Al Noor International School

A Guide to Digital SAT Math Exam (SAT Math Booklet)

Student's Name: _____

Class: _____

Guide to SAT EXAM

Al Noor International School
Department of Mathematics and Computer.

Digital Sat Test Dates

International students have been taking the digital SAT since March 2023. The SAT is offered 7 times per year: in March, May, June, August, October, November, and December. Some schools also administer the test for their students during the school day. You can take the SAT as many times as you want to. We recommend you plan on testing at least twice.

Format of the Digital SAT

The new SAT is a fully digital test, taken on a computer within College Board's Bluebook App. The Digital SAT is 2 hours and 14 minutes long and has 98 questions. The length of the test is one of the most substantial changes to the SAT, as the new test is 46 minutes shorter and has 56 fewer questions than the old paper test.

The Digital SAT has two sections: (1) a Reading and Writing section and (2) a Math section. Both sections are divided into two modules of equal length.

On test day, you start with Module 1 of the Reading and Writing section. You have 32 minutes to answer 27 questions. During this time, you can move freely around Module 1, but you can't move onto Module 2 until your time is up.

Once your 32 minutes are up, you're moved directly to Reading and Writing Module 2, where you have another 32 minutes to answer 27 more questions. During this time, you can move freely around Module 2, but you can't go back to Module 1 or move onto the Math section. After Module 2 is over, you have a 10-minute break.

After the break, you start Module 1 of the Math section. You have 35 minutes to answer 22 questions. Once again, you can move freely around the module you are currently taking, but you can't move ahead to the next module or go back to a previous module. When your 35 minutes are up, you move directly to Module 2, where you'll have another 35 minutes to answer 22 more questions.

What are operational and pretest questions on the digital SAT?

Each Math module contains 20 operational questions and 2 pretest questions. "Operational questions" are questions that count towards your score. "Pretest questions," also known as "experimental questions," are questions that are being tested for future use. These questions do not count towards your score, but rather are used to check the quality of the question and collect data on difficulty. There won't be a way to tell which questions are operational and which are pretest, so you should treat all questions as if they were scored.

Computer Adaptive Testing

A computer adaptive test *adapts* to your level as you take the test. Essentially, your performance determines which questions you see next.
There are various kinds of computer adaptive tests. The digital SAT is a section adaptive test, or more specifically "a multistage adaptive test in two stages."

What does this mean? As mentioned above, the Reading and Writing Section and the Math section are each divided into two modules. Module 1 contains a broad distribution of easy, medium, and hard questions, with a medium average difficulty. Module 2 also contains a mixture of easy, medium, and hard questions. However, the average question difficulty is either harder or easier than Module 1, depending on your performance in Module 1. In other words, students with a stronger performance in Module 1 will see questions targeted to a higher level of difficulty in Module 2.

What do these changes mean for me on test day?

The computer adaptive element is understandably a source of anxiety for many students. However, this new format could really have a positive impact on your test-day experience. For one, the computer adaptive model makes it possible to have a significantly shorter test. The new test is 46 minutes shorter and has 56 fewer questions. You also have more time per question on the digital test, which allows you to focus more on demonstrating your knowledge and less on demonstrating your test-taking speed.

Can I still skip questions and review previous questions on the digital SAT?

Yes. The digital SAT is not a question-by-question adaptive test. You can move around to any question within a module. However, you won't be able to move onto the next module or go back to a previous module. For example, if you are in Module 1 of the Math section, you have 35 minutes to work on the 22 questions of that module in any order you choose. You cannot move onto Module 2 until your 35 minutes are up, and you cannot return to the Reading and Writing section.

Digital SAT Scores

The digital SAT is still scored on a 1600-point scale. You receive a score for the Reading and Writing section, a score for the Math section, and a total score. Section scores are calculated from your performance on both modules and translated into a number between 200 and 800. Your two section scores are added together to give you your total score, between 400 and 1600.

Are scores on the digital SAT and the paper SAT the same?

Yes. Digital and paper scores can be used side by side as a standard metric. College Board has conducted a number of studies to link the scaled scores on the digital SAT to the scaled scores on the current paper SAT. For example, a 1160 on the digital SAT is statistically equivalent to a 1160 on the paper SAT.

Technology for the Digital SAT

Students take the digital SAT on a computer within the Bluebook App, which is College Board's digital testing application.

What tools and features are available in the Bluebook App?

- **Timer:** You can see how much time is left in the current module. You'll get an alert when there are 5 minutes left.
- **Answer choice elimination:** You can eliminate the answer choices that you think are wrong.
- **Flagging questions:** You can flag questions that you would like to review later.
- **Question menu**: You can see which questions you've skipped or flagged for review and jump to any question in the module.
- **Highlighting and annotation:** In the Reading and Writing section, you can highlight and annotate text.
- **Formula sheet:** In the Math section, you'll have access to a formula sheet.
- **Calculator:** In the Math section, you'll have access to a built-in graphing calculator.

What type of device do I need for the digital SAT?

Students can use a variety of devices for the digital SAT, including personal laptops and iPads, school-owned desktops and laptops, and school-managed Chromebooks. Please visit College Board's website for the most up-to-date list of approved devices and system requirements.

What if I don't have a computer for the digital SAT?

Students who don't have access to an approved device can borrow one from College Board. This option is available to both US and international students who are taking the test on a standard weekend test date. Students need to make the request to borrow a device during the registration process and must do so at least 30 days before the test date to allow time for shipping. Please refer to College Board's website for more information about borrowing a device.

Can I bring my own calculator to the digital SAT?

Yes. The Bluebook App includes a built-in graphing calculator, but students may also bring their own approved calculator to use during the Math section. Please refer to College Board's website for a list of approved calculators for the Digital SAT.

Accommodations on the Digital SAT

College Board remains committed to accessibility and continues to support the same range of accommodations that were available on the paper test, including extended time and double time. However, some of these accommodations are administered differently on the digital test. There's also a new, linear paper version of the test for students with relevant accommodations.

The process for requesting accommodations has remained the same. You need to apply for accommodations and receive approval before you can register for the SAT with accommodations. This process can take up to 7 weeks, so it's important to start as early as possible. Please visit College Board's website to learn more about accommodations on the digital SAT.

The Math Section

The entire Math section is 70 minutes long and has 44 questions. It is split into two modules, which are each 35 minutes long with 22 questions. Students have an average of 1 minute and 35 seconds to complete each Math question.

In each module, 75% percent of the questions are multiple-choice and 25% of the questions require student-produced responses. In other words, there are a total of 33 multiple-choice questions and 11 student-produced response questions.

Approximately 30% of the Math consists of in-context questions, also known as word problems. These questions have an average of 50 or fewer words per question.

Questions within each module are arranged roughly by order of difficulty with easier questions towards the beginning and harder questions towards the end.

What topics are covered on the Digital SAT Math?

The digital SAT Math section covers four broad content domains: (1) algebra, (2) advanced math, (3) problem solving and data analysis, and (4) geometry and trigonometry. Questions from each content domain appear in both modules.

The content domains are broken down into the following testing points:

- Algebra: ~ 35% of the section | 13–14 questions overall
  - Linear equations in one variable
  - Linear equations in two variables
  - Linear functions
  - Systems of two linear equations in two variables
  - Linear inequalities in one or two variables
- Advanced math: ~ 35% of the section | 13–15 questions overall
  - Equivalent expressions
  - Nonlinear equations in one variable and systems of equations in two variables
  - Nonlinear functions (such as quadratic, polynomial, exponential, absolute value, rational, radical, etc.)
- Problem solving and data analysis: ~ 15% | 5–7 questions
  - Ratios, rates, proportional relationships, and units
  - Percentages
  - One-variable data: distributions and measures of center and spread
  - Two-variable data: models and scatter plots
  - Probability and conditional probability
  - Inference from sample statistics and margin of error
  - Evaluating statistical claims: observational studies and experiments
- Geometry and trigonometry: ~ 15% | 5–7 questions
  - Area and volume
  - Lines, angles, and triangles
  - Right triangles and trigonometry
  - Circles

Can I use a calculator on the digital SAT?

Yes. You can use a calculator on the entire Math section. Students can use the built-in calculator, or they can bring their own approved calculator. Please see the technology section for more information.
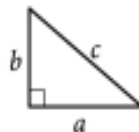
Math
27 QUESTIONS
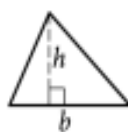
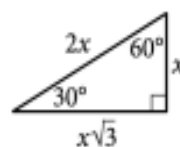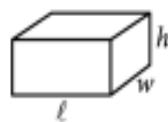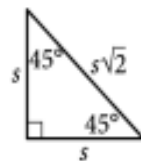$A = \pi r^2$ $A = \ell w$ $A = \frac{1}{2}bh$ $c^2 = a^2 + b^2$ Special Right Triangles
$C = 2\pi r$

$V = \ell wh$ $V = \pi r^2 h$ $V = \frac{4}{3}\pi r^3$ $V = \frac{1}{3}\pi r^2 h$ $V = \frac{1}{3}\ell wh$

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.

