Math

22 QUESTIONS
(TIME: 35 MIN)

DIRECTIONS

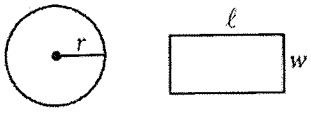
The questions in this section address a number of important math skills.
Use of a calculator is permitted for all questions.

NOTES

Unless otherwise indicated:

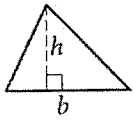
- All variables and expressions represent real numbers.
- Figures provided are drawn to scale.
- All figures lie in a plane.
- The domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

REFERENCE

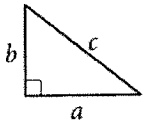


$A = \pi r^2$
$C = 2\pi r$

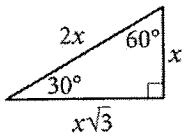
$A = \ell w$

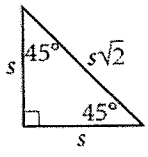


$A = \frac{1}{2}bh$

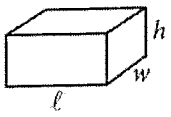


$c^2 = a^2 + b^2$

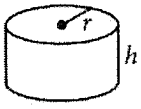




Special Right Triangles

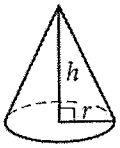


$V = \ell wh$

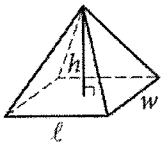


$V = \pi r^2 h$

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



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



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

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

The number of radians of arc in a circle is 2π.

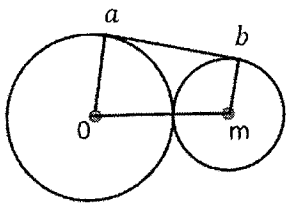
The sum of the measures in degrees of the angles of a triangle is 180.

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



Note: Not drawn to scale.

In the circles o and m, the length of $\overline{oa}$ is 7 and the length of $\overline{mb}$ is 1. If two circles are externally tangent and segment $\overline{ab}$ is common external tangent to both circles as shown above, what is the length of $\overline{ab}$, to the nearest tenth?

2

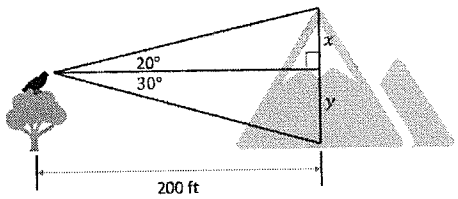
The Number of Lakes classified by Alkalinity and Depth

Depth In Lake	Alkalinity Level			
	Low	Medium	High	Total
Low	25	55	152	232
Medium	45	74	98	217
High	52	35	24	111
Total	122	164	274	560

The table shows the number of lakes in a certain country classified by alkalinity and depth. If a lake has medium depth, what is the probability that it has high alkalinity level?

A) $\frac{98}{217}$ B) $\frac{98}{560}$ C) $\frac{24}{111}$ D) $\frac{24}{560}$

3



A bird looks up to the top of a mountain from the top of a tree at an angle of elevation 20° and also looks down to the bottom of the same mountain at an angle of depression 30°. If the tree is 200 ft away from the bottom of the mountain as shown above, which of the following expression is the height of the mountain?

A) $\frac{200}{\tan(20°)} + \frac{200}{\tan(30°)}$

B) $200\tan(20°) + 200\tan(30°)$

C) $\frac{\tan(20°)}{200} + \frac{\tan(30°)}{200}$

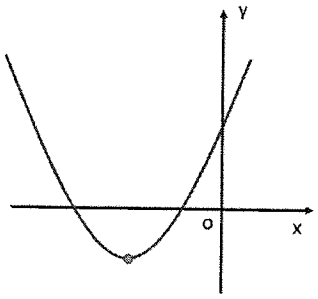
D) $\frac{\frac{200}{\sin(20°)}}{\frac{200}{\sin(30°)}}$

4

$$y = 2x + k^2$$
$$x^2 - 2kx + y = 0$$

In the system of equations above, k is a constant. When the equations are graphed in the XY-plane, they will intersect only at one point. What is the value of k?

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?

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

$$x^{\frac{2}{7}}\left(x^{\frac{1}{2}} \cdot x^{\frac{1}{3}}\right)^{\frac{6}{7}} = x^m$$

In the equation above, what is the value of m, where $m > 0$?

A) 1
B) 2
C) $\frac{3}{7}$
D) $\frac{83}{42}$

7

Which of the following examples best represent a linear pattern?

A) The balance after t years in a savings account which gains interest at 3% annually.
B) The population of ants after D days in a certain colony that the population will be doubled every day.
C) The salary in t years if it will increase 20% every year.
D) A worker gets paid at $40 hourly rate.

8

Which of the following samples will most likely show a negative correlation when graphed on a scatter plot?

A) The number of visitors at a museum and the length of the line for the admission tickets.
B) A person's height and shoe size.
C) Temperature outside and the cost of cooling down inside the house during the hot summer time.
D) The number of orders for a certain item and the number of items left in stock at the store.

9

In a survey of 500 people, $\frac{3}{5}$ indicated that they are for affirmative action. There were some people who didn't respond for the question and the rest of people were against affirmative action. If $\frac{4}{25}$ indicated that they are against it, how many people didn't respond the question?

