Math

22 QUESTIONS
(TIME: 35 MIN)

DIRECTIONS

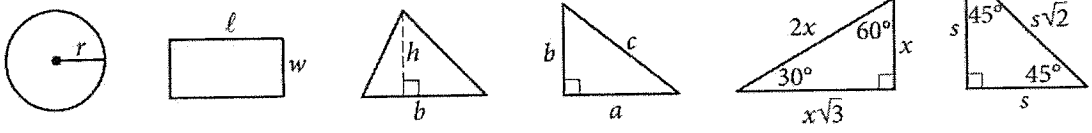
The questions in this section address a number of important math skills.
Use of a calculator is permitted for all questions.

NOTES

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



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

$A = \ell w$

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

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

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.

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

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

- Once you've written your answer, circle it clearly. You will not receive credit for anything written outside the circle, or for any questions with more than one circled answer.
- If you find **more than one correct answer**, write and circle only one answer.
- Your answer can be up to 5 characters for a **positive** answer and up to 6 characters (including the negative sign) for a **negative** answer, but no more.
- If your answer is a **fraction** that is too long (over 5 characters for positive, 6 characters for negative), write the decimal equivalent.
- If your answer is a **decimal** that is too long (over 5 characters for positive, 6 characters for negative), truncate it or round at the fourth digit.
- If your answer is a **mixed number** (such as $3\frac{1}{2}$), write it as an improper fraction (7/2) or its decimal equivalent (3.5).
- Don't include **symbols** such as a percent sign, comma, or dollar sign in your circled answer.

1

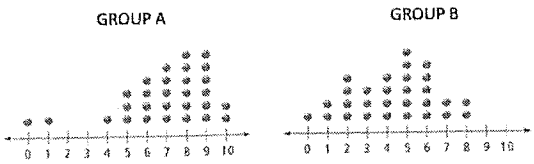
$$mx^2 + 10x + 1 = 0$$

In the equation above, c is a constant. If the equation has only one real solution, what is the value of m?

A) -25
B) 25
C) -50
D) 50

2

DISTRIBUTION OF NUMBER OF FOREIGN COUNTRIES VISITED



Which of the following statements must be true?

I. The range of group A is bigger than the range of group B.
II. The mean value describes more accurately in data A than the median value because it has outliers

A) I only
B) II only
C) I and II
D) Neither I or II

3

In a relation between two variables, x and y, they are related such that every increase by 1 in the value of x, the value of y decreases by a factor of 4. If $y = 30$ when $x = 0$, which equation represents the relationship?

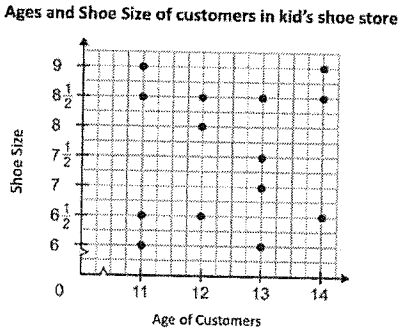
A) $y = 30\left(\frac{3}{4}\right)^x$
B) $y = 30(x + 1)^4$
C) $y = 30\left(\frac{1}{4}\right)^x$
D) $y = 30(-4)^x$

4

Elliott earns k dollars annually and pays r percent of what he earns for income taxes. Which of the following expressions represents the amount of money he earns after tax deduction?

A) $k(100 - r)$ dollars
B) $k(1 - r)$ dollars
C) $k(1 - 0.1r)$ dollars
D) $k(1 - 0.01r)$ dollars

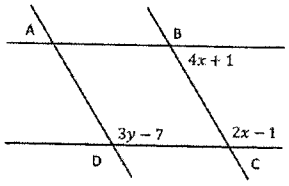
5



Which of the following statements describes the most appropriate about the scatter plot above?

A) The plot shows a positive correlation.
B) The plot shows a negative correlation.
C) The plot shows a constant trend.
D) The plot shows no correlation.

7



In the diagram above, if $\overline{AB} \parallel \overline{DC}$ and $\overline{AD} \parallel \overline{BC}$, what is the sum of values of x and y?

A) 22
B) 30
C) 52
D) 62

6

In a certain survey, 25% of people were at most 20 years old and 75% were at most 50 years old. If 120 people in the survey were more than 20 years old and at most 50 years old, what was the total number of people surveyed?

A) 120
B) 180
C) 220
D) 240

8

Julie's income in 2021 was 40 percent higher than her income in 2020. What is the ratio of her income in 2021 to her income in 2020?

A) 7 to 5
B) 5 to 7
C) 5 to 2
D) 2 to 5

9

$$S(m) = 50{,}000(0.98)^m$$

The function, $S(m)$, above represents the population of bacteria in a certain colony m minutes after exposing them into partial sunlight. Which of the following functions best models the population of bacteria after h hours?

