CollegeBoard

SAT® MARCH 2017

IMPORTANT REMINDERS:

1

A No. 2 pencil is required for the test. Do not use a mechanical pencil or pen.

2

Sharing any questions with anyone is a violation of the SAT® Program's Test Security and Fairness policies and may result in your scores being canceled.

3

Requests to cancel scores must be received in writing by the Wednesday following the test date.

Math Test—No Calculator

25 MINUTES, 20 QUESTIONS

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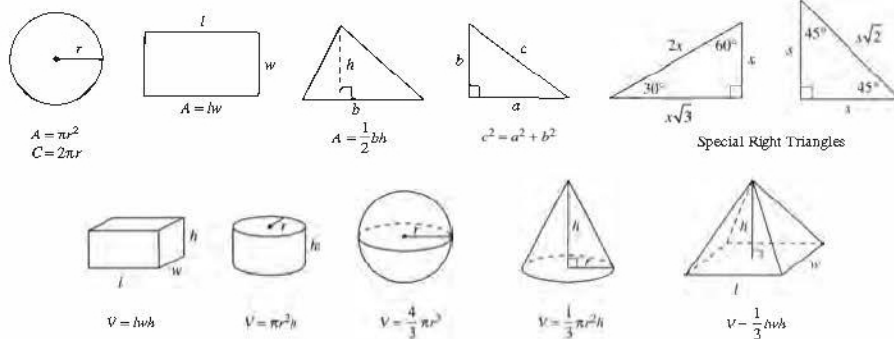

DIRECTIONS

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

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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

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

$A = lw$

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

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

Special Right Triangles

$V = lwh$

$V = \pi r^2 h$

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

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

$V = \frac{1}{3}lwh$

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.

CONTINUE ▶

1

A contractor rents a power saw for an initial fee of $15 and an additional fee of $12 per day. Which of the following represents the total cost c, in dollars, to rent a power saw for d days?

A) $c = 27d$

B) $c = 15(d + 12)$

C) $c = 12d + 15$

D) $c = 15d + 12$

2

A baker is making cakes. The recipe requires 3 eggs per cake, and the baker has 100 eggs before beginning the first cake. If the baker uses the eggs only for making the cakes, which of the following expressions represents the number of unused eggs after c cakes have been made?

A) $100 + 3c$

B) $100 - 3c$

C) $3c - 100$

D) $\dfrac{100}{3}c$

3

$$y = x^2$$
$$y = x$$

Which of the following ordered pairs (x, y) is a solution to the system of equations above?

A) $(-1, -1)$

B) $(-1, 1)$

C) $(1, -1)$

D) $(1, 1)$

4

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

Which of the following is equivalent to the expression above?

A) $2x^3 - 11x^2 + 23x - 20$

B) $2x^3 - x^2 + 23x - 20$

C) $2x^3 - 5x^2 + 8x - 20$

D) $x^2 - x - 1$

5

Two warehouse employees need to move microwave ovens and televisions that weigh 45 pounds and 85 pounds, respectively, using a freight elevator. The freight elevator can hold a maximum of 2,400 pounds. Together, the employees and their loading equipment weigh 400 pounds. What is the maximum number of microwave ovens the two employees can take on the elevator if both employees, the loading equipment, and 20 televisions are in the elevator?
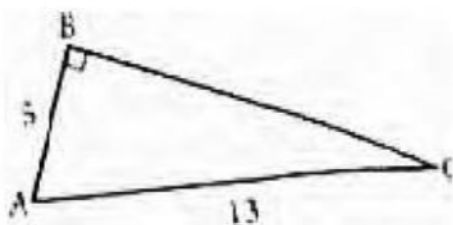
A) 5

B) 6

C) 7

D) 20

6

A hotel has two types of rooms: superior rooms that cost $100 per night and basic rooms that cost $80 per night. On a given night, the hotel received $4,200 from renting 46 rooms. How many superior rooms were rented on that night?

A) 20

B) 21

C) 26

D) 30

7

Triangle AB C above is similar to triangle DEF (not shown) where vertices A, B, and C correspond to vertices D, E, and F, respectively. If $DE = 10$, what is the area of triangle DEF?

