

The SAT

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2021-05-U.S.





Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding bubble on your answer sheet. **For questions 16-20**, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

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REFERENCE



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



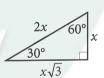
 $A = \ell w$



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



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



Special Right Triangles



 $V = \ell w h$



 $V = \pi r^2 h$



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



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



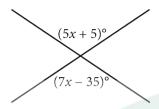
 $V = \frac{1}{3}\ell w k$

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.





Two lines intersect as shown. What is the value of x?

- A) 15
- B) 20
- C) 25
- D) 30

2

$$|2x - 4| = 8$$

What is the positive solution to the given equation?

- A) 2
- B) 4
- C) 6
- D) 8

3

Which of the following is equivalent to $4x^3 + 8x^2$?

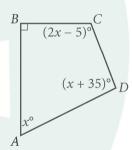
- A) $12x^5$
- B) $12x^2(2x+1)$
- C) $4x^2(x+2)$
- D) $x^2(12 + x)$

4

If 2n + 12 = 26n, what is the value of 6n?

- A) 8
- B) 4
- C) 3
- D) $\frac{1}{2}$

5



Quadrilateral *ABCD* is shown. Which equation shows how the measures of the angles of the quadrilateral are related?

A)
$$x + 90 + (2x - 5) + (x + 35) = 360$$

B)
$$4(x + 90 + (2x - 5) + (x + 35)) = 360$$

C)
$$x + (2x - 5) + (x + 35) = 360$$

D)
$$4(x + (2x - 5) + (x + 35)) = 360$$

In right triangle ABC, the length of side \overline{AC} is 12, the measure of $\angle A$ is 40°, and $\angle B$ is a right angle. Which of the following can be determined using the information given?

- I. The measure of $\angle C$
- II. The length of side \overline{AB}
- A) I only
- B) II only
- C) I and II
- D) Neither I nor II

7

In the *xy*-plane, line ℓ has a slope of 2. Line k is perpendicular to line ℓ and contains the point (4, 2). Which of the following is an equation of line k?

A)
$$y = -2x - 6$$

B)
$$y = -2x + 10$$

$$C) \quad y = -\frac{1}{2}x$$

D)
$$y = -\frac{1}{2}x + 4$$

8

$$c = \frac{x}{y}$$

The given equation relates the variables c, x, and y, where c > 0, x > 0, and y > 0. Which equation correctly expresses y in terms of c and x?

A)
$$y = cx$$

B)
$$y = \frac{1}{cx}$$

C)
$$y = \frac{c}{x}$$

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

9

The function f is a linear function. The y-intercept of the graph of y = f(x) in the xy-plane is (0, -12). What is the y-intercept of the graph of

$$y = f(x) + 2 ?$$

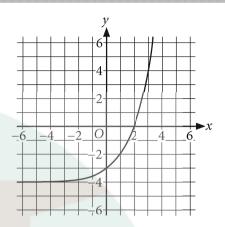
A)
$$(0, -14)$$

B)
$$(0, -10)$$

C)
$$(-2, -12)$$

Which of the following is(are) an *x*-intercept of the graph of $y = \frac{(x+3)(x-2)}{x}$ in the *xy*-plane?

- I. (-3, 0)
- II. (2, 0)
- III. (0,0)
- A) I only
- B) III only
- C) I and II only
- D) I, II and III

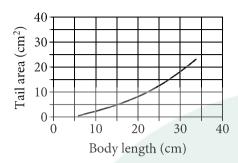


The graph of $y = 2^x - a$ is shown, where a is a constant. What is the value of a?

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

TestDaily





For a certain group of fish, the graph models the relationship between body length L, in centimeters (cm), and tail area A, in square centimeters (cm²), where $6 \le L \le 34$. Which equation represents the relationship between body length and tail area?

A)
$$A = 0.02L^2$$

B)
$$A = 1.23L^2$$

C)
$$A = 2.02L^2$$

D)
$$A = 3.23L^2$$

13

$$8x - 4y = 7$$
$$3x + 6y = 12$$

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

- A) 1.5
- B) 1.25
- C) 0.5
- D) 0.25

14

$$y = 2x + 5$$
$$y = kx + 3$$

In the given system of equations, k is a constant. The system has exactly one solution. Which of the following could be the value of k?

