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
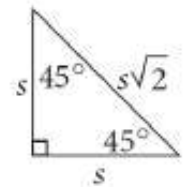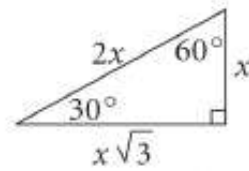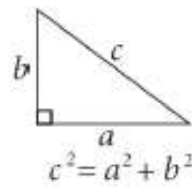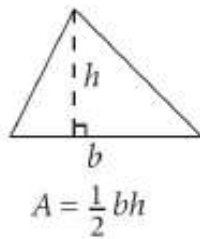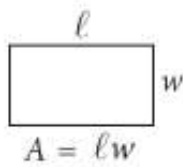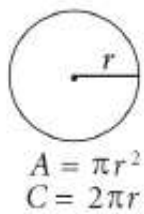
1. What is the sum of the complex numbers $6 + 2i$ and $3 + 5i$, where $i = \sqrt{-1}$?

A) $9 + 7i$

B) $18 + 10i$

C) 16

D) $16i$

2. Mary has decided to earn extra money by landscaping yards. In addition to her hourly rate, she charges each customer a flat fee for travel and s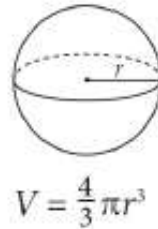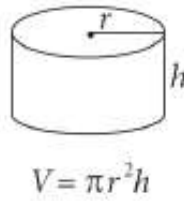upplies. The equation $C = 9h + 14$ represents the total cost C, in dollars, Mary will charge for h hours of work. What does 14 represent in the equation?

A) The total cost, in dollars, Mary charges a customer for one hour of work   B) The total cost, in dollars, Mary charges a customer for any amount of work   C) The amount of the flat fee, in dollars

D) The hourly rate, in dollars

3. Jeff has two different brands of trail mix. Trail Mix X contains 30%

peanuts by volume and Trail Mix Y contains 70% peanuts by volume. Combined, the two trail mixes Jeff purchased contain a total of 12 cups of peanuts. Which equation models this relationship, where a is the number of cups of Trail Mix X and b is the number of cups of Trail Mix Y ?

A) $12 = 0.3a + 0.7b$

B) $12 = 0.7a + 0.3b$

C) $12 = 30a + 70b$

D) $12 = 70a + 30b$

4. If $p = \dfrac{3}{4} q$ and $q = 12$, what is the value of $3p - 4$?

A) 8

B) 9

C) 17

D) 23

5. Which of the following is the graph of the equation $y = -3x + 6$ in the xy-plane?

A)

peanuts by volume and Trail Mix Y contains 70% peanuts by volume. Combined, the two trail mixes Jeff purchased contain a total of 12 cups of peanuts. Which equation models this relationship, where a is the number of cups of Trail Mix X and b is the number of cups of Trail Mix Y ?

