

2025 SAT Summer Class

Week 6

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SAT/DSAT/SSAT

Hans edu LLC (Columbia Academy)

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Written by Jaehoon Song (Lecturer)

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Math

22 QUESTIONS
(TIME: 35 MIN)

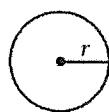
DIRECTIONS

The questions in this section address a number of important math skills.
 Use of a calculator is permitted for all questions.

NOTES

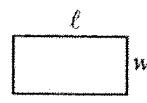
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REFERENCE

$$A = \pi r^2$$

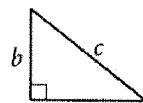
$$C = 2\pi r$$



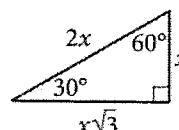
$$A = lw$$



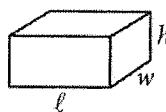
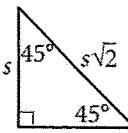
$$A = \frac{1}{2}bh$$



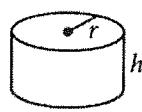
$$c^2 = a^2 + b^2$$



Special Right Triangles



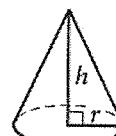
$$V = lwh$$



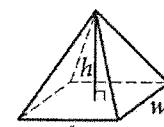
$$V = \pi r^2 h$$



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



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



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

The number of degrees of arc in a circle is 360.

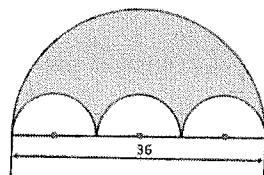
The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.

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.

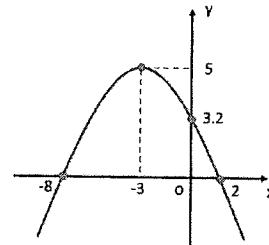
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- Don't include **symbols** such as a percent sign, comma, or dollar sign in your circled answer.



In the figure above, three small congruent semi-circles are inscribed to the bigger semi-circle as shown. If the diameter of the bigger semi-circle is 36, what is the value of the area of the shaded region?

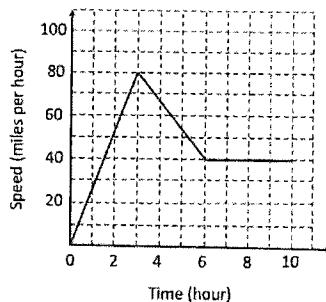
- A) 270π
- B) 216π
- C) 108π
- D) 54π



Which of the following quadratic forms shows the maximum value of the function as a constant in the equation?

- A) $y = -\frac{1}{5}x^2 - \frac{6}{5}x + \frac{16}{5}$
- B) $y = -\frac{1}{5}(x - 2)(x + 8)$
- C) $y = -\frac{1}{5}(x + 3)^2 + 5$
- D) $y = -\frac{1}{5}(x^2 + 6x) + \frac{16}{5}$

2



The graph above shows the speed profile for James's car while he was traveling LA to San Francisco. What is the total distance, in miles, traveled for 10 hours trip?

4

If a line is perpendicular to $y = -\frac{1}{2}x + 3$ and passes through $(0, -3)$ in the XY-plane, what is the equation of the line?

- A) $y = -2x - 3$
- B) $y = 2x - 3$
- C) $y = \frac{1}{2}x - 3$
- D) $y = 2x + 3$

5

$$x(3x + 1)^2(x - 1)^3 = 0$$

In the equation above, what is the solution set to the equation?

- A) $\left\{0, 1, -\frac{1}{3}, \frac{1}{3}\right\}$
- B) $\left\{0, 1, -1, -\frac{1}{3}\right\}$
- C) $\left\{0, 1, -\frac{1}{3}\right\}$
- D) $\left\{0, 1, \frac{1}{3}\right\}$

7

$$10^x \cdot 1000^{2x} = 100^{4x} \cdot 10$$

In the equation above, what is the value of x ?

- E) -1
- F) 0
- G) 1
- H) 2

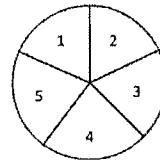
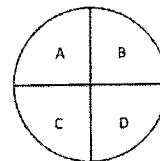
6

$$f(x) = 120,000 \cdot (0.95)^x$$

The function above represent to estimate the value of a certain luxury vehicle, in dollars, where x is the number of years after 2000. Which of the following best interpret the number 0.95 in this context?

- E) The estimated value of the vehicle, in dollars, in 2000.
- F) The estimated percent increase in value each year from 2000.
- G) The estimated percent, in decimal, of the value of the vehicle each year after 2000.
- H) The estimated percent of decrease in total value after 2000.

8



In two dart boards above, assuming that letters and numbers are equally spaced out on both circle boards, what is the probability that a dart will land on C and the other dart will land on even number if two darts are thrown?

- A) $\frac{1}{5}$
- B) $\frac{1}{10}$
- C) $\frac{2}{9}$
- D) $\frac{1}{9}$

9

11

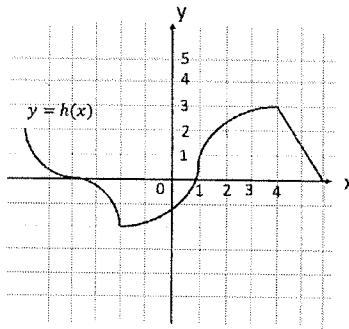
In the XY-plane, the equations $y = 2x - 5$ and $-4x + ky = -10$ represent the same line. What is the value k ?

$$\frac{2x}{3-x} = \frac{x}{4}$$

In the equation above, which of the following is the solution set to the equation?

- A) $\{0, -5\}$
- B) $\{-5\}$
- C) $\{0, 3\}$
- D) $\{3, -5\}$

10

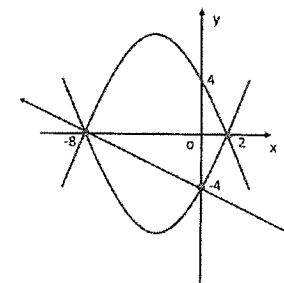


x	$F(x)$
-2	-2
-1	0
0	5
1	8
2	12
3	1/2

The complete graph of the function $y = h(x)$ and some values for $F(x)$ are shown in the table above. If the function $h(x)$ has a maximum at $x = k$, what is the value of $F(k - 2)$?

- A) 2
- B) -2
- C) $\frac{1}{2}$
- D) 12

12



A system of 3 equations is shown above in the XY-plane. How many solution(s) does the system have?

- A) Zero
- B) One
- C) Two
- D) Three

13

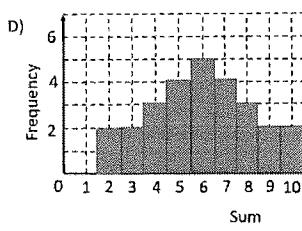
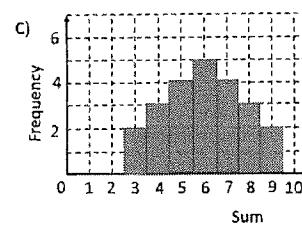
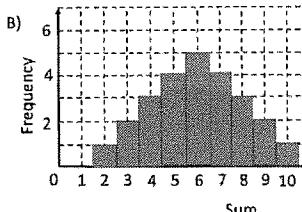
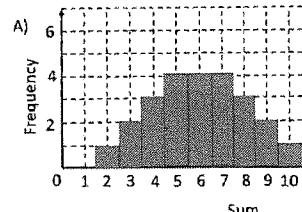
$$\begin{aligned}y &\leq -2x - 1 \\-y - 1 &\leq 0\end{aligned}$$

In the system of inequalities above, which of the following ordered pairs (x, y) satisfies the system?

- I) $(0, 0)$
- J) $(0, 1)$
- K) $(0, -1)$
- L) $(1, 1)$

15

Suppose that you have two spinners and each spinner has numbers 1 through 5, equally spaced out. Which of the following graphs correctly represents for the sum of the numbers in two spinners?



14

$$\sqrt{2x+3} + x = 0$$

What is the solution set to the equation above?

- A) $\{3\}$
- B) $\{-1, 3\}$
- C) $\{-1\}$
- D) No solution

16

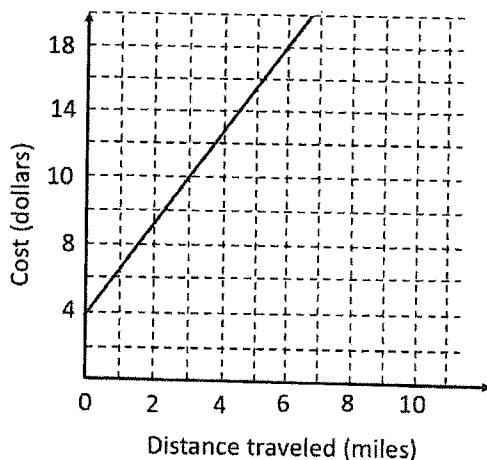
Which of the following statements are always true?

- I. $|a - b| = |b - a|$
- II. $-\frac{|a|}{|b|} = \frac{|-a|}{|b|}$
- III. $\frac{1}{|a-b|} = \frac{1}{|b-a|}$

- A) I only
- B) I and II only
- C) II only
- D) I and III only

7

19



The line graphed in the XY-plane above models the total cost, in dollars, for Uber ride, y , in a certain area based on the number of miles in distance traveled, x . Based on the graph, what is the meaning of slope in the line graph?

- A) Total cost, in dollars, for x miles traveled.
- B) Rate of cost, dollars per each additional mile traveled.
- C) Rate of speed which the driver drive.
- D) Rate of cost, dollars per every 2 miles traveled.

18

Sam visited a bridge (Danyang-Kunshan Grand Bridge) in China over the summer and he found out that it is officially the longest bridge in the world which stretches out 164.8 kilometers.

Approximately how many miles is the bridge? (1 kilometer ≈ 0.6214 miles)

- A) 98
- B) 100
- C) 102
- D) 104

$$(2 - 3ax)(x + 3) + x^2 - 6$$

In the equation above, a is a constant. If the expression is equal to $-kx$, where k is a constant, what is the value of k ?