A)   30

B)   60

C)   120

D)   180

8

$$3x - 6 = y$$
$$3y - 6 = x$$

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

A)   3

B)   6

C)   12

D)   18

9

A local movie theater is holding a fund-raiser for the South School. For each child ticket sold, the theater will donate \$2.25. For each adult ticket sold, the theater will donate \$3.50. Assuming the theater will sell 150 child tickets, which inequality can be used to determine the number of adult tickets, x, that will need to sell in order to donate at least \$1,000 to South School?

A) $3.5x \le 662.5$

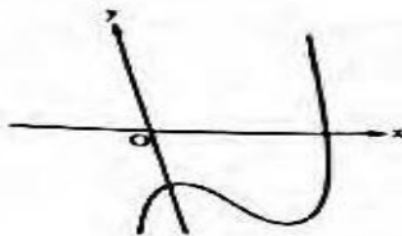B) $3.5x \ge 662.5$

C) $3.5x \le 1,337.5$

D) $3.5x \ge 1,337.5$

10

Which of the following is equivalent to $\dfrac{x^2 y}{x^4 y^{\frac{1}{2}}}$ for all $x > 0$

and all $y > 0$?

A) $\dfrac{\sqrt{y}}{x^2}$

B) $\dfrac{x^2}{y^{\frac{1}{2}}}$

C) $x^2\sqrt{y}$

D) $x^6\sqrt{y^3}$

11

Which of the following could be the equation of the graph in the xy-plane above?

A) $y = (x^2 + 1)(3 - x)$

B) $y = (x^2 + 1)(x - 3)$
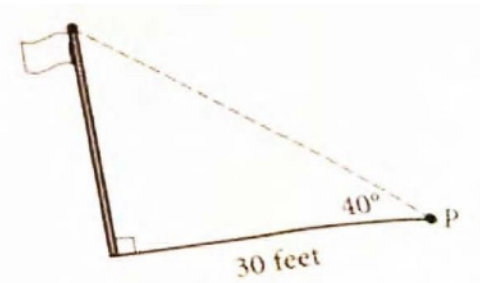
C) $y = (x^2 + 1)(x + 3)$

D) $y = (x^2 - 3)(x + 1)$

3

12

The kinetic energy of an object k, in joules, can be represented by the formula $k = \frac{1}{2}mv^2$, where m is the mass of the object, in kilograms, and v is the speed at which the object is traveling, in meters per second. Which of the following correctly shows the speed of the object in terms of its kinetic energy and mass?

A) $v = \sqrt{\dfrac{2k}{m}}$

B) $v = \sqrt{\dfrac{2m}{k}}$

C) $v = \dfrac{\sqrt{2m}}{k}$

D) $v = \sqrt{2mk}$

13

In the figure above, P is a point on the ground 30 feet from the base of a flagpole. The angle of elevation from point P to the top of the flagpole is $40°$, and the tangent of $40°$ is approximately 0.84. Of the following, which is the closest to the height of the flagpole?

A)　21 feet

B)　23 feet

C)　25 feet

D)　27 feet

14

Which of the following is equivalent to $\dfrac{2}{x+2} + \dfrac{1}{x+1}$ for x >0?

A) $\dfrac{3}{x+3}$

B) $\dfrac{2x+3}{x+3}$

C) $\dfrac{2x+3}{x^2+3x+2}$

D) $\dfrac{3x+4}{x^2+3x+2}$

15

$$3x^3 + bx^2 - 27x - 9b$$

In the polynomial above, b is constant. Which of the following is a factor of the polynomial?

A)　$x+3$

B)　$x+b$

C)　$3x^3+b$

D)　X^2+9

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 [3 1 / 2] is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
6. **Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Answer: $\frac{7}{12}$ Answer: 2.5

Write answer in boxes. ← Fraction line

Grid in result.

← 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

The graph of the linear function f is shown in the xy-plane above. What is the y- intercept of the line that is parallel to the graph of f and passes through the point (-4,0)?

17

The expression $-4.9t^2 + 23.2t + 1.8$ represents the height, in meters, of a ball t seconds after it was thrown straight up into the air. What was the initial height, in meters, of the ball when it was thrown?

18

The quadratic equation $9x^2 + 3 = 147$ has two solutions. What is the sum of the solutions?