A) $12 = 0.3a + 0.7b$

B) $12 = 0.7a + 0.3b$

C) $12 = 30a + 70b$

D) $12 = 70a + 30b$

4. If $p = \dfrac{3}{4} q$ and $q = 12$, what is the value of $3p - 4$?

A) 8

B) 9

C) 17

D) 23

5. Which of the following is the graph of the equation $y = -3x + 6$ in the xy-plane?

A)
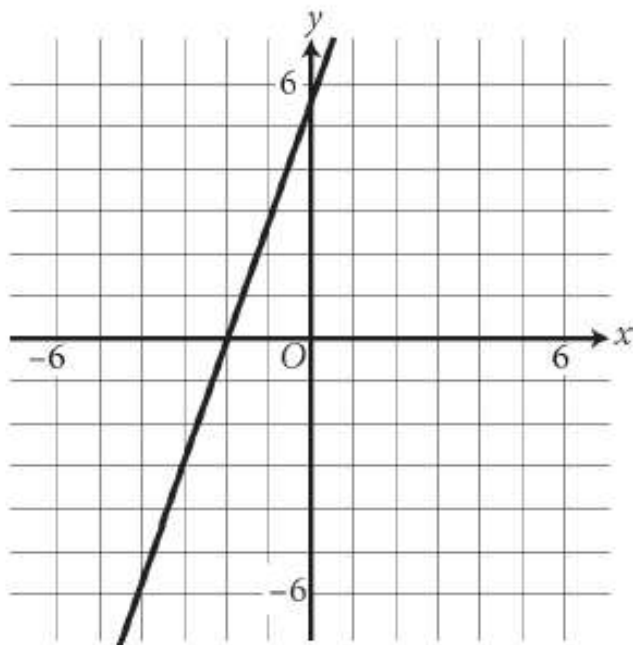
B)
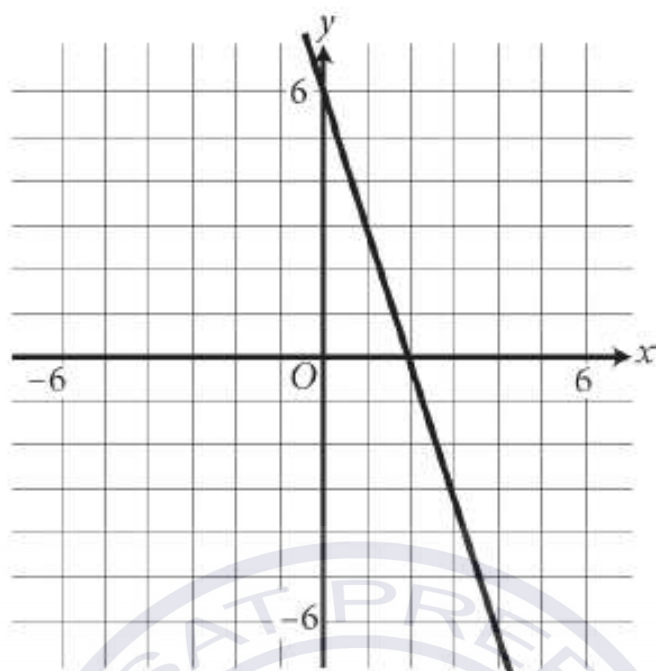
C)
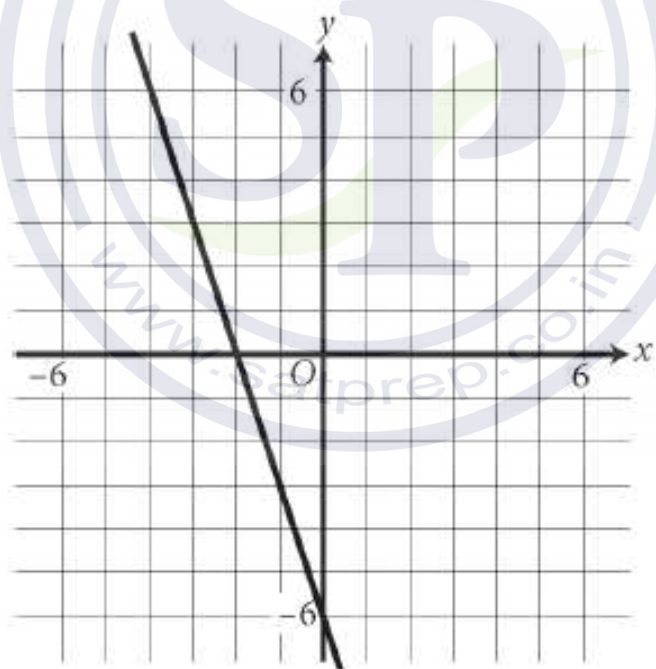
D)
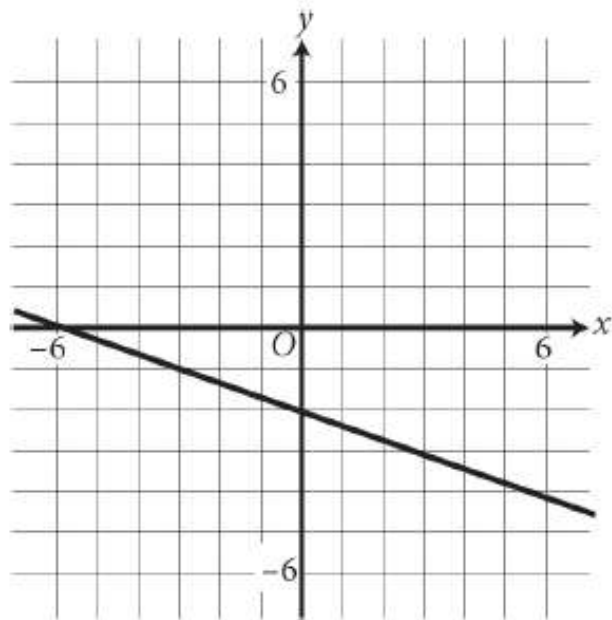
6.

$$9y^2 - 16 = (zy + r)(zy - r)$$

In the equation above, z and r are constants. Which of the following could be the value of z ?

A) 16

B) 9

C) 4

D) 3

7.

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

The table above shows some values of the functions f and g. For which value of x is $f(x) - g(x) = x$?

A)   2

B)   1

C) 0

D) –1

8. If $\sqrt{t} + \sqrt{4} = \sqrt{36}$, what is the value of t ?

A) 32

B) 16

C) 4

D) $\sqrt{4}$

9. A physics student uses the formula $E = 10mh$ to estimate the potential energy, E, of a ball that has a mass of m kilograms and is at a height of h meters above the ground. Which of the following correctly expresses m, in terms of E and h ?

A) $m = \dfrac{h}{10E}$

B) $m = \dfrac{E}{10h}$

C) $m = \dfrac{10}{Eh}$

D) $m = \dfrac{E}{10 + h}$

10. Which of the following is equivalent to $\dfrac{3b^2 + 9b}{3b + 6}$?

A) $b - \dfrac{6}{3b + 6}$

B) b

C) $b + 1 - \dfrac{6}{3b + 6}$

D) $b + 3$

11. Taylor is training for a gymnastics competition. Her goal is to practice an average of at least 45 hours per month for 5 months. She practiced for 39 hours the first month, 48 hours the second month, 46 hours the third month, and 49 hours the fourth month. Which inequality can be used to represent the number of hours, h, Taylor could practice in the 5th month to meet her goal?

