Math

22 QUESTIONS
(TIME: 35 MIN)

DIRECTIONS

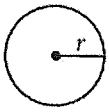
The questions in this section address a number of important math skills.
Use of a calculator is permitted for all questions.

NOTES

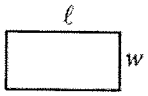
Unless otherwise indicated:

- 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.

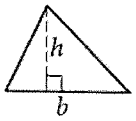
REFERENCE



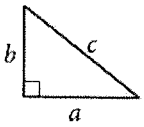
$A = \pi r^2$
$C = 2\pi r$



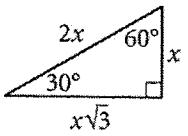
$A = \ell w$

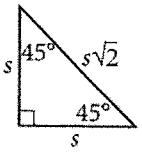


$A = \frac{1}{2}bh$

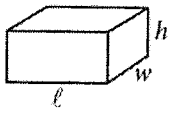


$c^2 = a^2 + b^2$

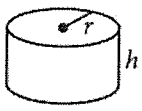




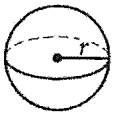
Special Right Triangles



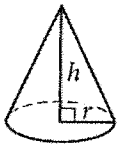
$V = \ell wh$



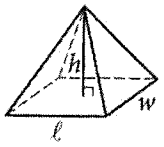
$V = \pi r^2 h$



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



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



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

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.

CONTINUE

1

Which of the following is equivalent to the expression $x^4 - 1$?

I. $(x^2 - 1)(x^2 + 1)$
II. $(x - 1)(x + 1)(x^2 + 1)$
III. $(x - 1)^2(x + 1)^2$

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

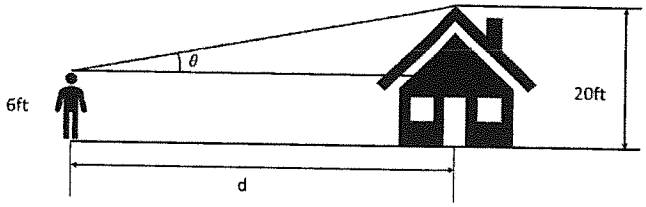
2

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

In the system of equations above, how many solutions does the system have?

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

3



A 6ft tall person looks at the top of the roof as shown above. If the height of the house from the ground to the top of the roof is 20ft and he knows the angle of elevation ($\theta°$), which of the following expression can be used to find the distance (d ft) from the person to the house?

A) $d = \frac{14}{sin\theta}$
B) $d = \frac{14}{tan\theta}$
C) $d = \frac{20}{tan\theta}$
D) $d = 14 \cdot tan\theta$

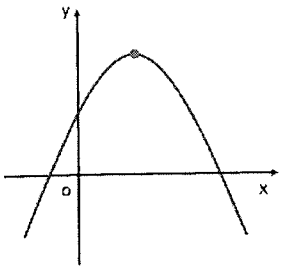
4

In a triangle ABC, which of the following must be true if $sin\angle A = cos\angle B$?

I. Triangle ABC is a right triangle.
II. Triangle ABC is an isosceles right triangle.
III. Triangle ABC is an obtuse triangle.

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

5

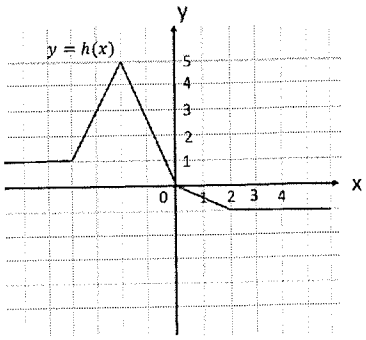


In the quadratic function in the XY-plane above, if the equation of the function is $y = ax^2 + bx + c$, where a, b, c are constants. Which of the followings must be true?