For multiple-choice questions, solve each problem, choose the correct answer from the choices provided, and then circle your answer in this book. Circle only one answer for each question. If you change your mind, completely erase the circle. You will not get credit for questions with more than one answer circled, or for questions with no answers circled.

For student-produced response questions, solve each problem and write your answer next to or under the question in the test book as described below.

- Once you've written your answer, circle it clearly. You will not receive credit for anything written outside the circle, or for any questions with more than one circled answer.

- If you find **more than one correct answer**, write and circle only one answer.

- Your answer can be up to 5 characters for a **positive** answer and up to 6 characters (including the negative sign) for a **negative** answer, but no more.

- If your answer is a **fraction** that is too long (over 5 characters for positive, 6 characters for negative), write the decimal equivalent.

- If your answer is a **decimal** that is too long (over 5 characters for positive, 6 characters for negative), truncate it or round at the fourth digit.

- If your answer is a **mixed number** (such as $3\frac{1}{2}$), write it as an improper fraction (7/2) or its decimal equivalent (3.5).

- Don't include **symbols** such as a percent sign, comma, or dollar sign in your circled answer.

1

What is 10% of 470?

A) 37

B) 47

C) 423

D) 460

2

$$4x + 6 = 18$$

Which equation has the same solution as the given equation?

A) $4x = 108$

B) $4x = 24$

C) $4x = 12$

D) $4x = 3$

3

The total cost, in dollars, to rent a surfboard consists of a $25 service fee and a $10 per hour rental fee. A person rents a surfboard for t hours and intends to spend a maximum of $75 to rent the surfboard. Which inequality represents this situation?

A) $10t \le 75$

B) $10 + 25t \le 75$

C) $25t \le 75$

D) $25 + 10t \le 75$

4

The function g is defined by $g(x) = x^2 + 9$. For which value of x is $g(x) = 25$?

A) 4

B) 5

C) 9

D) 13

5

Each face of a fair 14-sided die is labeled with a number from 1 through 14, with a different number appearing on each face. If the die is rolled one time, what is the probability of rolling a 2?

A) $\dfrac{1}{14}$

B) $\dfrac{2}{14}$

C) $\dfrac{12}{14}$

D) $\dfrac{13}{14}$

6

A printer produces posters at a constant rate of 42 posters per minute. At what rate, in posters per <u>hour</u>, does the printer produce the posters?

7

The function f is defined by the equation $f(x) = 7x + 2$. What is the value of $f(x)$ when $x = 4$?

8

A teacher is creating an assignment worth 70 points. The assignment will consist of questions worth 1 point and questions worth 3 points. Which equation represents this situation, where x represents the number of 1-point questions and y represents the number of 3-point questions?

A) $4xy = 70$

B) $4(x + y) = 70$

C) $3x + y = 70$

D) $x + 3y = 70$

9

Right triangles LMN and PQR are similar, where L and M correspond to P and Q, respectively. Angle M has a measure of $53°$. What is the measure of angle Q ?
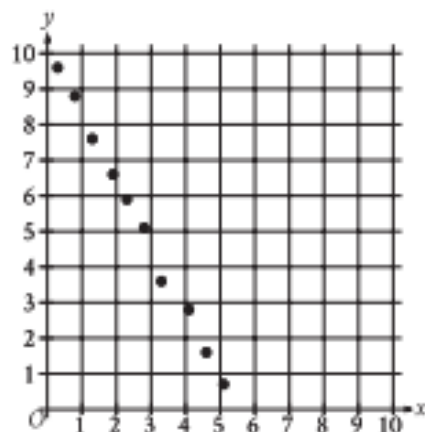
A) $37°$

B) $53°$

C) $127°$

D) $143°$

10

$$y = -3x$$
$$4x + y = 15$$

The solution to the given system of equations is (x, y). What is the value of x ?
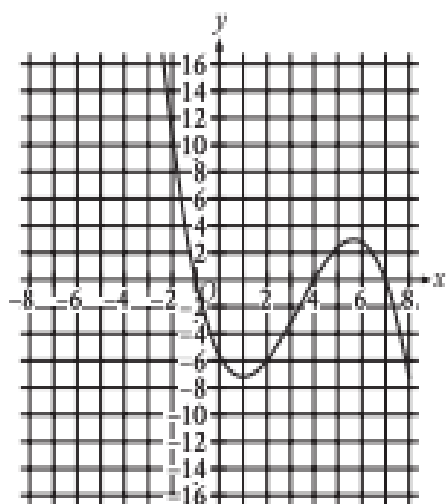
A) 1

B) 5

C) 15

D) 45

11

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

A) $y = -1.9x - 10.1$

B) $y = -1.9x + 10.1$

C) $y = 1.9x - 10.1$

D) $y = 1.9x + 10.1$

The graph of $y = f(x)$ is shown, where the function f is defined by $f(x) = ax^3 + bx^2 + cx + d$ and a, b, c, and d are constants. For how many values of x does $f(x) = 0$?

A) One

B) Two

C) Three

D) Four

Vivian bought party hats and cupcakes for $71. Each package of party hats cost $3, and each cupcake cost $1. If Vivian bought 10 packages of party hats, how many cupcakes did she buy?

$$z^2 + 10z - 24 = 0$$

What is one of the solutions to the given equation?

Bacteria are growing in a liquid growth medium. There were 300,000 cells per milliliter during an initial observation. The number of cells per milliliter doubles every 3 hours. How many cells per milliliter will there be 15 hours after the initial observation?

A) 1,500,000

B) 2,400,000

C) 4,500,000

D) 9,600,000

Which expression is equivalent to $6x^8y^2 + 12x^2y^2$?

A) $6x^2y^2(2x^6)$

B) $6x^2y^2(x^4)$

C) $6x^2y^2(x^6 + 2)$

D) $6x^2y^2(x^4 + 2)$

A neighborhood consists of a 2-hectare park and a 35-hectare residential area. The total number of trees in the neighborhood is 3,934. The equation $2x + 35y = 3,934$ represents this situation. Which of the following is the best interpretation of x in this context?

A) The average number of trees per hectare in the park

B) The average number of trees per hectare in the residential area

C) The total number of trees in the park

D) The total number of trees in the residential area
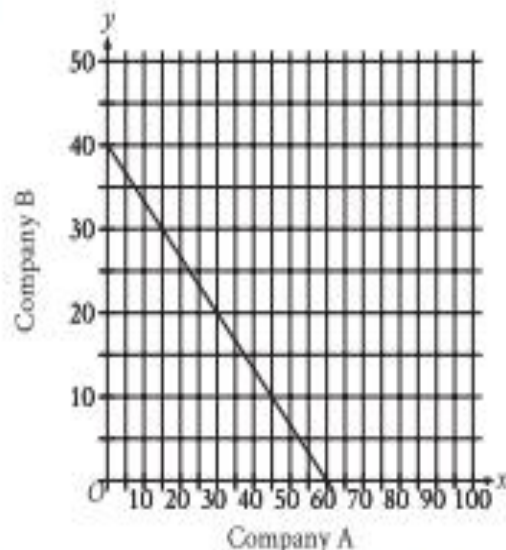
The graph shows the relationship between the number of shares of stock from Company A, x, and the number of shares of stock from Company B, y, that Simone can purchase. Which equation could represent this relationship?

A) $y = 8x + 12$

B) $8x + 12y = 480$

C) $y = 12x + 8$

D) $12x + 8y = 480$

Circle A has a radius of $3n$ and circle B has a radius of $129n$, where n is a positive constant. The area of circle B is how many times the area of circle A?

A) 43

B) 86

C) 129

D) 1,849

Data value	Frequency
6	3
7	3
8	8
9	8
10	9
11	11
12	9
13	0
14	6

The frequency table summarizes the 57 data values in a data set. What is the maximum data value in the data set?

A circle in the xy-plane has a diameter with endpoints $(2, 4)$ and $(2, 14)$. An equation of this circle is $(x - 2)^2 + (y - 9)^2 = r^2$, where r is a positive constant. What is the value of r ?

The measure of angle R is $\frac{2\pi}{3}$ radians. The measure of angle T is $\frac{5\pi}{12}$ radians greater than the measure of angle R. What is the measure of angle T, in degrees?

A) 75

B) 120

C) 195

D) 390

A certain town has an area of 4.36 square miles. What is the area, in square yards, of this town? (1 mile = 1,760 yards)

A) 404

B) 7,674

C) 710,459

D) 13,505,536

24

x	y
18	130
23	160
26	178

For line h, the table shows three values of x and their corresponding values of y. Line k is the result of translating line h down 5 units in the xy-plane. What is the x-intercept of line k?

A) $\left(-\dfrac{26}{3}, 0\right)$

B) $\left(-\dfrac{9}{2}, 0\right)$

C) $\left(-\dfrac{11}{3}, 0\right)$

D) $\left(-\dfrac{17}{6}, 0\right)$

25

In the xy-plane, the graph of the equation $y = -x^2 + 9x - 100$ intersects the line $y = c$ at exactly one point. What is the value of c?