- I. 2
- II. 5
- A) I only
- B) II only
- C) I and II
- D) Neither I nor II

15

$$b(t) = 100(1.11)^t$$

The given function b models the number of flour beetles in a certain area, where t represents the number of days after June 1. Which of the following is the best interpretation of the number 1.11 in this context?

- A) The model predicts that there were approximately 1.11 flour beetles in this area on June 1.
- B) The model predicts that the number of flour beetles in this area increases by approximately 1.11 each day.
- C) The model predicts that it will take approximately 1.11 days for the number of flour beetles to double.
- D) The model predicts that the number of flour beetles grows by a factor of approximately 1.11 each day.

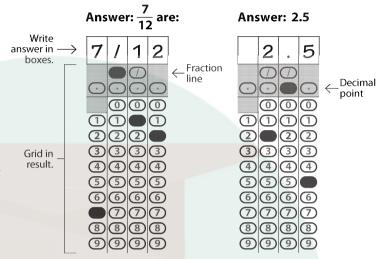
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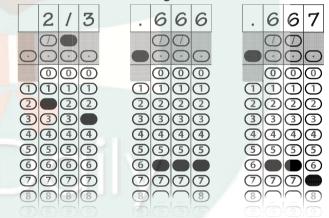
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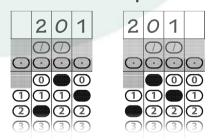
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Acceptable ways to grid $\frac{2}{3}$ are:



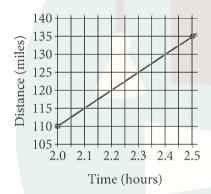
Answer: 201 - either position is correct



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

In the *xy*-plane, the graph of $y = \frac{1}{2}x + b$, where *b* is a constant, intersects the *x*-axis at (-6, 0). What is the value of *b* ?

17



For part of a trip, a car traveled directly away from its starting point at a constant speed. The graph shows the car's distance from its starting point, in miles, for times from 2.0 hours to 2.5 hours after the start of the trip. What was the speed of the car, in miles per hour, during this part of the trip?

18

$$x^2 - 8x + y^2 - 10y = 40$$

In the *xy*-plane, the graph of the given equation is a circle. What is the radius of this circle?

19

$$x^2 - 6x + 7 = 0$$

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

20

$$\left(\sqrt{x^3}\right)^a$$
, where $x \ge 0$

In the given expression, a is a constant. The expression is equivalent to x^6 , where $x \ge 0$. What is the value of a?

STOP

If you finish before time is called, you may check your work on this section only.

Do not turn to any other section.

Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

DIRECTIONS

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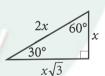
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 $A = \frac{1}{2}bh$



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



Special Right Triangles



 $V = \ell w h$



 $V=\pi r^2 h$



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





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.

It takes 6 hours to travel *m* miles. At this rate, how much time, in hours, will it take to travel 5*m* miles?

- A) 30
- B) 24
- C) 15
- D) 12

2

If 2x + 4 = 100, what is the value of 6x + 12?

- A) 400
- B) 300
- C) 288
- D) 48

3

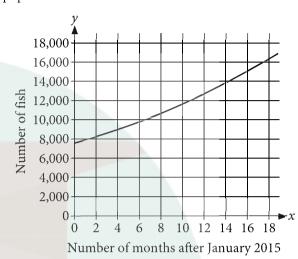
A length of 8 furlongs is equivalent to how many meters? (Use 1 furlong = 201 meters.)

- A) 25
- B) 40
- C) 209
- D) 1,608

4

出国党一同奋斗

The curve models the number of fish in a certain population.



Which of the following is closest to the number of fish in the population 16 months after January 2015?

- A) 8,000
- B) 10,000
- C) 15,000
- D) 18,000

5



What is the ratio of AB to BC?

- A) 25 to 1
- B) 20 to 5
- C) 20 to 4
- D) 5 to 4

Each of the whole numbers from 1 to 20 is written on one of 20 identical pieces of paper. The pieces of paper are then put into a hat and mixed together. If a piece of paper is selected at random from the hat, what is the probability that the number on it is a multiple of 3?

- A) $\frac{1}{20}$
- B) $\frac{3}{20}$
- C) $\frac{6}{20}$
- D) $\frac{1}{3}$

7

The table shows the maximum depth, in meters, of the 5 deepest oceanic trenches.