I. $a < 0$
II. $b > 0$
III. $c > 0$

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

6



x	f(x)
-2	2
-1	1
0	6
1	5
2	2
3	1

The complete graph of the function $y = h(x)$ and a table of some values for the function $y = f(x)$ are shown above. If the maximum value of $h(x)$ is m, what is the value of a if $f(a) = m$?

7

Concrete structures such as bridges, buildings, or stadiums have some safety gap between sections to allow for temperature expansion or contraction. The size of gap, $g(t)$, in inches, is a linear function of temperature t, in degrees Fahrenheit $(°F)$ where the temperature is between $32°F$ and $115°F$. For a certain building, the gap is 2.58 inches at $45°F$ and 1.12 inches at $85°F$. What is the size of gap expected in inches when the temperature is at $110°F$?

A) 0.2075
B) 0.6425
C) 0.8135
D) 0.7375

8

$$\frac{f(2x)}{3} = -h(x) + 6$$

In the equation above, if $h(3) = 4$, What is the value of $f(6)$?

A) 9
B) 8
C) -6
D) 6

9

$$\frac{2x + 4^2}{a} = 144$$

In the equation above, a is a constant. If $x = 1$ is one of the solutions, what could be the value of a?

A) 2
B) $-\frac{1}{2}$
C) 8
D) $\frac{1}{8}$

10

A survey was conducted for 500 people at random if they want to go back a cheaper phone without internet service after using a phone with internet service for a while. Of those surveyed, 97% won't go back to a cheaper phone without internet service. Which of the following inferences best interpret the result of this survey?

A) At least 97% of people who used a phone with internet service won't buy a cheaper phone even with internet service.
B) At least 97% of people who used a phone without internet service will change to use a phone with internet service in the future.
C) Most people who used a phone with internet service won't go back to a cheaper phone without internet service.
D) Most people who used a cheaper phone without internet service will change to use a phone with internet service in the future.

11

	CAT	DOG	TOTAL
ADOPTED	5	6	11
PURCHASED	12	23	35
TOTAL	17	29	46

The table above shows the distribution of ways to get a pet for 46-households surveyed at random. What fraction of the cats were purchased in the households surveyed?

A) $\frac{12}{17}$ B) $\frac{12}{46}$ C) $\frac{35}{46}$ D) $\frac{12}{35}$

12

The dimensions of a rectangular box for shipping in a local shipping center were restricted for the size of the box. The sum of the perimeter of base of the box plus the height of the rectangular box CANNOT exceed 120 inches. If the area of the square base of a certain box is 289 in^2, what is the maximum height of the box could be allowed, in inches?

A) 64 inches
B) 52 inches
C) 86 inches
D) 48 inches

13

Which of the following expressions is equivalent to $\frac{-2x^2+x-4}{x+2}$?

A) $-2x+5-\frac{14}{x+2}$
B) $-2x+5+\frac{14}{x+2}$
C) $-2x-5+\frac{-14}{x+2}$
D) $-2x-5+\frac{14}{x+2}$

14

$$F=\frac{9}{5}C+32$$

The equation shown above can be used to convert the temperature from degree Celsius to degree Fahrenheit. If the degree Celsius were changed from $5C°$ to $15°C$, How much degrees in Fahrenheit will change accordingly?

A) $\frac{9}{5}$
B) $\frac{5}{9}$
C) 10
D) 18

15

$$f(x)=a(x+1)(x-4)$$

The graph of the function f is parabola in the xy-plane, where a is a constant. Which of the following x intervals could contain the x coordinate of the vertex?

A) $-4<x<1$
B) $-4<x<-1$
C) $-1<x<4$
D) $-1<x<1$

16

In the equation ax^3+bx^2+cx+d, where $a,b,c,and\ d\ are\ constants$. If the equation has zeros at -2, 0, and 7, which of the following is a factor of the equation?

