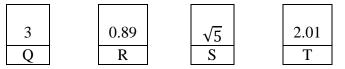1. Which number is a rational number?

   A) $\sqrt{61}$
   B) $\sqrt{9}$
   C) π
   D) $\sqrt{6}$
   E) 8π

2. What is the solution for x in the equation $f(x) = g(x)$, where $f(x) = 100 - 0.5x$ and $g(x) = 4x - 17$?

   A) 12
   B) 14
   C) 24
   D) 26
   E) 23

3. Jennifer received the four cards shown below.

3	0.89	$\sqrt{5}$	2.01
Q	R	S	T

   She was asked to put the cards in order from <u>least</u> to <u>greatest</u> value. Which list shows the correct order of the cards?

   A) Q, R, S, T
   B) S, R, Q, T
   C) R, S, T, Q
   D) R, T, S, Q
   E) R, S, Q, T

4. Matthew compared the price of windows at four different stores. Which store sells the windows at the lowest price per window?

   A) Store V sells 5 for $260.
   B) Store W sells 10 for $500.
   C) Store X sells 15 for $675.
   D) Store Y sells 24 for $720.
   E) Store Z sells 30 for $1,200.

5. What is the slope of a line that is perpendicular to the line that passes through the points (4, 12) and (10, 36)?

   A) 4

   B) 6

   C) $-\frac{1}{4}$

   D) $\frac{1}{4}$

   E) -4

6. Given $\begin{cases} f(x) = 4.8 + 0.8x \\ g(x) = 0.56x - 2.4 \end{cases}$

   What is the solution to $f(x) = g(x)$?
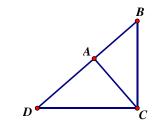
   A) -40
   B) -30
   C) 10
   D) 30
   E) -10

7. The table below shows the masses of some of the planets in our solar system.

Mass of Planets

Planet	Mass (in kilograms)
Earth	7.3483×10^{22}
Saturn	5.6846×10^{26}
Venus	4.8685×10^{24}
Neptune	1.0244×10^{26}

   Which list of planets is in order from the least mass to the greatest mass?

   A) Earth, Venus, Saturn, Neptune
   B) Earth, Venus, Neptune, Saturn
   C) Venus, Earth, Saturn, Neptune
   D) Venus, Earth, Neptune, Saturn
   E) Saturn, Neptune, Venus, Earth

8. The distance from the planet Mars to the sun is about 227.9×10^6 kilometers. Light travels at a rate of 3×10^5 kilometers per second. How much time, in seconds, does it take for light to travel from the sun to Mars?

   A) 732.337
   B) 759.667
   C) 895
   D) 967.05
   E) 73.23

9. John measured a right triangle with a hypotenuse 13 centimeters long and one leg 5 centimeters long. What is the length of the other leg of the triangle in centimeters?

   A) 6
   B) 8
   C) 10
   D) 12
   E) 144

10. In the diagram below, three right triangles are shown. The following lengths are given: $\overline{AC} = 3$ units and $\overline{AB} = 2$ units. Find the length of $\overline{AD}$. (You should not assume that the diagram is drawn to scale).

   A) 2 units
   B) 3 units
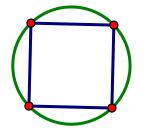   C) 4 units
   D) 4.5 units
   E) There is not enough information to find that length.

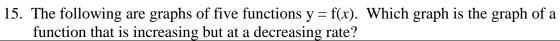11. If $a^8 = b^4 = c^2$ where a, b, and c are positive real numbers, then $\dfrac{ab}{c} =$