A) $39 + 46 + 48 + 49 + h \geq 5(45)$

B) $\dfrac{39 + 46 + 48 + 49}{4} + h \geq 45$

C) $39 + 46 + 48 + 49 \geq h(45)$

D) $\dfrac{39}{5} + \dfrac{46}{5} + \dfrac{48}{5} + \dfrac{49}{5} + i \geq 45$

12. The vertex of the parabola in the xy-plane below is $(0, n)$. Which of the following is true about the parabola with the equation $y = a(x + m)^2 + n$?
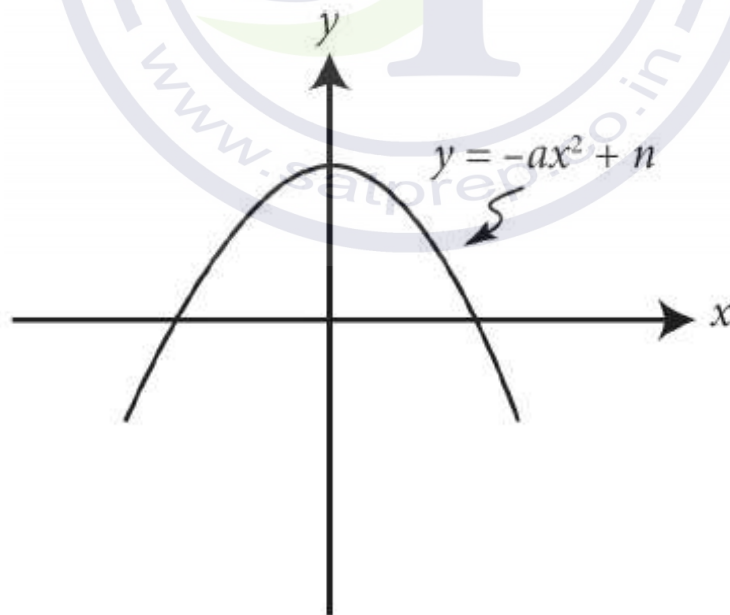
A) The vertex is $(-m, n)$ and the graph opens downward.

B) The vertex is (m, n) and the graph opens downward.

C) The vertex is $(-m, n)$ and the graph opens upward.

D) The vertex is (m, n) and the graph opens upward.

13. A restaurant owner is buying potatoes and carrots from her vegetable supplier. The supplier will deliver no more than $500 worth of product in each delivery. Each pound of potatoes costs $3.25 and each pound of carrots costs $2.47. The owner needs to buy at least three times as many pounds of potatoes as pounds of carrots. Let p represent the number of pounds of potatoes and let c represent the number of pounds of carrots, where p and c are nonnegative integers. Which of the following systems of inequalities best represents this situation?

A) $3.25p + 2.47c \leq 500$
   $3p \geq c$ B) $3.25p + 2.47c \leq 500$
   $p \geq 3c$

C) $9.75p + 2.47c \leq 500$
   $p \geq 3c$

D) $9.75p + 2.47c \leq 500$
   $3p \geq c$

14. Which of the following is equivalent to $\left(r + \dfrac{s}{3} \right)^2$?

A) $r^2 + \dfrac{rs}{3} + \dfrac{s^2}{3} + \dfrac{2rs}{3} + \dfrac{s^2}{9}$

B) $r^2 + \dfrac{s^2}{3} + \dfrac{s^2}{9}$

C) $r^2 + \dfrac{2rs}{3} + \dfrac{s^2}{9}$

D) $r^2 + \dfrac{s^2}{9}$

15.

$$3x^2 + 6x = d$$

In the equation above, d is a constant. If the equation has no real solutions, which of the following could be the value of d ?

A) 4

B) 2

C) –2

D) –4

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 as $3\frac{1}{2}$.) 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: $\frac{7}{12}$

Write answer in boxes.

Grid in result.

Fraction line

Answer: 2.5

Decimal point

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.

$$\frac{3}{2} = \frac{2}{7}n$$ What value of n is the solution of the equation above?

17. How many pints of a 30% sugar solution must be added to 5 pints of a 5% sugar solution to obtain a 20% sugar solution?

18. If $x^{\frac{y}{3}} = 81$ for positive integers x and y, what is one possible value of y ?

19. Points R and S lie on circle O with radius 2, and the area of sector ROS is $\frac{\pi}{2}$. What fraction of the area of the circle is the area of sector ROS ?

20.
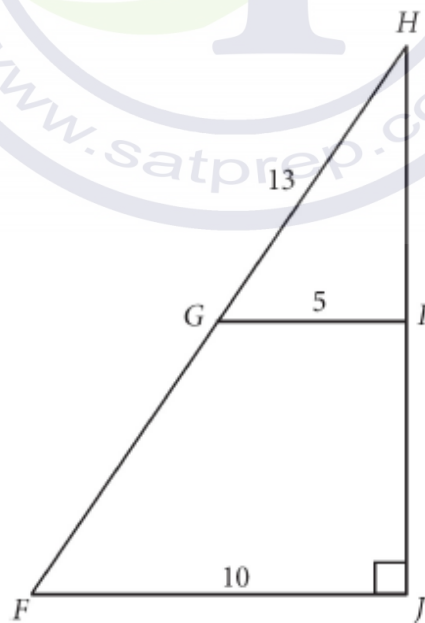
In the figure above, $\overline{GI}$ is parallel to $\overline{FJ}$. What is the length of $\overline{HJ}$?