A) $-\dfrac{481}{4}$

B) -100

C) $-\dfrac{319}{4}$

D) $-\dfrac{9}{2}$

26

$$2x + 3y = 7$$
$$10x + 15y = 35$$

For each real number r, which of the following points lies on the graph of each equation in the xy-plane for the given system?

A) $\left(\dfrac{r}{5} + 7, -\dfrac{r}{5} + 35\right)$

B) $\left(-\dfrac{3r}{2} + \dfrac{7}{2}, r\right)$

C) $\left(r, \dfrac{2r}{3} + \dfrac{7}{3}\right)$

D) $\left(r, -\dfrac{3r}{2} + \dfrac{7}{2}\right)$

27

The perimeter of an equilateral triangle is 624 centimeters. The height of this triangle is $k\sqrt{3}$ centimeters, where k is a constant. What is the value of k?

1

Tilly earns p dollars for every w hours of work. Which expression represents the amount of money, in dollars, Tilly earns for $39w$ hours of work?

A) $39p$

B) $\dfrac{p}{39}$

C) $p + 39$

D) $p - 39$

2

For a training program, Juan rides his bike at an average rate of 5.7 minutes per mile. Which function m models the number of minutes it will take Juan to ride x miles at this rate?

A) $m(x) = \dfrac{x}{5.7}$

B) $m(x) = x + 5.7$

C) $m(x) = x - 5.7$

D) $m(x) = 5.7x$

3

$$3x = 12$$
$$-3x + y = -6$$

The solution to the given system of equations is (x, y). What is the value of y ?
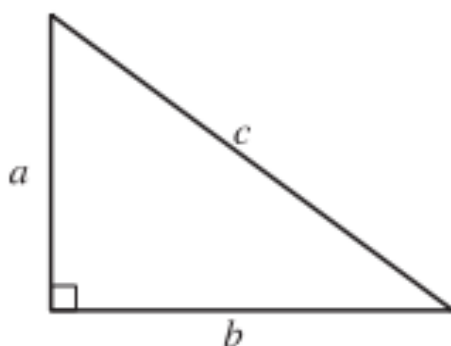
A) -3

B) 6

C) 18

D) 30

4

$$s = 40 + 3t$$

The equation gives the speed s, in miles per hour, of a certain car t seconds after it began to accelerate. What is the speed, in miles per hour, of the car 5 seconds after it began to accelerate?

A) 40

B) 43

C) 45

D) 55

Note: Figure not drawn to scale.

For the right triangle shown, $a = 4$ and $b = 5$.
Which expression represents the value of c ?

A) $4 + 5$

B) $\sqrt{(4)(5)}$

C) $\sqrt{4 + 5}$

D) $\sqrt{4^2 + 5^2}$

$$4x + 5 = 165$$

What is the solution to the given equation?
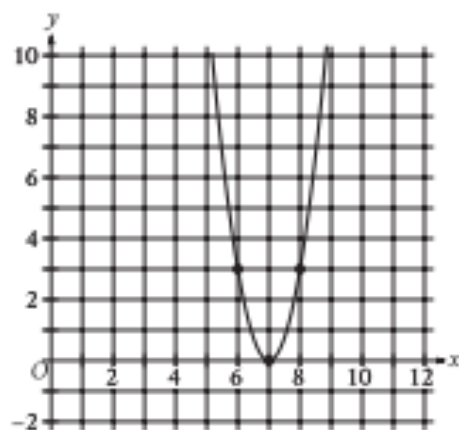
The x-intercept of the graph shown is $(x, 0)$. What is
the value of x ?

The function f is defined by $f(x) = \dfrac{1}{10}x - 2$. What
is the y-intercept of the graph of $y = f(x)$ in the
xy-plane?

A) $(-2, 0)$

B) $(0, -2)$

C) $\left(0, \dfrac{1}{10}\right)$

D) $\left(\dfrac{1}{10}, 0\right)$

14

The function f is defined by $f(x) = 7x^3$. In the xy-plane, the graph of $y = g(x)$ is the result of shifting the graph of $y = f(x)$ down 2 units. Which equation defines function g ?

A) $g(x) = \dfrac{7}{2}x^3$

B) $g(x) = 7x^{\frac{3}{2}}$

C) $g(x) = 7x^3 + 2$

D) $g(x) = 7x^3 - 2$

$$x + 7 = 10$$
$$(x + 7)^2 = y$$

Which ordered pair (x, y) is a solution to the given system of equations?

A) $(3, 100)$

B) $(3, 3)$

C) $(3, 10)$

D) $(3, 70)$

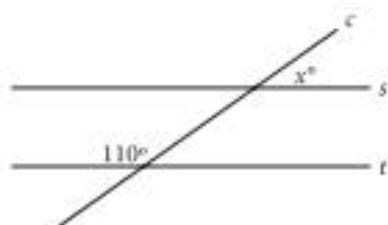Which expression is equivalent to $(7x^3 + 7x) - (6x^3 - 3x)$?

A) $x^3 + 10x$

B) $-13x^3 + 10x$

C) $-13x^3 + 4x$

D) $x^3 + 4x$

The function p is defined by $p(n) = 7n^3$. What is the value of n when $p(n)$ is equal to 56?

A) 2

B) $\dfrac{8}{3}$

C) 7

D) 8

13

Note: Figure not drawn to scale.

In the figure shown, line c intersects parallel lines s and t. What is the value of x ?

14

A list of 10 data values is shown.

6, 8, 16, 4, 17, 26, 8, 5, 5, 5

What is the mean of these data?

15

The equation $E(t) = 5(1.8)^t$ gives the estimated number of employees at a restaurant, where t is the number of years since the restaurant opened. Which of the following is the best interpretation of the number 5 in this context?

A) The estimated number of employees when the restaurant opened

B) The increase in the estimated number of employees each year

C) The number of years the restaurant has been open

D) The percent increase in the estimated number of employees each year

16

$$g(x) = x^2 + 55$$

What is the minimum value of the given function?

A) 0

B) 55

C) 110

D) 3,025

17

Each year, the value of an investment increases by 0.49% of its value the previous year. Which of the following functions best models how the value of the investment changes over time?

A) Decreasing exponential
B) Decreasing linear
C) Increasing exponential
D) Increasing linear

18

The population of Greenville increased by 7% from 2015 to 2016. If the 2016 population is k times the 2015 population, what is the value of k ?

A) 0.07
B) 0.7
C) 1.07
D) 1.7

19

Which expression is equivalent to $a^{\frac{11}{12}}$,

where $a > 0$?

A) $\sqrt[12]{a^{132}}$

B) $\sqrt[144]{a^{132}}$

C) $\sqrt[121]{a^{132}}$

D) $\sqrt[11]{a^{132}}$

20

An event planner is planning a party. It costs the event planner a onetime fee of \$35 to rent the venue and \$10.25 per attendee. The event planner has a budget of \$200. What is the greatest number of attendees possible without exceeding the budget?

21

If $|4x - 4| = 112$, what is the positive value of $x - 1$?

22

A cube has an edge length of 68 inches. A solid sphere with a radius of 34 inches is inside the cube, such that the sphere touches the center of each face of the cube. To the nearest cubic inch, what is the volume of the space in the cube not taken up by the sphere?

A) 149,796
B) 164,500
C) 190,955
D) 310,800

What is the diameter of the circle in the xy-plane with equation $(x - 5)^2 + (y - 3)^2 = 16$?

A) 4

B) 8

C) 16

D) 32

For the exponential function f, the value of $f(1)$ is k, where k is a constant. Which of the following equivalent forms of the function f shows the value of k as the coefficient or the base?

A) $f(x) = 50(1.6)^{x+1}$

B) $f(x) = 80(1.6)^{x}$

C) $f(x) = 128(1.6)^{x-1}$

D) $f(x) = 204.8(1.6)^{x-2}$

A model estimates that at the end of each year from 2015 to 2020, the number of squirrels in a population was 150% more than the number of squirrels in the population at the end of the previous year. The model estimates that at the end of 2016, there were 180 squirrels in the population. Which of the following equations represents this model, where n is the estimated number of squirrels in the population t years after the end of 2015 and $t \le 5$?

A) $n = 72(1.5)^{t}$

B) $n = 72(2.5)^{t}$

C) $n = 180(1.5)^{t}$

D) $n = 180(2.5)^{t}$

$$5x + 7y = 1$$

$$ax + by = 1$$

In the given pair of equations, a and b are constants. The graph of this pair of equations in the xy-plane is a pair of perpendicular lines. Which of the following pairs of equations also represents a pair of perpendicular lines?

A) $10x + 7y = 1$

$ax - 2by = 1$

B) $10x + 7y = 1$

$ax + 2by = 1$

C) $10x + 7y = 1$

$2ax + by = 1$

D) $5x - 7y = 1$

$ax + by = 1$

$$x^2 - 34x + c = 0$$

In the given equation, c is a constant. The equation has no real solutions if $c > n$. What is the least possible value of n?