   A) $\dfrac{1}{a}$

   B) $a^{\frac{3}{4}}$

   C) $a^{\frac{4}{3}}$

   D) $\dfrac{1}{a^2}$

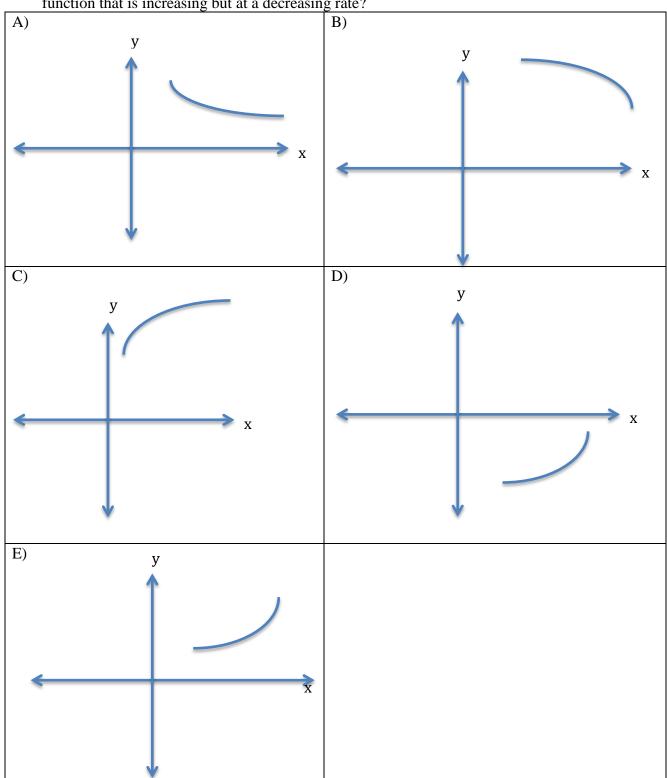   E) Any of the above could be correct, depending on the value of a.

12. The first digit of a number written in a base other than 10 is 1 and the last digit is 1 and there are several 0's in between with a 3 in the middle. We know there are at least 4 zeros, maybe more. What is the smallest the number could be in base 10?

    A) 4,289
    B) 4,292
    C) 811
    D) 810
    E) 89

13. The math club designs a t-shirt as a way to publicize the club. The local t-shirt store charges a one-time $15 set up fee and $10 for each shirt the math club orders. Tax is not charged since the math club is associated with a tax-exempt school. Consider the graph of the math club's amount owed to the t-shirt store in dollars for purchasing n shirts as a function of n. Which of the following is true?

    A) The slope is constant and is 25.
    B) The slope is constant and is 15.
    C) The slope is constant and is 10.
    D) The slope is 0.
    E) The slope is not constant.

14. What approximate percentage of the circular region lies outside the square?

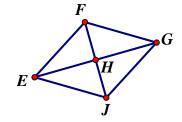
    A) 25%

    B) 36%

    C) 41%

    D) 50%

    E) 15%

15. The following are graphs of five functions y = f(x). Which graph is the graph of a function that is increasing but at a decreasing rate?

A)

B)

C)

D)

E)

16. If the coordinates in the tables below were graphed, which graph would have a quadratic shape?

A)

x	y
1	-1
2	-2
3	-3
4	-4
5	-5

B)

x	y
0	0
1	1
2	3
3	6
4	10

C)

x	y
1	¼
2	1/8
3	1/16
4	1/32
5	1/64

D)

x	y
1	1
2	3
3	5
4	7
5	9

E)

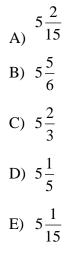| x	y
1	1
2	8
3	27
4	64
5	125

17. Find the area of the rhombus below. $\overline{EG} = 22$ units and $\overline{FH} = 5$ units.

A) 220 square units

B) 50 square units

C) 100 square units

D) 110 square units

E) 155 square units

18. The data in the table below has the property that y is directly proportional to x.

x	y
1	$2\dfrac{1}{3}$
2	$4\dfrac{2}{3}$
3	7
4	$9\dfrac{1}{3}$
5	$11\dfrac{2}{3}$

When x is 2.2, what is the value of y?

A) $5\dfrac{2}{15}$

B) $5\dfrac{5}{6}$

C) $5\dfrac{2}{3}$

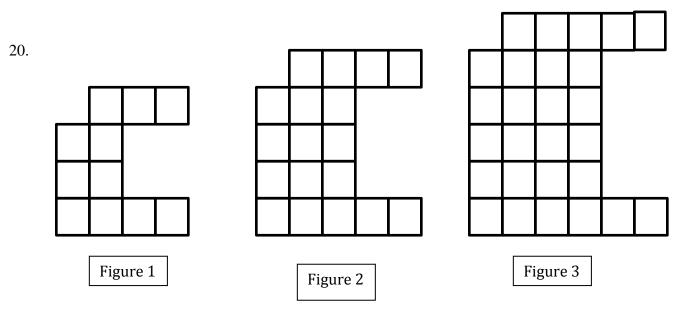D) $5\dfrac{1}{5}$

E) $5\dfrac{1}{15}$

19. Which of the following is not equivalent to $a^{\frac{x}{y}} \cdot b^{\frac{x}{y}}$?

A) $\sqrt[y]{a^x b^x}$

B) $\left(\sqrt[y]{ab}\right)^x$

C) $(ab)^{\frac{2x}{y}}$

D) $\left[(ab)^{\frac{1}{y}}\right]^x$

E) All of the above are equivalent to $a^{\frac{x}{y}} \cdot b^{\frac{x}{y}}$
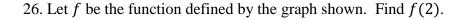
20.

