1. An isosceles triangle has a height of 2 units and two sides each with length $\sqrt{5}$ units. What is the area of the triangle?

   (a) 1
   (b) 2
   (c) 5
   (d) $2\sqrt{5}$
   (e) $2\sqrt{5} + 2$

2. Alice can mow the lawn twice as fast as Bill. Working together they can mow the lawn in 2 hours. How long would it take Alice working by herself?

   (a) 3 hours
   (b) 4 hours
   (c) 5 hours
   (d) 6 hours
   (e) Cannot be determined from the given information

3. Three distinct lines have equations $x - y = -2$, $6x + y = 9$, and $x - 2y = -5$. A point lying on all three lines

   (a) has coordinates $(0, 2)$.
   (b) has coordinates $(1, 3)$.
   (c) has coordinates $(2, 4)$.
   (d) has coordinates $(3, 5)$.
   (e) does not exist.

4. If $a_{n+1} = \dfrac{3a_n + 1}{a_n - 5} + \dfrac{a_n + 4}{a_n + 2} - \dfrac{3a_n^2 + 9a_n - 8}{a_n^2 - 3a_n - 10}$ and $a_1 = 1$, then determine a_{2018}.

   (a) 0
   (b) 1
   (c) undefined
   (d) 2019
   (e) -1

5. How many real number solutions does the equation $2x^3 - x^2 + 10x - 5 = 0$ have?

   (a) 0
   (b) 1
   (c) 2
   (d) 3
   (e) $\frac{1}{2}$

6. Which of the following fractions equal the repeating decimal $\overline{0.285714}$?

   (a) $\frac{2}{7}$
   (b) $\frac{285,714}{999,999}$
   (c) $\frac{31,746}{111,111}$
   (d) $\frac{2,886}{10,101}$
   (e) All of the above

7. Two points on a line perpendicular to the graph of $3x + 7y = 4$ are

   (a) $(1, 3)$ and $(4, 10)$
   (b) $(4/3, 0)$ and $(0, 7/3)$
   (c) $(3/4, 0)$ and $(0, 3/7)$
   (d) $(0, 2)$ and $(-3, 9)$
   (e) $(0, 3)$ and $(7, 0)$

8. Which of the following pairs (x, y) is a solution to the equation

$$x^5 = y^{-10}?$$

   (a) $(4, 0.25)$
   (b) $(100, 0.1)$
   (c) $(2, 1)$
   (d) $(5, 25)$
   (e) $(0, 0)$

9. Four pipes are stacked as shown below, with each pipe having a diameter of 5 inches. Of the following numbers, which is the largest possible diameter a pipe that would fit within the space enclosed by the four 5-inch-diameter pipes?

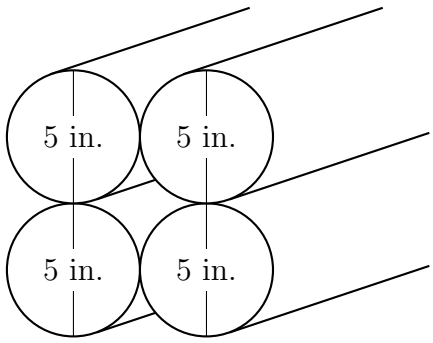
(a) 1.00

(b) 1.41

(c) 2.00

(d) 2.50

(e) 2.82



10. The hypotenuse of a right triangle has endpoints with coordinates $(1, 3)$ and $(-5, 7)$ in the xy-plane. Which of the following could be the coordinates for other vertex of the triangle?