19

The product of the two complex numbers + 2i and 7 + 6i is written in the form a + bi where a and b are real numbers. What is the value of b? (Note: $i = \sqrt{-1}$)

20

$$an + 2 = a(n + 2) + 0.8$$

If n = -3 in the equation above, what is the value of a?

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.

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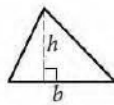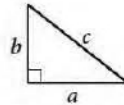
REFERENCE

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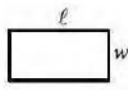
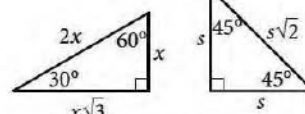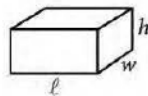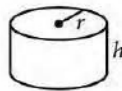$A = \ell w$

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

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

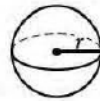Special Right Triangles
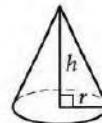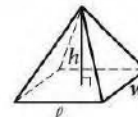
$V = \ell wh$

$V = \pi r^2 h$

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

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

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

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.

4

1

Yin mowed m lawns each day for 8 days. In terms of m, what is the total number of lawns Yin mowed in the 8 days?

A) 8m

B) $\dfrac{8}{m}$

C) m^8

D) $8 + m$

2

One brand of a commercial ice machine can produce a maximum of 263 pounds of ice each day. If 1 cubic foot of ice weights about 57.2 pounds, which of the following best approximates the maximum number of cubic feet of ice the machine can produce in one day?

A) 0.2

B) 4.6

C) 206

D) 320

3

$$(x + 1) - 2(x + 1) = 0$$

What is the solution x to the equation above?

A)   -2

B)   -1

C)   0

D)   1

4

At a large college, of the students working toward a degree in English, 250 were selected at random and asked how many books on average they read each month. The results of this survey can be best generalized to which of the following populations?

A)   All students at the same large college

B)   Any sample of 250 students at the same large college

C)   All students working toward a degree in English at any college

D)   All students working toward a degree in English at the same large college

5

A meteorologist records the daily high temperature, in degrees Fahrenheit (°F), over the course of a week in a city as shown below:
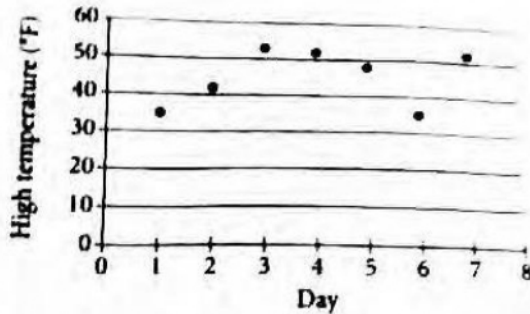
Between which two consecutive days did the greatest increase in high temperature take place?

A)   Day 2 and day 3

B)   Day 4 and day 5

C)   Day 5 and day 6

D)   Day 6 and day 7

6

Over a two-year period, scientists searched for neutrinos (subatomic particles) that are produced outside the solar system. The energy, E, of those neutrinos is measured in units of 10^{12} electron volts (TeV). The table below shows the results of the scientists' investigation:

Neutrino energy, E (TeV)	Number of neutrinos detected
$E \leq 30$	1
$30 < E \leq 60$	10
$60 < E \leq 90$	7
$90 < E \leq 120$	3
$120 < E \leq 150$	0
$E > 150$	7

Approximately what percentage of neutrinos detected had an energy of 90 TeV or less?

A)   18%

B)   25%

C)   64%

D)   75%

7
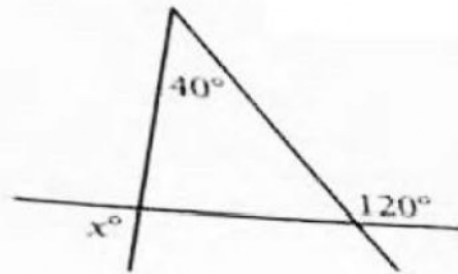
In the figure above, the sides of a triangle are extended as shown. What is the value of x?