Figure 1

Figure 2

Figure 3

As illustrated above there are 11 tiles in Figure 1. How many tiles are in figure 100?
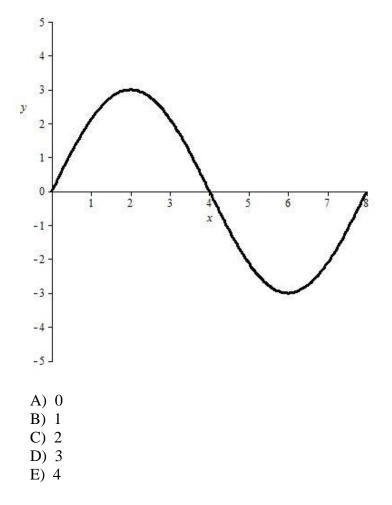
A) 704
B) 9,406
C) 9,604
D) 10,406
E) 10,604

21. Solve: $x^3 = 125$

    A) 5
    B) $\sqrt{125}$
    C) -5
    D) A, B, and C
    E) A and C only

22. The population of Haiti is approximately 9×10^6. The population of Greenland is approximately 6×10^5. About how many times as large as the population of Greenland is the population of Haiti?

    A) 3, 000, 000 times as large
    B) 1.5 times as large
    C) 100 times as large
    D) 15 times as large
    E) 2 times as large

23. Which of the following equations has exactly one solution?

    A) x + 3 = x - 2
    B) 3x + 6 = x + 2x + 6
    C) 5x + 6 = 5x - 6
    D) 7x - 5 = 7x - 5
    E) 3x + 5 = x - 2

24. Max rows a kayak on a river. An 8 mile trip upstream, against the current, takes four hours. Max stops, has lunch, and then rows back to his starting point. The return trip, with the current now, takes one hour. If Max rows at a constant rate, what is the speed of the river current?

    A) 1 mile per hour
    B) 2 miles per hour
    C) 3 miles per hour
    D) 4 miles per hour
    E) 5 miles per hour

25. Find the altitude of a triangular face of a right pyramid whose base is a square with edge length 8 centimeters and whose height is 12 centimeters.

    A) 12 centimeters
    B) $4\sqrt{13}$ centimeters
    C) $4\sqrt{5}$ centimeters
    D) $4\sqrt{10}$ centimeters
    E) 10 centimeters

26. Let f be the function defined by the graph shown. Find $f(2)$.

   A) 0
   B) 1
   C) 2
   D) 3
   E) 4

27. Five cars travel for 45 minutes on straight flat roads without interruption. Information
   about their speeds and time at each speed follows.

> Car A travels at 1 km/min for 30 min then travels at 1.2 km/min for 15 min.
> Car B travels at 1 mi/min for 20 min then .8 mi/min for 25 min.
> Car C travels at 50 mi/hr for 25 min then 70 mi/hr for 20 min.
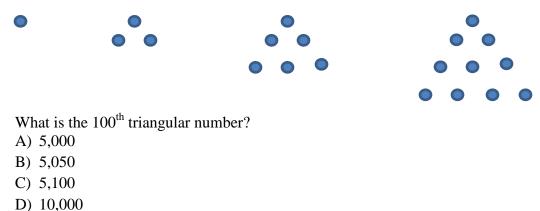> Car D travels at 60 km/hr for 15 min then 80 km/hr for 30 min.
> Car E travels at 60 mi per hour for 45 minutes.

> Which car has the highest average speed for the entire trip?

   A) Car A
   B) Car B
   C) Car C
   D) Car D
   E) Car E

28. As illustrated below: The first triangular number is 1. The second triangular number is 3. The third triangular number is 6. The fourth triangular number is 10.

What is the 100th triangular number?
A) 5,000
B) 5,050
C) 5,100
D) 10,000
E) 10,050

29. Mr. Smith asked his students whether they prefer to go to a museum or the zoo for a field trip. He found that 45% of the students prefer to go to a museum, 25% prefer to go to the zoo, and the rest have no preference. What is the ratio of students who have no preference to the students who prefer to go to the museum?

A) 2:3
B) 1:2
C) 4:9
D) 9:6
E) 3:6

30. Which is more likely to happen when flipping a fair coin?

A) Getting exactly 4 heads in 10 coin tosses
B) Getting exactly 40 heads in 100 coin tosses
C) Getting exactly 400 heads in 1,000 coin tosses
D) Each is equally likely
E) A) and B) are equally likely, and more likely than C).