Algebra

1. Line k is defined by $y = -\frac{17}{3}x + 5$. Line j is perpendicular to line k in the xy-plane. What is the slope of line j?

2. A cargo helicopter delivers only 100-pound packages and 120-pound packages. For each delivery trip, the helicopter must carry at least 10 packages, and the total weight of the packages can be at most 1,100 pounds. What is the maximum number of 120-pound packages that the helicopter can carry per trip?

A. 2

B. 4

C. 5

D. 6

3.

x	y
k	13
$k+7$	-15

The table gives the coordinates of two points on a line in the xy-plane. The y-intercept of the line is $(k-5, b)$, where k and b are constants. What is the value of b?

4.
$$-x+y=-3.5$$
$$x+3y=9.5$$

If (x, y) satisfies the system of equations above, what is the value of y?

5. 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

6.
$$\tfrac{3}{2}y - \tfrac{1}{4}x = \tfrac{2}{3} - \tfrac{3}{2}y$$
$$\tfrac{1}{2}x + \tfrac{3}{2} = py + \tfrac{5}{2}$$

In the given system of equations, p is a constant. If the system has no solution, what is the value of p?

7.
$$\tfrac{1}{2}y = 4$$
$$x - \tfrac{1}{2}y = 2$$

The system of equations above has solution (x, y). What is the value of x?

A. 3

B. $\dfrac{7}{2}$

C. 4

D. 6

8 A window repair specialist charges $220 for the first two hours of repair plus an hourly fee for each additional hour. The total cost for 5 hours of repair is $400. Which function f gives the total cost, in dollars, for x hours of repair, where $x \geq 2$?

A. $f(x) = 60x + 100$

B. $f(x) = 60x + 220$

C. $f(x) = 80x$

D. $f(x) = 80x + 220$

9 Hector used a tool called an auger to remove corn from a storage bin at a constant rate. The bin contained 24,000 bushels of corn when Hector began to use the auger. After 5 hours of using the auger, 19,350 bushels of corn remained in the bin. If the auger continues to remove corn at this rate, what is the total number of hours Hector will have been using the auger when 12,840 bushels of corn remain in the bin?

A. 3

B. 7

C. 8

D. 12

10 The function h is defined by $h(x) = 4x + 28$. The graph of $y = h(x)$ in the xy-plane has an x-intercept at $(a, 0)$ and a y-intercept at $(0, b)$, where a and b are constants. What is the value of $a + b$?

A. 21

B. 28

C. 32

D. 35

11

x	y
18	130
23	160
26	178

For line h, the table shows three values of x and their corresponding values of y. Line k is the result of translating line h down 5 units in the xy-plane. What is the x-intercept of line k?

A. $\left(-\frac{26}{3}, 0\right)$

B. $\left(-\frac{9}{2}, 0\right)$

C. $\left(-\frac{11}{3}, 0\right)$

D. $\left(-\frac{17}{6}, 0\right)$

20

12

An economist modeled the demand Q for a certain product as a linear function of the selling price P. The demand was 20,000 units when the selling price was $40 per unit, and the demand was 15,000 units when the selling price was $60 per unit. Based on the model, what is the demand, in units, when the selling price is $55 per unit?

A. 16,250

B. 16,500

C. 16,750

D. 17,500

13 A certain apprentice has enrolled in 85 hours of training courses. The equation $10x + 15y = 85$ represents this situation, where x is the number of on-site training courses and y is the number of online training courses this apprentice has enrolled in. How many more hours does each online training course take than each on-site training course?

14 The cost of renting a backhoe for up to 10 days is $\$270$ for the first day and $\$135$ for each additional day. Which of the following equations gives the cost y, in dollars, of renting the backhoe for x days, where x is a positive integer and $x \le 10$?

A. $y = 270x - 135$

B. $y = 270x + 135$

C. $y = 135x + 270$

D. $y = 135x + 135$

15

According to a model, the head width, in millimeters, of a worker bumblebee can be estimated by adding 0.6 to four times the body weight of the bee, in grams. According to the model, what would be the head width, in millimeters, of a worker bumblebee that has a body weight of 0.5 grams?

16 Line p is defined by $4y + 8x = 6$. Line r is perpendicular to line p in the xy-plane. What is the slope of line r?

17 Adam's school is a 20-minute walk or a 5-minute bus ride away from his house. The bus runs once every 30 minutes, and the number of minutes, w, that Adam waits for the bus varies between 0 and 30. Which of the following inequalities gives the values of w for which it would be faster for Adam to walk to school?

A. $w - 5 < 20$

B. $w - 5 > 20$

C. $w + 5 < 20$

18 A company that provides whale-watching tours takes groups of 21 people at a time. The company's revenue is 80 dollars per adult and 60 dollars per child. If the company's revenue for one group consisting of adults and children was 1,440 dollars, how many people in the group were children?

A. 3

B. 9

C. 12

D. 18

18 senior directors, who will be paid $880 per week. Her budget for paying the staff members is no more than $9,700 per week. She must hire at least 3 junior directors and at least 1 senior director. Which of the following systems of inequalities represents the conditions described if x is the number of junior directors and y is the number of senior directors?

A.
$640x + 880y \geq 9,700$
$x + y \leq 10$
$x \geq 3$
$y \geq 1$

B.
$640x + 880y \leq 9,700$
$x + y \geq 10$
$x \geq 3$
$y \geq 1$

C.
$640x + 880y \geq 9,700$
$x + y \geq 10$
$x \leq 3$
$y \leq 1$

D.
$640x + 880y \leq 9,700$
$x + y \leq 10$
$x \leq 3$
$y \leq 1$

2.

19

A group of 202 people went on an overnight camping trip, taking 60 tents with them. Some of the tents held 2 people each, and the rest held 4 people each. Assuming all the tents were filled to capacity and every person got to sleep in a tent, exactly how many of the tents were 2-person tents?

A. 30

B. 20

C. 19

D. 18

20

In North America, the standard width of a parking space is at least 7.5 feet and no more than 9.0 feet. A restaurant owner recently resurfaced the restaurant's parking lot and wants to determine the number of parking spaces, n, in the parking lot that could be placed perpendicular to a curb that is 135 feet long, based on the standard width of a parking space. Which of the following describes all the possible values of n ?

A. $18 \leq n \leq 135$

B. $7.5 \leq n \leq 9$

C. $15 \leq n \leq 135$

D. $15 \leq n \leq 18$

21

Alan drives an average of 100 miles each week. His car can travel an average of 25 miles per gallon of gasoline. Alan would like to reduce his weekly expenditure on gasoline by $5. Assuming gasoline costs $4 per gallon, which equation can Alan use to determine how many fewer average miles, m, he should drive each week?

A. $\dfrac{25}{4}m = 95$

B. $\dfrac{25}{4}m = 5$

C. $\dfrac{4}{25}m = 95$

D. $\dfrac{4}{25}m = 5$

23

22 A laundry service is buying detergent and fabric softener from its supplier. The supplier will deliver no more than 300 pounds in a shipment. Each container of detergent weighs 7.35 pounds, and each container of fabric softener weighs 6.2 pounds. The service wants to buy at least twice as many containers of detergent as containers of fabric softener. Let d represent the number of containers of detergent, and let s represent the number of containers of fabric softener, where d and s are nonnegative integers. Which of the following systems of inequalities best represents this situation?

A. $7.35d + 6.2s \leq 300$
$d \geq 2s$

B. $7.35d + 6.2s \leq 300$
$2d \geq s$

C. $14.7d + 6.2s \leq 300$
$d \geq 2s$

D. $14.7d + 6.2s \leq 300$
$2d \geq s$

23 Line t in the xy-plane has a slope of $-\frac{1}{3}$ and passes through the point $(9, 10)$. Which equation defines line t?

A. $y = 13x - \frac{1}{3}$

B. $y = 9x + 10$

C. $y = -\frac{x}{3} + 10$

D. $y = -\frac{x}{3} + 13$

24 $2n + 6 = 14$

A tree had a height of 6 feet when it was planted. The equation above can be used to find how many years n it took the tree to reach a height of 14 feet. Which of the following is the best interpretation of the number 2 in this context?

A. The number of years it took the tree to double its height

B. The average number of feet that the tree grew per year

C. The height, in feet, of the tree when the tree was 1 year old

D. The average number of years it takes similar trees to grow 14 feet

24

25

$$2x + 16 = a(x + 8)$$

In the given equation, **a** is a constant. If the equation has infinitely many solutions, what is the value of **a**?

26

$$(b - 2)x = 8$$

In the given equation, b is a constant. If the equation has no solution, what is the value of b ?

A. 2

B. 4

C. 6

D. 10

27

A local transit company sells a monthly pass for $95 that allows an unlimited number of trips of any length. Tickets for individual trips cost $1.50, $2.50, or $3.50, depending on the length of the trip. What is the minimum number of trips per month for which a monthly pass could cost less than purchasing individual tickets for trips?

