

Math

22 QUESTIONS
(TIME: 35 MIN)

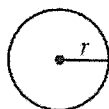
DIRECTIONS

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

NOTES

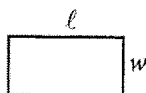
Unless otherwise indicated:

- 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.

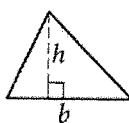
REFERENCE

$$A = \pi r^2$$

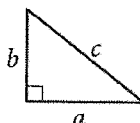
$$C = 2\pi r$$



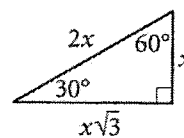
$$A = \ell w$$



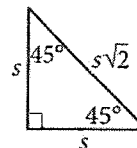
$$A = \frac{1}{2}bh$$



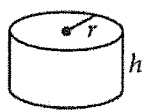
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



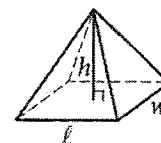
$$V = \pi r^2 h$$



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



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



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

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

If $x > 0$, which of the following is equivalent to $\sqrt[3]{x^8}$?

- I. $(x^8)^{\frac{1}{3}}$
- II. $(x^3)^{\frac{1}{8}}$
- III. $(x^{\frac{1}{3}})^2 \cdot x^2$

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

2

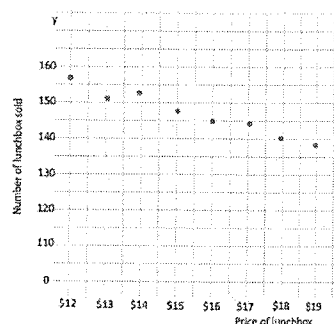
$$8^x \cdot y^2 = 8^{x-1} \cdot y$$

In the equation above, x and y are positive numbers. What is the value of y ?

3

If $3x + 2y = -7$, what is the value of $9x^2 + 12xy + 4y^2$?

4



A certain restaurant sells take-out lunch boxes ranging in price from \$12 to \$19 in increments of \$1. The scatter plot above shows the total number of lunchboxes sold at each price. Approximately how much more revenue did the restaurant get from the lunchboxes it sold priced at \$17 than it did at \$12?

- A) \$400
- B) \$580
- C) \$820
- D) \$1,100

5

A party planner is ordering balloons for a party. The planner wants to have at least 100 balloons in her order, and she will order no more than twice as much red balloons as white balloons. Each cost for red balloon and white balloon is \$1.25 and \$1.50, respectively. If r represents the number of red balloons and w represents the number of white balloons and her budget is \$1,000, which of the following inequalities below best represents this situation?

- A) $\begin{cases} r + w \geq 100 \\ 1.25r + 1.50w \leq 1,000 \\ r \leq 2w \end{cases}$
- B) $\begin{cases} r + w \geq 100 \\ 1.25w + 1.59r \leq 1,000 \\ r \leq 2w \end{cases}$
- C) $\begin{cases} r + w \geq 100 \\ 1.25r + 1.50w \leq 1,000 \\ w \leq 2r \end{cases}$
- D) $\begin{cases} r + w \geq 100 \\ 1.25w + 1.50r \leq 1,000 \\ w \leq 2r \end{cases}$

6

$$k(x + 1)(x - 1) + 3x^2 - 2x = ax^2 + bx + c$$

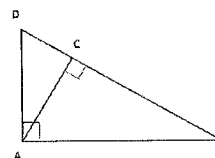
In the equation above, a , b , c , and k are constants. If the equation is true for all values of x , what is the value of $a + b + c$?

7

Jeremiah deposited his allowance \$150 into a bank savings account which earns an annual interest rate of 6%. If he doesn't withdraw any money nor make any additional deposits, how long will it take him, in years, to increase the value of account by at least 40%?

- A) 4
B) 5
C) 6
D) 7

8



Note: Not drawn to scale.

In the right triangle ABD above, the value of $\cos B$ is 0.2 and the length of BC is 5. What is the length of CD?

- A) 5
B) 25
C) 120
D) 125

9

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

The volume of sphere is shown above, where r is the radius of the sphere. If the value of the radius is double, what happens to the value of the volume of the sphere?

- A) Double the original value
- B) Triple the original value
- C) Eight times the original value
- D) 27 times the original value

10

An invasive insect was found to have a population of P after t weeks of uninhibited growth.

$$P(t) = C(2)^{\frac{t}{4}}$$

The equation above gives the number of populations, P , of the insects, where t is the number of weeks after the uninhibited growth began, and C is the number of initial population. Which of the following statements is valid based on the equation above?

- A) The population will be increased by 100% every 4 weeks.
- B) The population will be increased by 200% every 4 weeks.
- C) The population will be double every 2 weeks.
- D) The population will be double every week.

11

Jerome usually spends $3\frac{3}{4}$ hours a day working on his math and English homework. It takes him $\frac{1}{2}$ hour to complete one of his math assignments and $\frac{3}{4}$ hour to complete one of his English assignments. If m represents the number of math assignments and e represents the number of English assignments, which of the following best represents this situation?