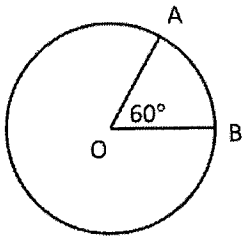
A) 300
B) 200
C) 120
D) 80

10

The average price per pound of grapes started at $2.50 at ABC market. But the store increased the price at a constant rate each week for several weeks until it reached $5.10 because of market inflation. The equation $2.50 + 0.20x = 5.10$ represent this situation, where x is the number of weeks after the average price per pound is $2.50. which of the following best interpret 0.20 in this context?

A) The rate of change, in dollars per week, in the average price per pound of grapes.
B) The average price of grapes per pound x weeks after the average price per pound is $2.50.
C) The percent increase in the average price of grapes in pounds.
D) Total price increase, in dollars, x weeks after the average price per pound is $2.50.

11



In the figure above, the measure of central angle ∠AOB is 60°. If the area of sector $\widehat{AOB}$ is 20π, what is the length of radius of the circle O?

A) $\sqrt{30}$
B) $2\sqrt{30}$
C) $\sqrt{\frac{10}{3}}$
D) $2\sqrt{\frac{10}{3}}$

12

An insect scientist researched to predict the number of ants (y) that will be come out in a certain ant hole during 2 hours period in the morning. x represents the number of days after the date a scientist started to monitor $(0 \leq x \leq 30)$ and he determined the equation of a line of best fit using data collected as below.

$$y = 125 + 25x$$

Based on the equation above, what is the positive difference between the number of ants came out when the scientist first time recorded and the number of ants came out in the same hole 10 days after the date the scientist started to monitor?

13

If $ax - 1$ is a factor of $-8x^3 + 28x^2 - 12x$, where a is a positive constant, what could be the value of a?

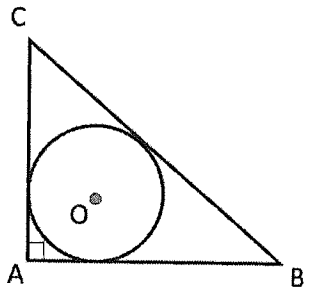
A) 2
B) 4
C) 6
D) 8

14

A quadratic function can model the height of a cannon ball above the ground in terms of time, in seconds, after shooting in the air. According to the model, a cannon ball was launched from the ground and reached the maximum height of 180 ft 3 seconds after it was launched. Based on the model, what is the height, in feet, of the cannon ball 2 seconds after it was launched?

A) 100 ft
B) 120 ft
C) 140 ft
D) 160 ft

15



In the figure above, the circle O is tangent to three sides of triangle ABC as shown. If $AB = 9$ and $AC = 12$, what is the area of the circle O?

A) 15π
B) 12π
C) 9π
D) 6π

16

$$f(x) = a(x + 2)(x - 6)$$

The graph of the function f is parabola in the xy-plane, where a is a constant. What is the x coordinate of the vertex?

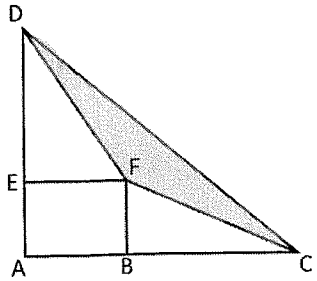
E) 1
F) 2
G) -2
H) 4

17

A delivery service company is contracted to deliver 100 chairs for $50 each. The company agrees to compensate $250 for each chair that is broken during transport. If the delivery company wants to earn at least $4,000, what is the maximum number of chairs that can be broken during transport?

A) 3
B) 4
C) 5
D) 6

18



Note: Not drawn to scale.

In the figure above, $\overline{AB} = 5, \overline{BC} = 8, \overline{AE} = 6, and\ \overline{ED} = 12$. Find the area of the shaded triangle CDF.

19

Armaan visited a local fishing farm to play a game. The fishing farm has two kinds of fish, catfish and trout. Gaming laws allow him to catch no more than 10 catfish, no more than 5 trout per day, and less than 11 fish per day. Which of the following systems of inequalities can represent these constraints?

A) $\begin{cases} x \leq 10 \\ y \leq 5 \\ x + y \geq 11 \end{cases}$

B) $\begin{cases} x \leq 10 \\ y \leq 5 \\ x + y < 11 \end{cases}$

C) $\begin{cases} x < 10 \\ y < 5 \\ x + y > 11 \end{cases}$

D) $\begin{cases} x \leq 10 \\ y \leq 5 \\ x + y > 11 \end{cases}$

20

$$f(x) = 2x^2 + 4x - 8$$
$$h(x) = a$$

In the system of equations above, a is a constant. If $h(x) \leq f(x) + 12$ for all values of x, what is the maximum value of a?

A) 2
B) 4
C) -10
D) 10

21

The measure of an angle is 135° can be written as $\frac{k}{4}\pi$ in radians. What is the value of k?

22

Noah orders floor tables for his company. The floor table cost $\$ 450$ each and sales tax is 10% of the total cost of the purchase. If he can spend no more than $\$30{,}000$ on the floor tables, including tax, what is the maximum number of floor tables Noah can order?

A) 60
B) 61
C) 62
D) 63

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.