28

In the xy-plane, line k intersects the y-axis at the point $(0, -6)$ and passes through the point $(2, 2)$. If the point $(20, w)$ lies on line k, what is the value of w ?

29

A team of workers has been moving cargo off of a ship. The equation below models the approximate number of tons of cargo, y, that remains to be moved x hours after the team started working.

$$y = 120 - 25x$$

The graph of this equation in the xy-plane is a line. What is the best interpretation of the x-intercept in this context?

A. The team will have moved all the cargo in about 4.8 hours.

B. The team has been moving about 4.8 tons of cargo per hour.

25

C. The team has been moving about 25 tons of cargo per hour.

D. The team started with 120 tons of cargo to move.

30

$$4x - 6y = 10y + 2$$
$$ty = \tfrac{1}{2} + 2x$$

In the given system of equations, t is a constant. If the system has no solution, what is the value of t?

31

$$F(x) = \tfrac{9}{5}(x - 273.15) + 32$$

The function F gives the temperature, in degrees Fahrenheit, that corresponds to a temperature of x kelvins. If a temperature increased by 9.10 kelvins, by how much did the temperature increase, in degrees Fahrenheit?

A. 16.38

B. 48.38

C. 475.29

D. 507.29

32 A salesperson's total earnings consist of a base salary of x dollars per year, plus commission earnings of 11% of the total sales the salesperson makes during the year. This year, the salesperson has a goal for the total earnings to be at least 3 times and at most 4 times the base salary. Which of the following inequalities represents all possible values of total sales s, in dollars, the salesperson can make this year in order to meet that goal?

A. $2x \leq s \leq 3x$

B. $\frac{2}{0.11}x \leq s \leq \frac{3}{0.11}x$

C. $3x \leq s \leq 4x$

D. $\frac{3}{0.11}x \leq s \leq \frac{4}{0.11}x$

33
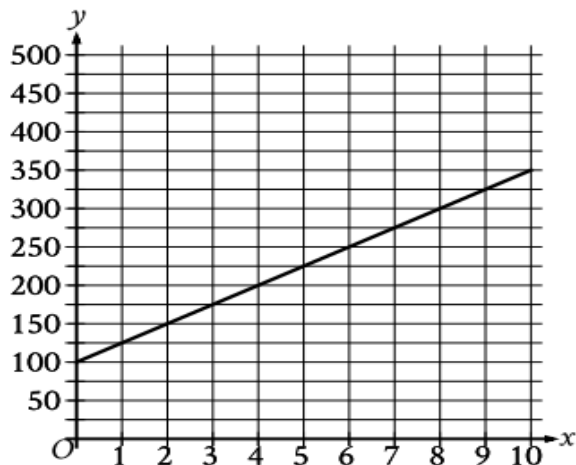
The graph of the function f, where $y = f(x)$, gives the total cost y, in dollars, for a certain video game system and x games. What is the best interpretation of the slope of the graph in this context?

A. Each game costs $\$25$.

B. The video game system costs $\$100$.

C. The video game system costs $\$25$.

D. Each game costs $\$100$.

26

34

A bus traveled on the highway and on local roads to complete a trip of 160 **miles**. The trip took 4 **hours**. The bus traveled at an average speed of 55 **miles per hour (mph)** on the highway and an average speed of 25 **mph** on local roads. If x is the time, in hours, the bus traveled on the highway and y is the time, in hours, it traveled on local roads, which system of equations represents this situation?

A. $55x + 25y = 4$
$x + y = 160$

B. $55x + 25y = 160$
$x + y = 4$

C. $25x + 55y = 4$
$x + y = 160$

D. $25x + 55y = 160$
$x + y = 4$

35

During a month, Morgan ran r miles at 5 miles per hour and biked b miles at 10 miles per hour. She ran and biked a total of 200 miles that month, and she biked for twice as many hours as she ran. What is the total number of miles that Morgan biked during the month?

A. 80

B. 100

C. 120

D. 160

36

$$x + 3 = -2y + 5$$
$$x - 3 = 2y + 7$$

The solution to the given system of equations is (x, y). What is the value of $2x$?

A. -2

B. 6

C. 12

D. 24

37 A number x is at most 2 less than 3 times the value of y. If the value of y is -4, what is the greatest possible value of x?

38

Caleb used juice to make popsicles. The function $f(x) = -5x + 30$ approximates the volume, in fluid ounces, of juice Caleb had remaining after making x popsicles. Which statement is the best interpretation of the y-intercept of the graph of $y = f(x)$ in the xy-plane in this context?

A. Caleb used approximately 5 fluid ounces of juice for each popsicle.

B. Caleb had approximately 5 fluid ounces of juice when he began to make the popsicles.

27

C. Caleb had approximately 30 fluid ounces of juice when he began to make the popsicles.

D. Caleb used approximately 30 fluid ounces of juice for each popsicle.

39

According to data provided by the US Department of Energy, the average price per gallon of regular gasoline in the United States from September 1, 2014, to December 1, 2014, is modeled by the function F defined below, where $F(x)$ is the average price per gallon x months after September 1.

$$F(x) = 2.74 - 0.19(x - 3)$$

The constant 2.74 in this function estimates which of the following?

A. The average monthly decrease in the price per gallon

B. The difference in the average price per gallon from September 1, 2014, to December 1, 2014

C. The average price per gallon on September 1, 2014

D. The average price per gallon on December 1, 2014

40

Keenan made **32** cups of vegetable broth. Keenan then filled x small jars and y large jars with all the vegetable broth he made. The equation $3x + 5y = 32$ represents this situation. Which is the best interpretation of $5y$ in this context?

A. The number of large jars Keenan filled

B. The number of small jars Keenan filled

C. The total number of cups of vegetable broth in the large jars

D. The total number of cups of vegetable broth in the small jars

Advanced Math

1

A rectangle has a length that is **15** times its width. The function $y = (15w)(w)$ represents this situation, where y is the area, in square feet, of the rectangle and $y > 0$. Which of the following is the best interpretation of $15w$ in this context?

A. The length of the rectangle, in feet

B. The area of the rectangle, in square feet

C. The difference between the length and the width of the rectangle, in feet

D. The width of the rectangle, in feet

2
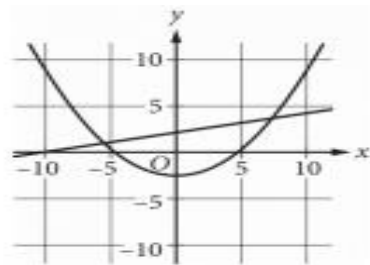
A system of equations consists of a quadratic equation and a linear equation. The equations in this system are graphed in the xy-plane above. How many solutions does this system have?

A. 0

B. 1

C. 2

D. 3

28

$$4a^2 + 20ab + 25b^2$$

3

Which of the following is a factor of the polynomial above?

A. $a+b$

B. $2a+5b$

C. $4a+5b$

D. $4a+25b$

$$h(x) = 2(x-4)^2 - 32$$

4

The quadratic function h is defined as shown. In the xy-plane, the graph of $y = h(x)$ intersects the x-axis at the points $(0,0)$ and $(t,0)$, where t is a constant. What is the value of t ?

A. 1

B. 2

C. 4

$$2|4-x| + 3|4-x| = 25$$

5

What is the positive solution to the given equation?

6

$$x^2 - 2x - 9 = 0$$

One solution to the given equation can be written as $1 + \sqrt{k}$, where k is a constant. What is the value of k?

A. 8

B. 10

C. 20

D. 40

7

In the xy-plane, a line with equation $2y = 4.5$ intersects a parabola at exactly one point. If the parabola has equation $y = -4x^2 + bx$, where b is a positive constant, what is the value of b?

1

8

$$f(x) = 9{,}000(0.66)^x$$

The given function f models the number of advertisements a company sent to its clients each year, where x represents the number of years since **1997**, and $0 \le x \le 5$. If $y = f(x)$ is graphed in the xy-plane, which of the following is the best interpretation of the y-intercept of the graph in this context?

A. The minimum estimated number of advertisements the company sent to its clients during the **5** years was **1,708**.

B. The minimum estimated number of advertisements the company sent to its clients during the **5** years was **9,000**.

C. The estimated number of advertisements the company sent to its clients in **1997** was **1,708**.

D. The estimated number of advertisements the company sent to its clients in **1997** was **9,000**.

9

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

Which ordered pair is a solution to the system of equations above?

A. $(1 + \sqrt{3}, \sqrt{3})$

B. $(\sqrt{3}, -\sqrt{3})$

C. $(1 + \sqrt{5}, \sqrt{5})$

D. $(\sqrt{5}, -1 + \sqrt{5})$

10

$$(ax + 3)(5x^2 - bx + 4) = 20x^3 - 9x^2 - 2x + 12$$

The equation above is true for all x, where a and b are constants. What is the value of ab ?

A. 18

B. 20

C. 24

D. 40

11

Which of the following expressions is(are) a factor of $3x^2 + 20x - 63$?