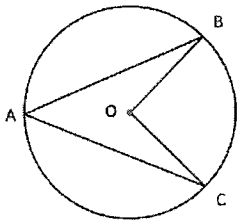
E) $P(h) = 50{,}000\left(\frac{0.98}{60}\right)^h$
F) $P(h) = 50{,}000(0.98)^{\frac{h}{60}}$
G) $P(h) = 50{,}000(0.98)^{60h}$
H) $P(h) = \frac{50{,}000}{60}(0.98)^h$

10

$$f(x) = -2x^2 + 4x + 3$$

In the quadratic function, $f(x)$, shown above, what is the maximum value of the function $f(x)$?

11



The circle O is shown above, if the radius of the circle is 6 and the measure of angle $\angle BAC = 30°$, what is the length of arc BC?

A) 2π
B) 4π
C) 6π
D) 8π

12

The average (arithmetic mean) of three positive integers, $a, b, and\ c$ is 32 where $c < b < a$. If the sum of two smaller numbers is 46, what is the value of a?

13

$$f(x) = (x-1)(x-3)(x+1)$$

The function f is shown above. Which of the following table values represents $y = f(x) + 1$?

A)

x	y
1	2
3	4
-1	0

B)

x	y
1	0
3	0
-1	0

C)

x	y
1	-1
3	-1
-1	-1

D)

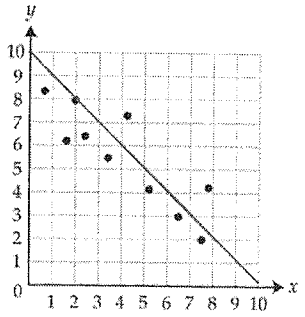
x	y
1	1
3	1
-1	1

14

The number of tiles needed to cover 50 square feet of wall is 100. A bathroom has a total of t square feet on the wall to cover. Which of the following could represent the total number of tiles needed to cover three bathrooms in terms of t?

A) $2t$
B) $3t$
C) $5t$
D) $6t$

15



In the scatterplot shown above, which of the following equations best represents the line of best fit shown?

A) $y = -x + 8$
B) $y = -x + 10$
C) $y = 10 + x$
D) $y = 10 - 2x$

16

$$\frac{(m^{-2}n^3)(m^2n^{-2})^2}{(mn^{-1})^{-1}}$$

If the algebraic expression above is simplified to $\frac{m^x}{n^y}$, where x *and* y are positive integers. What is the value of the sum of x *and* y?

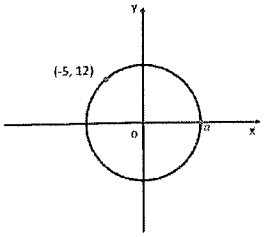
17

$$\frac{1}{r_t} = \frac{1}{r_a} + \frac{1}{r_b}$$

To calculate the total resistance in a parallel circuit, we can use the formula above. Which equation correctly expresses r_t in term of r_a *and* r_b?

A) $r_t = r_a + r_b$
B) $r_t = \frac{r_a + r_b}{r_a r_b}$
C) $r_t = \frac{r_a r_b}{r_a + r_b}$
D) $r_t = \frac{r_a}{r_a + r_b}$

18



In the circle above, if (-5, 12) is one point on the circle as shown, what is the coordinates of point a?

A) (0,13)
B) (13,0)
C) (5,0)
D) $(\sqrt{159}, 0)$

19

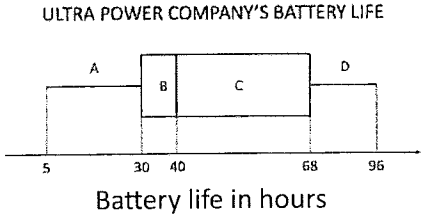
Demographic Characteristics of Education for random 200 participants

	Male	Female	Total
Less than high school	8	5	
High school degree	30		56
College degree	22	50	72
Bachelor's degree or higher		19	59
Total	100	100	200

In the survey above, some data were deleted by accident. If a female was chosen at random, what is the probability that the person has a high school degree or college degree?

A) 0.38
B) 0.69
C) 0.76
D) 0.81

20



The boxplot represents the distribution of battery life in hours for Ultra Power Company in 2022. Which of the following must be true?

I. The number of batteries in region B is smaller than in region C.
II. Approximately 75% of the batteries have a battery life 30 hours or more.
III. The range of data above is 38.

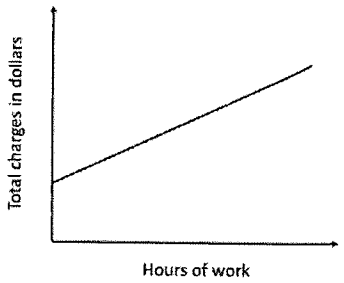
A) I only
B) II only
C) I and II only
D) I, II, and III

21

What is the equation of the line which is perpendicular to $y = -\frac{1}{2}x + 3$ and passes through the point $(1,4)$ in the XY-plane?

A) $y = \frac{1}{2}x + \frac{7}{2}$
B) $y = -\frac{1}{2}x + \frac{9}{2}$
C) $y = 2x + 2$
D) $y = -2x + 6$

22



The graph above represents total charges of plumbing work by a certain plumber. The plumber charges the basic fee plus an hourly rate. What is the best interpretation of the y intercept in the graph?

A) The plumber's total charge
B) The plumber's hourly rate
C) One-time basic fee
D) The plumber's minimum hourly rate

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.