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

1. The use of a calculator **is 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
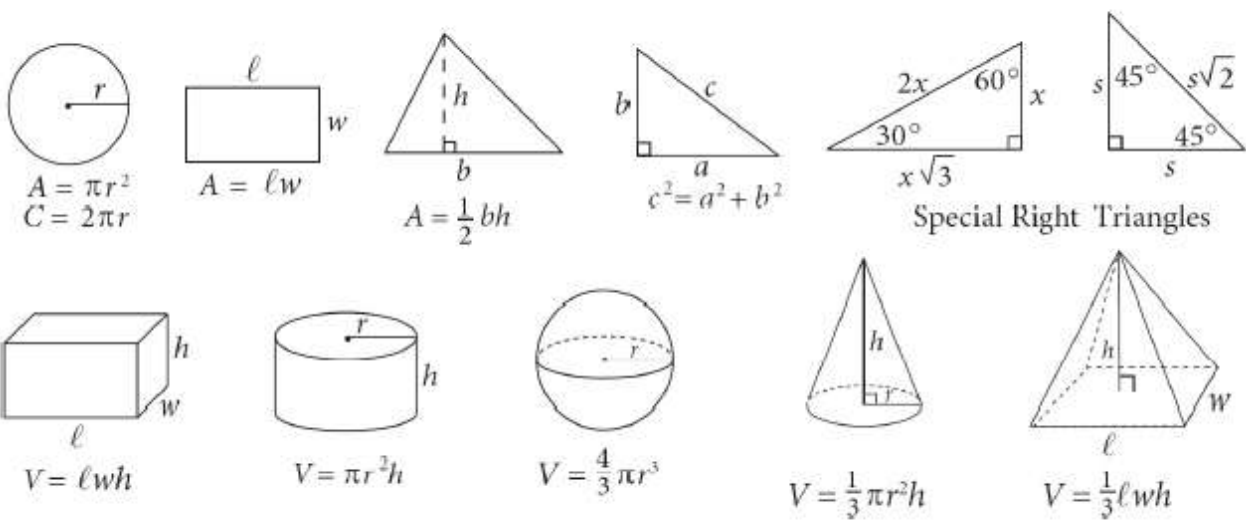
1.
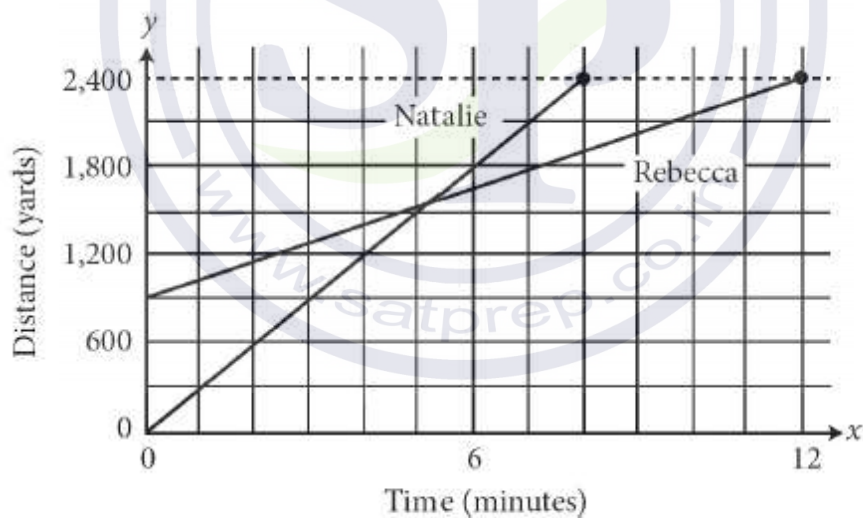
Rebecca and Natalie begin bicycling from their homes at the same time to a destination that is 2,400 yards from Natalie's house. The graph shows the distance that Rebecca and Natalie are from Natalie's house along the route. Natalie and Rebecca each bicycle at a constant rate and Rebecca's house is on the way from Natalie's house to the destination. Natalie reached the destination in 8 minutes and Rebecca reached the destination in 12 minutes. According to the graph, Rebecca's trip is how many yards shorter than Natalie's?

A) 2,400

B) 900

C) 600

D) 300

2. Alejandro began driving to work and then stopped in a store for some time. Once he began again, he continued to work at a slower speed. Which of the following graphs could model the total distance traveled by Alejandro versus time?

A)

B)

C)

D)

Time — Total Distance
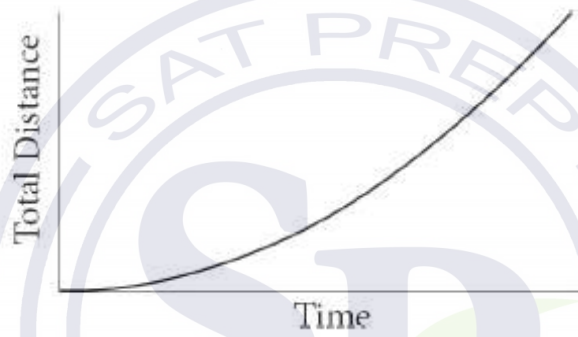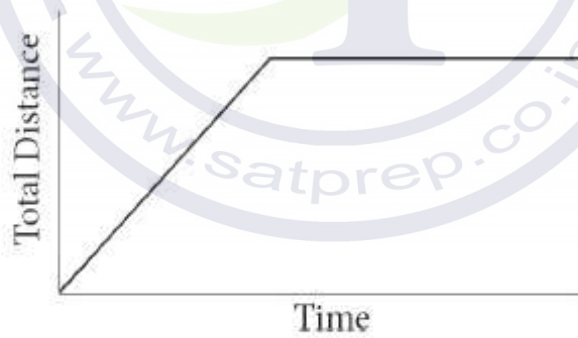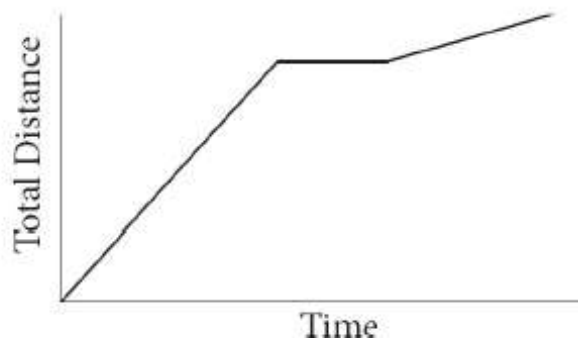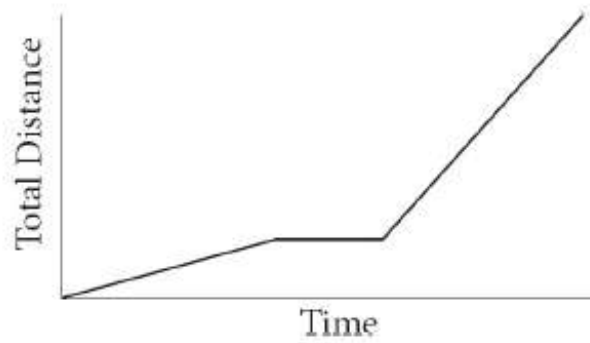
3. Which expression is equivalent to $(4y^2 - 5) - (-6y^2 + 3y - 11)$?

