1. Which of the following pairs of points are on the line $3x + 4y = 8$ and are a distance of 5 units from the point $(-4, 5)$?

   (a) $(-4, 0)$ and $(-4, 10)$
   (b) $(1, 5)$ and $(-9, 5)$
   (c) $(8, -8)$ and $(0, -2)$
   (d) $(-8, 8)$ and $(0, 2)$
   (e) $(8, 8)$ and $(0, 2)$

2. $10^{\log_{10}(x)} + \log_2(2^{-x}) =$

   (a) 12
   (b) 1
   (c) 0
   (d) 20
   (e) $12x$

3. If

$$x = \cfrac{4}{3 + \cfrac{4}{3 + \cfrac{4}{\cdots}}}$$

   then $x =$

   (a) 4
   (b) -1
   (c) -4
   (d) 1
   (e) $\frac{4}{3}$

4. Starting with 2017 coins, Chris makes a triangular array with 1 coin on the first row, 3 coins on the second row, 5 coins on the third row, and so on up to $2N - 1$ coins on the Nth row. Leftover coins are set aside. What is the sum of the digits of N?

   (a) 7
   (b) 8
   (c) 9
   (d) 10
   (e) none of the above

5. $\sqrt{\dfrac{4+\sqrt{7}}{2}} =$

(a) $\dfrac{2+\sqrt{7}}{2}$ (c) $\sqrt{\dfrac{3}{2}}$ (e) $\dfrac{23+2\sqrt{7}}{4}$

(b) $\dfrac{1+\sqrt{7}}{2}$ (d) $\dfrac{23+2\sqrt{7}}{4}$

6. Pump A will pump water out of a tank 20% faster than Pump B. If Pump B requires 1 hour to empty a certain tank, then how long would it take for both pumps working together to empty the same tank?

(a) 1 hour and 20 minutes

(b) $26\ \frac{2}{3}$ minutes

(c) 30 minutes

(d) 12 minutes

(e) $37\ \frac{1}{2}$ minutes

7. The solution set of the equation $\dfrac{(x+5)^2}{x^2+10x+25} = 1$ is

(a) $\{-5\}$

(b) $\{-5, 5\}$

(c) the empty set, since the equation has no solutions

(d) all real numbers

(e) none of the above

8. Terry practices exactly one sport each day of the week. She runs three days a week but never on two consecutive days. On Monday she plays basketball and two days later golf. She swims and plays tennis, but she never plays tennis the day after running or swimming. Which day of the week does Terry swim?

(a) Sunday

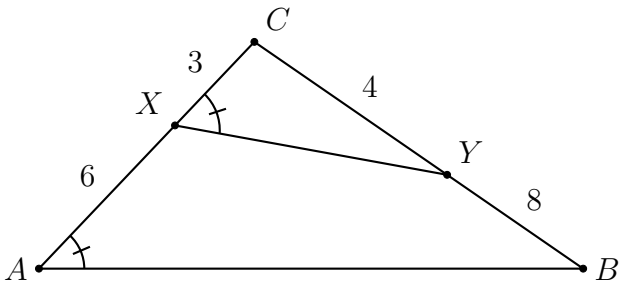
(b) Tuesday

(c) Thursday

(d) Friday

(e) Saturday

9. The following figure depicts a triangle $\triangle ABC$ and a triangle $\triangle XYC$, where X is on the segment $\overline{AC}$ and Y is on the segment $\overline{BC}$. We have $AX = 6$, $XC = 3$, $BY = 8$, and $YC = 4$. Moreover, $\angle CAB \cong \angle CXY$. (Note: The figure is not necessarily drawn to scale.)



If the area of $\triangle ABC$ is 54, then what is the area of $\triangle XYC$?

(a) 6

(b) 9

(c) 18

(d) 27

(e) cannot be determined from the information given

10. A circle of radius 4 has a center in the first quadrant of the coordinate plane. The circle is tangent to the x-axis and the y-axis. The rightmost point on the circle is

(a) $(4, 2)$

(b) $(4, 4)$

(c) $(4, 8)$

(d) $(8, 4)$

(e) $(8, 2)$

11. $\sqrt[5]{3} - \sqrt[3]{2}$ is

(a) a positive number

(b) a negative number

(c) 0

(d) an integer

(e) undefined

12. Suppose the system of equations

$$\begin{aligned} 4x - 5y &= -2 \\ 6x + dy &= -3 \end{aligned}$$

has at least two solutions. What is the value of d?

