

Section 2, Module 1: Math

35 MINUTES, 22 QUESTIONS

DIRECTIONS

- All expressions and variables use real numbers.
- All figures are drawn to scale.
- Every figure lies in a plane.
- The domain of given functions is the set of all real numbers for which the corresponding value of the function is real.

For **multiple-choice questions**, solve the problem and pick the correct answer from the provided choices. Each multiple-choice question has only one correct answer.

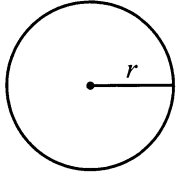
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Examples

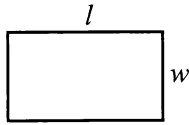
Answer	Acceptable Entries	Unacceptable Entries That Will Receive Zero Credit
4.5	4.5 4.50 9/2	$4\frac{1}{2}$ 41/2
$\frac{8}{9}$	8/9 .8888 .8889 0.888 0.889	0.88 .88 .89 0.89
$-\frac{1}{9}$	-1/9 -.1111 -0.111	-.11 -0.11

REFERENCE ∨

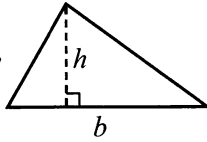


$$A = \pi r^2$$

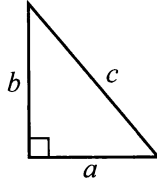
$$C = 2\pi r$$



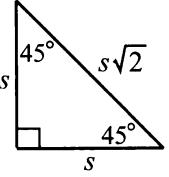
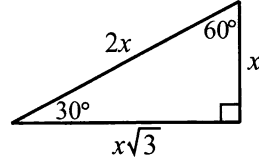
$$A = lw$$



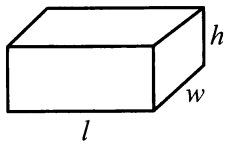
$$A = \frac{1}{2}bh$$



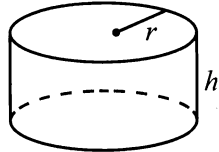
$$c^2 = a^2 + b^2$$



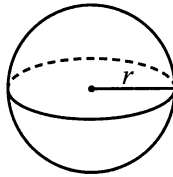
Special Right Triangles



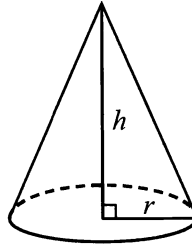
$$V = lwh$$



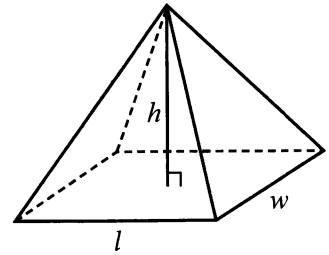
$$V = \pi r^2 h$$



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



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



$$V = \frac{1}{3}lwh$$

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.

1

$$\frac{6}{7} \times \frac{14}{3} = ?$$

- (A) $\frac{1}{3}$
- (B) 4
- (C) $\frac{27}{4}$
- (D) 9

2

If $\frac{2}{3}x - 1 = \frac{1}{6}x + 4$, what is the value of x ?

3

The graph of a line in the x - y plane is totally vertical and has a negative x -intercept. Which of the following could represent a line with these conditions?

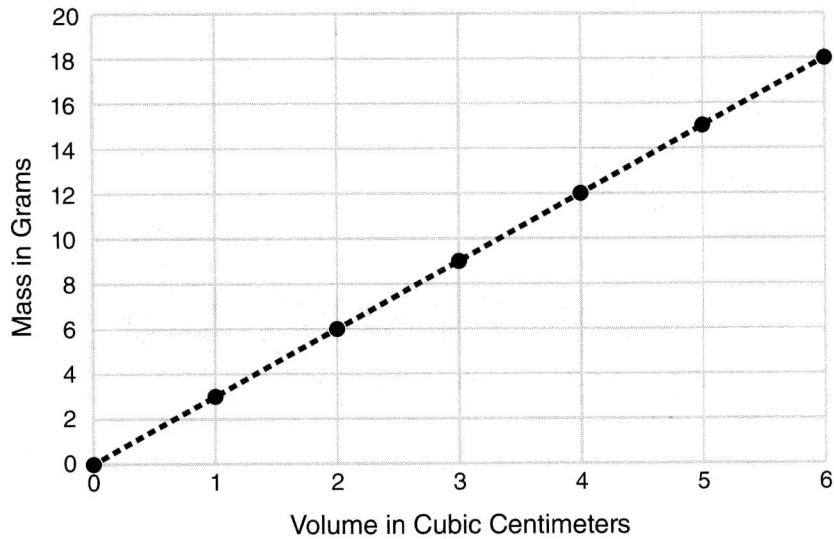
- (A) $x = -5$
- (B) $y = -4$
- (C) $y = -x - 2$
- (D) $x = -4y$

4

If $\frac{x}{4} = 6$, what is $\frac{x}{8}$?