20

A manufacturing company bought a robot automation system valued at \$500,000. The marketing department expected that the cost would pay off after some time by saving the cost for employee's labor. If the company saves the same amount, \$70,000 every six months, which of the following equations gives the value of time (t), in year, that the company would take to pay off the purchasing cost?

- A) $y = 500,000 + 70,000t$
- B) $y = -70,000t + 500,000$
- C) $y = 500,000 - 140,000t$
- D) $y = 500,000 + 140,000t$

21

Some radio channel host invited listeners to respond a poll on the show's website that asked, "Do you support the proposition discussed during the show? The show host reported that 80% responded "No" and 18% responded "Yes" on the next session of the show. Which of the following best explains why these results are unlikely to represent the sentiments of the entire population?

- A) The response must be 50% "Yes" and 50% "No" to be fair discussion in the show.
- B) The percentage don't add up to 100%, so no conclusion can be made.
- C) Those who responded to the poll were volunteered, not a random sample of the population.
- D) The show host could be against the proposition such that 80% of responders were against it.

22

$$\frac{\frac{9}{x+1} + \frac{9}{x^2+x}}{\frac{x^2}{x+1} - \frac{3x+4}{x+1}}$$

For $x \neq 1, 3$, which of the following expressions is equivalent to the above?

- A) $\frac{9(x+1)}{x(x+4)(x-1)}$
- B) $\frac{9}{x(x-4)}$
- C) $\frac{-9}{x(x-4)}$
- D) $\frac{x+1}{x(x-4)}$

STOP

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

Math

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(TIME: 35 MIN)

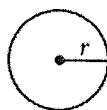
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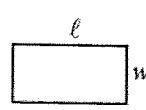
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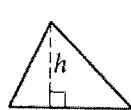
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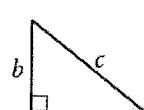
$$C = 2\pi r$$



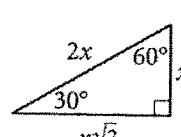
$$A = lw$$



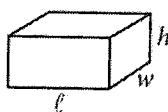
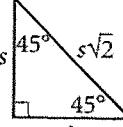
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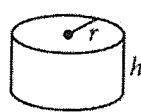
$$c^2 = a^2 + b^2$$



Special Right Triangles



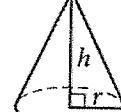
$$V = lwh$$



$$V = \pi r^2 h$$



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



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



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

The number of degrees of arc in a circle is 360.

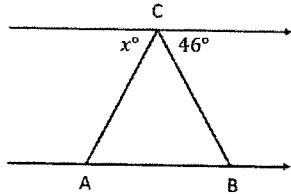
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In the figure above, Isosceles $\triangle ABC$ is located between two parallel lines. If $\overline{AC} \cong \overline{BC}$, what is the measure of x° ?

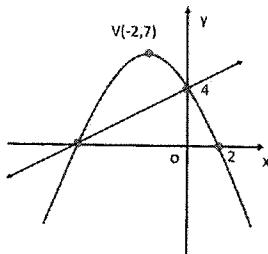
3

$$F = G \frac{Mm}{r^2}$$

The equation above shows the formula for the gravitational force between two objects, where G is a gravitational force constant. If r is halved and m is doubled, how does the change affect to the gravitational force, F ?

- A) No effect on F .
- B) F will be doubled.
- C) F will be $\frac{1}{8}$ times.
- D) F will be 8 times.

2



The graphs of a linear function and a quadratic function intersect at two points as shown in the XY-plane. The vertex of the parabola is $V(-2, 7)$ and the parabola passes through x axis at $(2, 0)$. What is the equation of the line?

- A) $y = \frac{2}{3}x + 4$
- B) $y = x + 4$
- C) $y = 2x + 4$
- D) $y = \frac{1}{3}x + 4$

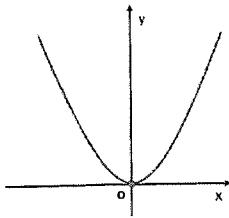
4

$$2x^2 + k + 3kx - 3 = (2x + m)(x + 1)$$

In the equation above, m and k are constants. If the equation is true for all values of x , what is the value of m ?

- A) -0.5
- B) -1
- C) -2.5
- D) -3.5

5

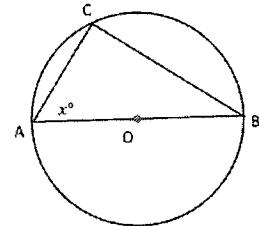


In the quadratic function in the XY-plane above, if the equation of the function is $y = ax^2 + bx + c$, which of the following must be true?

- IV. $a > 0$
- V. $b = 0$
- VI. $c > 0$

- E) I only
- F) I and II only
- G) I and III only
- H) I, II, and III

7



In the figure above, triangle ABC is inscribed into a circle O. If the radius of the circle O is 2, which of the following equations correctly represents to find the length of \overline{AC} ?

- A) $\overline{AC} = 4\sin x^\circ$
- B) $\overline{AC} = 2\cos x^\circ$
- C) $\overline{AC} = 4\cos x^\circ$
- D) $\overline{AC} = 4\tan x^\circ$

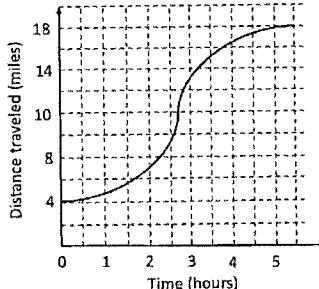
6

$$k^{x^2-4x-1} = \left(\frac{1}{k}\right)^{4x}$$

In the equation above, what is the value of x , where k is a positive constant?

- E) -1
- F) 2
- G) 4
- H) -4

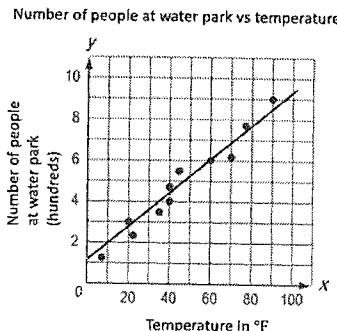
8



Philip drove from home to Las Vegas. There were some traffic delays because it was a national holiday. In which time interval does the graph show the greatest average rate of change, miles per hour?

- A) Between 1 and 2
- B) Between 2 and 3
- C) Between 3 and 4
- D) Between 4 and 5

9



The scatter plot above shows the number of people, in hundreds, at an indoor water park and the temperature ($^{\circ}\text{F}$) in a certain city. A line of best fit is graphed. Which of the following best represents the equation of the line of best fit?

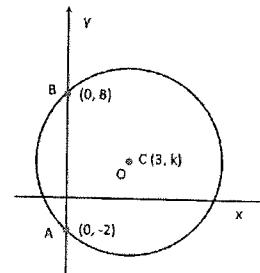
- A) $y = 1.2x + 1.2$
- B) $y = 0.08x + 1.2$
- C) $y = 0.08x + 2$
- D) $y = 1.2x + 2$

10

A wooden crate contains m boxes of paper towels and each box contains n paper towels. If 10 crates cost k dollars, how much is cost per paper towel in cents?

- A) $\frac{100k}{mn}$
- B) $\frac{k}{10mn}$
- C) $\frac{10k}{mn}$
- D) $\frac{10km}{n}$

11



A circle O is graphed in the XY -plane. If the center of the circle is $C(3, k)$ as shown above, where k is a constant, what is the equation of the circle?

- A) $(x - 3)^2 + (y - 3)^2 = 34$
- B) $(x + 3)^2 + (y + 3)^2 = 34$
- C) $(x - 3)^2 + (y - 3)^2 = \sqrt{34}$
- D) $(x + 3)^2 + (y + 3)^2 = \sqrt{34}$

12

A researcher found out that a new system of manufacturing facilities will lose approximately 4% of its value every year. If a new system cost \$55,000 when it was purchased, the value of the system of manufacturing facilities can be modeled by $f(t) = 55,000 \cdot (k)^t$, where k is a constant and t is the number of years after it was purchased. What is the value of k ?

- A) 1.04
- B) 0.96
- C) 1.40
- D) 0.04

13

Kim drove from home to a library at the average speed of 30 mph, and returned home along the same route at the average speed of 50 mph. what is the average speed the entire round-trip, in mph?

15

Margaux planned for a fundraiser by selling lemonade drinks near her house. She spent \$150 for one-time setup cost and each cup of lemonade costs her \$0.50 and sells each cup for \$2.75. which of the following equations could represent to find how many cups she would need to sell in order to make a profit of \$100?

- A) $100 = 2.75x - 150$
- B) $100 = 2.50x + 150$
- C) $150 - 2.25x + 100 = 0$
- D) $150 - 100 = 2.25x$

14

A quadratic function can be modeled for the height of a ball after thrown from the ground in terms of time, in seconds, after throwing in the air. According to the model, a ball was thrown from the ground and reached the maximum height of 100ft in 5 seconds after it was thrown. How long will it take when the ball hit the ground after it was thrown?

- E) 8 sec
- F) 10 sec
- G) 15 sec
- H) 17 sec

16

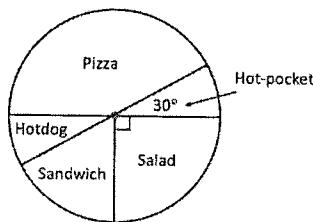
$$\begin{aligned}x^2 + y^2 &\leq 36 \\x - 3 &\geq 0\end{aligned}$$

In the inequalities above, what is the greatest y value to satisfy the given constraints?

- A) $3\sqrt{3}$
- B) 3
- C) 4
- D) 6

17

Favorite Lunch menu distribution



Mr. Peter, the teacher in a class, surveyed his 90 students for their favorite lunch menu and the results are shown in the circle graph above. How many students picked "Sandwich" for their favorite lunch menu based on the graph?