A) $-2y^2 + 3y - 16$

B) $-2y^2 - 3y - 16$

C) $10y^2 + 3y - 6$

D) $10y^2 - 3y + 6$

4.

$$12a + 9b < 36$$

Which of the following inequalities is equal to the inequality shown above?

A) $a + b < 3$

B) $3a + 4b < 12$

C) $4a + 3b < 12$

D) $4a + 3b < 3$

5.

What Is the Most Important Issue in the Election?

Issue	Percent of Those Surveyed
Economy	54%
Crime	15%

Environment	12%
Health Care	7%
Education	3%
Other	9%

The table above shows a summary of 1,800 responses to a survey question. Based on the information in the table, how many of those surveyed believe that the most important issue in the election is the economy or crime?

A) 1,242

B) 1,296

C) 1,328

D) 1,384

6. A cable company charges customers a one-time installation fee of $150 plus x dollars for each month. If a customer paid $960 for the first 18 months, including the installation fee, what is the value of x ?

A) 45

B) 55

C) 65

D) 75

7.

Coffee Selection

		Milk	
		Yes	No
Sugar	Yes	5	7
	No	6	13

The table above shows the coffee selections of the people at an office. Of

people who select milk, what fraction also select sugar?

A) $\dfrac{6}{11}$

B) $\dfrac{5}{11}$

C) $\dfrac{6}{31}$

D) $\dfrac{5}{31}$

8. The administrative staff of a high school wanted to gauge the preference of its entire student body for increasing funding to the athletic department. The staff surveyed 200 students who play a sport. The survey showed that the majority of those surveyed were in favor of increasing funding to the athletic department. Which of the following is true about the administrative staff's survey?

A) The survey should have included more students who play a sport.

B) The survey sample is biased because it is not representative of the entire student body.

C) It shows that a majority of students favored increased funding to the athletic department.

D) The survey sample should have only included students who did not play a sport.

9. Between 1839 and 1860, the United Kingdom and China engaged in the two wars known as the Opium Wars. The length of the First Opium War was 218 days shorter than the Second, and the two wars together lasted a total of 2,738 days. How many days did the First Opium War last?

A) 1,140

B) 1,180

C) 1,260

D) 1,480

10. In 2011, Toronto had a population of 2.615 million people, which was an increase of 0.134 million people from the population in 2001. In 2001, there were 43 hospitals located within Toronto. Which of the following is the approximate number of residents served per hospital in Toronto in 2001 ?

A)   320

B) 3,100

C) 57,700

D) 60,800

Questions 11–13 refer to the following information.

Fetal Growth

Week	Weight (oz)
0	0.00
3	0.02
6	0.04
9	0.07
12	0.49
15	2.47
18	6.70
21	12.70
24	21.12
27	30.88

30	46.56
33	67.68
36	92.48
39	116.00
42	129.92

Fetus Weight Over Time

Time (weeks)
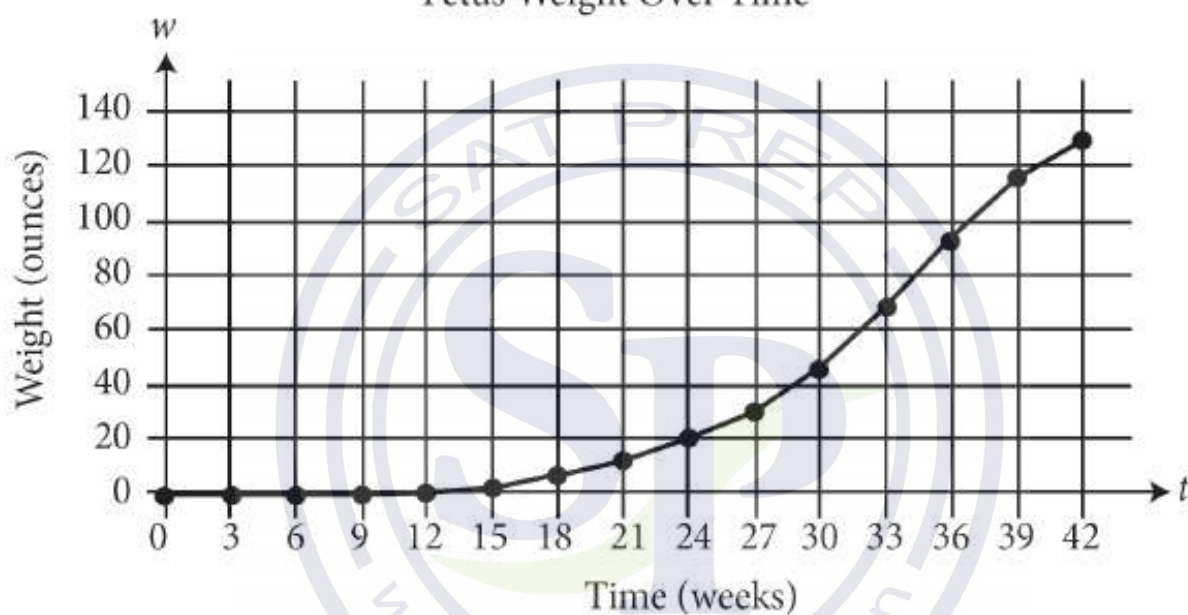
A team of research obstetricians conducted a study to determine the growth rate of a fetus. The graph and table above model the weight, w, in ounces, of a fetus t weeks after conception.