- (A) 3
- (B) 4
- (C) 8
- (D) 12

5



What equation represents the relationship between mass, m , and volume, v , in the above graph?

- (A) $v = 3m$
- (B) $m = 3v$
- (C) $m = 6v$
- (D) $v = m + 2$

6

What is the median of this set of numbers?

{2, 5, 7, 9, 12, 16}

- (A) 7
- (B) 8
- (C) 8.5
- (D) 9

7

There are 3 teaspoons in a tablespoon and 16 tablespoons in a cup. How much of a cup or cups would there be in 12 teaspoons?

- (A) $\frac{1}{12}$ cup
- (B) $\frac{1}{4}$ cup
- (C) 2 cups
- (D) 6 cups

8

The total calories for a particular salad are 1,100. The salad consists of only cheese, vegetables, and dressing. If the total caloric value of the cheese and vegetables is 650, and each packet of dressing used on the salad has 75 calories, how many packets of dressing were used on the salad?

9

If $\frac{x^2}{6} = \frac{x}{2}$, what is the value of x ?

10

Suppose the price of a product is typically p dollars. If a 30% discount is applied to the price, what is the discounted price in terms of p ?

- (A) $0.03p$
- (B) $0.3p$
- (C) $0.7p$
- (D) $1.3p$

11

The equation for gravitational force, F_g , is the following:

$$F_g = G \frac{m_1 m_2}{r^2}$$

G is the gravitational constant, m_1 and m_2 are the masses of objects, and r is the distance between the objects.

How would the gravitational force between two objects change if the distance between the objects doubles while all other quantities remain the same?

- (A) It would be twice the original force.
- (B) It would be four times the original force.
- (C) It would be $\frac{1}{2}$ of the original force.
- (D) It would be $\frac{1}{4}$ of the original force.

12

Pet Owners Who Have Only One Pet

	Dog	Cat	Total
Male	60	40	100
Female	50	38	88
Total	110	78	188

If there were a randomly selected pet owner from the table above, what is the probability that they would be a male cat owner?

- (A) $\frac{40}{188}$
- (B) $\frac{40}{100}$
- (C) $\frac{60}{188}$
- (D) $\frac{40}{78}$

13

A restaurant charges \$5 for a cheeseburger and \$4 for a hamburger. If Connor wants to buy at least 2 of each sandwich and spend a total of between \$20–\$30 (inclusive) on sandwiches, what is a possible value for the number of cheeseburgers Connor purchased?

14

What is y in terms of x in the following inequality?

$$12 < -4x + 6y$$

- (A) $3 + 2x > y$
- (B) $6x - 2 < y$
- (C) $\frac{1}{2}x + 3 > y$
- (D) $2 + \frac{2}{3}x < y$

15

A particular line is graphed in the xy -plane and uses only real numbers. The line has a positive slope and a positive y -intercept. Which of these points could be on the line?

- (A) $(-4, 5)$
- (B) $(2, 0)$
- (C) $(3, -6)$
- (D) $(0, -1)$

16

Triangle ABC has a right angle B . If side AB has a length of 7 units and side BC has a length of 24 units, what is the length in units of side AC ?

17

The function f is expressed as $f(x) = k$ for all values of x , and k is a constant real number. Which of the following must be true?

- I. $f(x)$ forms a line.
- II. $f(x)$ has a slope of zero.
- III. $f(x)$ has a range from $-\infty$ to $+\infty$.

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

18

In a right rectangular prism, the smallest edge is 2 cm long. The next greatest edge is twice the length of the smallest edge, and the greatest edge is 3 times the length of the smallest edge. What is the surface area of the prism?

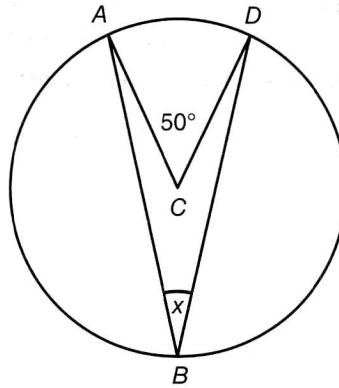
- (A) 6 sq cm.
- (B) 24 sq cm.
- (C) 64 sq cm.
- (D) 88 sq cm.