A) x
B) $x-2$
C) $x+7$
D) $x-1$

17

Edward needs to recruit at least 12 students, consisting of juniors and seniors only to do science group project. The project requires at least 3 juniors and at least 5 seniors for the project members. He knows that each senior is allowed to spend 2 hours only and each junior is allowed to spend 3 hours only and he also found out that the project should not take more than 180 hours in total. Which of the inequalities best represents all the constraints described if x is the number of juniors and y is the number of seniors?

A) $\begin{cases} x + y \leq 12 \\ x \geq 3 \\ y \geq 5 \\ 3x + 2y < 180 \end{cases}$

B) $\begin{cases} x + y \geq 12 \\ x \geq 3 \\ y \geq 5 \\ 2x + 3y < 180 \end{cases}$

C) $\begin{cases} x + y \geq 12 \\ x \geq 3 \\ y \geq 5 \\ 3x + 2y \leq 180 \end{cases}$

D) $\begin{cases} x + y \geq 12 \\ x \geq 3 \\ y \geq 5 \\ 2x + 3y \leq 180 \end{cases}$

18

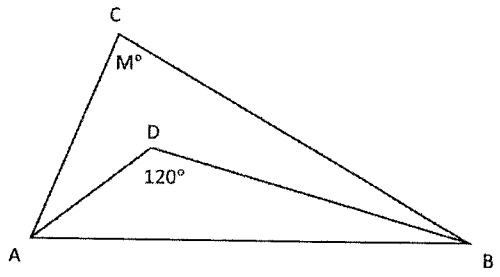
Result of the number of defective light bulbs for a sample of 15 boxes at random

Number of boxes	2	3	6	4
Number of defective light bulbs per box	3	1	2	3

The table shows the result of the number of defective light bulbs per box for a sample of 15 boxes. What is the average of defective light bulbs per box for the results in the table above?

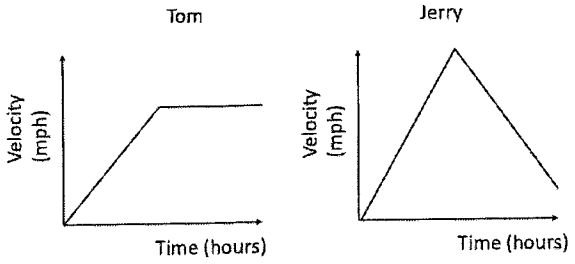
A) 1.8
B) 2.0
C) 2.2
D) 2.6

19



In the figure shown above, $m\angle ADB = 120°$ and $\overline{AD}$ and $\overline{BD}$ are angle bisectors of $\angle CAB$ and $\angle CBA$, respectively. What is the measure of angle M in the figure?

20

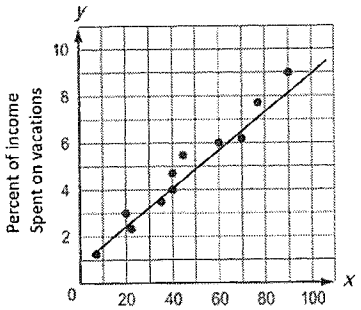


The two graphs above show time vs velocity profiles for two people, Tom and Jerry. The areas under the curves are same on both graphs. If two people started and ended their journeys at the same time, which of the following statements is valid for the graphs shown above?

A) Both people traveled the same distance in total.
B) Jerry's average speed is higher in value than Tom's average speed.
C) Tom stopped for a while along the journey.
D) Jerry must have turned around at some point along the journey.

21

Income vs percent of income spent on vacations



The scatterplot above shows several data for the relationship between income and percent of income spent on vacations. Which of the following is closest to the difference of the actual percent and the predicted percent by the line of best fit for the person whose income is $\$45{,}000$?

A) 0.5
B) 1
C) 1.5
D) 2

22

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

The volume of a cylinder can be calculated by the equation above. If the radius increased by 100 percent and the length of height decreased by 50 percent, what is the percent change in the volume of the cylinder?

A) The volume increases by 100%.
B) The volume increases by 200%.
C) The volume decreases by 100%.
D) The volume doesn't change.

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.