I. $x - 9$

II. $3x - 7$

A. I only

B. II only

C. I and II

D. Neither I nor II

1

12

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

13

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

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

A. $\dfrac{1}{2}$

B. $\dfrac{5}{2}$

C. $\dfrac{9}{2}$

D. $\dfrac{11}{2}$

14

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

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

2

$$\frac{2}{x-2}+\frac{3}{x+5}=\frac{rx+t}{(x-2)(x+5)}$$

The equation above is true for all $x>2$, where r and t are positive constants. What is the value of rt?

A. -20

B. 15

C. 20

D. 60

Growth of a Culture of Bacteria

Day	Number of bacteria per milliliter at end of day
1	2.5×10^5
2	5.0×10^5
3	1.0×10^6

A culture of bacteria is growing at an exponential rate, as shown in the table above. At this rate, on which day would the number of bacteria per milliliter reach 5.12×10^8 ?

A. Day 5

B. Day 9

C. Day 11

D. Day 12

$$\sqrt[3]{70n}\left(\sqrt[3]{70n}\right)^2$$

For what value of x is the given expression equivalent to $(70n)^{30x}$, where $n>1$?

18

$$7m = 5(n+p)$$

The given equation relates the positive numbers m, n, and p. Which equation correctly gives n in terms of m and p?

A. $n = \frac{5p}{7m}$

B. $n = \frac{7m}{5} - p$

C. $n = 5(7m) + p$

D. $n = 7m - 5 - p$

19

$$f(x) = ax^2 + 4x + c$$

In the given quadratic function, a and c are constants. The graph of $y = f(x)$ in the xy-plane is a parabola that opens upward and has a vertex at the point (h, k), where h and k are constants. If $k < 0$ and $f(-9) = f(3)$, which of the following must be true?

I. $c < 0$

II. $a \geq 1$

A. I only

B. II only

C. I and II

D. Neither I nor II

20 In the xy-plane, a line with equation $2y = c$ for some constant c intersects a parabola at exactly one point. If the parabola has equation $y = -2x^2 + 9x$, what is the value of c?

21

$$f(x) = 4x^2 + 64x + 262$$

The function g is defined by $g(x) = f(x + 5)$. For what value of x does $g(x)$ reach its minimum?

A. -13

B. -8

C. -5

D. -3

22 The expression $(3x - 23)(19x + 6)$ is equivalent to the expression $ax^2 + bx + c$, where a, b, and c are constants. What is the value of b?

23 The function f is defined by $f(x) = (x - 6)(x - 2)(x + 6)$. In the xy-plane, the graph of $y = g(x)$ is the result of translating the graph of $y = f(x)$ up 4 units. What is the value of $g(0)$?

24

Which expression is equivalent to $\frac{4}{4x-5} - \frac{1}{x+1}$?

A. $\frac{1}{(x+1)(4x-5)}$

B. $\frac{3}{3x-6}$

C. $-\frac{1}{(x+1)(4x-5)}$

D. $\frac{9}{(x+1)(4x-5)}$

25

$$\frac{x^2 - c}{x - b}$$

In the expression above, b and c are positive integers. If the expression is equivalent to $x + b$ and $x \neq b$, which of the following could be the value of c?

A. 4

B. 6

C. 8

D. 10

26

A quadratic function models a projectile's height, in meters, above the ground in terms of the time, in seconds, after it was launched. The model estimates that the projectile was launched from an initial height of 7 meters above the ground and reached a maximum height of 51.1 meters above the ground 3 seconds after the launch. How many seconds after the launch does the model estimate that the projectile will return to a height of 7 meters?

A. 3

B. 6

C. 7

D. 9

27

$$\sqrt{(x-2)^2} = \sqrt{3x + 34}$$

What is the smallest solution to the given equation?

28

An oceanographer uses the equation $s = \dfrac{3}{2}p$ to model the speed s, in knots, of an ocean wave, where p represents the period of the wave, in seconds. Which of the following represents the period of the wave in terms of the speed of the wave?

A. $p = \dfrac{2}{3}s$

B. $p = \dfrac{3}{2}s$

C. $p = \dfrac{2}{3}+s$

D. $p = \dfrac{3}{2}+s$

29

$$57x^2 + (57b+a)x + ab = 0$$

In the given equation, a and b are positive constants. The product of the solutions to the given equation is kab, where k is a constant. What is the value of k?

A. $\frac{1}{57}$

B. $\frac{1}{19}$

C. 1

D. 57

30

$$f(x) = (x-14)(x+19)$$

The function f is defined by the given equation. For what value of x does $f(x)$ reach its minimum?

A. -266

B. -19

C. $-\frac{33}{2}$

D. $-\frac{5}{2}$

31 Function f is defined by $f(x) = -a^x + b$, where a and b are constants. In the xy-plane, the graph of $y = f(x) - 15$ has a y-intercept at $\left(0, -\frac{99}{7}\right)$. The product of a and b is $\frac{65}{7}$. What is the value of a?

32

$$-x^2 + bx - 676 = 0$$

In the given equation, b is a positive integer. The equation has no real solution. What is the greatest possible value of b?

33 Immanuel purchased a certain rare coin on January 1. The function $f(x) = 65(1.03)^x$, where $0 \leq x \leq 10$, gives the predicted value, in dollars, of the rare coin x years after Immanuel purchased it. What is the best interpretation of the statement "$f(8)$ is approximately equal to 82" in this context?

A. When the rare coin's predicted value is approximately 82 dollars, it is 8% greater than the predicted value, in dollars, on January 1 of the previous year.

B. When the rare coin's predicted value is approximately 82 dollars, it is 8 times the predicted value, in dollars, on January 1 of the previous year.

C. From the day Immanuel purchased the rare coin to 8 years after Immanuel purchased the coin, its predicted value increased by a total of approximately 82 dollars.

D. 8 years after Immanuel purchased the rare coin, its predicted value is approximately 82 dollars.

34
$$f(x) = |59 - 2x|$$
The function f is defined by the given equation. For which of the following values of k does $f(k) = 3k$?

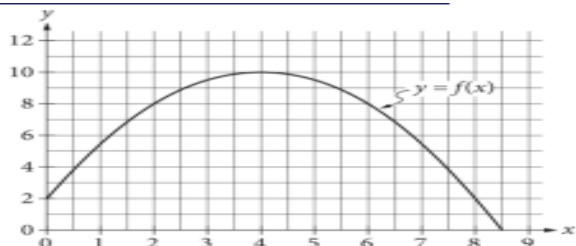A. $\frac{59}{5}$

B. $\frac{59}{2}$

C. $\frac{177}{5}$

D. 59

35 $\sqrt{2x+6} + 4 = x + 3$

What is the solution set of the equation above?

A. $\{-1\}$

B. $\{5\}$

C. $\{-1, 5\}$

D. $\{0, -1, 5\}$

36

The graph of the function f, defined by $f(x) = -\frac{1}{2}(x-4)^2 + 10$, is shown in the xy-plane above. If the function g (not shown) is defined by $g(x) = -x + 10$, what is one possible value of a such that $f(a) = g(a)$?
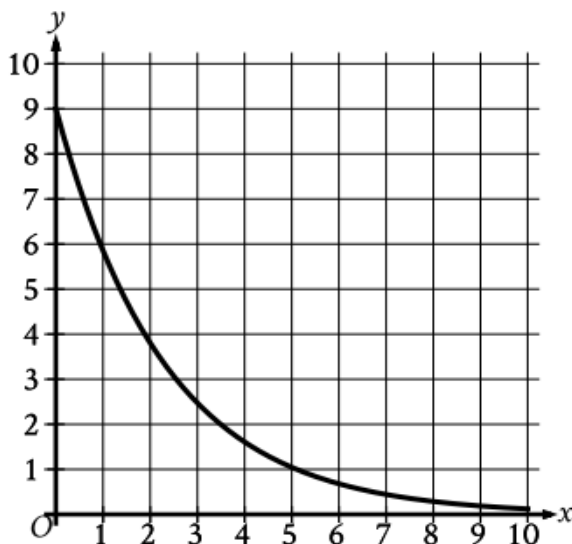
The population P of a certain city y years after the last census is modeled by the equation below, where r is a constant and P_0 is the population when $y = 0$.

$$P = P_0(1 + r)^y$$

If during this time the population of the city decreases by a fixed percent each year, which of the following must be true?

A. $r < -1$

B. $-1 < r < 0$

C. $0 < r < 1$

D. $r > 1$

The graph gives the estimated number of catalogs y, in thousands, a company sent to its customers at the end of each year, where x represents the number of years since the end of **1992**, where $0 \le x \le 10$. Which statement is the best interpretation of the y-intercept in this context?

A. The estimated total number of catalogs the company sent to its customers during the first **10** years was **9,000**.

B. The estimated total number of catalogs the company sent to its customers from the end of **1992** to the end of **2002** was **90**.

