

## Math

22 QUESTIONS

(TIME: 35 MIN)

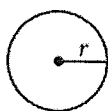
**DIRECTIONS**

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

**NOTES**

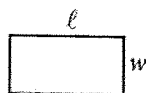
Unless otherwise indicated:

- 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.

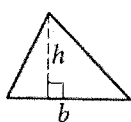
**REFERENCE**

$$A = \pi r^2$$

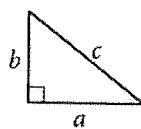
$$C = 2\pi r$$



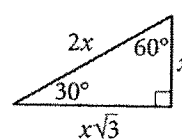
$$A = \ell w$$



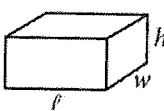
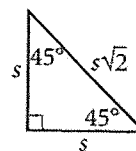
$$A = \frac{1}{2}bh$$



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



Special Right Triangles



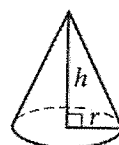
$$V = \ell wh$$



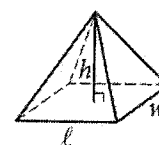
$$V = \pi r^2 h$$



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



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



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

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

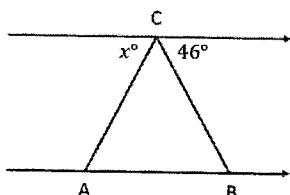
The number of radians of arc in a circle is  $2\pi$ .

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.

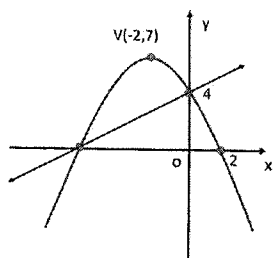
**For student-produced response questions**, solve each problem and write your answer next to or under the question in the test book as described below.

- 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.



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

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

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.

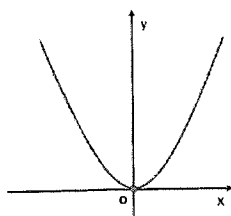
4

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

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

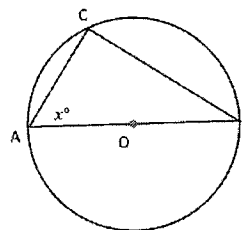
6

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

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

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

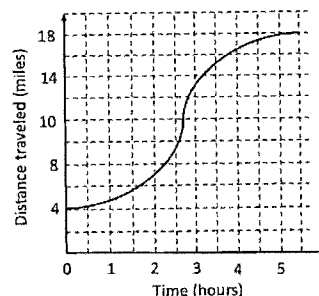
7



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)  $\overline{AC} = 4\tan x^\circ$

8

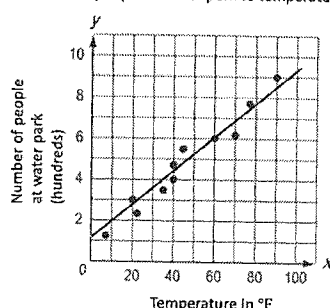


Philip drove from home to Las Vegas. There were some traffic delays because it was a national holiday. In which time interval does the graph show the greatest average rate of change, miles per hour?

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

9

Number of people at water park vs temperature



The scatter plot above shows the number of people, in hundreds, at an indoor water park and the temperature (°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?

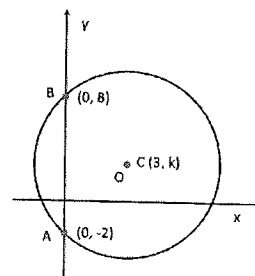
- A)  $y = 1.2x + 1.2$
- B)  $y = 0.08x + 1.2$
- C)  $y = 0.08x + 2$
- D)  $y = 1.2x + 2$

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)  $\frac{mn}{10mn}$
- C)  $\frac{k}{10k}$
- 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?

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

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)  $150 - 100 = 2.25x$

16

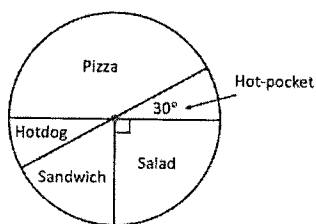
$$\begin{aligned}x^2 + y^2 &\leq 36 \\ x - 3 &\geq 0\end{aligned}$$

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

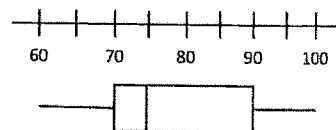
18

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 it 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)   | <table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>f(x)</td><td>27</td><td>9</td><td>3</td><td>1</td></tr></table> | x | 1 | 2  | 3 | 4 | f(x) | 27 | 9 | 3 | 1  |
| x    | 1   | 2 | 3 | 4  |   |   |      |    |   |   |    |
| f(x) | 27  | 9 | 3 | 1  |   |   |      |    |   |   |    |
| B)   | <table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>f(x)</td><td>1</td><td>3</td><td>9</td><td>27</td></tr></table> | x | 1 | 2  | 3 | 4 | f(x) | 1  | 3 | 9 | 27 |
| x    | 1   | 2 | 3 | 4  |   |   |      |    |   |   |    |
| f(x) | 1   | 3 | 9 | 27 |   |   |      |    |   |   |    |
| C)   | <table><tr><td>x</td><td>1</td><td>3</td><td>6</td><td>9</td></tr><tr><td>f(x)</td><td>10</td><td>7</td><td>4</td><td>1</td></tr></table> | x | 1 | 3  | 6 | 9 | f(x) | 10 | 7 | 4 | 1  |
| x    | 1   | 3 | 6 | 9  |   |   |      |    |   |   |    |
| f(x) | 10  | 7 | 4 | 1  |   |   |      |    |   |   |    |
| D)   | <table><tr><td>x</td><td>1</td><td>3</td><td>6</td><td>9</td></tr><tr><td>f(x)</td><td>1</td><td>4</td><td>7</td><td>10</td></tr></table> | x | 1 | 3  | 6 | 9 | f(x) | 1  | 4 | 7 | 10 |
| 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.