11. Over which time period is the average growth of a fetus the greatest?

A) Week 0 to Week 12

B) Week 12 to Week 24

C) Week 30 to Week 39

D) Week 39 to Week 42

12. The growth rate of a fetus from Week 33 to Week 39 is nearly constant. On this interval, which of the following best models the weight, w, in ounces, of a fetus t weeks after conception?

A) $w = 2.5t - 220$

B) $w = 5.8t - 180$

C) $w = 8.1t - 200$

D) $w = 12.4t - 150$

13. The function w, defined by $w(t) = ct + d$, where c and d are constants, models the weight, in ounces, of a fetus after t weeks of growth during a time period in which the growth is approximately linear. What does c represent?

A) The predicted total increase in weight, in ounces, of a fetus during the period   B) The predicted number of ounces of growth per week during the period   C) The predicted weight, in ounces, of a fetus at the beginning of the period   D) The predicted weight, in ounces, of a fetus at the end of the period

---

14.

$$6x + 5y = 9$$

$$5x - 5y = 2$$

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

A) $-\dfrac{8}{5}$

B) $\dfrac{1}{5}$

C) $\dfrac{2}{5}$

D) $\dfrac{8}{5}$

15.
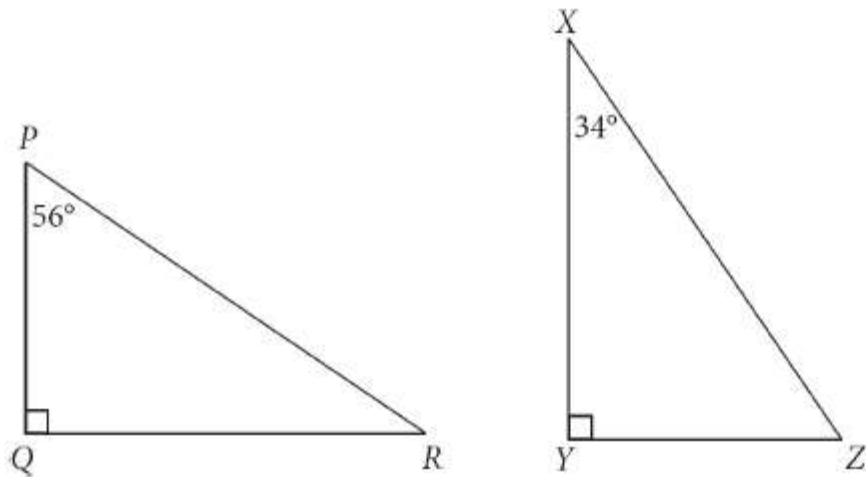
Triangles *PQR* and *XYZ* are shown above. Which of the following is equal to the ratio $\dfrac{PQ}{PR}$?

A) $\dfrac{YZ}{XY}$

B) $\dfrac{XY}{XZ}$

C) $\dfrac{XZ}{YZ}$

D) $\dfrac{YZ}{XZ}$

16.

x	y
1	$\dfrac{31}{4}$
2	$\dfrac{49}{4}$

3	$\dfrac{67}{4}$
4	$\dfrac{85}{4}$
5	$\dfrac{103}{4}$

Which of the following equations relates y to x for the values in the table above?

A) $y = \dfrac{1}{2} \cdot \left(\dfrac{7}{2}\right)^x$

B) $y = \dfrac{47}{4}x - 4$

C) $y = \dfrac{9}{2}x + \dfrac{13}{4}$

D) $y = 2 \cdot \left(\dfrac{47}{4}\right)^x$

▼

Questions 17–19 refer to the following information.

Player	Gold (g)	Gold ($\times 3$)	Silver (s)	Total
Johnny				
Melissa				
Dulce				
Ezekiel				
Juliet				

Gold **x 3 +** **Silver** **= 38**

In a certain board game, players mine for gold and silver at the beginning of each round. Players are restricted in the amount of gold and silver they can mine using the equation $3g + s = 38$, where g is amount of gold, in ounces, the player mines and s is the amount of silver, in ounces, the player mines.

A player can choose the amount of gold and silver to mine at the beginning of the first round and will receive the same amount of each in each succeeding round.