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

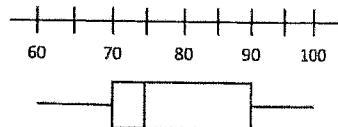
18

When a number, N , is divided by 5, the quotient is q and the remainder is r . Which of the following equations correctly represents N ?

- A) $N = 5r + q$
- B) $N = 5q + r$
- C) $N = qr + 5$
- D) $N = 5r + q$

19

EXAM SCORE DISTRIBUTION



The boxplot represents exam scores for a certain class. Approximately what percent of test scores were between 70 and 75 from the boxplot above?

- A) 5%
- B) 10%
- C) 25%
- D) 50%

20

A number is selected at random from 1 to 40 in the shuffle box. What is the probability that the number is a prime that is less than 20?

- A) $\frac{1}{5}$
- B) $\frac{9}{40}$
- C) $\frac{8}{20}$
- D) $\frac{7}{40}$

21

Which of the following table values could represent for an exponential decay function?

A)

x	1	2	3	4
f(x)	27	9	3	1

B)

x	1	2	3	4
f(x)	1	3	9	27

C)

x	1	3	6	9
f(x)	10	7	4	1

D)

x	1	3	6	9
f(x)	1	4	7	10

22

Which of the following expressions are equivalent to $\left(\frac{1}{a} - \frac{1}{b}\right)^2$?

- I. $\left(\frac{1}{a} + \frac{1}{b}\right)^2$
- II. $\frac{1}{a^2} + \frac{1}{b^2} - 2$
- III. $\left(\frac{1}{a} + \frac{1}{b}\right)^2 - \frac{4}{ab}$

- A) I only
- B) I and III only
- C) II only
- D) III only

STOP

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

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Math

22 QUESTIONS
(TIME: 35 MIN)

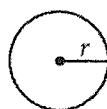
DIRECTIONS

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NOTES

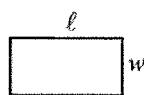
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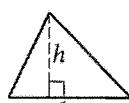
REFERENCE

$$A = \pi r^2$$

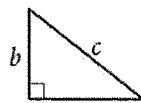
$$C = 2\pi r$$



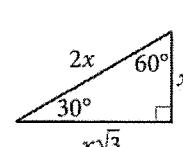
$$A = \ell w$$



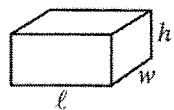
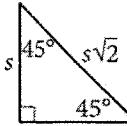
$$A = \frac{1}{2}bh$$



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



Special Right Triangles



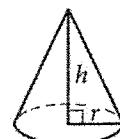
$$V = \ell wh$$



$$V = \pi r^2 h$$



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



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



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

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

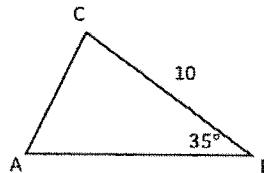
The sum of the measures in degrees of the angles of a triangle is 180.

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

1



Triangle ABC is similar to another triangle FGH (not shown). If $\angle A$ and $\angle C$ correspond to $\angle F$ and $\angle H$, respectively and $AC = \frac{1}{2} FH$, Which of the following must be true?

- I. The perimeter of ΔABC is $\frac{1}{2}$ the perimeter of ΔFGH
 - II. $m\angle G = 35^\circ$
 - III. The length of FG is 20
- A) I only
B) I and II only
C) II only
D) I, II, and III

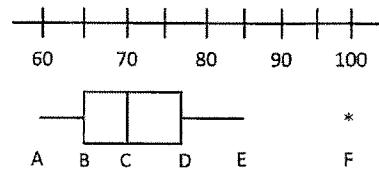
2

A quadratic function is graphed in the XY-plane. Which of the following forms shows where the graph intersects y-axis in the equation?

- A) $y = a(x - h)^2 + k$
 B) $y = a(x - b)(x - c)$
 C) $y - k = a(x^2 + bx)$
 D) $y = ax^2 + bx + c$

3

TEMPERATURE DISTRIBUTION IN A YEAR



In the boxplot above, one of the data (F) is far away from the rest of data, called “outlier”. If the outlier is removed from the data, which of the following would change from least to greatest?

- I. Mean
 - II. Median
 - III. Range
- A) II < I < III
 B) I < II < III
 C) III < I < II
 D) II < III < I

4

If a line is parallel to $y = -\frac{1}{2}x - 5$ and has a x-intercept at (4,0) in the XY-plane, what is the equation of the line?

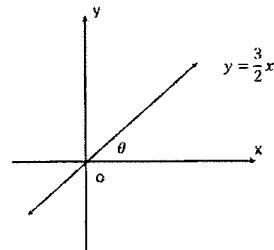
- E) $y = 2x - 8$
 F) $y = 2x - 5$
 G) $y = -\frac{1}{2}x + 2$
 H) $y = -\frac{1}{2}x + 4$

5

$$2x - 5kx = 26$$

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

7



In the graph above, A line $y = \frac{3}{2}x$ forms an angle θ between the line and positive x-axis in the XY-plane. What is the value of $\sin\theta$?

- A) $\frac{\sqrt{13}}{2}$
- B) $\frac{\sqrt{13}}{3}$
- C) $\frac{3}{2}$
- D) $\frac{3}{\sqrt{13}}$

6

A spinner is divided into 15 equal parts and numbered 1 through 15. What is the probability of spinning a number less than 6 or greater than 10 in a single spin?

- A) $\frac{1}{3}$
- B) $\frac{2}{3}$
- C) $\frac{11}{15}$
- D) $\frac{12}{15}$

8

Two of three sides of a triangle are 10 and 5. Which of the following numbers cannot be a perimeter of the triangle?

- A) 21
- B) 25
- C) 27
- D) 30

9

Two years ago, Amelie was twice as old as Peter. 6 years ago, Amelie was four times as old as Peter. What is the value of sum of their current ages?

- A) 20
- B) 21
- C) 22
- D) 24

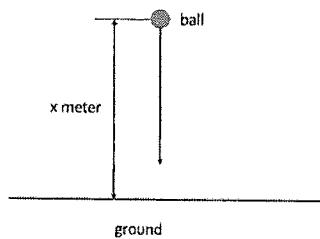
11

$$y = 2(2a)^{x+1} - a$$

If the exponential function above is graphed in the XY-plane, what is the value of y-intercept assuming a is a constant?

- A) $-a$
- B) a
- C) $2a$
- D) $3a$

10



When a ball released x meter (initial height) above the ground as shown in the figure, the maximum height, in meter, the ball can reach after bouncing once could represent in the following equation.

$$y = \frac{1}{3}x + 2$$

Where x is the initial height, in meters, and x must be greater than 4. If the maximum height, in meters, the ball reaches after bouncing once is half the initial height, what is the initial height the ball should be released?

- A) 2
- B) 6
- C) 12
- D) 24

12

An Uber driver charges a basic fare of \$3.25 plus \$0.60 for every $\frac{1}{4}$ of a mile driven. If the total charge for a ride is \$32.05, what is the total distance traveled, in miles?

13

$$\begin{aligned}4 &\leq -2x \\-y - 1 &\leq 0\end{aligned}$$

In the system of inequalities above, which of the following ordered pairs (x, y) satisfies the system?

- M) $(0, 0)$
- N) $(-3, -5)$
- O) $(0, 2)$
- P) $(-3, 0)$

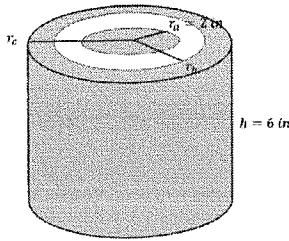
15

Summer Class Enrollments in ABC Community College

Class Enrollments	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
Calculus	23	12	8	10	6	12	2	73
Physics	45	6	7	20	8	11	7	134

The table above shows summer class enrollment distribution during the registration week in ABC Community College. Based on the data, by how much does the median number of enrollments in Calculus class exceed the median number of enrollments in Physics class during the 7 days?

14



The cutout of electric wire is shown above. The most inner portion is the place for all electric wires and the white portion of the cylinder is non-conductive material to insulate electricity and the outer most portion is plastic rubber (PVC) to bend freely. If the radius of the inner most portion, r_a , is 2 mm and $r_c = 2r_b = 3r_a$ in the figure, what is the ratio of volumes of white portions to the entire volume?

- A) $\frac{5}{36}$
- B) $\frac{8}{9}$
- C) $\frac{1}{9}$
- D) $\frac{1}{4}$

16

In the XY-plane, the graph of $y = x^2 + ax + b$, where a and b are constants, has two x-intercepts at $(2, 0)$ and $(-4, 0)$. What is the sum of $a + b$?

- A) -10
- B) 10
- C) -6
- D) 6

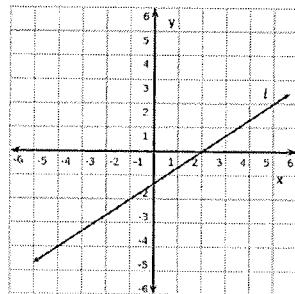
17

$$-3x^2 + 6x - 3y^2 - 3y - 1 = 0$$

In the circle equation above, what are the coordinates of the center of the circle?

- A) $(-1, \frac{1}{2})$
- B) $(1, \frac{1}{2})$
- C) $(1, -\frac{1}{2})$
- D) $(1, -1)$

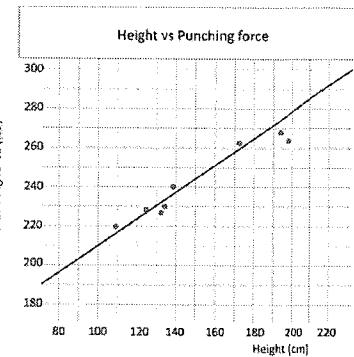
18



In the XY-plane above, line l is shown above. If another line m (not shown) is perpendicular to the line l , which of the following could be the equation of line m ?

