

Name: Key

1. William put the tip of his pencil on the outer edge of a graph of the unit circle at the point $(0, -1)$. He moved his pencil tip through an angle of $\frac{4\pi}{3}$ radians in the counterclockwise direction along the edge of the circle. At what angle of the unit circle did William's pencil tip stop?

- A. $\frac{\pi}{3}$ B. $\frac{5\pi}{6}$ C. $\frac{7\pi}{6}$ D. $\frac{5\pi}{3}$

2. A reporter wants to know the percentage of voters in the state who support building a new highway. What is the reporter's population?

- A. the number of people who live in the state
 B. the people who were interviewed in the state
 C. all voters over 25 years old in the state
 D. all eligible voters in the state

3. A principal wants to survey 150 students to determine which electives to offer during the next school year. There are 1,800 students in the school. Which procedure could the principal use to select a sample using a systematic random sample?

- A. Obtain a list of all students. Start with the eighth student, and select every twelfth student until 150 students have been selected.
 B. Select the first 150 students who enter the school.
 C. Choose the fifth student to come into the cafeteria, and then select every third student who comes into the cafeteria until 150 students have been selected.
 D. Place students' names on slips of paper and select 150 slips.

4. Which choice shows the solutions to the equation $8x^2 + 3x = -7$?

- A. $\frac{-3 \pm i\sqrt{215}}{16}$ B. $\frac{3 \pm i\sqrt{215}}{16}$ C. $\frac{-3 \pm \sqrt{233}}{16}$ D. $\frac{3 \pm \sqrt{233}}{16}$

5. The volume of a rectangular prism is represented by the expression $(x^3 - 2x^2 - 20x - 24)$. If the length is $(x - 6)$ and the height and width are equal, what is the width of the prism?

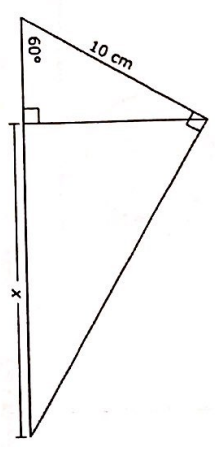
- A. $x + 2$ B. $x - 2$ C. $x + 4$ D. $x - 4$

A

6. A box with an open top will be constructed from a rectangular piece of cardboard.
 • The piece of cardboard is 8 inches wide and 12 inches long.
 • The box will be constructed by cutting out equal squares of side x at each corner and then folding up the sides.
 What is the entire domain for the function $V(x)$ that gives the volume of the box as a function of x ?

- A. $0 < x < 4$ B. $0 < x < 6$ C. $0 < x < 8$ D. $0 < x < 12$

7. What is the value of x in the triangle below?



- A. $5\sqrt{3}$ cm B. $5\sqrt{3}$ cm C. 10 cm D. 15 cm

8. The graph of the function $f(x) = x^2$ will be shifted down 2 units and to the right 3 units. Which is the function that corresponds to the resulting graph?

- A. $g(x) = (x + 3)^2 + 2$ B. $g(x) = (x + 3)^2 - 2$
 C. $g(x) = (x - 3)^2 + 2$ D. $g(x) = (x - 3)^2 - 2$

9. A function is shown below.

$$f(x) = \begin{cases} -x^2 + 2x & \text{for } x \leq -3 \\ 2\left(\frac{1}{3}\right)^x & \text{for } -3 < x < 4 \\ 2x - 5 & \text{for } x \geq 4 \end{cases}$$

What is the value of the expression $f(-3) + 2f(-1) - f(4)$?

- A. $\frac{101}{36}$ B. $\frac{32}{9}$ C. 4 D. 22

D

10. A farmer wants to buy between 90 and 100 acres of land.
- He is interested in a rectangular piece of land that is 1,500 yards long and 300 yards wide.
 - The piece of land is being sold as one complete unit for \$87,000.
- If the farmer does not want to spend more than \$900 an acre, does the land meet all of his requirements? (1 acre \approx 43,560 ft²)

- A. Yes, the amount of land satisfies his needs, and the price is low enough.
 B. No, the price is low enough, but there is too much land.
 C. No, the price is low enough, but there is not enough land.
 D. No, the amount of land satisfies what he needs, but the price is too high.

B

11. A system of equations is shown below.
- $$y = |x - 3|$$
- $$y = \frac{1}{2}x$$

- What is the distance between the points of intersection of the system?
- A. $\sqrt{6}$ B. $\sqrt{20}$ C. $\sqrt{48}$ D. $\sqrt{80}$

C

12. To completely cover a spherical ball, a ball company uses a total area of 36 square inches of material. What is the maximum volume the ball can have?
 (Note: Surface area of a sphere = $4\pi r^2$. Volume of a sphere = $\frac{4}{3}\pi r^3$.)