17. Juliet wants to use a strategy in which she mines at least 4 ounces of gold and at least 14 ounces of silver at the beginning of each round. According to the game's equation, which of the following inequalities represents the set of all possible amounts of gold that she can mine to meet this strategy?

A) $8 \leq g \leq 14$

B) $4 \leq g \leq 8$

C) $g \geq 4$

D) $0 \leq g \leq 4$

18. Johnny wants to create a strategy designed to mine 6 pounds of gold,

taking between 10 and 15 ounces per round for a game in which there is an even number of rounds. Within Johnny's strategy, which of the following must be the amount of silver, in ounces, Johnny mines? (16 ounces = 1 pound)   A) 2

B) 8

C) 9.6

D) 12

19. Which of the following expresses the amount of gold mined each round in terms of the amount of silver mined in that round?

A) $g = -\dfrac{1}{3}(38 + s)$ B) $g = -\dfrac{1}{3}(38 - s)$ C) $g = \dfrac{1}{3}(38 + s)$ D) $g = \dfrac{1}{3}(38 - s)$

---

20. A study was conducted on the heights of fourth-graders in a particular county. A random sample of girls was taken with each girl's height measured and recorded. The sample contained 250 girls, and 20% of the girls were more than 57 inches tall. Which of the following conclusions is best supported by the sample data?

A) Approximately 20% of all fourth-grade girls in the county were taller than 57 inches.

B) Approximately 20% of all fourth-graders in the county were taller than 57 inches.

C) The average height of all fourth-graders in the county was 57 inches.

D) The majority of all fourth-graders in the county are shorter than 57 inches.

21. What is the sum of the solutions to $(x + 5)(x - 0.4) = 0$?

A) −5.4

B) −4.6

C) 4.6

D) 5.4

22. During his previous visit, a customer's bill at a restaurant was $91.94. At his current visit, the bill is $86.53. To the nearest tenth of a percent, by what percent did the customer's bill decrease?

A) 5.4%

B) 5.9%

C) 6.2%

D) 6.3%

23.

Entry Year into the European Union

Year	Number of Countries
1957	6
1973	3
1981	1
1986	2
1995	3
2004	10
2007	2

In 2012, there were 27 nations in the European Union, as shown in the table above. Based on the table, what is the median entry year for the 27 countries?
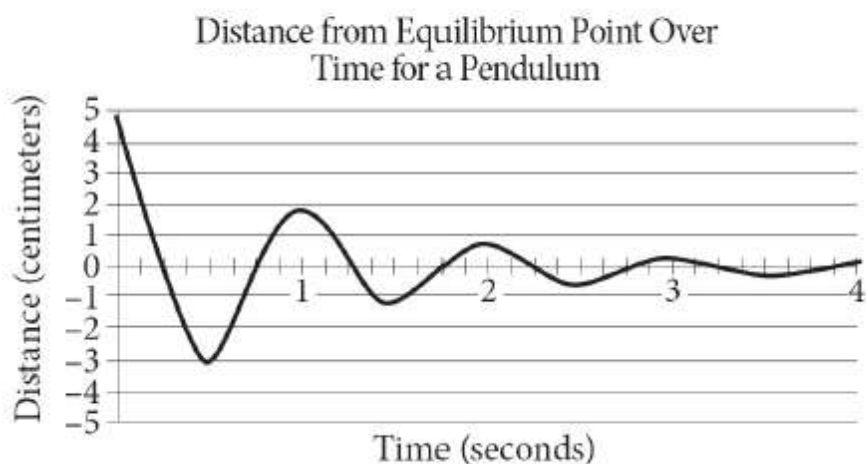
A) 1981

B) 1986

C) 1995

D) 2004

24.

Distance from Equilibrium Point Over
Time for a Pendulum

A pendulum was released 5 centimeters to the right of its equilibrium point and allowed to swing until it came to a rest. The graph above represents the relationship between time elapsed after the pendulum was released and the distance from the equilibrium point with negative distances representing distances to the left of the equilibrium point and positive distances representing distances to the right of the equilibrium point. After it was released, how many times was the pendulum 1 centimeter to the left of the equilibrium point?

A) One

B) Two

C) Three

D) Four

25. In the xy-plane, the graph of $2x^2 + 2x + 2y^2 - 10y = 85$ is a circle. What is the radius of the circle?

A) $\sqrt{95}$

B) 9.5

C) $\sqrt{90}$

D) 7

26.

x	g(x)
0	−3
3	3
9	15

Some of the values of the linear function g are shown in the table above. What is the value of $g(4)$?

A) 5
B) 6
C) 7
D) 8

27. At a constant temperature, if the ratio of the volumes of two containers filled with equal amounts of gas is $p:q$, then the ratio of the pressures in the containers is $q:p$. In the diagram below, Container X is filled with gas and the pressure in Container X is measured. Then all the gas is pumped into Container Y. Once the pressure in Container Y is measured, the gas is finally pumped into Container Z, and the pressure in Container Z is measured.