- A) $2x + 3y = 2$
- B) $3x + 2y = -1$
- C) $2x - 3y = 9$
- D) $3x - 2y = 3$

19



The scatter plot above shows the punching force, in lbs., and the height of the person, in cm, of 8 people as well as the line of best fit for the data. Which of the following best represents an equation of the line of best fit?

- A) $y = 0.67x + 190$
- B) $y = 0.67x + 143$
- C) $y = 1.5x + 190$
- D) $y = 1.5x + 143$

20

$$(2ax + 3)(x - 1) - x^2 + 3$$

In the equation above, a is a constant. If the expression is equal to mx , where m is a constant, what is the value of m ?

21

After math final exam, a math teacher found out that mean score for class A is at least 20 points lower than class B. If the mean score for class B is y and the mean score for class A is x , which of the following correctly represents this situation?

- A) $y \geq x + 20$
- B) $y \leq x + 20$
- C) $y = x + 20$
- D) $y \leq x - 20$

22

Edison, an electric power company, charges $\$k$ for monthly basic fee plus $\$0.07$ per kilowatt-hour (kWh) of electricity in a certain area. If Philip paid $\$123.14$ for the electric bill for a certain month, which of the following expressions could be used to find how many kilowatt-hours (kWh) of electricity did he use for that month?

- A) $\frac{123.14 - k}{0.07}$
- B) $123.14 - k - 0.07$
- C) $\frac{123.14 - 0.07}{k}$
- D) $\frac{123.14 - 100k}{0.07}$

STOP

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Math

22 QUESTIONS
(TIME: 35 MIN)

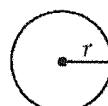
DIRECTIONS

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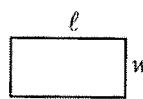
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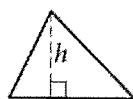
REFERENCE

$$A = \pi r^2$$

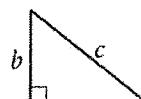
$$C = 2\pi r$$



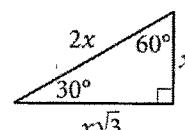
$$A = \ell w$$



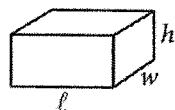
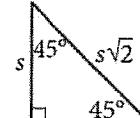
$$A = \frac{1}{2} bh$$



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



Special Right Triangles



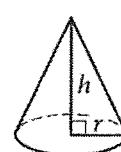
$$V = \ell wh$$



$$V = \pi r^2 h$$



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



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



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

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

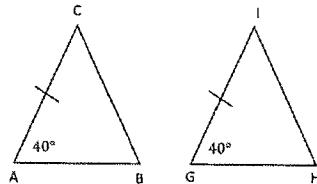
The sum of the measures in degrees of the angles of a triangle is 180.

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

1



In triangle ABC and triangle GHI, $m\angle A = m\angle G = 40^\circ$ and $\overline{AC} \cong \overline{GI}$. Which of the following information is sufficient to prove that the triangles are congruent?

- I. $\overline{AC} \cong \overline{HI}$
 - II. $m\angle B = m\angle H$
 - III. $\angle C \cong \angle I$
- A) I and II
B) I and III
C) II and III
D) I, II, and III

3

$$T = 2\pi \sqrt{\frac{l}{g}}$$

The equation above shows the formula for the period of the pendulum (T), where g is a gravitational acceleration. If g is halved in a certain planet and l , the length of the pendulum, is doubled, how does the change affect to the period of the pendulum, T ?

- E) No effect on T .
- F) T will be doubled.
- G) T will be $\frac{1}{2}$ times.
- H) T will be 4 times.

4

2

$$y = a(b)^x + k$$

In the exponential function above, a , b , and k are constants. What is the y -intercept of the graph of the function in the XY-plane?

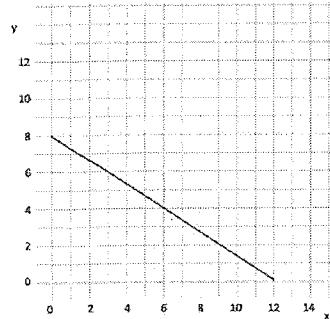
- A) $(0, ab + k)$
B) $(0, k)$
C) $(0, a + k)$
D) $(0, b + k)$

Value	Frequency
10	2
12	3
18	1
22	4
25	7

Which of the following statements best explains for the mean and median values from the frequency table above?

- A) The mean is equal to the median.
B) The mean is greater than the median.
C) The median is greater than the mean.
D) Not enough information to calculate.

5



Jonathan sells tickets for music concert and play in theater. The graph above models the possible number of tickets for both music concerts and play. Total amount he collected for tickets is \$240. If he sold a fixed amount of each ticket for music concert and another fixed amount of each ticket for the play, which of the following equations best represent this situation?

- A) $20x + 30y = 240$
- B) $30x + 20y = 240$
- C) $8x + 12y = 240$
- D) $12x + 8y = 240$

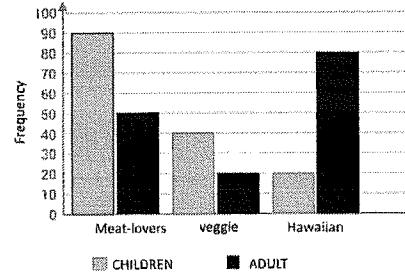
6

$$\left(\frac{1}{a}\right)^{x^2+2x-1} = a^{-2}$$

In the equation above, what is the sum of x values, where a is a positive constant?

- I) -1
- J) 2
- K) 4
- L) -2

7



The bar graph above summarizes the distribution of favorite topping of pizza for both adults and children during one week at a certain Pizza restaurant. What is the ratio of the adults' percent for meat-lover favorite to the children's percent for meat-lover favorite?

- A) 9:5
- B) 5:9
- C) 9:4
- D) 4:9

8

In the XY-plane, the graph of quadratic function $y = ax^2 + bx + c$ has a vertex at $(2, -3)$ and the graph passes through two points on the x-axis. Which of the following can NOT be the value of $a + b + c$?

- A) -3
- B) -2
- C) 0
- D) 2

9

$$\begin{aligned}x + 3y &= -7 \\-15y &= 5x + 35\end{aligned}$$

In the system of equations above, for a real number k , which of the following points could lie on the graph of the given system of equations in the XY-plane?

- A) $\left(k, -\frac{1}{3}k - \frac{7}{3}\right)$
- B) $\left(k, \frac{1}{3}k + \frac{7}{3}\right)$
- C) $(3k - 7, k)$
- D) $(k, -3k - 7)$

10

$$x^2 + 16x - k = 0$$

In the equation above, k is a constant. If the equation has two real solutions, where $m < k$, what is the greatest value of m ?

- A) -63
- B) -64
- C) -65
- D) -66

11

An isosceles right triangle ABC has a perimeter of $16 + 16\sqrt{2}$ cm. What is the length, in inches, of a leg of the triangle?

- A) 8
- B) 16
- C) $8\sqrt{2}$
- D) $16\sqrt{2}$

12

A ball is dropped from a height of 15 meters above the ground and hit the ground several times.

Assuming that the ball bounces off $\frac{2}{3}$ its previous height, which of the following would approximate the maximum height, in meters, of the ball between the second and third time it hit the ground?

- A) 10m
- B) 6.7m
- C) 2.2m
- D) 1.5m

13

To determine if turmeric reduces the risk of type 2 diabetes for men, study was conducted by interviewing random sample of 20,000 men who had no history of diabetes. Participants reported they were turmeric users in their diet. Seven years later, participants were interviewed again and the researcher found out that the proportion of men who diagnosed type 2 diabetes was significantly lowered for men identified as regular turmeric users. Which of the following statements is the most appropriate conclusion of this study?

- A) This study shows that turmeric is a medical cure of type 2 diabetes to anyone.
- B) Turmeric definitely caused the reduction in the risk of type 2 diabetes.
- C) There is an association between turmeric use and the risk of type 2 diabetes for men, but it is not necessarily a cause-and-effect relationship, and the association may not exist for women.
- D) There is an association between turmeric use and the risk of type 2 diabetes for both men and women, but it is not necessarily a cause-and-effect relationship.

14

$$\begin{aligned}x^2 + y^2 &\leq 81 \\y - 7 &\geq 0\end{aligned}$$

In the inequalities above, what is the least x value to satisfy the given constraints?

- E) 7
- F) -7
- G) $4\sqrt{2}$
- H) $-4\sqrt{2}$

15

A quadratic function can be modeled for Projected Annual Revenue (f), in millions of dollars, based on the unit price in dollars, x , of the products as follows.

$$f(x) = a(x - 1,200)^2 + 20$$

If the quadratic function is open-downward parabola, which of the following best represents the number 1,200 in the context?

- A) The company could approximate a maximum annual revenue 20 million dollars if the price per unit is \$1,200.
- B) The company could approximate a maximum annual revenue 20 million dollars if the company makes 1,200 product units per year.
- C) The company could approximate a maximum revenue 20 million dollars as long as the company sells 1,200 units of their products.
- D) The company could approximate a maximum revenue 1,200 million dollars if the price per unit is \$20.

16

$$D = 2,777 - 505t$$

The equation above shows the estimated distance (D), in miles, from Los Angeles airport (LAX) of the airplane t hours after taking off from New York airport (JFK). Which of the following statement best represents the number, 505, in the context?

- A) Average distance, in miles, the airplane flies every hour.
- B) Average speed, in mph, of the airplane for the entire trip.
- C) The time, in minutes, it takes the airplane from JFK to LAX.
- D) Total distance, in miles, between JFK and LAX.

17

A scientist observes the population of bees in a hive for his project. At the beginning of his observation, there were 12 bees visible in the hive and he found out that the population of bees in the same hive quadruples every week. Which of the following equations best models the number, f , of bees x months after the beginning of his observation?