A) 80

B) 70

C) 60

D) 40

8

In a soccer league, each team received 3 points for a win, 1 point for a tie, and 0 points for a loss. The Blue Jersey team has no losses and a total of 36 points after playing 18 games. Which system of equations could be used to solve for the number of wins and ties, where w is the number of wins and t is the number of ties?

A) $3w + t = 36$
     $w + t = 18$

B) $3w + t = 18$
     $w + t = 36$

C) $3w + 3t = 36$
     $w + t = 18$

D) $3w + 3t = 12$
     $w + t = 18$

9

An investor receives divided payments that are 5% of a business's monthly profits. The table below shows the amount A, in dollars, the investor received and the business profits p, in dollars, for each of four months:

Monthly Profits and Dividend Payments

Month	p, in dollars	A, in dollars
January	100,000	5,000
February	120,000	6,000
March	144,000	7,200
April	172,800	8,640

Which of the following equations represents the relationship between p and A, where k is a positive constant?

A) $A = k^p$

B) $A = p^k$

C) $A = p + k$

D) $A = kp$

10

$$f(x) = \sqrt{x}$$

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

What is the value of $f(g(-27))$?

A) 27

B) -27

C) $\sqrt{27}$

D) $f(g(-27))$ is not a real number

11

Musical Works of Two Composers

Musical works	Composer	
	Mozart	Haydn
Symphony	61	106
Concerto	79	45
Piano music	68	19
Opera	23	29

The table above shows the number of each of four different types of music composed by Mozart and Haydn. If a concerto composed by one of these composers is selected at random, what is the probability that Haydn was the composer?

A) $\dfrac{199}{430}$

B) $\dfrac{45}{430}$

C) $\dfrac{45}{199}$

D) $\dfrac{45}{124}$

12

This week, Maxine can work a maximum of 30 hours and needs to earn at least $425. Her job at a mall pays $12 per hour, and her job at a college pays $15 per hour. If x represents the number of hours worked at the mall and y represents the number of hours worked at the college, which of the following system of inequalities represents the situation?

A) $x + y \leq 30$
   $x + y \geq 425$

B) $x + y \geq 30$
   $12x + 15y \leq 425$

C) $x + y \leq 30$
   $15x + 12y \geq 425$

D) $x + y \leq 30$
   $12x + 15y \geq 425$

13

Which of the following is equivalent to the expression $1 - x + x^2 - x^3$?

A) $(x + 1)(x - 1)^2$

B) $(x - 1)(x + 1)^2$

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

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

Questions 14-16 refer to the following information.

On the first night of each movie's release, the manager of a movie theater asks the people who saw the movie to rate it on a scale of 1 (worst) to 5 (best). The table above summarizes the responses of all 400 viewers of one particular movie.

Ratings Given to a Movie on Release Night

	1	2	3	4	5	Total
Adults	13	35	103	82	17	250
Children	6	22	27	70	25	150
Total	19	57	130	152	42	400

14

How does the median rating of the adults who saw the movie compare to the median rating of the children who saw the movie?

A) The median ratings are the same

B) The median rating of the adults is greater

C) The median rating of the children is greater

D) The table does no give enough information to compare the medians

15

What fraction of the adults surveyed gave a rating of 4 or 5 to the movie?

A) $\dfrac{82}{250}$

B) $\dfrac{99}{250}$

C) $\dfrac{194}{400}$

D) $\dfrac{99}{194}$

16

If the theater manager assumes the surveyed group is representative of the first 4,000 people to view the movie at this theater, about how many of the 4,000 people would the theater manager expect to rate the movie a 2 or lower?

A) 380

B) 760

C) 1,064

D) 3,240

17

If a is a constant and a < 0, how many solutions does the equation $\sqrt{x + a} = a$ have?

A) No solution

B) 1 distinct solution

C) 2 distinct solutions

D) Infinitely many solutions

4

Questions 18 and 19 refer to the following information.

Men: $t_{men} = -0.1569x + 361.8$

Women: $t_{women} = -0.2514x + 555.6$

Since 1912, both men and women have competed in 100-meter freestyle swimming races at the Summer Olympic Games. The winning times for men and women from 1912 through 2012 can be modeled by the equations above, where t represents the winning time, in seconds, in year x.