Container X
10 Liters

Container Y
70 Liters

Container Z
30 Liters
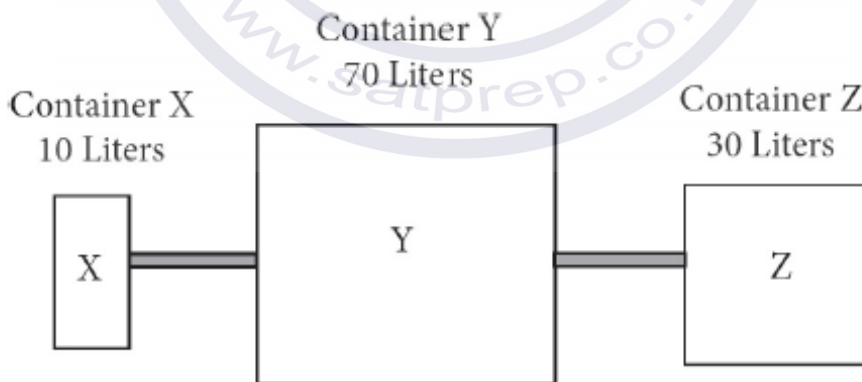
If the pressure in Container X is 300 torr, what is the pressure, in torr, in Container Z after the gas has been pumped into it?

A)   100
B)   330
C)   900

D) 9,000

28. The mean distance, d, in micrometers, glucose travels in free solution in t seconds can be determined using the formula $d = 10\sqrt{5t}$. Which of the following gives the average speed of the glucose, in micrometers per second, over the first t seconds after it begins to move?
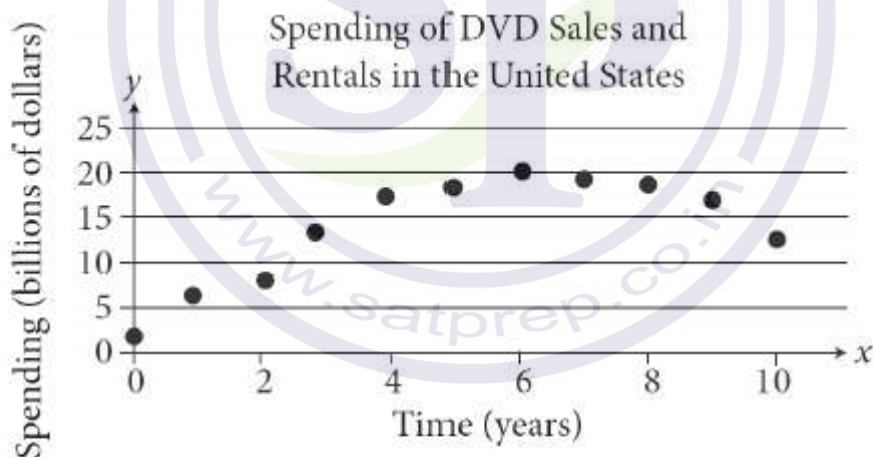
A) $10t\sqrt{5t}$

B) $\dfrac{10}{\sqrt{5t}}$

C) $\dfrac{10\sqrt{5t}}{t}$

D) $\dfrac{100\sqrt{5t}}{t}$

29. The scatterplot below shows spending, in billions of dollars, on DVD rentals and sales in the United States over a 10-year period.

Spending of DVD Sales and Rentals in the United States

Of the following equations, which best models the scatterplot?

A) $y = -0.4339x^2 + 5.6673x + 0.7685$

B) $y = 0.4339x^2 + 5.6673x + 0.7685$

C) $y = -0.4339x^2 - 5.6673x - 0.7685$

D) $y = 0.4339x^2 + 5.6673x - 0.7685$

30. Two distinct points on the number line are at a distance of 2 units from the

point with coordinate −5. The solution to which of the following equations gives the coordinates of both points?

A) $|x - 2| = 5$

B) $|x + 2| = 5$

C) $|x - 5| = 2$

D) $|x + 5| = 2$

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 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 [3 1 / 2] is entered into the grid, it will be interpreted as $\frac{31}{2}$, not as $3\frac{1}{2}$.) 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: $\frac{7}{12}$

Write answer in boxes. ← Fraction line

Grid in result.

Answer: 2.5

← Decimal point

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

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

31. A homeowner is choosing between different sizes of cylindrical swimming pools. If she wants a pool with a radius of 3 feet and a height between 5.75 feet and 6 feet, what is one possible volume, rounded to the nearest cubic foot, of a pool the homeowner could select?

32. A group of roommates equally shared the $6,000 rent for an apartment. When four of the roommates moved out, those roommates remaining still shared the $6,000 rent equally, but each roommate's share of the rent increased by $250. How many roommates were there originally?

33.

$$5(3y - 12) - (23 + 11y) = 13$$

What value of y satisfies the equation above?

34. The line with the equation $\dfrac{3}{4}x + \dfrac{2}{7}y = 1$ is graphed on the xy-plane. What is the y-coordinate of the y-intercept of the line?

35.

	GPAs					
Jennifer	3.5	3.2	2.7	3.7	3.6	3.1
Michael	2.8	3.3	2.9	3.3	3.1	y

Jennifer and Michael have each spent six semesters in college, and their GPAs during these six semesters are shown in the table above. The mean of the GPAs for Michael's six semesters is 0.2 less than the mean of the GPAs for Jennifer's six semesters. What is the value of y ?

36. In the xy-plane, the graph of $y = 2x^2 + 13x$ intersects the graph of $y = -x$ at the points $(0, 0)$ and $(-k, k)$. What is the value of k ?

37. A local homeowner association has voted to alter current fines for noise violations. Of the members who voted, 35% voted to raise fines, 10% voted to keep the fines the same, 30% voted to lower the fines, and the remaining 15 voted to eliminate the fines completely. How many more members voted to raise the fines than to lower the fines?

38. The number of people in Oxford County who support a proposed highway system was p people on January 1, 2006. The number of people who support the highway system triples every year until there are 675 who support the proposal on January 1, 2009. What is the value of p ?