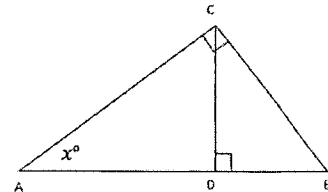
- A) $f = 12(1 + 4x)$
- B) $f = 12(4)^x$
- C) $f = 12(4)^{\frac{x}{4}}$
- D) $f = 12(4)^{4x}$

18

Sam harvested 60,000 pounds of barley last year in his farm. He increased the harvest by 20% this year by applying new method of irrigation system. And he expects another increment to the next year at the same rate as this year by expanding the area of his farm. How many pounds of barley does he expect to harvest in his farm for the next year?

- A) 72,000
- B) 84,000
- C) 86,400
- D) 96,000

19



In the figure above, $\sin x^\circ = 0.75$ and the lengths of AC and BD are 10 inches and 7 inches, respectively. What is the length of BC, in inches?

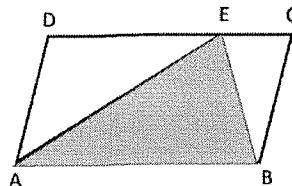
- A) 7.00
- B) 10.26
- C) 9.33
- D) 7.50

20

The area of a forest is decreasing at a rate of 1.2 acre per year in a certain developing country. If 1 square mile is equivalent to 640 acres and 1 kilometer is equivalent to 0.62 miles, which of the following converts the rate correctly which the area of forest is decreasing, in square kilometers per year?

- A) 0.0049
- B) 0.0030
- C) 1997.92
- D) 0.0015

21



In the figure above, point E is located on the side CD of the parallelogram. If $DE:EC = 4:1$ and the area of shaded region is 20, what is the area of triangle BCE?

- A) 3
- B) 4
- C) 5
- D) 6

22

Amount of money spent by each customer

Number of customers	Amount of money spent in dollars
5	Above 300
25	200-300
134	100-200
17	Below 100

The table shows four separated ranges of money, in dollars, spent by each customer in ABC whole sale market during the independence sale. Which of the following can be obtained from the table given?

- I. Average amount of money, in dollars each customer spent.
 - II. The median amount of money, in dollars for total 181 customers.
 - III. The range of money, in dollars, spent by more than half of all customers during the sale.
- A) I only
 B) I and II only
 C) III only
 D) I, II, and III

STOP

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

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Math

22 QUESTIONS
(TIME: 35 MIN)

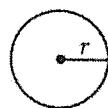
DIRECTIONS

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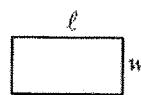
NOTES

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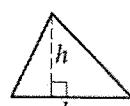
- All variables and expressions represent real numbers.
- Figures provided are drawn to scale.
- All figures lie in a plane.
- The domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

REFERENCE

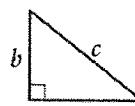
$$\begin{aligned}A &= \pi r^2 \\C &= 2\pi r\end{aligned}$$



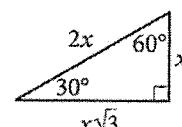
$$A = lw$$



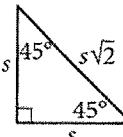
$$A = \frac{1}{2}bh$$



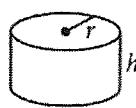
$$c^2 = a^2 + b^2$$



Special Right Triangles



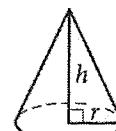
$$V = lwh$$



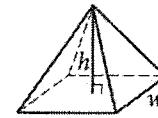
$$V = \pi r^2 h$$



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



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



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

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.

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.

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- If your answer is a **mixed number** (such as $3\frac{1}{2}$), write it as an improper fraction ($\frac{7}{2}$) or its decimal equivalent (3.5).
- Don't include **symbols** such as a percent sign, comma, or dollar sign in your circled answer.

1

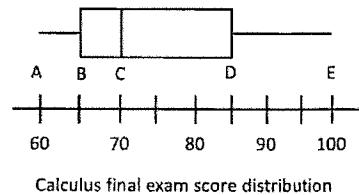
Average number of hours weekly spent in leisure time



In the bar graph above, which of the following statements interprets correctly?

- The percent of weekly time spent on Media for both married men and single men are same.
 - The percent of weekly time spent on Recreation for Married Men is higher than that of single men.
 - The number of weekly hours spent on recreation, media, and other leisure for married men is lower than the number of weekly hours spent on social life for single men.
- A) I only
B) I and II only
C) II only
D) II and III

2



In the boxplot above, which of the followings are valid statements?

- There must be more data between C and D than between B and C.
 - There are approximately 50% of data located A and C.
 - There are approximately 50% of data located between B and D.
- A) I only
B) I and III only
C) II and III only
D) I, II, and III

3

Which of the following expressions is equivalent to $(\sqrt{4x} + \sqrt{16y})^{\frac{2}{5}}$, where $x, y > 0$?

- A) $\sqrt[5]{4x + 16y}$
 B) $(4x + 16y)^{\frac{5}{2}}$
 C) $\sqrt[5]{4x + 16y + 16\sqrt{xy}}$
 D) $\sqrt[5]{4x + 16y + 8\sqrt{xy}}$

4

The function f is defined by $f(x) = -2(3)^{\frac{x}{5}} - 6$. What is the coordinate of y-intercept of the graph it is graphed in the XY-plane?

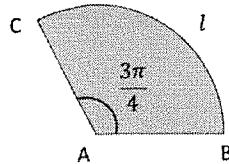
- A) $(-12, 0)$
- B) $(-8, 0)$
- C) $(0, -6)$
- D) $(0, -8)$

6

Susan plans her birthday party and orders for foods. There will be no more than 50 people in the party. The food catering restaurant charges \$25 per adult and \$20 per child and her budget is limited to \$1,200. If the number of adults is a and the number of children is c and no other charges, which of the following systems best represents all constraints mentioned above?

- A) $\begin{cases} a + c \leq 50 \\ 25a + 20c \leq 1,200 \end{cases}$
- B) $\begin{cases} a + c > 50 \\ 25a + 20c \leq 1,200 \end{cases}$
- C) $\begin{cases} a + c \leq 50 \\ 20a + 25c \leq 1,200 \end{cases}$
- D) $\begin{cases} a + c < 50 \\ 25a + 20c > 1,200 \end{cases}$

5



In the sector ABC of a circle above, if the central angle CAB is $\frac{3\pi}{4}$ as shown, what is the fraction of the length of an arc (l) to the entire circumference of the circle A?

- A) $\frac{13}{32}$
- B) $\frac{3}{8}$
- C) $\frac{1}{3}$
- D) $\frac{7}{16}$

7

If $x + y = 17$ and $xy = 24$, what is the value of $x^2 + y^2$?

- A) 265
- B) 241
- C) 313
- D) 337

8

The average (arithmetic mean) of five numbers is 12. After one of the numbers is removed, the average of the remaining numbers becomes 13.5. What number has been removed?

- A) 6
- B) 8
- C) 10
- D) 12

9

If sixty eight percent of the people who made it to the final round in a certain competition are female, what is the ratio of the number of males who made it to the final round to the number of females who made it to the final round?

- A) $\frac{8}{25}$
- B) $\frac{17}{25}$
- C) $\frac{8}{17}$
- D) $\frac{25}{8}$

10

If the ratio of the measures of angles in a triangle is 4:5:6, what is the measure of the largest angle, in degrees, in the triangle?

- A) 48°
- B) 60°
- C) 72°
- D) 120°

11

$$\begin{aligned}y &< -4x - 2 \\y &< -\frac{1}{4}x - 2\end{aligned}$$

In the system of inequalities above, which of the following ordered pairs (x, y) satisfies the system?

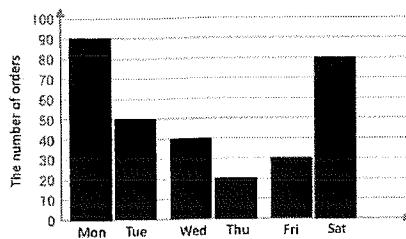
- Q) $(0, 0)$
- R) $(-3, -1)$
- S) $(-1, -5)$
- T) $(3, 0)$

12

A wooden stick of length l inches is cut into two pieces such that the length of one piece is 2 inches more than twice the length of the other piece. Which of the following is the length, in inches, of the longer piece in term of l ?

- A) $\frac{2+l}{3}$
- B) $\frac{2+2l}{3}$
- C) $\frac{1+l}{3}$
- D) $\frac{2l+1}{3}$

13



The bar graph shows the number of orders per day on a local pick-up restaurant last week. For these six days, how much greater is the mean number of orders per day than the median number of orders per day?

- A) 31.67
- B) 21.67
- C) 11.67
- D) 6.67

14

$$(2 - x)^2 - (2 - x) + 11 = 0$$

In the equation above, how many distinct real solutions does the equation have?

- A) Zero
- B) One
- C) Two
- D) Infinitely many

15

$$-x^2 + 6x - y^2 - 4y - k = 0$$

In the circle equation above, what is the value of k in the equation to have 7 as a radius of the circle?

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

16

$$Q = mc\Delta T$$

The equation above shows how much energy (Q), in joules, required to raise the temperature of water from T_1 to T_2 (ΔT), in degree Celsius, of m grams of water, where c is specific heat capacity of water. If the specific heat capacity of water (c) is $4.2 \frac{J}{g \cdot ^\circ C}$, about how much energy, in joules, is required to raise the temperature of 2.0 grams of water from $18^\circ C$ to $21^\circ C$?

- A) 16.8
- B) 12.6
- C) 25.2
- D) 33.6

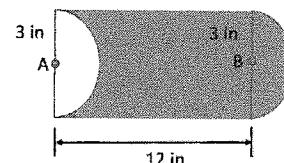
17

$$\left(-x - \frac{1}{3}\right)(mx + 1) - 3x^2 + 1$$

In the equation above, m is a constant. If the expression is equal to k , where k is a constant, what is the value of $k - m$?

- A) $\frac{7}{3}$
- B) $\frac{11}{3}$
- C) $-\frac{7}{3}$
- D) $-\frac{11}{3}$

18



In the figure above, two semi-circles, A and B, with 3 inches radii and a rectangle with 12 inches in length are shown. What is the area of the shaded region, in square inches?