- A) $\left(m + \frac{1}{2}\right)\left(e + \frac{3}{4}\right) = \frac{15}{4}$
- B) $\left(\frac{m}{2}\right)\left(\frac{3e}{4}\right) = 1$
- C) $\left(\frac{1}{2}m\right)\left(\frac{3}{4}e\right) = \frac{15}{4}$
- D) $\frac{1}{2}m + \frac{3}{4}e = \frac{15}{4}$

12

$$|3x + 1| = |-x|$$

In the equation above, how many solutions to the equation exists?

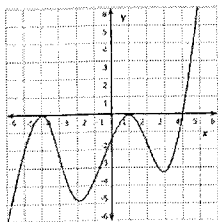
- A) None
- B) One
- C) Two
- D) Three

13

The sum of three numbers is 220. If the largest number is 20 percent more than the sum of the other two numbers, what is the value of the largest number?

- A) 200
- B) 100
- C) 150
- D) 120

14



The graph of function f is shown in the xy -plane, where $y = f(x)$. Which of the following functions could be f ?

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

15

$$t = \sqrt{\frac{k}{4hl}}$$

The experimental equation above gives the estimate time, called a half-life(t), for a certain element to decay 50% of its original amount. k ; the average temperature of soil, h ; the ph. level of the soil, and the humidity index ; l .

Which of the following correctly expresses the humidity index in terms of other variables?

- A) $l = \left(\frac{16th}{k}\right)^2$
- B) $l = \frac{k}{4ht^2}$
- C) $l = \frac{k}{2ht^2}$
- D) $l = \left(\frac{k}{4ht}\right)^2$

16

A parabola of $y = f(x)$ is graphed in the xy -plane, where $f(x) = (x - 1)(x - 4)$. Which of the following intervals contains the x -coordinate of the vertex of the graph of $f(x)$?

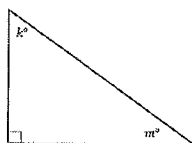
- A) $0 < x < 1$
- B) $1 < x < 3$
- C) $4 < x < 5$
- D) $5 < x < 6$

17

During a special sale, Edward spent a total of d dollars, which includes the discounted price at 25% discount and the sales tax 9.5% on the discounted price, on a certain item. In terms of d , what was the original price of the item?

- A) $\frac{(0.75)(d)}{1.095}$
 B) $\frac{(1.095)(d)(0.75)}{d}$
 C) $\frac{d}{(1.095)(0.25)}$
 D) $\frac{d}{(1.095)(0.75)}$

18

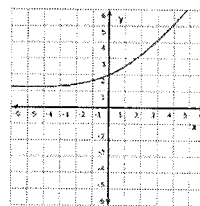


In the right triangle above, k and m are two acute angles of the right triangle. Which of the following operations is correct for the following expressions based on the figure?

$$\cos(m^\circ) \quad \text{_____} \quad \sin(k^\circ)$$

- A) $>$
 B) $<$
 C) $=$
 D) Can't be determined.

19



The graph of $y = f(x) + 2$ is shown above. Which of the following could define f ?

- A) $f(x) = -3^x + 2$
 B) $f(x) = -3^x + 1$
 C) $f(x) = 3^x + 1$
 D) $f(x) = 3^x - 1$

20

The area of circle is increasing at a rate of 15 square inches per hour. Which of the following expressions correctly expresses to this rate in square meters per min? (1 inch = 2.54 centimeters, 1 meter = 100 centimeters)

- A) $\frac{(15)(2.54^2)}{(100^2)(60)}$
 B) $\frac{(15)(100^2)}{(2.54)^2(60)}$
 C) $\frac{(15)(100)^2}{(2.54)^2}$
 D) $\frac{(15)(60)^2}{(2.54)^2(100)}$

21

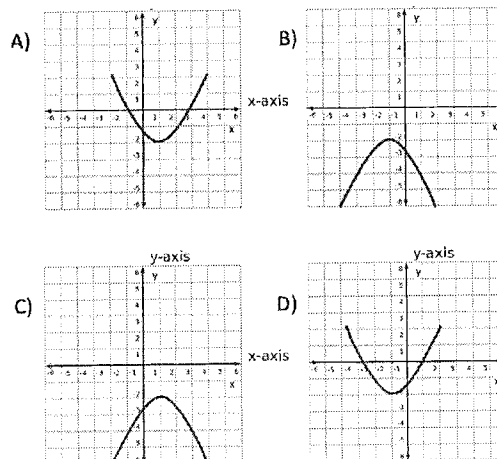
$$\begin{aligned}x^2 + 4x + y^2 - 2y - 4 &= 0 \\x - k &= 0\end{aligned}$$

In the system of equations above, what is a possible value of k if the system has exactly two real solutions?

- A) 0
- B) 1
- C) 2
- D) 3

22

The quadratic function h is defined by $h(x) = -(x - 1)^2 - 2$. Which of the following could be the graph of $y = h(x)$ shifted 2 units to the left?

**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.