19

Kamini wants to make money from recycling aluminum cans and glass bottles. Her local government pays her \$0.10 per can and \$0.16 for each bottle. If she wants to earn a total of at least \$100 and has collected a total of 600 cans, what is the minimum number of bottles she would need to collect to reach her goal?

- (A) 250
- (B) 270
- (C) 300
- (D) 420

20



What is the measure in degrees of $\angle X$ given that AB , AC , CD , and DB are straight lines and C is the center of the circle?

21

Jane is watering her garden and spends 5 minutes watering each tree and 2 minutes watering each shrub. If she can spend no more than 30 minutes watering her garden, which inequality represents the number of T trees and S shrubs she can water given these constraints?

- (A) $5T + 2S \geq 30$
- (B) $5T + 2S \leq 30$
- (C) $5 \times T \times S \leq 30$
- (D) $5 > 30 \times T \times S$

22

The price of a video streaming service increases by 15% each year. If the price, P , of the service begins at v dollars, what is the value of the constant c in the following function that models the price of the service t years after it begins?

$$P = vc^t$$

- (A) 0.15
- (B) 0.85
- (C) 1.15
- (D) 1.55

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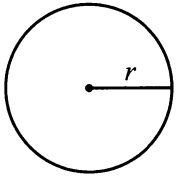
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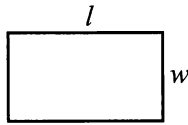
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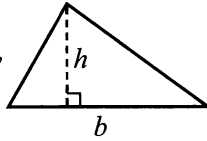


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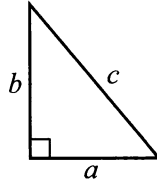
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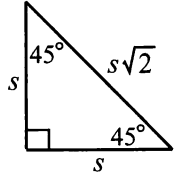
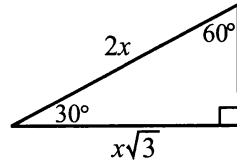
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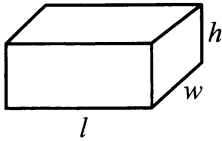
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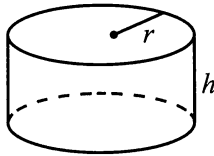
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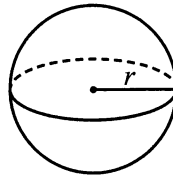
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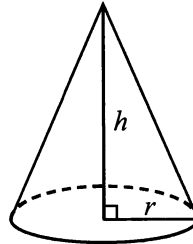
$$V = lwh$$



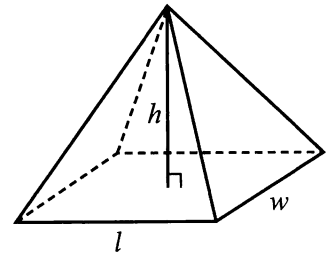
$$V = \pi r^2 h$$



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



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



$$V = \frac{1}{3}lwh$$

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.

1

Density equals mass divided by volume. If density is graphed as a line with mass corresponding to the y value and the volume corresponding to the x value, what aspect of the function corresponds to the density of the substance?

- (A) slope
- (B) y -intercept
- (C) x -intercept
- (D) domain

2

What is the sum of the following polynomials?

$$5x^3 - x + 4 \quad \text{and} \quad 6x^3 + x^2 - 3$$

- (A) $30x^6 + x^3 - x + 1$
- (B) $30x^3 + 2x^2 + x - 1$
- (C) $11x^3 + x^2 - x + 1$
- (D) $11x^3 - x^2 + x - 1$

3

Which of the following is equivalent to $8^{\left(\frac{1}{3}\right)}$?

- (A) 0
- (B) 1
- (C) 2
- (D) 6

4

$$2x - 3y = 7$$

$$6x + ky = 21$$

For what value of the constant k will the above system of equations have infinitely many solutions?

- (A) -9
- (B) -7
- (C) 2
- (D) 13

5

What is the y -intercept of the graph of the function $y = 2^x - 3$?

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

6

Which of the following is an equivalent form of $z = x - y$?