- A) $36 - 9\pi$
- B) $72 - 9\pi$
- C) 36
- D) 72

19

$$\left(\frac{1}{x} + \frac{1}{y}\right)^2$$

For $x, y \neq 0$, if $x^2 + y^2 = 70$ and $xy = 6$, what is the value of the expression shown above?

- E) $\frac{41}{18}$
- F) $\frac{19}{9}$
- G) $\frac{18}{41}$
- H) $\frac{9}{19}$

20

$$m = \frac{a+b}{2}$$

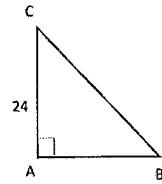
$$n = \frac{a+c}{2}$$

$$k = \frac{b+c}{2}$$

In the equations above, a , b , and c are positive constants. If $m > n > k$, which of the following inequalities is true?

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

22



In the right triangle ABC above, if $\cos\angle B = 0.5$, what is the value of $\tan\angle C$?

- A) $\frac{\sqrt{3}}{3}$
- B) $\frac{\sqrt{3}}{24}$
- C) $\frac{1}{2}$
- D) $\sqrt{3}$

21

$$f(x) = -\frac{x^2}{3} + 2x - l$$

In the quadratic equation above, where l is a constant. What is the value of c if $f(c) = f(5)$?

STOP

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Math

22 QUESTIONS
(TIME: 35 MIN)

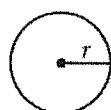
DIRECTIONS

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NOTES

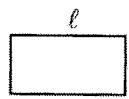
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REFERENCE

$$A = \pi r^2$$

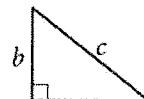
$$C = 2\pi r$$



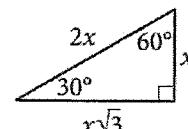
$$A = lw$$



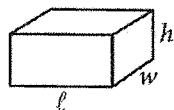
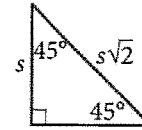
$$A = \frac{1}{2}bh$$



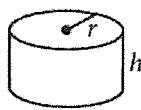
$$c^2 = a^2 + b^2$$



Special Right Triangles



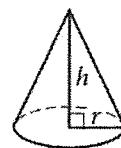
$$V = lwh$$



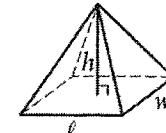
$$V = \pi r^2 h$$



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



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



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

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.



2

Module
2

2

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1

$x - a$ is one of the factors of $3x^3 + 15x^2 - 42x$, where a is a positive constant. What is the value of a ?

- A) 2
- B) 3
- C) 7
- D) 42

3

$$KE = \frac{1}{2} I \omega^2$$

The equation above shows the formula for the rotational kinetic energy (KE), where I is a rotational inertia and ω is an angular speed. If I is quadrupled and ω is halved, how does the change affect to the rotational kinetic energy, KE ?

- I) No effect on KE .
- J) KE will be doubled.
- K) KE will be $\frac{1}{2}$ times.
- L) KE will be 4 times.

2

Fitness class size	Frequency
10	20
12	18
15	10
20	7
22	5

The table above shows the distribution of 60 fitness classes size in a certain metropolitan area. What is the positive difference between the median and the mean of the data?

- A) 3.6
- B) 2.6
- C) 1.6
- D) 1.4

4

Demographic scientist observed and interviewed the visitors to a certain shopping mall to study the characteristics of customers in a holiday. $\frac{6}{13}$ are females, $\frac{1}{5}$ are children, and $\frac{2}{7}$ are from other cities. Based on the result of survey, what number could be the total number of visitors to the shopping mall on that day?

- A) 450
- B) 453
- C) 455
- D) 458

5

Michelle hosts a party for graduation. She found out that one 2L bottle of soda can serve 8 people, one large bag of chips can serve 4 people, and one box of assorted bread can serve 12 people. If total sum of the number of sodas, large bag of chips, and box of assorted bread is 77, how many people will be at her graduation party?

- A) 160
- B) 162
- C) 165
- D) 168

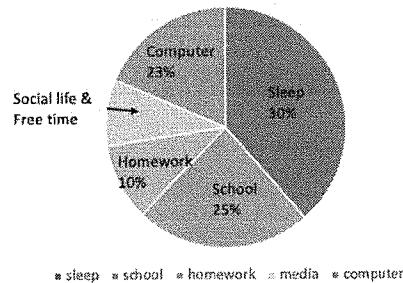
6

In the equation above, what is the absolute value of the difference of two x values, where a is a positive constant?

- M) -2
- N) 2
- O) 0
- P) 1

7

Time (24-hours) distribution of the average high school student



The circle graph shows how the average high school student spends their time 24-hours a day. Based on the graph, how many hours does the average high school student spend for social life and free time?

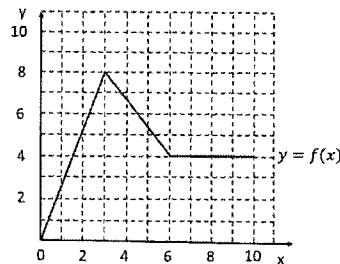
- A) 2.22
- B) 2.88
- C) 3.02
- D) 3.88

8

Julia is standing near the light post. She is 182cm tall and she is 4m away from the light post. If the height of the light post is 6m, what is the length of the shadow, in meters, of Julia? (1m = 100cm)

- A) 174.16
- B) 574.16
- C) 1.74
- D) 5.74

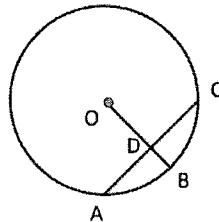
9



The figure above shows the complete graph of $y = f(x)$ in the XY-plane. The function h (not shown) is defined by $h(x) = f(x) - 3$. What is the maximum value of the function h ?

- A) 4
- B) 5
- C) 6
- D) 8

10

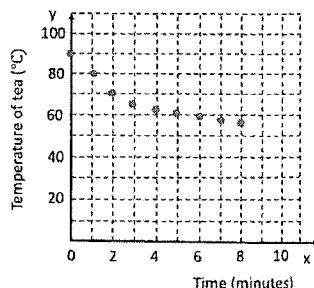


In the circle O above, the radius of a circle O is 8. If the length of BD is 2, what is the length of AC ?

- A) $2\sqrt{7}$
- B) $4\sqrt{7}$
- C) 20
- D) 10

11

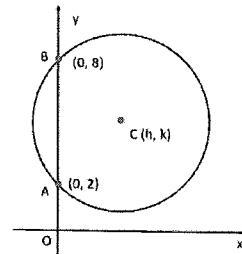
Temperature of a cup of tea vs time in minutes



In the dot plots above, it shows the temperature profile of a cup of tea over time after the cup is removed from a heat source and then left it in a room that is kept at a constant temperature. Which of the following best approximate the temperature, in °C, when it is just removed from the heat source?

- A) 60
- B) 70
- C) 80
- D) 90

12



In the circle graph above, the center of the circle is $C(h, k)$ and the radius of the circle is 5, what is the value of h ?

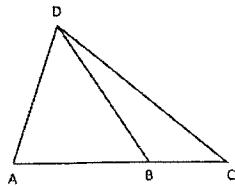
- A) 3
- B) 4
- C) 5
- D) 6

13

Gender	Short track distance			
	500m	1,000m	1,500m	3,000m
Male	23	11	9	20
Female	18	x	7	15

The table above shows the distribution of the number of Olympic short track athletes by various distances and gender in a certain country. If one of the female athletes was chosen at random, the probability that the athlete runs for 1,000m is $\frac{1}{5}$, what is the value of x?

14



In the figure above, $\overline{AB} = 2.5\overline{BC}$. If the area of triangle ABD is 30, what is the area of triangle BCD?

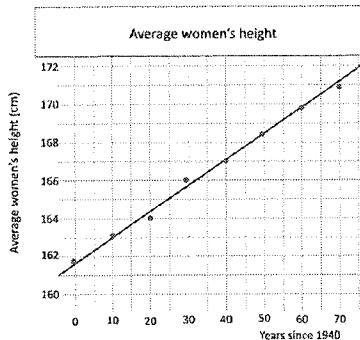
- A) 10
- B) 11
- C) 12
- D) 14

15

$$\begin{aligned}x &= 3 \\|y - 2| &= x\end{aligned}$$

In the system of equations above, what is the sum of y values of the solutions to the system?

16



The scatter plot shows the average women's height, in centimeters, in a certain country since 1940s. A line of best fit is shown on the graph and its equation is $y = 0.133x + 161.67$, where x is the number of years after 1940. What does the line of best fit predict about the increase over the 70-year period?

- A) Every 10 years between 1940 and 2010, the average increase in women's height in that specific country is 0.133cm.
- B) For 10 years between 1940 and 2010, the total increase in women's height in that specific country is 161.67cm.
- C) Every year between 1940 and 2010, the average increase in women's height in that specific country is 0.133cm.
- D) Every year between 1940 and 2010, the average increase in women's height all over the world is 0.133cm.

17

If $f(x) = \frac{3}{4}x^2 + 1$ and $f(x - a) = \frac{3}{4}x^2 + 3x + 4$, what is the value of a ?

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

18

An oceanologist detected a sunken ship 4.5 miles below the ocean's surface by radar. Approximately, how many kilometers below the ocean's surface was the sunken ship located? (1 kilometer = 0.6214 miles)

- A) 2.80
- B) 6.24
- C) 7.24
- D) 8.24

19

$$\frac{1}{3x-4} + 2$$

Which of the following is equivalent to the expression above, where $x > 2$?

- A) $\frac{6x-8}{3x-4}$
- B) $\frac{3}{3x-4}$
- C) $\frac{6x-7}{3x-4}$
- D) $\frac{6x-6}{3x-4}$

20

$$(4x^2 - ax + 1)(bx - 3)$$

The expression above is equivalent to $28x^3 - 19x^2 + 10x - 3$ for all x , where a and b are constants. What is the value of $a + b$?