18

According to the predictions from the equations, if the Summer Olympic Games had occurred in the year 2006, which of the following is closest to the number of seconds by which the men's winning time was less than the women's winning time?

A) 2 seconds

B) 3 seconds

C) 4 seconds

D) 5 seconds

19

According to the equations, which of the following conclusions can be drawn concerning the winning times for men and women from 1912 through 2012?

A) t_{men} decreases faster per year than t_{women}, and the value $t_{women} - t_{men}$ is increasing as x increases.

B) t_{men} decreases faster per year than t_{women}, and the value $t_{women} - t_{men}$ is decreasing as x increases.

C) t_{women} decreases faster per year than t_{men}, and the value $t_{women} - t_{men}$ is increasing as x increases.

D) t_{women} decreases faster per year than t_{men}, and the value $t_{women} - t_{men}$ is decreasing as x increases.

20

A manufacturer packages vegetables in cans that are in the shape of right cylinders with height 15 centimeters and volume 750 cubic centimeters. If the manufacturer reduces the volume of the cans to 600 cubic centimeters but keeps the area of the base the same, by how many centimeters does the height of the can decrease?

A) 3

B) 4

C) 5

D) 6

21

Vitrivius, a Roman architect of the first century BCE, set guidelines in his writings for the relationship between the height (rise) and tread (run) of stairs in a building. He wrote that the rise should be between 9 and 10 inches, inclusive, per step, and the run should be between 18 and 24 inches, inclusive. Which of the following could NOT be the ratio of rise to run for a set of stairs that follows this guideline?

A) $\dfrac{1}{3}$

B) $\dfrac{5}{12}$

C) 0.38

D) 0.49

22

$$y = -(x-1)(x-2)(x+3)$$

In the xy-plane, which of the following could be a graph of the equation above?

- 215 -

4
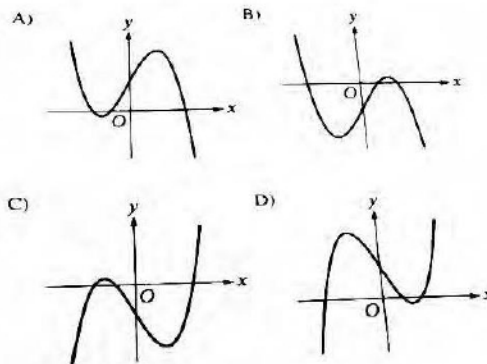
Questions 23 and 24 refer to the following information.

The payload package of a weather balloon is 5 feet above the ground before the balloon is launched from a weather station. After launch, the balloon rises for 30 minutes. The height of the payload package is estimated to increase by 10 feet every 15 seconds. The function h gives the height $h(x)$, in feet, of the payload package above the ground in terms of the time x, in seconds, after the weather balloon is launched.

23

Which of the following represents $h(x)$?

A) $h(x) = x + 5$

B) $h(x) = \dfrac{2}{3}x$

C) $h(x) = \dfrac{2}{3}x + 5$

D) $h(x) = 5 + 2x$

24

Which of the following is the best interpretation of the slope of the graphh?

A) The ratio of the height of the payload package, in feet above the ground, to the distance from the weather station, in feet

B) The ratio of the height of the payload package, in feet above the ground, to the height of 5 feet

C) The ratio of the number of feet the payload package has risen since launch to the number of seconds since the weather balloon was launched

D) The angle that the path of the balloon makes with the ground

25

$$\frac{3}{2}x - \frac{1}{3}y = 14$$

$$x + 2y = -4$$

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

A) -4

B) -2

C) 2

D) 4

26

7-Day Tidal Predictions for Herring Cove

Day	Low tide (feet)	High tide (feet)
Monday	7.9	30.2
Tuesday	7.9	29.5
Wednesday	7.2	30.2
Thursday	6.6	30.8
Friday	5.9	31.5
Saturday	5.6	33.1
Sunday	6.9	31.5

The table above shows tidal predictions for Herring Cove. According to the table, what is the difference between the median predicted high tide and the median predicted low tide over the 7-day period?

A) 23.6 feet

B) 23.9 feet

C) 24.2 feet

D) 24.9 feet

27

$$x^2 + y = 4x - 3$$
$$y = 1 - 2x$$

If (x_1, y_1) and (x_2, y_2) are two distinct solutions of the system of equations above, what is the value of $|x_1 - x_2|$?

