

1. Simplify: $\frac{1}{3} + \frac{1}{4} + \frac{1}{5}$. Express your answer as a common fraction.

$$\frac{1}{3} + \frac{1}{4} + \frac{1}{5} = \frac{20}{60} + \frac{15}{60} + \frac{12}{60} = \frac{47}{60}$$

$$\frac{6}{12} + \frac{4}{12} + \frac{3}{12} = \frac{13}{12}$$

$$\frac{13}{12}$$

$$\frac{13}{12} + \frac{1}{12} + \frac{3}{12} = \frac{17}{12}$$

$$\frac{13}{12} + \frac{1}{12} + \frac{3}{12} = \frac{17}{12}$$

2. What is the result when Ellen starts with the integer 123,456 and performs the following sequence of operations: subtract 6, divide by 10, subtract 5, divide by 10, subtract 4, divide by 10, subtract 3, divide by 10, subtract 2, divide by 10?

$$\begin{array}{r} 11.94 \\ - 3.00 \\ \hline 8.94 \end{array}$$

$$\begin{array}{r} 6.94 \\ 0.694 \end{array}$$

$$\begin{array}{r} 123450 \\ 12345 \end{array}$$

$$\begin{array}{r} 1234 \\ 1234 \end{array}$$

$$\begin{array}{r} 1234 \\ + 23.4 \\ - 4.0 \\ \hline 119.4 \end{array}$$

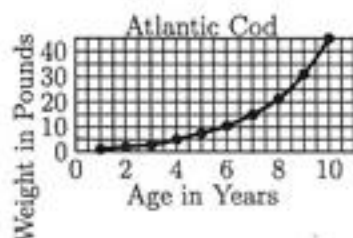
3. Let $a = 1.234$, $b = 2.34$, and $c = 3.4$. Round the sum $a + b + c$ to the nearest hundredth.

$$\begin{array}{r} 1.234 \\ + 2.34 \\ + 3.4 \\ \hline 6.974 \end{array}$$

$$6.974$$

$$6.97$$

4. The graph shows the weight in pounds of an average Atlantic cod given its age in years. How many years old is an average Atlantic cod that weighs 15 pounds?



4

5. Mellie has 6 pairs of pants and 10 shirts. She buys 2 more pairs of pants. If an outfit consists of a pair of pants and a shirt, how many more outfits can Mellie make now compared to the number that she could make before this purchase?

$$8 \times 10 = 80$$

6. Congruent segments are used to form equilateral triangles in this sequence so that each figure contains one more triangle than the preceding figure. Figure 3 of the sequence is made with seven congruent segments. How many congruent segments must be used to make Figure 25 of the sequence?



Figure 1

Figure 3

Figure 2

Figure 4

$$7 \times 25 = 175$$

7. It costs 2.5 cents to copy a page. How many pages can you copy for \$20?

$$25 \overline{)1000} \quad 40 \text{ pages} = \$1$$

8. The counting numbers are written in a table with six columns so that in each successive row the numbers alternate between increasing from left to right and increasing from right to left, as shown. What is the first number in the 15th row?

1	2	3	4	5	6
12	11	10	9	8	7
13	14	15	16	17	18
24	23	22	21	20	19
25

$$6 \cdot 10 = 60 + 25 = 85$$

85

9. Karina wrote the addition problem shown here on the board. However, one digit is incorrect. When written correctly, the number containing the incorrect digit is what four-digit integer?

$$\begin{array}{r} 2635 \\ + 1862 \\ \hline 4537 \end{array}$$

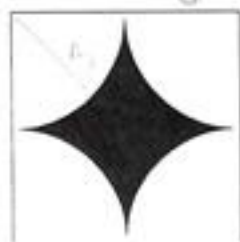
10. Suppose that by using the spare tire on her car as much as she uses the other four tires, Coleen drives the car 80,000 miles. What is the wear, in miles, on each tire?

$$5 \overline{)80,000} = 16,000$$

11. What integer is closest to the value of $\sqrt[5]{1000}$?

$$3 \cdot 3 \cdot 9 \cdot 9 \cdot 81 = 1029$$

12. A quarter-circle of radius 3 units is drawn at each of the vertices of a square with sides of 6 units. The area of the shaded region can be expressed in the form $a - b\pi$ square units, where a and b are both integers. What is the value of $a + b$?



$$36 - 9\pi$$

$$36 - 9\pi + 9\pi = 36$$

13. For what value of m will the graphs of the three lines $y = 2x + 1$, $x = 3$, and $y = mx + 3$ have a single point of intersection? Express your answer as a common fraction.

$$2x + 1 =$$

$$\left(\frac{4}{3}\right)$$

$$y = 2x + 1$$

$$x = 3$$

$$y = mx + 3$$

$$mx + 3 = 2x + 1$$

$$3m + 3 = 6 + 1$$

$$\frac{3m}{2} = \frac{4}{3}$$

14. The sequence A_n is such that $a_n = 2a_{n-1} + 1$. If $a_6 = 191$ and $a_5 = 95$, what is the value of a_2 ?

$$\begin{array}{r} 9 \\ 10 \end{array}$$

$$191 = 2a_5 + 1$$

$$\frac{190}{2} = 95 = a_5$$

$$95 = 2a_4 + 1$$

$$\frac{94}{2}$$

$$47 = a_4$$

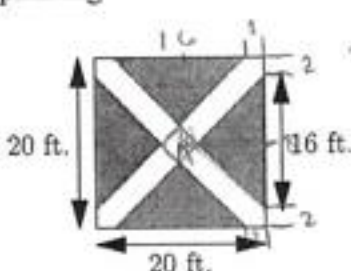
$$47 = 2a_3 + 1$$

$$46$$

$$23 = 2a_2 + 1$$

$$\frac{22}{2} = 11$$

15. A garden is laid out in the fashion shown in the diagram. If only the shaded isosceles triangles are used for planting, what is the total area, in square feet, that is to be used for planting?