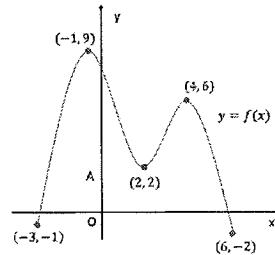
- A) 7
- B) 8
- C) 9
- D) 10

21

A math teacher scored 55 students' math exam. The teacher calculated class mean, median, range, and standard deviation of 55 scores. Later he found out that the highest score was mistakenly 2 points lower than it should have been. Which of the following remains unchanged if the teacher uses the corrected score?

- A) Mean
- B) Median
- C) Range
- D) Standard deviation

22



The complete function f is graphed in the XY-plane above. There is another function, $y = a$, where a is a constant (not shown). Which of the following could be the value of a if the system of two functions has three real solutions?

- A) 1
- B) 3
- C) 5
- D) 6

STOP

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

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Math

22 QUESTIONS
(TIME: 35 MIN)

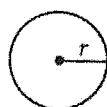
DIRECTIONS

The questions in this section address a number of important math skills.
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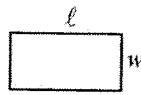
NOTES

Unless otherwise indicated:

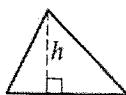
- All variables and expressions represent real numbers.
- Figures provided are drawn to scale.
- All figures lie in a plane.
- The domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

REFERENCE

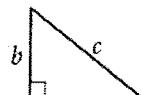
$$\begin{aligned} A &= \pi r^2 \\ C &= 2\pi r \end{aligned}$$



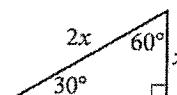
$$A = \ell w$$



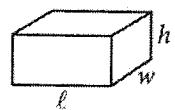
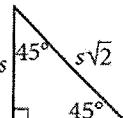
$$A = \frac{1}{2}bh$$



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



Special Right Triangles



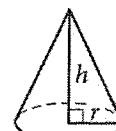
$$V = \ell wh$$



$$V = \pi r^2 h$$



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



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



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

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.

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.

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

1

$$144 = 8x + y$$

The equation above can be used to model the amount of money (y), in dollars, left after buying boba drinks for x times in a month. If $(18, 0)$ is a solution to the equation, what does it mean in this context?

- A) The unit price of a boba drink is \$18.
- B) It will take 18 days to use all the money in the budget.
- C) The person bought 18 boba drinks and no money left in the budget.
- D) The person's budget was \$18.

2

If $\frac{\sqrt{2x}}{4} = 2\sqrt{2}$, what is the value of x ?

- A) 64
- B) 16
- C) 8
- D) 4

3

Which of the following must be true if $xy < 0$?

- I. $xy \neq 0$
- II. $x^2 - y^2 < 0$
- III. $x^2 + y^2 > 0$

- A) I only
- B) I and II only
- C) I and III only
- D) III only

4

Which of the following is an example of a function whose graph has exactly one x intercept in the XY-plane?

- A) A linear function whose rate of change is zero.
- B) A quadratic function whose vertex is located at $(-1, -3)$ and opens upwards.
- C) A quadratic function whose vertex is located at the origin and opens downwards.
- D) A quadratic function whose vertex is located at $(1, 3)$ and opens upwards.

5

On a certain test, all correct answers earn the same points and all incorrect answers lose the same points, and no response earns one point. The equation $P = 5c - 2i + s$ represents a score obtained by the number of correct answers, c , and the number of incorrect answers, i , and the number of unanswered, s . If a student got 25 correct answers and 5 incorrect answers, and got 120 points on the final score, how many problems did the student leave no answers on the test?

7

Adrian has two part-time jobs. He works as a caterer at \$25 per hour, and he also works as a math tutor at \$45 per hour. He can work no more than 30 hours per week, but he will need to earn at least \$1,500 in order to pay his rent. Which of the following inequalities represents this situation if x represents the number of hours he worked as a tutor and y represents the number of hours he worked as a caterer?

- A) $\begin{cases} x + y \leq 30 \\ 25x + 45y \leq 1,500 \end{cases}$
- B) $\begin{cases} x + y \geq 30 \\ 25x + 45y \geq 1,500 \end{cases}$
- C) $\begin{cases} x + y \leq 30 \\ 45x + 25y \geq 1,500 \end{cases}$
- D) $\begin{cases} x + y \geq 30 \\ 45x + 25y \geq 1,500 \end{cases}$

6

$$ax^2 - 10x + 5 = 0$$

In the quadratic equation above, where a is a constant. If the equation has exactly one solution, what is the value of a ?

8

In a certain college, 40% of students take fine arts classes. Of those who doesn't take fine arts classes 50% take graphic design classes. If all students in the college must take only one art related class and there are 320 students in total, how many students will take other art related classes than fine art classes or graphic design classes?

- A) 128
- B) 96
- C) 64
- D) 48

9

$$\begin{aligned} ax - by &= 12 \\ 2x + 7y &= -36 \end{aligned}$$

In the system of equations above, a and b are constants. If the system has infinitely many solutions, what is the value of $\frac{b}{a}$?

- A) $-\frac{7}{2}$
- B) $\frac{7}{2}$
- C) $-\frac{2}{7}$
- D) $\frac{2}{7}$

10

$$x^2 + 10x + y^2 - 8y + 40 = 0$$

In the circle equation above, if the circle is graphed in the XY-plane, how many units horizontally need to be translated in order to be tangent to the y-axis?

- A) 5 units to the right.
- B) 4 units to the right.
- C) 5 units to the left.
- D) 5 units to the right.

11

$$f(x) = a \cdot 2^{x-1}$$

In the exponential function f above, where a is a constant. What is the value of $f(2)$ if $f(1) = 3$?

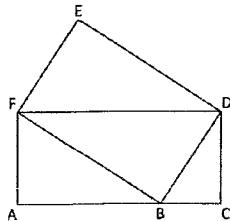
12

The height above the ground, in feet, of the riding cart in a certain roller coaster is given by $h(t) = -1.75(t - 8)^2 + 120$, t seconds after the ride starts, where $0 \leq t \leq 16$. If the riding cart is 113 ft above the ground, after how many seconds will the riding cart be at the same height, in feet, when it moves downward?

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

13

15



In the figure above, rectangle $ACDF$ is overlaid with parallelogram $BDEF$ as shown. If the area of parallelogram $BDEF$ is 50, what is the area of rectangle $ACDF$?

14

16

The landlord in a commercial building sent letters to all tenants that the lease amount will be raised 12% every year. If a tenant is paying \$15,000 for one-year lease in the beginning of 2020, Approximately, how much will the tenant need to pay in the beginning of 2023?

- A) \$18,816
- B) \$20,400
- C) \$21,074
- D) \$23,603

The mean of 7 numbers in a list is x . When an additional number is added to the list, the mean of all numbers is $2x - 1$. What is the value, in terms of x , of the number added to the list?

- A) $9x - 1$
- B) $8x - 8$
- C) $9x - 8$
- D) $8x - 1$

If $x^2 + y^2 = a$ and $xy = b$, which of the following is equivalent to $-4b + 2a$?

- A) $-2(y - x)^2$
- B) $2(y - x)^2$
- C) $4(x - y)^2$
- D) $-4(y - x)^2$

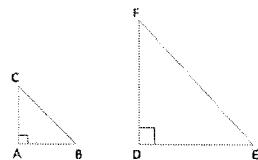
17

	A	B	C	D	E
Basalt	0.41	0.40	0.42	0.39	0.41
Sandstone	0.02	0.54	0.35	0.42	0.13

Five samples of each of two different rock types are collected from a mountain in California. The values in the table shows the amount of Carbon, in milligrams, found in 1 gram of each rock sample. Which of the following statements is valid based on the values in the table?

- I. The standard deviation of Basalt samples is greater than that of Sandstone samples.
 - II. The median of Sandstone samples is smaller than that of Basalt samples.
 - III. The range of Sandstone samples is greater than that of Basalt samples.
- A) I only
 B) I and II only
 C) II and III only
 D) III only

18



In the right triangles above, if two triangles are similar and $AB = 3$ and $BC = 5$, then what is the value of $\sin E$?

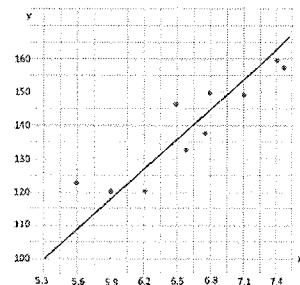
- A) $\frac{3}{4}$
 B) $\frac{2}{5}$
 C) $\frac{3}{5}$
 D) $\frac{4}{5}$

19

A right triangular prism has a height of 8 cm and the area of right triangle (Base) is 10 cm^2 . If the mass of the prism is 146 g , what is the density, in g/cm^3 , of the prism?

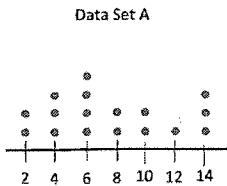
- A) 1.825
 B) 3.650
 C) 0.548
 D) 0.274

20



The scatter plot above shows the distribution of heights (y values), in centimeters, of women based on their shoe sizes (x values). The line of best fit is also drawn in the XY-plane. What is the number of women for which the line of best fit predicts a value greater than the actual value?

21



Data set A is shown above. Data set B is created by adding 2 to each of the values in the data set A. Which of the following statements is valid for the data?

- A) The range of data set A is smaller than that of data set B.
- B) The mean of data set A is equal to that of data set B.
- C) The median of data set A is equal to that of data set B.
- D) The standard deviation of data set A is equal to that of data set B.

22

A survey was conducted randomly at a local shopping mall to determine the proportion of people who know a recent new dancing boys' group. Out of 360 participants sampled, 234 knew the dancing boys' group. The margin of error of the survey was 5%. Which of the following statements best represents a possible conclusion about the percentage of people who know the dancing boys' group?