C. The estimated number of catalogs the company sent to its customers at the end of **1992** was **9**.

D. The estimated number of catalogs the company sent to its customers at the end of **1992** was **9,000**.

$$-16x^2 - 8x + c = 0$$

In the given equation, c is a constant. The equation has exactly one solution. What is the value of c?

The expression $\dfrac{x^{-2}y^{\frac{1}{2}}}{x^{\frac{1}{3}}y^{-1}}$, where $x > 1$ and $y > 1$, is equivalent to which of the following?

A. $\dfrac{\sqrt{y}}{\sqrt[3]{x^2}}$

B. $\dfrac{y\sqrt{y}}{\sqrt[3]{x^2}}$

C. $\dfrac{y\sqrt{y}}{x\sqrt{x}}$

D. $\dfrac{y\sqrt{y}}{x^2\sqrt[3]{x}}$

The expression $4x^2 + bx - 45$, where b is a constant, can be rewritten as $(hx + k)(x + j)$, where h, k, and j are integer constants. Which of the following must be an integer?

A. $\dfrac{b}{h}$

B. $\dfrac{b}{k}$

C. $\dfrac{45}{h}$

D. $\dfrac{45}{k}$

1

Texting behavior	Talks on cell phone daily	Does not talk on cell phone daily	Total
Light	110	146	256
Medium	139	164	303
Heavy	166	74	240
Total	415	384	799

In a study of cell phone use, 799 randomly selected US teens were asked how often they talked on a cell phone and about their texting behavior. The data are summarized in the table above. Based on the data from the study, an estimate of the percent of US teens who are heavy texters is 30% and the associated margin of error is 3%. Which of the following is a correct statement based on the given margin of error?

A. Approximately 3% of the teens in the study who are classified as heavy texters are not really heavy texters.

B. It is not possible that the percent of all US teens who are heavy texters is less than 27%.

C. The percent of all US teens who are heavy texters is 33%.

D. It is doubtful that the percent of all US teens who are heavy texters is 35%.

2

Jennifer bought a box of Crunchy Grain cereal. The nutrition facts on the box state that a serving size of the cereal is $\frac{3}{4}$ cup and provides 210 calories, 50 of which are calories from fat. In addition, each serving of the cereal provides 180 milligrams of potassium, which is 5% of the daily allowance for adults. If p percent of an adult's daily allowance of potassium is provided by x servings of Crunchy Grain cereal per day, which of the following expresses p in terms of x ?

A. $p = 0.5x$

B. $p = 5x$

C. $p = (0.05)^x$

D. $p = (1.05)^x$

3

Prices of 14 Different Cars

Type of car	Priced at no more than $25,000	Priced greater than $25,000	Total
Nonhybrid	5	3	8
Hybrid	2	4	6
Total	7	7	14

The table above shows information about 14 cars listed for sale on an auto dealership's website. If one of the cars listed for sale is selected at random, what is the probability that the car selected will be a hybrid car priced at no more than $25,000 ?

A. $\dfrac{1}{7}$

B. $\dfrac{2}{7}$

C. $\dfrac{1}{3}$

D. $\dfrac{4}{7}$

4

The International Space Station orbits Earth at an average speed of 4.76 miles per second. What is the space station's average speed in miles per hour?
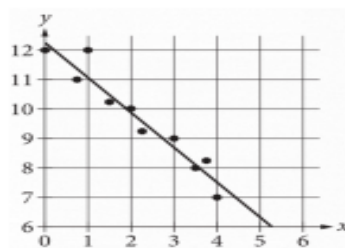
A. 285.6

B. 571.2

C. 856.8

D. 17,136.0

5

The scatterplot shows the relationship between two variables, x and y. A line of best fit for the data is also shown. Which of the following is closest to the difference between the y-coordinate of the data point with $x = 1$ and the y-value predicted by the line of best fit at $x = 1$?


A. 1

B. 2

C. 5

D. 12

1

6

Views on Nuclear Energy
Use

Response	Frequency
Strongly favor	56
Somewhat favor	214
Somewhat oppose	104
Strongly oppose	37

A researcher interviewed 411 randomly selected US residents and asked about their views on the use of nuclear energy. The table above summarizes the responses of the interviewees. If the population of the United States was 300 million when the survey was given, based on the sample data for the 411 US residents, what is the best estimate, in millions, of the difference between the number of US residents who somewhat favor or strongly favor the use of nuclear energy and the number of those who somewhat oppose or strongly oppose it? (Round your answer to the nearest whole number.)

7

Group 1

Group 2

```
20  22  24  26  28  30  32
```
Mass (kilograms)
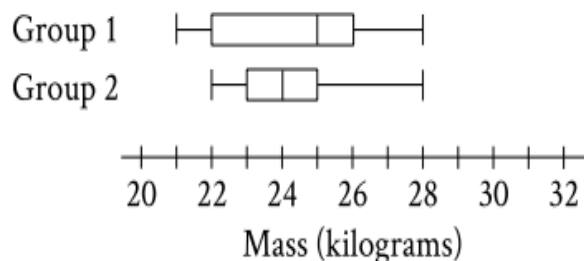
The box plots summarize the masses, in kilograms, of two groups of gazelles. Based on the box plots, which of the following statements must be true?

A. The mean mass of group 1 is greater than the mean mass of group 2.

B. The mean mass of group 1 is less than the mean mass of group 2.

C. The median mass of group 1 is greater than the median mass of group 2.

D. The median mass of group 1 is less than the median mass of group 2.

8

A school district is forming a committee to discuss plans for the construction of a new high school. Of those invited to join the committee, 15% are parents of students, 45% are teachers from the current high school, 25% are school and district administrators, and the remaining 6 individuals are students. How many more teachers were invited to join the committee than school and district administrators?

2

9 A sample of 40 fourth-grade students was selected at random from a certain school. The 40 students completed a survey about the morning announcements, and 32 thought the announcements were helpful. Which of the following is the largest population to which the results of the survey can be applied?

A. The 40 students who were surveyed

B. All fourth-grade students at the school

C. All students at the school

D. All fourth-grade students in the county in which the school is located

10 Residents of a town were surveyed to determine whether they are satisfied with the concession stand at the local park. A random sample of 200 residents was selected. All 200 responded, and 87% said they are satisfied. Based on this information, which of the following statements must be true?
I. Of all the town residents, 87% would say they are satisfied with the concession stand at the local park.
II. If another random sample of 200 residents were surveyed, 87% would say they are satisfied.

A. Neither

B. I only

C. II only

D. I and II

11

Ages of 20 Students Enrolled in a College Class

Age	Frequency
18	6
19	5
20	4
21	2
22	1
23	1
30	1

The table above shows the distribution of ages of the 20 students enrolled in a college class. Which of the following gives the correct order of the mean, median, and mode of the ages?

A. mode < median < mean

B. mode < mean < median

C. median < mode < mean

D. mean < mode < median

3

Year	Subscriptions sold
2012	5,600
2013	5,880

The manager of an online news service received the report above on the number of subscriptions sold by the service. The manager estimated that the percent increase from 2012 to 2013 would be double the percent increase from 2013 to 2014. How many subscriptions did the manager expect would be sold in 2014?

A. 6,020

B. 6,027

C. 6,440

D. 6,468

Rhesus factor	Blood type			
	A	B	AB	O
+	33	9	3	37
−	7	2	1	x

Human blood can be classified into four common blood types—A, B, AB, and O. It is also characterized by the presence $(+)$ or absence $(-)$ of the rhesus factor. The table above shows the distribution of blood type and rhesus factor for a group of people. If one of these people who is rhesus negative $(-)$ is chosen at random, the probability that the person has blood type B is $\frac{1}{9}$. What is the value of x ?
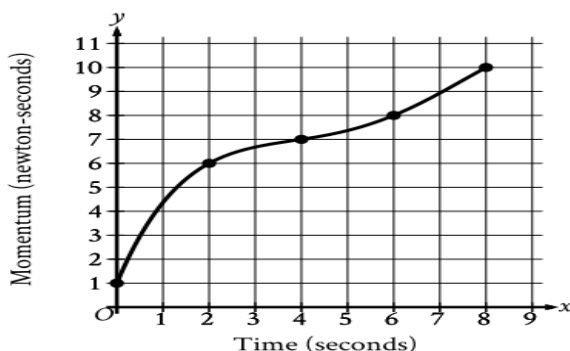
The graph shows the momentum y, in newton-seconds, of an object x seconds after the object started moving, for $0 \le x \le 8$. What is the average rate of change, in newton-seconds per second, in the momentum of the object from $x = 2$ to $x = 6$?

15

A park ranger asked a random sample of visitors how far they hiked during their visit. Based on the responses, the estimated mean was found to be 4.5 miles, with an associated margin of error of 0.5 miles. Which of the following is the best conclusion from these data?

A. It is likely that all visitors hiked between 4 and 5 miles.

B. It is likely that most visitors hiked exactly 4.5 miles.

C. It is not possible that any visitor hiked less than 3 miles.

D. It is plausible that the mean distance hiked for all visitors is between 4 and 5 miles.

16

A data set of 27 different numbers has a mean of 33 and a median of 33. A new data set is created by adding 7 to each number in the original data set that is greater than the median and subtracting 7 from each number in the original data set that is less than the median. Which of the following measures does NOT have the same value in both the original and new data sets?