(a) $(0, 2)$
(b) $(0, 8)$
(c) $(-4, 2)$
(d) only (a) and (b)
(e) All of the above

11. Which point on the graph of the line $2x - y = 4$ is closest to the point $(5, 2)$?

(a) $(-1, 0)$
(b) $(0, 2)$
(c) $(5, 1)$
(d) $(-1, -6)$
(e) None of the above

12. The solution set of the equation $\dfrac{x}{x+1} + \dfrac{1}{x-1} - \dfrac{2}{x^2-1} = 1$ is

(a) $\{-1\}$
(b) $\{-1, 1\}$
(c) All real numbers
(d) All real numbers except 1 and -1
(e) The empty set, since the equation has no solutions

13. Two sides of the parallelogram have lengths a and b with $a < b$. The parallelogram diagonals have unequal lengths, with c as the length of the longest diagonal. Then (a, b, c) could be

    (a) $(1, 3, 2)$

    (b) $(0, 4, 3)$

    (c) $(3, 5, 7)$

    (d) $(3, 4, 5)$

    (e) $(5, 12, 13)$

14. All toves are slithy. Some bandersnatches are toves. A frumious bandersnatch cannot be slithy. Which of the following must be true?

    (a) There are no frumious toves.

    (b) Some bandersnatches are frumious.

    (c) All slithy bandersnatches are toves.

    (d) A frumious tove cannot be a bandersnatch.

    (e) None of the above statements are necessarily true.

15. In the parallelogram $\square ABCD$, sides $\overline{AB}$ and $\overline{CD}$ have length 13, sides $\overline{AD}$ and $\overline{BC}$ have length 5, and angle $\angle DAB$ is obtuse, and angle $\angle DAC$ is a right angle. What is the area of the parallelogram?

    (a) 65 (b) 12 (c) $\frac{25}{13}$

    (d) 60 (e) $\frac{25}{12}$

16. In the xy-coordinate plane, points $P = (0, 3)$ and $Q = (4, 0)$ are endpoints for a side of a square $\square PQRS$ whose interior points are in Quadrant I. If S is the vertex of the square with maximum y-value, then S is

    (a) $(3, 5)$

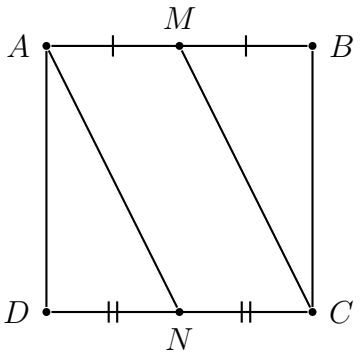
    (b) $(5, 7)$

    (c) $(3, 7)$

    (d) $(4, 6)$

    (e) $(7, 5)$

17. The following figure depicts a rectangle $\square ABCD$, with M as the midpoint of AB and N as the midpoint of CD. Suppose $\overline{AD}$ is twice the length of $\overline{AB}$ and that $\overline{AN}$ has length $\sqrt{5}$. What is the area of quadrilateral $\square AMCN$?



(a) 2

(b) 3

(c) 4

(d) 5

(e) Cannot be determined from the given information

18. If $f(x) = \dfrac{2x+3}{x-2}$, then $f\big(f(x)\big)$ is

(a) $\dfrac{2x+3}{x-2}$

(b) $\dfrac{x-2}{2x+3}$

(c) $x+1$

(d) x

(e) $\left(\dfrac{2x+3}{x-2}\right)^2$

19. A circle in the coordinate plane has its center on the positive part of the x-axis and passes through the points $(0,2)$ and $(-1,0)$. The radius of the circle is

(a) $\dfrac{1}{2}$

(b) 1

(c) $\dfrac{3}{2}$

(d) 2

(e) $\dfrac{5}{2}$

20. $\left(\left(\sqrt[3]{3}^{\sqrt[3]{3}}\right)^{\sqrt[3]{3}}\right)^{\sqrt[3]{3}} + \left(\sqrt{3}^{\sqrt{2}}\right)^{\sqrt{2}} =$

(a) 9

(b) 6

(c) 3

(d) 1

(e) 0

21. In the figure below, the semicircle with diameter $\overline{AB}$ has area $\frac{9}{2}\pi$ and the semicircle with diameter $\overline{BC}$ has area 8π. The sum of these areas is the area of the semicircle with diameter $\overline{AC}$. What is the length of $\overline{AC}$?