- A) Exactly 65% of the people in the mall know the dancing boys' group.
- B) More than 70% of the people in the mall know the dancing boys' group.
- C) Less than 60% of the people in the mall don't know the dancing boys' group.
- D) It is plausible that between 60% and 70% of the people in the mall know the dancing boys' group.

STOP

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Math

22 QUESTIONS
(TIME: 35 MIN)

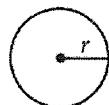
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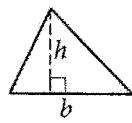
REFERENCE

$$A = \pi r^2$$

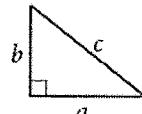
$$C = 2\pi r$$



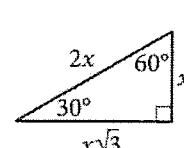
$$A = \ell w$$



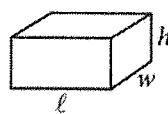
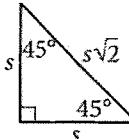
$$A = \frac{1}{2}bh$$



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



Special Right Triangles



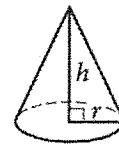
$$V = \ell wh$$



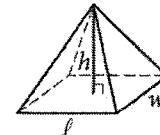
$$V = \pi r^2 h$$



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



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



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

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.

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

In the xy -plane, what is a point of intersection between two graphs of $y = 2x - 4$ and $y = x^2 + x - 6$?

- A) $(-2, -8)$
- B) $(2, 0)$
- C) $(1, -2)$
- D) $(-1, 2)$

2

Function f is graphed in the xy -plane by translating the function h up 4 units. If the function h is defined by $h(x) = 3x^2 - x$, what is the value of $f(2)$?

- A) 10
- B) 12
- C) 14
- D) 6

3

There are 620 students in ABC college. 110 of the students were randomly chosen and surveyed on whether or not they will travel abroad over the summer. The results of the survey show that 66 of the surveyed students were planning to travel abroad over the summer. The margin of error on this survey is $\pm 5\%$. What is the range of students in the entire college that would travel abroad over the summer?

- A) 55-65
- B) 79-141
- C) 341-403
- D) 217-279

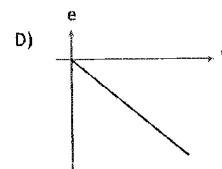
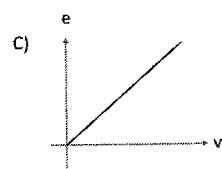
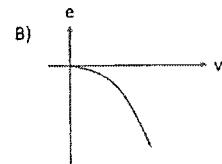
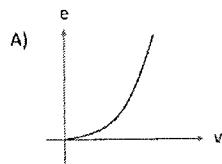
4

A technician manufactured 6 more lamps on Tuesday than he manufactured on Monday. If he manufactured 20% more lamps on Tuesday than on Monday, how many lamps did he manufactured on Tuesday?

5

Kinetic Energy (J)	Velocity (m/s)
100	10
400	20
900	30
1,600	40

In physics lab, a student found that the velocity of a miniature cart affected the kinetic energy, as shown in the table above. Which of the following graphs best represents the relationship between the velocity (v) of cart, in m/s, and the kinetic energy (e), joule, as indicated in the table?



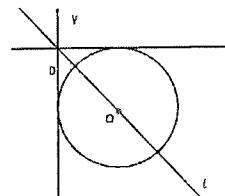
7

Ages	Frequency
17	50
18	150
19	170
20	80
21	34
22	16

The table above shows the distribution of ages of 500 freshmen in a certain college. What is the positive difference between the mean and the median of the data in the table?

- A) 0.500
- B) 0.108
- C) 1.080
- D) 5.000

8



A circle O with radius 3 is tangent to both x -axis and y -axis in the xy -plane as shown above. If a line l passes through the origin and the center of the circle O , what is the equation of the line l ?

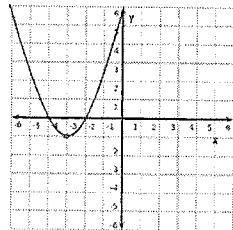
- A) $y = x + 3\sqrt{2}$
- B) $y = x$
- C) $y = -x - 3\sqrt{2}$
- D) $y = -x$

6

$$\frac{3x - 3}{(x - 3)^2} - \frac{3}{x - 3}$$

If the expression above is equivalent to $\frac{k}{(x-3)^2}$, where k is a constant and $x \neq 2$, what is the value of k ?

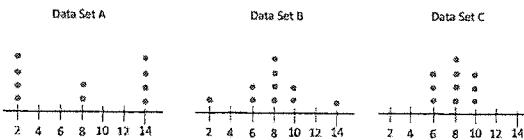
9



The graph of quadratic function of $y = f(x)$ is shown in the xy -plane above. Which of the following equations shows the minimum value of the function in the equation?

- A) $y = (x + 2)(x + 4)$
- B) $y = x^2 + 6x + 8$
- C) $y = x(x + 6) + 8$
- D) $y = (x + 3)^2 - 1$

11



The dot plots of three data sets are shown above. Which data set has the least standard deviation?

- A) Data set A
- B) Data set B
- C) Data set C
- D) All data sets have the same standard deviation.

10

Veronica has 1.2 miles left after running k percent of the entire trail in the morning. Which of the following expressions represents the distance of the entire trail in terms of k ?

- A) $\frac{120}{100-k}$
- B) $\frac{100}{100-k}$
- C) $\frac{120}{120-1.2k}$
- D) $\frac{100}{120-k}$

12

If $f(x - 1) = x^2 - 3x - 2$ for all values of x , which of the following could be the function f ?

- A) $f(x) = x^2 - 5x + 2$
- B) $f(x) = x^2 - 3x - 3$
- C) $f(x) = x^2 - x - 4$
- D) $f(x) = x^2 + x - 4$

13

The census shows that the number of labor force population in a certain country-side town is reduced by one-fifth every year. If the number of labor force population in the country-side town t years after the first census surveyed is represented by P and the initial labor population on the country-side town was k , where k is a constant, which of the following equations best represents this situation after t years of the first census surveyed?

- A) $P(t) = \frac{1}{5}k^t$
- B) $P(t) = k\left(\frac{1}{5}\right)^t$
- C) $P(t) = t\left(\frac{1}{5}\right)^k$
- D) $P(t) = k\left(\frac{4}{5}\right)^t$

14

$$f(x) = 2\left(\frac{1}{4}\right)^x - 2$$

If the exponential function of $y = f(x)$ is graphed in the xy -plane, what are the coordinates of the x -intercept of the function?

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

15

Two triangles, ΔABC and ΔKML , are similar. The area of triangle ΔABC is 46 in^2 . If the length of sides $AB = 4 \text{ in}$ and $KM = 8 \text{ in}$, what is the area of ΔKML ?

- A) 184
- B) 92
- C) 46
- D) 23

16

$$\begin{aligned} \text{Circle A: } & (x - 1)^2 + y^2 = 4 \\ \text{Circle B: } & x^2 - 2x + y^2 - c = 0 \end{aligned}$$

In the xy -plane, two circles A and B are co-centered. If the radius of circle A is two less than the radius of circle B, what is the value of constant c in the equation of circle B?

- A) 36
- B) 35
- C) 16
- D) 15

17

A triangle has a height that is 125% of its base. If the height is increased by 2 cm, how much does the base need to change in order to keep the same proportion of the original triangle?

- A) The base needs to increase 1.6 cm.
- B) The base needs to decrease 1.6 cm.
- C) The base needs to increase 2 cm.
- D) The base needs to decrease 2 cm.

18

A quadratic function f is graphed in the xy -plane. If one of the x -intercept is $(2, 0)$ and the vertex is located at $(4, 3)$, what is the coordinates of the other x -intercept of the function?

- A) $(4, 0)$
- B) $(5, 0)$
- C) $(6, 0)$
- D) $(7, 0)$

19

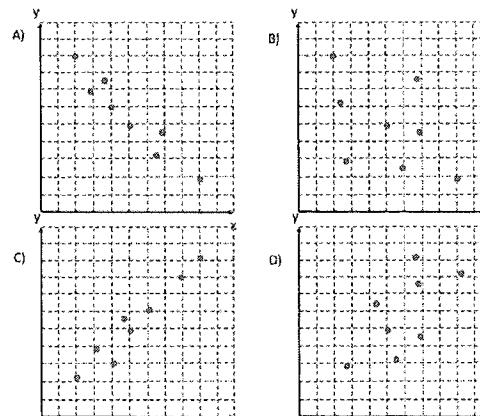
If $x > 0$, which of the following is equivalent to $\sqrt[7]{x^5}$?

- I. $x^{\frac{5}{7}}$
- II. $\frac{x^{\frac{2}{7}}}{x^{\frac{5}{7}}}$
- III. $x \cdot \left(x^{\frac{1}{7}}\right)^{-2}$

- A) I only
- B) I and II only
- C) I and III only
- D) I, II, and III

20

Which of the following scatter plots best represent a strong negative association between x and y ?



21

For $x > 0$ and $y > 0$, the quotient of the square root of x and twice the square of y is 56, and the cube root of the sum of 5 and y is the square of x . Which of the following equations best represents the statements above.

- A) $\begin{cases} \frac{\sqrt{x}}{2y^2} = 56 \\ (5+y)^3 = \sqrt{x} \end{cases}$
- B) $\begin{cases} \frac{\sqrt{x}}{(2y)^2} = 56 \\ \sqrt[3]{(5+y)} = \sqrt{x} \end{cases}$
- C) $\begin{cases} \sqrt[3]{(y+5)} = \sqrt{x} \\ \frac{\sqrt{x}}{2y^2} = 56 \end{cases}$
- D) $\begin{cases} \frac{\sqrt{x}}{2y^2} = 56 \\ \sqrt[3]{(y+5)} = x^2 \end{cases}$

22

A right triangle has angles measuring 45° , 45° , and 90° . If the length of the hypotenuse is 4, what is the area of the right triangle?

STOP

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