A) 2

D) 6

C) $\sqrt{20}$

D) $\sqrt{44}$

28

$$9x^2 + bx + 49 = 0$$

In the equation above, b is a constant. If the equation has more than one real solution, which of the following could be the value of b?
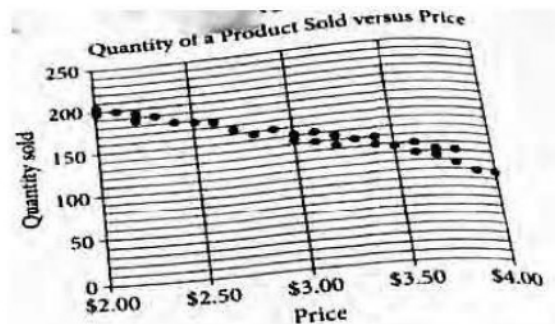
A) 7

B) 21

C) -42

D) -53

29

In a scale drawing of a rectangular living room floor, the width of the floor is 2 inches and the length is 4 inches. If the width of the actual living room floor is w feet, which of the following function A could represent the area, in square feet, of the actual living room floor?

A) $A(w) = \dfrac{w^2}{8}$

B) $A(w) = 2w^2$

C) $A(w) = 4w^2$

D) $A(w) = 8w^2$

30

Quantity of a Product Sold versus Price

In the scatterplot above, each point represents the quantitiy n of a product sold by a business at price p, in dollars, for one of 30 days. Which of the following equations best models the relationship between price and quantity sold?

A) $n = 50p + 200$

B) $n = -50p + 200$

C) $n = -50p + 300$

D) $p = \dfrac{1}{50}n + 2$

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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 $3\frac{1}{2}$.)
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:

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

At Mount Rushmore National Memorial, four sculptures of United States presidents' heads are carved into a granite mountain. The ratio of a sculpture's head length to the actual president's head length is 40 feet to 6 icnhes. What is the sculpture's head length, in feet, for a president with a head length of 9 inches?

33

The graph of the linear function f in the xy-plane has a y-intercept of 12 and a slope of $-\frac{3}{4}$. What is the x-intercept of the graph of f?

32

Miguel is buying prizes for a raffle. He will buy one prize that costs $50 and four prizes that cost $20 each. The remainder of the prizes will cost $10 each. If Miguel can spend no more than $300 on all the prizes, what is the largest total number of prizes he can buy for the raffle? (Assume there is no sales tax.)

34

Lead Samples on a Farm

Sample	1	2	3	4	5	6	7
Lead (ppm)	1523	847	1267	692	1401	1088	?

To determine whether to buy a plot of land, a farmer is having the soil tested for lead. The table above shows the amount of lead, in parts per million (ppm), in six of the seven samples of soil selected at random. If the average (arithmetic mean) amount of lead in the seven samples, in ppm, is no more than 1200, the farmer will buy the plot of land; otherwise, the farmer will not buy it. What is the greatest possible amount of lead, in ppm, that can be in the seventh sample if the farmer buys the land?

35

What is the radius of the circle in the xy-plane that has (1,5)and contains the point (4,9) ?

36

A certain alloy is a mixture of different components as given in the table below.

Component	Percentage (by weight)
Chromium	18%
Nickel	10%
Steel (by weight, 98% iron and 2% carbon)	72%

This alloy is p percent carbon by weight. What is the value of p?

Questions 37 and 38 refer to the following information.

A researcher conducted a study of the effects of taking a specific vitamin once a day on the blood pressure of elderly people in the state of Vermont. The sample used for the study is all residents at the Chestnut Hills Nursing Home, located in Vermont. The sample is made up of 38 male participants and 56 female participants. The distribution of the ages of all participants in the study is shown in the table below.

Age range	Number of participants
70 to 74	12
75 to 79	37
80 to 84	37
85 and older	8
Total	94

37

If the ration of male to female participants is 1 to 4 for participants who are 80years or older, how many participants 80 years or older are male?

38

The participants younger than 75 years old are x percent of all participants. What is the value of x to the nearest whole number?