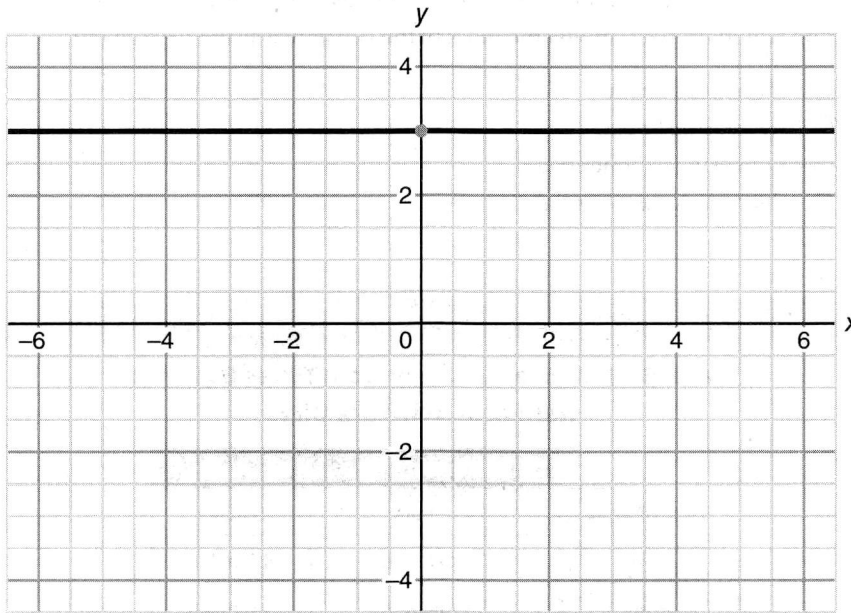
- (A) $z = (\sqrt{x} - \sqrt{y})(\sqrt{x} - \sqrt{y})$
- (B) $z = (\sqrt{x} - \sqrt{y})(\sqrt{x} + \sqrt{y})$
- (C) $z = (\sqrt{x} + \sqrt{y})(\sqrt{x} + \sqrt{y})$
- (D) $z = \frac{(\sqrt{x} + \sqrt{y})}{(\sqrt{x} - \sqrt{y})}$

7

If $x + 3 = y$ and $xy = 40$, what is the sum of x and y , given that both x and y are positive?

- (A) 5
- (B) 8
- (C) 13
- (D) 15

8



The graph of the above line is portrayed by which of the following equations?

- (A) $y = 3$
- (B) $y = \frac{1}{3}x$
- (C) $y = 3x$
- (D) $y = x + 3$

9

$$2a - 3b = 5$$

$$3a - 2b = 10$$

The solution to the above system of equations is (a, b) . What is the value of $a - b$?

10

Due to radiation, the mass of a substance decreases by 0.5% every day. Which type of function would properly model the mass of the substance as the days go by?

- (A) increasing linear
- (B) decreasing linear
- (C) increasing exponential
- (D) decreasing exponential

11

Travel Statistics on Journey from Times Square to Harlem in New York City

	Estimated Time	Distance
Subway	17 minutes	5 miles
Car	19 minutes	4.9 miles
Walk	93 minutes	4.6 miles
Bicycle	33 minutes	5.7 miles

If Sarah took the subway from Times Square to Harlem, what was her speed in miles per hour, to the nearest tenth?

- (A) 0.7 mph
- (B) 3.4 mph
- (C) 17.6 mph
- (D) 204.0 mph

12

If $x + y = 7$ and $x - y = 3$, what is the value of $3x^2 - 3y^2$?

13

Water from the ocean has 3.5% salt, and water from the Dead Sea has 33.7% salt. If someone has 10 gallons of ocean water, how many gallons of water from the Dead Sea (measured to the nearest hundredth of a gallon) need to be added so that the solution has 10% salt?

14

Which of the following is a solution for x in the equation $4x = 2 - 3x^2$?

- (A) $\frac{-3 + \sqrt{10}}{4}$
 (B) $\frac{2 - \sqrt{5}}{3}$
 (C) $\frac{\sqrt{3}}{4}$
 (D) $\frac{-2 - \sqrt{10}}{3}$

15

A function $g(x)$ has values given in the table below:

x	$g(x)$
-3	-1
-2	0
-1	2
0	1
1	0
2	3

Which of the following would be a factor of $g(x)$?

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

16

Students at a university were surveyed as to whether they wanted a new library for the university. Out of the 100 students surveyed, 40% said they wanted a new library. What is justifiable based on this information?

