $f(x) = 3^x + 2$

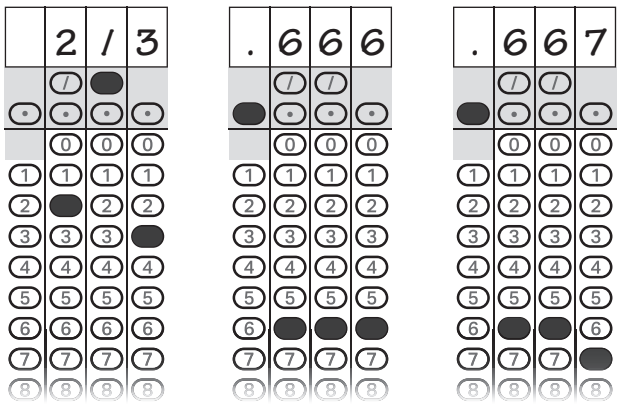
DIRECTIONS

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

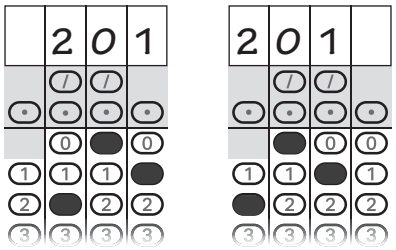
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
2. Mark no more than one bubble in any column.
3. No question has a negative answer.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

Over a period of one year, two points on opposite sides of a mid-ocean ridge moved a distance of 4 centimeters farther apart. What is this distance, in meters? (1 meter = 100 centimeters)

32

If $7(x\text{-}3)=2(x\text{-}3)$, what is the value of $(x\text{-}3)$?

33

One of the factors of $2x^3 + 14x^2 + 24x$ is x+b, where b is a positive constant. What is one possible value of b?

34

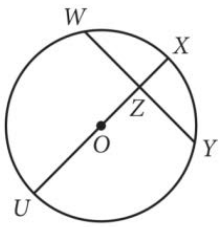
Class size	Frequency
21	10
22	13
23	30
24	36
25	20

The table shows the distribution of class sizes for the 109 classes of a high school. What is the median class size at the high school?

35

When Arban walks from home to class, he burns 4.2 calories per minute, and when he rides his bike from home to class, he burns 5.1 calories per minute. If Arban spent a total of 2 hours walking and bicycling from home to class in a week and burned a total of 531 calories, how many minutes did he spend walking?

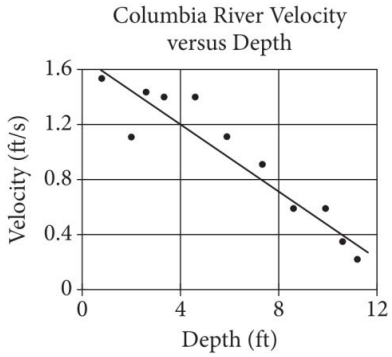
36



Note: Figure not drawn to scale.

In the circle shown, point O is the center, and diameter $\overline{UX}$ bisects $\overline{WY}$ at point Z. The radius of the circle is 6, and XZ=2 . If $WZ = \sqrt{x}$, what is the value of x ?

Questions 37 and 38 refer to the following information.



At a certain location in the Columbia River, the velocity of the water flow at different depths was measured. The scatterplot shown gives 11 measurements of the velocity v, in feet per second (ft/s), of the water at various depths d, in feet. A line of best fit for the data is also shown.

37

According to the line of best fit, what is the predicted velocity of the water flow, in feet per second, at a depth of 4 feet?

38

For what fraction of the data points in the scatterplot is the velocity of the water flow predicted by the line of best fit greater than the measured velocity?

STOP

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