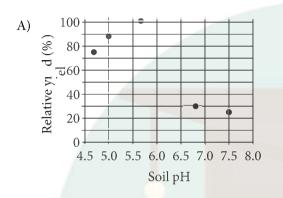
| Trench name | Depth (meters) |
|-----------------|----------------|
| Kermadec | 10,047 |
| Kuril-Kamchatka | 10,500 |
| Mariana | 11,033 |
| Philippine | 10,540 |
| Tonga | 10,882 |

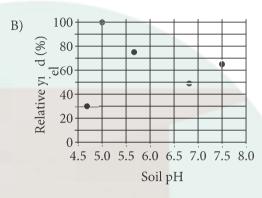
What is the range, in meters, of these 5 trench depths?

- A) 151
- B) 533
- C) 835
- D) 986

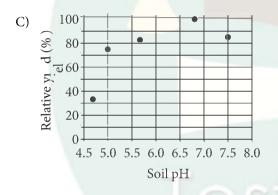
TestDaily

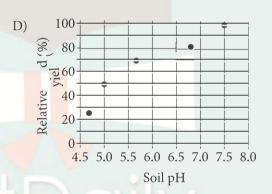
The relative yield of corn, expressed as a percent, and soil pH were recorded for 5 samples. For the 5 samples, the relative yield of corn reached a maximum when the soil had a pH of 6.8, and then decreased as the soil pH increased. Which scatterplot could represent these data?





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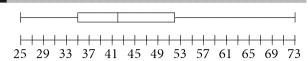




9

After a new car is purchased, the value of the car is modeled by a function that decreases exponentially over time. Which of the following could describe how the value of the car changes each year?

- A) Each year, the value of the car is \$800 more than the previous year.
- B) Each year, the value of the car is \$800 less than the previous year.
- C) Each year, the value of the car is 8% more than the previous year.
- D) Each year, the value of the car is 8% less than the previous year.



The daily high temperatures, in degrees Fahrenheit, for a city in the month of February in 2017 are summarized in the box plot shown. Which of the following is closest to the median of the high temperatures, in degrees Fahrenheit, of the city in February 2017?

- A) 35
- B) 42
- C) 48
- D) 51

11

$$2a + b = 17$$
$$a + 2b = 19$$

The solution to the given system of equations is (a, b). What is the value of 3a + 3b?

- A) 2
- B) 6
- C) 22
- D) 36

12

In triangle *ABC*, the measure of angle *C* is 90°. If $\sin A = \frac{3}{5}$, what is $\cos B$?

- A) $\frac{3}{5}$
- B) $\frac{4}{5}$
- C) $\frac{5}{4}$
- D) $\frac{5}{3}$

13

For the linear function f, the graph of y = f(x) in the xy-plane passes through the points (0, 2) and (2, 6). Which equation defines f?

$$A) \quad y = \frac{1}{2}x + 2$$

$$B) \quad y = \frac{2}{3}x + 2$$

C)
$$y = 2x + 2$$

D)
$$y = 3x + 2$$

The 2017 Wyoming state senate had 30 elected members consisting of Democrats and Republicans. Let d represent the number of Democrats who vote yes for a bill, and let r represent the number of Republicans who vote yes for a bill. For a bill to pass, more than half of the 30 senators must vote yes. Which of the following inequalities represents all possible values of d and r for a bill to pass?

- A) d + r > 15
- B) d + r < 15
- C) $d + r \ge 15$
- D) $d + r \le 15$

15

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

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

- A) -2
- B) 0
- C) 1
- D) 2

16

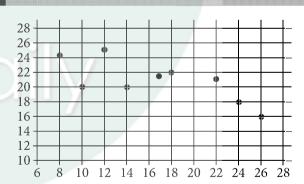
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| | Cost |
|----------------|-----------------------|
| Length (miles) | (millions of dollars) |
| 5 | 405 |
| 10 | 810 |
| 15 | 1,215 |

The table gives some values of possible lengths x, in miles, of a monorail system, and their corresponding costs to build f(x), in millions of dollars. Which of the following equations models this relationship?

- A) f(x) = 81x
- B) f(x) = 405x
- C) f(x) = 5x + 405
- D) f(x) = 405x + 5

17



A set of data is represented by the scatterplot in the portion of the *xy*-plane shown. Which of the following linear equations best models the data?