- (A) Of the 100 students surveyed, 40 wanted a new library.
- (B) 40% of all people in the university community want a new library.
- (C) Exactly 40 students at the university want a new library.
- (D) No more than 40 university students want a new library.

17

A circle has the equation $(x - a)^2 + (y - b)^2 = 9$, in which a and b are positive constants. What must the values of a and b be in order for all the x and y coordinates of the circle to be greater than zero?

- (A) $a < 9$ and $b > 9$
- (B) $a > \sqrt{3}$ and $b > \sqrt{3}$
- (C) $a > 6$ and $b < 6$
- (D) $a > 3$ and $b > 3$

18

$$v_e = \sqrt{\frac{2GM}{r}}$$

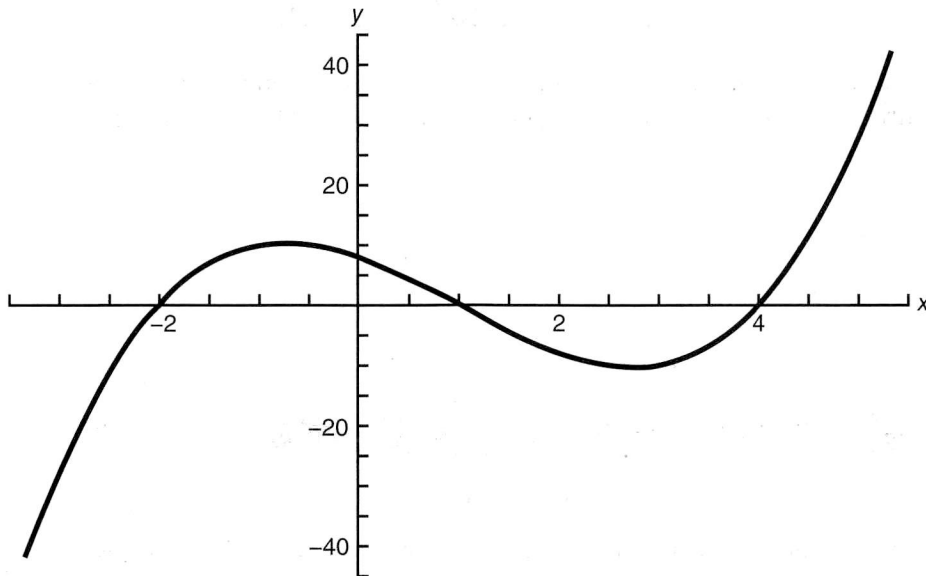
The escape velocity for a given spherical body, like a planet or a star, is given by the above formula, in which G is the gravitational constant, r is the distance from the center of the body's mass to the object, and m is the mass of the spherical body. What is M in terms of the other variables?

- (A) $M = \frac{(v_e)G}{2r}$
- (B) $M = \frac{2G}{(v_e)^2 r}$
- (C) $M = \frac{(v_e)^2 r}{2G}$
- (D) $M = \frac{2r \sqrt{v_e}}{G}$

19

A sphere has a volume of 8 cubic feet. What is the volume in cubic feet of a sphere with twice the radius of the original one?

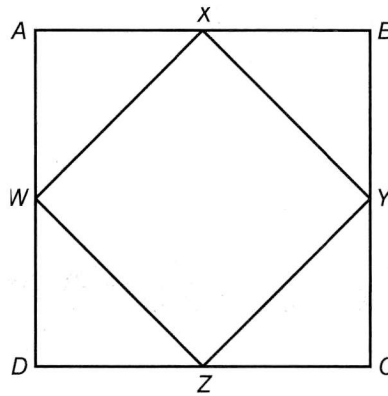
20



Which equation would portray the function graphed above?

- (A) $y = (x - 2)(x + 4)(x - 1)$
- (B) $y = (x - 4)(x + 2)(x - 1)$
- (C) $y = (x - 4)(x - 2)$
- (D) $y = (x + 1)(x + 2)$

21



If square $ABCD$ has an area of 36 square units, what is the perimeter of square $WXYZ$ given that each vertex of square $WXYZ$ bisects the side of square $ABCD$ that it intersects?

- (A) 6
- (B) $6\sqrt{3}$
- (C) 12
- (D) $12\sqrt{2}$

22

$$h(t) = -16t^2 + 16t + 10$$

The function above portrays the height, h , of a projectile t seconds after being thrown. Which of the following would be the time in seconds at which the height of the projectile is at its maximum value?