A. Median

B. Mean

C. Sum of the numbers

D. Standard deviation

17

Minimum Wage

The scatterplot above shows the federal-mandated minimum wage every 10 years between 1940 and 2010. A line of best fit is shown, and its equation is $y = 0.096x - 0.488$. What does the line of best fit predict about the increase in the minimum wage over the 70-year period?

A. Each year between 1940 and 2010, the average increase in minimum wage was 0.096 dollars.

B. Each year between 1940 and 2010, the average increase in minimum wage was 0.49 dollars.

C. Every 10 years between 1940 and 2010, the average increase in minimum wage was 0.096 dollars.

D. Every 10 years between 1940 and 2010, the average increase in minimum wage was 0.488 dollars.

18

A sample of oak has a density of **807** kilograms per cubic meter. The sample is in the shape of a cube, where each edge has a length of **0.90** meters. To the nearest whole number, what is the mass, in kilograms, of this sample?
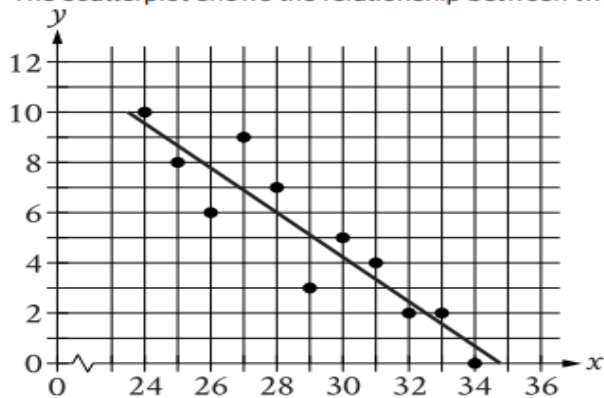
A. **588**

B. **726**

C. **897**

D. **1,107**

19 Last year, Cedric had **35** plants in his garden. This year, the number of plants in Cedric's garden is **60%** greater than the number of plants in his garden last year. How many plants does Cedric have in his garden this year?

20 The scatterplot shows the relationship between two variables, *x* and *y*. A line of best fit for the data is also shown.
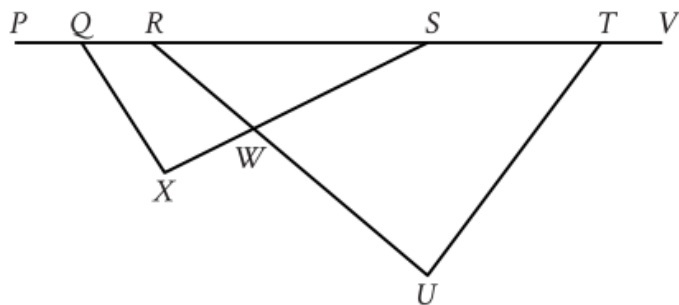

At $x = 25.5$, which of the following is closest to the *y*-value predicted by the line of best fit?

A. **6.2**

B. **7.3**

C. **8.2**

D. **9.1**

1

Note: Figure not drawn to scale.
In the figure shown, points Q, R, S, and T lie on line segment PV, and line segment RU intersects line segment SX at point W. The measure of $\angle SQX$ is $48°$, the measure of $\angle SXQ$ is $86°$, the measure of $\angle SWU$ is $85°$, and the measure of $\angle VTU$ is $162°$. What is the measure, in degrees, of $\angle TUR$?

2

A cube has an edge length of **68** inches. A solid sphere with a radius of **34** inches is inside the cube, such that the sphere touches the center of each face of the cube. To the nearest cubic inch, what is the volume of the space in the cube not taken up by the sphere?
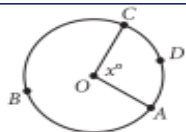
A. **149,796**

B. **164,500**

C. **190,955**

D. **310,800**

3

The circle above has center O, the length of arc $\overset{\frown}{ADC}$ is 5π, and $x = 100$. What is the length of arc $\overset{\frown}{ABC}$?
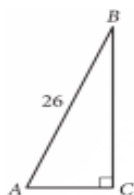
A. 9π

B. 13π

C. 18π

D. $\dfrac{13}{2}\pi$

7

4

Triangle ABC above is a right triangle, and $\sin(B) = \dfrac{5}{13}$.

What is the length of side $\overline{BC}$?

---

5 The graph of $x^2 + x + y^2 + y = \frac{199}{2}$ in the xy-plane is a circle. What is the length of the circle's radius?

---

6 In triangles ABC and DEF, angles B and E each have measure $27°$ and angles C and F each have measure $41°$. Which additional piece of information is sufficient to determine whether triangle ABC is congruent to triangle DEF?

A. The measure of angle A

B. The length of side AB

C. The lengths of sides BC and EF

D. No additional information is necessary.

7

A graphic designer is creating a logo for a company. The logo is shown in the figure above. The logo is in the shape of a trapezoid and consists of three congruent equilateral triangles. If the perimeter of the logo is 20 centimeters, what is the combined area of the shaded regions, in square centimeters, of the logo?
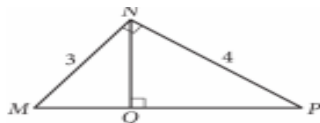
A. $2\sqrt{3}$

B. $4\sqrt{3}$

C. $8\sqrt{3}$

D. 16

8 A cube has a volume of $474{,}552$ cubic units. What is the surface area, in square units, of the cube?

---

9 Circle A in the xy-plane has the equation $(x+5)^2 + (y-5)^2 = 4$. Circle B has the same center as circle A. The radius of circle B is two times the radius of circle A. The equation defining circle B in the xy-plane is $(x+5)^2 + (y-5)^2 = k$, where k is a constant. What is the value of k?

In the figure above, what is the length of $\overline{NQ}$?
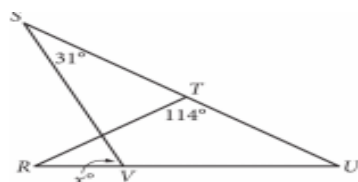
A. 2.2

B. 2.3

C. 2.4

D. 2.5

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. $V = \pi r^3 + 4\pi r^2$

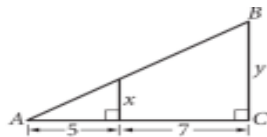In the figure above, $RT = TU$.
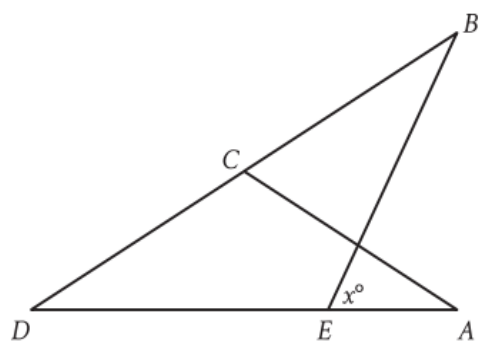
What is the value of x ?

A. 72

B. 66

C. 64

D. 58

Note: Figure not drawn to scale.

The area of triangle ABC above is at least 48 but no more than 60. If y is an integer, what is one possible value of x ?

14 The volume of right circular cylinder A is 22 cubic centimeters. What is the volume, in cubic centimeters, of a right circular cylinder with twice the radius and half the height of cylinder A?

A. 11

B. 22

C. 44

D. 66

15 Two identical rectangular prisms each have a height of 90 **centimeters (cm)**. The base of each prism is a square, and the surface area of each prism is K cm^2. If the prisms are glued together along a square base, the resulting prism has a surface area of $\frac{92}{47}K$ cm^2. What is the side length, in cm, of each square base?

A. 4

B. 8

C. 9

D. 16

16 A circle in the xy-plane has its center at $(-5, 2)$ and has a radius of 9. An equation of this circle is $x^2 + y^2 + ax + by + c = 0$, where a, b, and c are constants. What is the value of c?

17 In triangle RST, angle T is a right angle, point L lies on $\overline{RS}$, point K lies on $\overline{ST}$, and $\overline{LK}$ is parallel to $\overline{RT}$. If the length of $\overline{RT}$ is 72 units, the length of $\overline{LK}$ is 24 units, and the area of triangle RST is 792 square units, what is the length of $\overline{KT}$, in units?

18 A rectangular poster has an area of 360 square inches. A copy of the poster is made in which the length and width of the original poster are each increased by 20%. What is the area of the copy, in square inches?

19 An isosceles right triangle has a perimeter of $94 + 94\sqrt{2}$ inches. What is the length, in inches, of one leg of this triangle?

A. 47

B. $47\sqrt{2}$

C. 94

D. $94\sqrt{2}$

Note: Figure not drawn to scale.

In the figure, $AC = CD$. The measure of angle EBC is $45°$, and the measure of angle ACD is $104°$. What is the value of x?