- A) y = 26.2 0.32x
- B) y = 18.2 + 0.28x
- C) y = 25.4 6x
- D) y = 18.2 6x

Questions 18 and 19 refer to the following information.

| | Hardcover | Paperback |
|---------|-----------|-----------|
| Revenue | \$24 | \$18 |
| Cost | \$14 | \$10 |

A certain book is available from a publishing company in both hardcover and paperback. The table shows the revenue and cost in 2016 for each of the hardcover and paperback books produced by the company.

18

In 2016 the total cost for 200 of the books that were sold was between \$2,200 and \$2,400. Which of the following could be the number of hardcover books that were sold?

- A) 80
- B) 120
- C) 160
- D) 200

19

An analyst estimates that the cost of each of the paperback books will increase \$0.50 each year after 2016. Which of the following models the cost c, in dollars, of each of the paperback books t years after 2016?

- A) c = 0.5 + 10t
- B) c = 0.5 + 18t
- C) c = 10 + 0.5t
- D) c = 18 + 0.5t

20

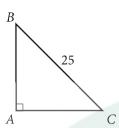
Line *m* is defined by $y = -\frac{3}{4}x + 2$. Line *p* is parallel to line *m* in the *xy*-plane and passes through the point (4, -3). Which equation defines line *p* ?

$$A) \quad y = -\frac{3}{4}x - 3$$

$$B) \quad y = -\frac{3}{4}x$$

C)
$$y = -\frac{3}{4}x + 1$$

D)
$$y = -\frac{3}{4}x + 4$$

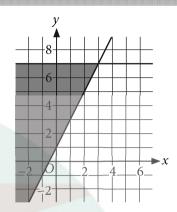


Which of the following additional measurements to the triangle provides enough information to determine the length of \overline{AB} ?

- I. The length of \overline{AC}
- II. The measure of $\angle ABC$
- A) I only
- B) II only
- C) Either I or II
- D) Neither I nor II

22

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The solution to which system of inequalities is represented by the shaded region of the graph?

- A) $y \le 7$ $y \le 2x + 1$
- B) $y \le 7$ $y \ge 2x + 1$
- C) $x \le 7$ $2y \le x$
- D) $x \le 7$ $2y \ge x$

TestDaily

| Number of | |
|-----------|-----------|
| pages | Frequency |
| 46 | 1 |
| 47 | 2 |
| 48 | 4 |
| 49 | 5 |
| 50 | 5 |
| 51 | 2 |
| 52 | 5 |
| 53 | 4 |

Paulina has 28 books in her collection. The frequency table summarizes the number of pages in each book. If she buys a new book that has 62 pages, how will this impact the mean and median numbers of pages of the books in her collection?

- A) The mean and median will both increase.
- B) The mean and median will both decrease.
- C) The mean will increase, and the median will remain the same.
- D) The mean will decrease, and the median will remain the same.

25

| | Triangle | Rectangle |
|------|----------|-----------|
| Blue | 7 | 8 |
| Red | 5 | 6 |

The table shows the distribution of objects in a collection by shape and color. If a triangle is selected at random, what is the probability that the selected triangle is red?

- A) $\frac{5}{26}$
- B) $\frac{5}{12}$
- C) $\frac{5}{11}$
- D) $\frac{5}{7}$

24

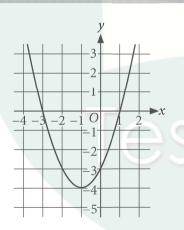
A recipe requires f cups of flour. Arnold accidentally used 50% more flour than the recipe required. How much flour did Arnold use in terms of f?

- A) 50f
- B) 150*f*
- C) 0.5f
- D) 1.5f

A group of students participated in a study. It was determined that for each hour of experience performing a certain task, the time necessary for each student to complete the task decreased by 5%. Wendy took 30 minutes to complete the task with no experience. Which function models the amount of time T, in minutes, it will take Wendy to complete the task after x hours of experience?

- A) $T = 30(0.05)^x$
- B) $T = 30(0.50)^x$
- C) $T = 30(0.95)^x$
- D) $T = 95(0.30)^x$

27



An equation for the graph shown is y = (x - 1)(x + b), where b is a constant. What is the value of b?

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

28

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A school club is paid \$315 for recycling c pounds of aluminum cans and p tons of paper. The equation 0.50c + 60p = 315 represents this situation. What is the interpretation of 60p in this context?

- A) The total weight, in tons, of paper the club recycled
- B) The total amount, in dollars, the club is paid for each ton of paper recycled
- C) The total weight, in tons, of all the aluminum cans and paper the club recycled
- D) The total amount, in dollars, the club is paid for *p* tons of paper recycled

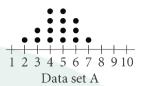
$$(x-3)^2 = 81$$

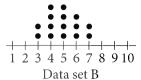
What is the sum of the solutions to the given equation?