- A. 27π cubic inches B. $36\sqrt{\pi}$ cubic inches
 C. $\frac{36}{\sqrt{\pi}}$ cubic inches D. $\frac{27}{\pi}$ cubic inches

B

13. Let $f(x) = 14x^3 + 28x^2 - 46x + 7$. Which is the solution set to the equation $\frac{1}{2}f(x) = g(x)$?
- A. $\{-3, 0, 1\}$ B. $\{-3, -1, 2\}$ C. $\{-2, 1, 3\}$ D. $\{1, 5, 11\}$

C

14. Which is the inverse of $f(x) = 1.5^x + 4$?
- A. $f^{-1}(x) = \frac{x-4}{1.5}$ B. $f^{-1}(x) = \frac{\log(x)-4}{1.5}$
 C. $f^{-1}(x) = \frac{\log(x-4)}{\log(1.5)}$ D. $f^{-1}(x) = \frac{4-\log(x)}{\log(1.5)}$

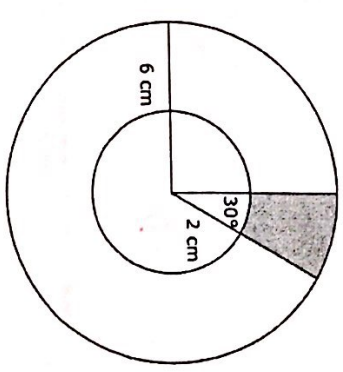
B

B

15. Which function goes to positive or most quickly as x increases?
- A. $y = \log(x) + 100$ B. $y = e^{x-9} - 3$
 C. $y = x^2 + 5x + 6$ D. $y = 3x^3 + 4x^2 - 11x - 6$

D

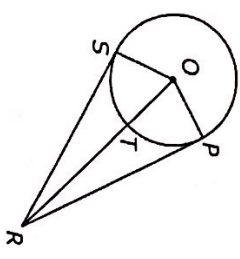
16. In the figure below, the larger circle has a radius of 6 cm, and the smaller circle has a radius of 2 cm.



- What is the approximate area of the shaded region?
- A. 2.1 cm² B. 3.4 cm² C. 4.2 cm² D. 8.4 cm²

A

17. In the figure below, \overline{PR} and \overline{SR} are tangent to circle O .



- If $OT = 11$ cm and $PR = 60$ cm, what is the length of \overline{OR} ?
- A. 61 cm B. 59 cm C. 50 cm D. 48 cm

$$50 + 11 = 61 \text{ cm}$$

C

18. A student wants to determine the most liked professor at her college. Which type of study would be the most practical to obtain this information?

- A. a simulation
- B. an experiment
- C. a survey
- D. an observation

D

19. What is the approximate solution to the equation $3^{x-1} = 42^{x+5}$?

- A. 3.875
- B. 1.262
- C. -2.354
- D. -4.797

B

20. What value of h is needed to complete the square for the equation $x^2 + 10x - 8 = (x - h)^2 - 33$?

- A. -25
- B. -5
- C. 5
- D. 25

C

21. Samantha invested \$10,000 in each of two different financial plans in 2013. The predicted value of each plan is modeled below.

- Plan M: a rate of 7.5%, compounded continuously
- Plan N: The value is determined by the function $y = 5x^3 - 50x^2 + 4x + 10,000$, where x is the number of years after 2013.

Plan N has a greater predicted value than Plan M during which year?

- A. from 2014 to 2041
- B. from 2028 to 2055
- C. from 2042 to 2073
- D. Plan N never has a greater value than Plan M.

D

22. Suppose $p(x) = x^3 - 2x^2 + 11x + k$. The remainder of the division of $p(x)$ by $(x + 1)$ is -8. What is the remainder of the division of $p(x)$ by $(x - 1)$?

- A. -8
- B. 8
- C. 16
- D. 20

B

23. The diameter of a circle is 8 centimeters. A central angle of the circle intercepts an arc of 12 centimeters. What is the radian measure of the angle?

- A. $\frac{1}{3}$
- B. $\frac{3}{4}$
- C. 4
- D. 4π

B

24. A board is made up of 9 squares. A certain number of pennies is placed in each square, following a geometric sequence. The first square has 1 penny, the second has 2 pennies, the third has 4 pennies, etc. When every square is filled, how many pennies will be used in total?

- A. 512
- B. 511
- C. 256
- D. 81

C

25. A shipping company is designing boxes to meet specific requirements.

- Each box must be a completely closed rectangular prism with no overlapping material.
- The boxes must hold 24 cans in two layers of 12 cans each.
- The cans are 3 inches in diameter and 5 inches in height.

What is the smallest amount of cardboard needed to meet the specifications?

- A. 1,080 in.²
- B. 840 in.²
- C. 630 in.²
- D. 540 in.²

A

26. Which expression is equivalent to $(x + 3)^3 - 9x(x + 3)$?

- A. $x^3 + 27$
- B. $x^3 - 27$
- C. $x^3 - 9x^2 - 27x + 27$
- D. $x^3 - 9x^2 + 27x + 27$