Math

22 QUESTIONS
(TIME: 35 MIN)

DIRECTIONS

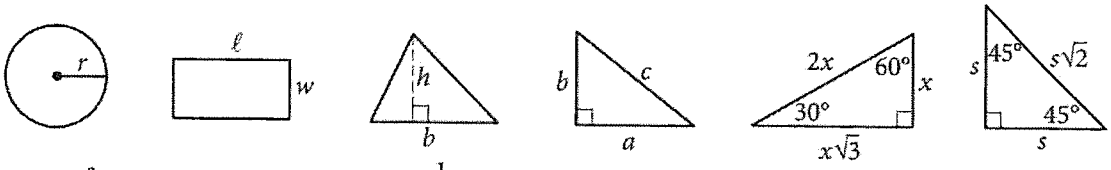
The questions in this section address a number of important math skills.
Use of a calculator is permitted for all questions.

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



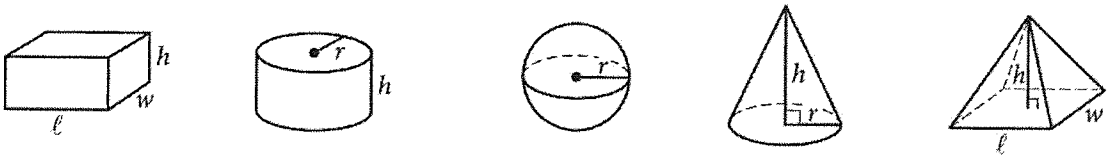
$A = \pi r^2$
$C = 2\pi r$

$A = \ell w$

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

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

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

$$\frac{3x-9}{x^2-x-20}\cdot\frac{x^2-25}{x^2+2x-15}$$

If $x \neq 5, -5, and -4$, Which of the following expressions is equivalent to the above?

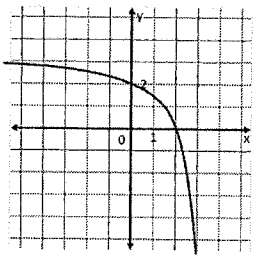
A) $\frac{3}{-x-4}$
B) $\frac{3(x-3)}{(x+4)(x-5)}$
C) $\frac{3}{x+4}$
D) $\frac{3}{x-5}$

2

Two dice are rolled at the same time. If both dice show the same numbers, then the player wins \$70. Otherwise, the player receives \$4. The cost of game is \$10. What is the expected value per game considering the cost?

A) \$50
B) \$15
C) \$5
D) \$3.33

3



The partial graph of rational function $f(x) = \frac{k}{x+m} + 3$ is shown above, where $k\ and\ m$ are constants. What is the value of $k + m$?

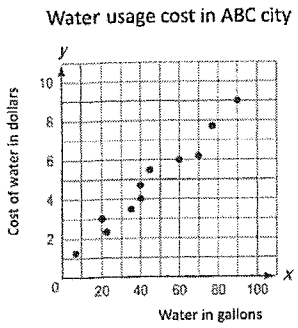
A) 3
B) -3
C) -2
D) 0

4

The maximum value of m is 8 less than two times the quantity of $n - 4$. Which inequality represents the values of m?

A) $m \geq 2(n-4) - 8$
B) $m \leq 2(n-4) - 8$
C) $m \leq 8 - 2(n-4)$
D) $m \geq 8 - 2(n-4)$

5



The scatterplot above shows the relationship between the amount of water used in gallons and the cost of water usage in ABC city. If you predict the cost using the line of best fit, what is the closest amount, in dollars, to the cost of a 120 gallons water usage?

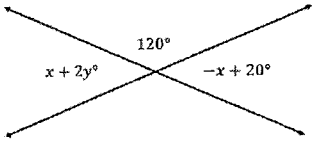
A) $11
B) $15
C) $20
D) $22

6

For an exponential function f, if $f(0)$ is a, where a is a constant. Which of the following equivalent forms of the function f shows the value of a as the coefficient of the function?

A) $f(x) = 23(1.2)^{x-1}$
B) $f(x) = -2(0.9)^{x}$
C) $f(x) = 3(1.1)^{x+1}$
D) $f(x) = 1.2(0.23)^{x-1}$

7



In the diagram above, what is the sum of values of x and y?

E) 10
F) 20
G) 90
H) 120

8

$$x^2 + 4x + k = 0$$

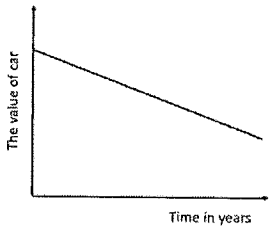
In the quadratic equation above, k is a constant. The equation has no real solution if $k > m$. What is the greatest possible value of m?

9

PSA test is a blood test that is commonly used to detect possible prostate cancer but it is known to produce false positive result which induces a patient undergoes unnecessary biopsy to confirm they don't have prostate cancer. If PSA test generates one false positive in 20 tests and a doctor conducts the test to three patients, which of the following shows the probability that none of patients will generate false positive?

A) $\left(\frac{1}{20}\right)\left(\frac{1}{20}\right)\left(\frac{1}{20}\right)$
B) $\left(\frac{19}{20}\right)\left(\frac{19}{20}\right)\left(\frac{19}{20}\right)$
C) $\left(\frac{3}{20}\right)$
D) $\left(\frac{1}{8000}\right)$

10



The graph above represents the values of a certain car over the years. If the value of the car follows the graph, which of the following statements best interprets the slope of the line?