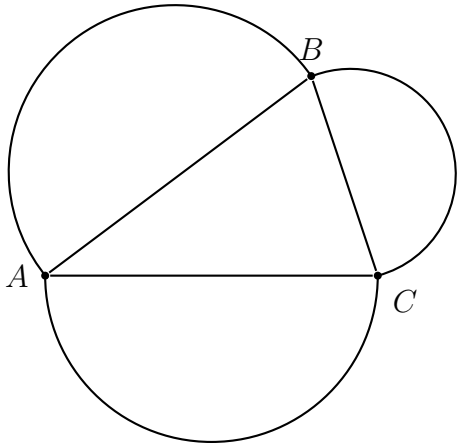
(a) 5

(b) 10

(c) $\frac{25}{2}\pi$

(d) 5π

(e) None of the above



22. If $x = \cfrac{8}{2+\cfrac{12}{1+\cfrac{12}{1+\cfrac{12}{\cdots}}}}$, then $x =$

(a) 1.6

(b) 1

(c) $\frac{1+\sqrt{5}}{2}$

(d) $\sqrt{2}$

(e) 8

23. Starting with 2018 coins, Beth makes a square array that is as large as possible. How many coins are not used in making this square array?

(a) 18 (b) 0 (c) 82
(d) 30 (e) 44

24. If a and b are rational numbers, then $\dfrac{1}{a\sqrt{2}+b}$ is

(a) $\dfrac{a\sqrt{2}-b}{2a^2-b^2}$

(b) $\dfrac{\sqrt{2}}{2a+b}$

(c) $a\sqrt{2}-b$

(d) undefined

(e) 1

25. In the equilateral triangle $\triangle ABC$ depicted below, points X and Y are chosen on sides $\overline{AB}$ and $\overline{AC}$ respectively, so that $\overleftrightarrow{XY}$ is parallel to $\overleftrightarrow{BC}$. Suppose segment $\overline{XY}$ has length 1 and segment $\overline{BC}$ has length 3. Then quadrilateral $\square BCXY$ has area

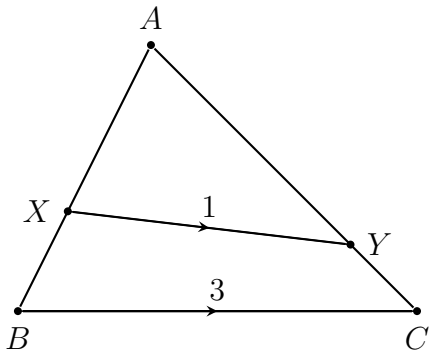
(a) $\sqrt{3}$

(b) 2

(c) $2\sqrt{3}$

(d) 4

(e) none of the above



26. What is the ones digit of 3^{2018}?

(a) 9

(b) 8

(c) 7

(d) 3

(e) 1

27. If $x = \sqrt[8]{3} - \sqrt[12]{5}$ and $y = \sqrt[6]{4} - \sqrt{2}$, then x and y are

(a) both positive.

(b) both negative.

(c) both $\sqrt[4]{2}$.

(d) both zero.

(e) not both positive.

28. Consider the region of the coordinate plane consisting of those points (x, y) for which $|x| - 1 \leq y$ and $x^2 + y^2 \leq 1$. What is its area?

(a) $\pi \cdot 1^2$

(b) $2\pi + 2\sqrt{2}$

(c) $\pi + \sqrt{2}$

(d) $\pi/2 + 1$

(e) $\pi + 2$.

29. Five adults and six children are randomly positioned in a line. What is the probability that no two children are standing next to one another?

(a) $\dfrac{1}{462}$ (b) $\dfrac{1}{252}$ (c) $\dfrac{11}{(5!)^2}$

(d) $\dfrac{1}{11}$ (e) $\dfrac{3}{55}$

30. For which value(s) of c will the graphs of the functions $y = \dfrac{1/3}{x + c}$ and $y = \dfrac{1}{3x - 6}$ fail to intersect?

(a) -2

(b) 2

(c) ± 2

(d) All real numbers

(e) None of the above