(a) 7

(b) -7

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

(d) $-\frac{3}{2}$

(e) none of the above

13. Given that $x = 4$ is a solution to the equation

$$3x^3 + x^2 - 62x + 40 = 0,$$

then the other solutions to the equation are

(a) -5

(b) $\frac{2}{3}$ and -5

(c) -2 and 2

(d) $\frac{3}{2}$ and 5

(e) none of the above

14. Two points on a line parallel to the graph of $5x - 2y = 7$ are

(a) $(1, 1)$ and $(6, 1)$

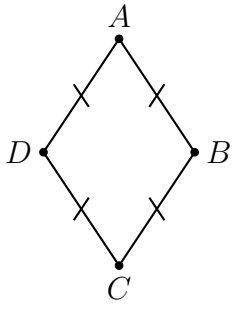
(b) $(1, 1)$ and $(-1, -4)$

(c) $(1, 1)$ and $(-4, -1)$

(d) $(1, 1)$ and $(-1, 6)$

(e) $(1, 1)$ and $(-1, -6)$

15. For the rhombus pictured here, the ratio of the length of the longer diagonal AC to the shorter diagonal BD is $3:1$. The area of the rhombus is 60. What is the length of each side of the rhombus? (Note: The figure is not necessarily drawn to scale.)



(a) $\sqrt{5}$
(b) 5
(c) 10
(d) 15
(e) 20

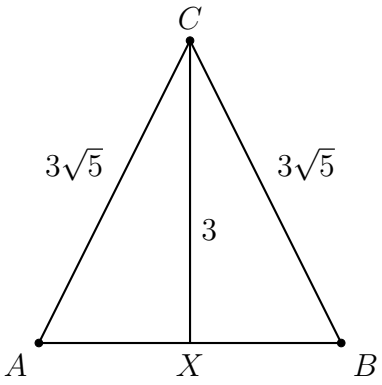
16. A solution to $x^{-7/3} = 0.0000001$ is

(a) 10
(b) 100
(c) 1000
(d) 1
(e) There are no solutions.

17. Which of the following could not be the sides of a triangle?

(a) $8, 4, 7$
(b) $4, 7, 5$
(c) $1, 2, 4$
(d) $7, 7, 8$
(e) $3, 4, 6$

18. In the isosceles triangle depicted here, the lengths of the sides $\overline{AC}$ and $\overline{BC}$ are $3\sqrt{5}$. With segment $\overline{AB}$ as a base, the height of $\triangle ABC$ is the length of $\overline{CX}$, which is 3. What is the area of $\triangle ABC$? (Note: The figure is not necessarily drawn to scale.)



(a) 6
(b) 9
(c) 15
(d) $12\sqrt{2}$
(e) 18

19. In the xy-coordinate plane, point $\mathcal{O}$ is the origin with coordinates $(0, 0)$, point $\mathcal{P}$ has coordinates $(4, 0)$, and point $\mathcal{Q}$ has coordinates $(6, y)$, where y is an unknown constant. If $\triangle \mathcal{OPQ}$ has an area of 14, then what is y?

(a) 5

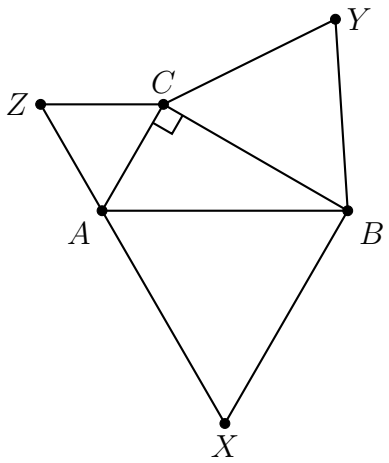
(b) 28

(c) 14

(d) 7

(e) $\frac{7}{2}$

20. In the figure below, $\triangle ABC$ is a right triangle with $\angle C$ right, and $\triangle ACZ$, $\triangle BCY$, and $\triangle ABX$ are equilateral. If $\triangle ACZ$ has an area of $17\sqrt{3}$ square inches and $\triangle ABX$ has an area of $98\sqrt{3}$ square inches, then what is the length of $\overline{BC}$? (Note: The figure is not necessarily drawn to scale.)