A) The price when it was purchased
B) One time charge from the dealership
C) The annual decrease rate of the value of the car over years
D) The value of the car over years

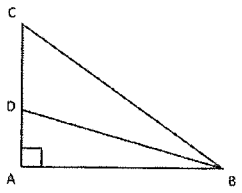
11

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

In the quadratic equation of $ax^2 + bx + c = 0$, we can derive the quadratic formula as shown above. Which of the following equations shows D in terms of $a, b, and\ x$?

A) $D = \left(x + \frac{b}{2a}\right)^2$
B) $D = (b + 2ax)^2$
C) $D = \left(x - \frac{b}{2a}\right)^2$
D) $D = \frac{(x+b)^2}{2a}$

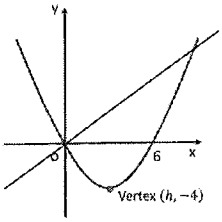
12



Note: Not drawn to scale.

In the figure above, $\overline{BD}\ bisects\ \angle ABC$. If the length of $\overline{BD}$ is twice the length of $\overline{AD}$ and $\overline{AB} = 4$, What is the length of $\overline{BC}$?

13



The graphs of linear and quadratic functions in the XY-plane are shown above. If the vertex of parabola graph is $(h, -4)$ and the equation of line is $y = 4x$, what is the coordinates of the point of intersection?

A) $(3,12)$
B) $(10,20)$
C) $(12,40)$
D) $(15,60)$

14

$$\frac{m^{\frac{2}{3}}(m^{-2}m^{4})^{3}}{m^{4}}$$

Which of the following expressions is equivalent to the expression above, where $m > 0$?

A) $\sqrt[3]{m^8}$
B) $\sqrt[8]{m^3}$
C) $\sqrt[4]{m^3}$
D) $\sqrt{m^{-3}}$

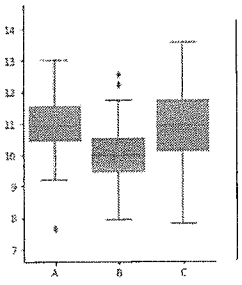
15

$$7, 4, 5, 4, 5, 6, 6, 7, 3, 10$$

Ten people were selected at random to participate in a survey. The numbers represent the scale of satisfaction of life from 1 to 10. The list above shows the result of the survey. What is the fraction of the number of people who gave a number of 5 or higher to the number of people who gave a number of lower than 5?

A) $\frac{3}{7}$
B) $\frac{7}{3}$
C) $\frac{3}{2}$
D) $\frac{2}{3}$

16



The box plots summarize the number of vacation days for the employees for three companies. Which of following statements represents correctly for the plots above?

I. The range of numbers of vacation days of company C is the largest.
II. The mode of number of vacation days is 11 for two companies.
III. The median value of vacation days for company B is the smallest.

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

17

x	f(x)
0	4
2	36
4	324

For the exponential function f(x), if $f(x) = a \cdot b^x$, where a and b are constants. Which of the following functions represents the data in the table above?

E) $f(x) = 3 \cdot 4^x$
F) $f(x) = 4 \cdot 3^x$
G) $f(x) = 3 \cdot \left(\frac{1}{4}\right)^x$
H) $f(x) = 4 \cdot \left(\frac{1}{3}\right)^x$

18

The average price per pound of lamb meat in a certain butcher shop started at \$7.20. However, it was increased at a constant rate each week for several weeks until it reached \$8.45 because of high inflation. The equation, $7.20 + 0.25x = 8.45$, represents this situation, where x stands for the number of weeks after the average price per pound started to increase. Which of the following statements best represents 0.25 in this context?

A) The average price per pound of lamb meat
B) The weekly rate of change in the average price per pound of lamb meat
C) The percent change in average price per pound of lamb meat
D) The total increase in average price per pound while it reached \$8.45.

19

The monthly payment for a certain gym in 2021 was 1.45 times the monthly payment in 2020. By how much percent did the monthly payment increase from 2020 to 2021?

A) 0.45%
B) 1.45%
C) 145%
D) 45%

20

$$-2ax + by - 3 = 0$$

In the linear equation above, where a and b are non-zero constants. If $2a + b = 0$, which of the following statements correctly describes the graph in the XY-plane?

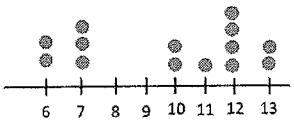
A) The y intercept of the graph is positive.
B) The slope of the graph is positive.
C) The slope of the graph is zero.
D) The slope of the graph is -1.

21

The television broadcasting company conducts a survey for a tax raise issue. A telephone number is provided and respondents are asked to call and register their opinions by pressing 1 if they support it and 2 if they oppose it. Which of the following statements best represents this survey?

A) This survey is non-biased because the survey is open to anyone.
B) This survey could be biased because only those who feel strongly either for or against will call and register their opinions voluntarily.
C) This survey is well designed because of simple random samples.
D) This survey is not trustworthy because some radio broadcasting company can do the same survey.

22



In the dot-plots shown above, what is the value of median of data?

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.