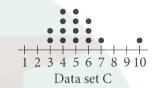
- A) 0
- B) 6
- C) 9
- D) 12

30

Each of the three data sets represented by the three dot plots has 15 values.







The medians of data sets A, B, and C are a, b, and c, respectively. What is the relationship between a, b, and c?

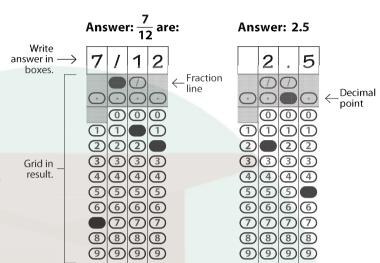
- A) a > b > c
- B) b > a > c
- C) c > b > a
- D) a = b = c

TestDaily

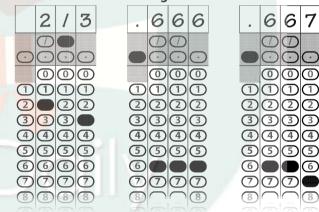
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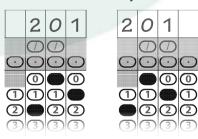
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- 5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If $3\frac{1}{2}$ is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
- Decimal answers: If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.



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



Answer: 201 – either position is correct



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

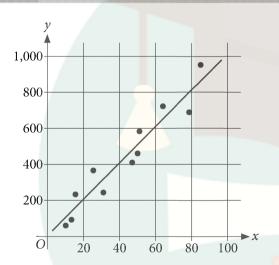
The side length of square *ABCD* is twice the side length of square *EFGH*. If the area of square *EFGH* is 9, what is the area of square *ABCD* ?

31

$$\frac{1}{4}x = cx + 2$$

In the given equation, c is a constant. The equation has no solution. What is the value of c?

32



The scatterplot shows 11 data points, along with a line of best fit for the data. For how many of the data points does the line of best fit predict a *y*-value that is less than the actual *y*-value?

34

What number is 1% greater than 7000?

Questions 35 and 36 refer to the following information.

Percentage of Components in a Liquid Mixture, by Volume

| Component A | 10.0% |
|-------------|-------|
| Component B | 25.0% |
| Component C | 20.0% |
| Component D | 45.0% |

A liquid mixture is composed of four components, and the table shows the percentage, by volume, of each component. The volume of each component prior to mixing is the same as the volume of that component in the mixture. A procedure can be used to extract the individual components that were combined to form the liquid mixture. When the procedure is applied to extract the components in the mixture, a portion of the volume of the components may be lost.

35

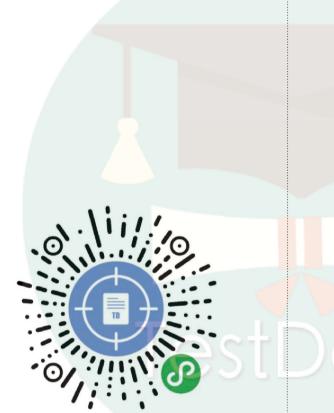
If the volume of component B in the liquid mixture is 1.00 milliliter, what is the total volume, in milliliters, of the liquid mixture?

36

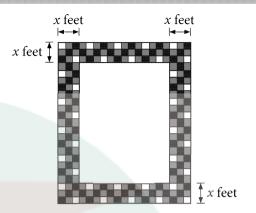
The procedure was applied to a new sample of 9.00 milliliters of the liquid mixture to extract component C. Due to the loss of volume from the procedure, the extracted volume of component C was only 90.0% of the original volume of this component. What was the extracted volume of component C, in milliliters?

$$f(x) = x^2 + bx$$
$$g(x) = 3x^2 - 9x$$

The functions f and g are defined above, where b is a constant. If $f(x) \cdot g(x) = 3x^4 - 8x^3 - 3x^2$, what is the value of b?



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Note: Figure not drawn to scale.

The rectangular mirror shown above has width 3 feet and length 5 feet and is surrounded by a mosaic border with a width of x feet. If the area of the mirror with the border is 35 square feet, what is the width x, in feet, of the border?

STOP

If you finish before time is called, you may check your work on this section only.

Do not turn to any other section.