(a) $81\sqrt{3}$ inches

(b) $9\sqrt{3}$ inches

(c) $115\sqrt{3}$ inches

(d) 7 inches

(e) none of the above

21. What is the remainder when $23 + 10^{2017}$ is divided by 6?

(a) 0

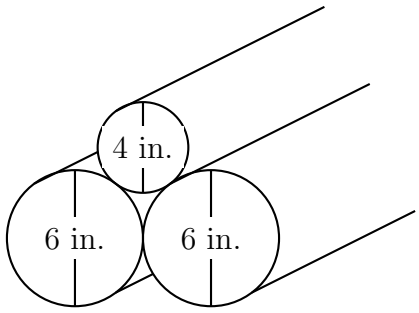
(b) 1

(c) 2

(d) 3

(e) 4

22. Three pipes are stacked, the bottom two being 6 inches in diameter and the top one being 4 inches in diameter. Find the height of the stack.



(a) 6 inches

(b) $(7 + \sqrt{2})$ inches

(c) 9 inches

(d) $(6 + \sqrt{3})$ inches

(e) 8 inches

23. Find a fractional representation for the number $0.\overline{37}$.

(a) $\dfrac{12}{33}$

(b) $\dfrac{370}{999}$

(c) $-\dfrac{74}{99}$

(d) $\dfrac{37}{99}$

(e) There is no fractional representation.

24. Three vertices of a rectangle are $(3, 10)$, $(7, 4)$, and $(-9, 2)$. The fourth vertex is

(a) $(-4, -6)$

(b) $(-4, -8)$

(c) $(-4, -3)$

(d) $(-5, -6)$

(e) $(-5, -4)$

25. If

$$f(x) = \frac{x+1}{1-\frac{1}{x}}$$

then $\dfrac{f\left(\frac{1}{x}\right)}{f(x)}$ equals

(a) $\dfrac{1-\frac{1}{x}}{x+1}$

(b) $\dfrac{x+1}{1-x^2}$

(c) $\dfrac{\left(1+\frac{1}{x}\right)^2}{1-x^2}$

(d) $-\dfrac{1}{x^2}$

(e) $\dfrac{1-x}{x+1}$

26. The area of a rectangle is 16 square inches. P and Q are adjacent vertices of the rectangle. Let R be the geometric center of the rectangle. Assume that the degree measure of $\angle PRQ$ is $120°$. The length of the side PQ is

(a) $8\sqrt[4]{3}$

(b) $2\sqrt[4]{3}$

(c) $\sqrt[4]{3}$

(d) $4\sqrt[4]{3}$

(e) none of the above

27. Consider the region in the xy-plane consisting of all points satisfying $|x| + |y| \leq 2$. What is its area?

(a) $8\sqrt{2}$

(b) 8

(c) $2\sqrt{2}$

(d) 2

(e) 4

28. In a closet, there are four pairs of shoes. If four shoes are selected at random, what is the probability of exactly two complete pairs?

(a) $\frac{8}{35}$

(b) $\frac{2}{35}$

(c) $\frac{3}{35}$

(d) $\frac{4}{35}$

(e) none of the above

29. For which value of c will the curves $y = \frac{x}{1-c}$ and $y = \frac{1}{x-c}$ have exactly one intersection?

(a) 2

(b) 3

(c) 0

(d) -1

(e) none of these

30. What is the value of

$$\frac{1}{1\cdot 3} + \frac{1}{3\cdot 5} + \frac{1}{5\cdot 7} + \cdots + \frac{1}{2015\cdot 2017} \, ?$$

(a) $\dfrac{508}{2017}$

(b) $\dfrac{1016}{2017}$

(c) $\dfrac{2016}{2017}$

(d) $\dfrac{1008}{2017}$

(e) $\dfrac{504}{2017}$