$$8\sqrt{2} \times 4$$

$$2^2 + 1^2 = 5$$

$$32\sqrt{2}$$

$$2x^2 = 16^2$$

$$x^2 = 128$$

$$\sqrt{128}$$

$$16 \times 4$$

$$\frac{16}{4} = 4$$

$$16 \times 4 = 64$$

$$256$$

$$16 \times 8 = 128$$

$$8\sqrt{2}$$

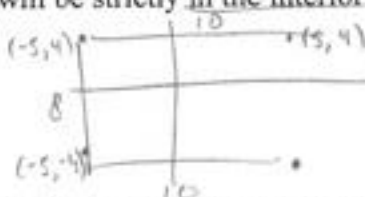
16. Consider the rectangular region with the following points as vertices:

$$(5, 4), (-5, 4), (-5, -4), (5, -4).$$

How many points with integer coordinates will be strictly in the interior of this rectangular region?

$$\sqrt{(5+5)^2 + (4-4)^2}$$

$$10$$



$$80$$

17. When a number is multiplied by its multiplicative inverse, the answer is 1. Find the multiplicative inverse, expressed as a common fraction, of the following:

$$\frac{1}{1 + \frac{1}{2}}$$

$$x = 1$$

$$\frac{1 + \frac{1}{2}}{1} = \frac{3}{2}$$

18. What is the mean of all three-digit numbers that can be created using each of the digits 1, 2, and 3 exactly once?

$$\begin{array}{r} 11 \\ 123 \\ 132 \\ 213 \\ 231 \\ 312 \\ 321 \\ \hline 1232 \end{array}$$

$$1 \quad 2 \quad 3$$

$$123, 132, 231, 213, 312, 321$$

$$\begin{array}{r} 272 \\ 6 \overline{) 1332} \\ \underline{12} \\ 13 \\ \underline{12} \\ 12 \end{array}$$

$$272$$

19. A log is cut into 4 pieces in 12 seconds using parallel slices. At the same rate, how many seconds will it take to cut the log into 5 pieces?



15 seconds

- * 20. Select four numbers from the table, selecting exactly one from each row and exactly one from each column. What is the sum of the four numbers that produce the least possible product?

3	5	7	14
15	8	6	4
2	9	10	11
13	12	15	1

41

11

22

22

21. Josh mowed one-third of a 2000-ft² lawn in 18 minutes. At the same rate, how many minutes would it take him to mow a 4200-ft² lawn? Express your answer to the nearest whole number.

$$\begin{array}{r} 4 \times 2 \\ 18 \\ \hline 336 \\ 42 \end{array}$$

75600

$$\begin{array}{r} 3 \overline{) 2000} \\ 18 \\ \hline 20 \\ 72 \\ \hline 20 \end{array}$$

$$666.6$$

$$666.6 \times \frac{2}{3}$$

$$\frac{2000}{18} =$$

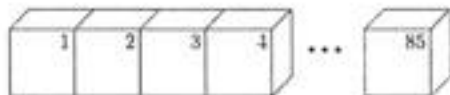
$$\frac{4200}{x}$$

$$2000 \overline{) 75600}$$

$$\begin{array}{r} 37.8 \\ 20 \overline{) 756} \\ 60 \\ \hline 156 \\ 140 \\ \hline 16 \end{array}$$

22. Eighty-five unit cubes are placed in a line such that they are joined face to face. Find the number of square units in the surface area of the resulting solid.

$$\begin{array}{r} 1 \times 85 \\ 4 \\ \hline 340 \end{array}$$



$$1 \times 85$$



$$85 + 85 + 85 + 85 + 1 + 1 + 85$$

23. Seven math students ordered \$15.00 worth of pizza. They split the cost as evenly as possible, so some students paid \$2.14 each, and the others paid \$2.15 each. How many students paid the lesser amount?

5

$$\begin{array}{r} 2.14 \\ 7 \overline{) 15.00} \\ 14 \\ \hline 10 \\ 7 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 2.14 \\ 5 \\ \hline 12.70 \\ 2.30 \\ \hline 00 \end{array}$$

$$\begin{array}{r} 2.15 \\ 2 \\ \hline 2.30 \end{array}$$

24. Zan has created this rule for generating sequences of whole numbers.

- If a number is 25 or less, double the number.
- If a number is more than 25, subtract 12 from it.

For example, if Zan starts with 10, she gets the sequence 10, 20, 40, 28, 16, ... If the third number in Zan's sequence is 36, what is the sum of the four distinct numbers that could have been the first number in her sequence?

$$36 + 48 + 60 + 72$$

$$+ 12$$

$$\begin{array}{r} 26 \\ + 48 \\ \hline 84 \\ + 60 \\ \hline 144 \end{array}$$

$$+ 137$$

$$144$$

25. The numbers on a standard six-faced die are arranged such that numbers on opposite faces always add to seven. The product of the numbers appearing on the four lateral faces of a rolled die is calculated (ignoring the numbers on the top and bottom). What is the maximum possible value of this product?

26. Find a number between 100 and 999 such that

- the sum of the digits is 12,
- the hundreds digit equals the sum of the tens and units digit, and
- one greater than the tens digit equals the hundreds digit.

651

27. Ben and Jerry each have a collection of toy animals. Ben collects only two-legged toy animals and Jerry collects only toy animals with four legs. Jerry has 10 more toy animals than Ben. There are 220 legs in their combined collections. How many toy animals does Jerry have?

$$\begin{aligned} 2x + 4y &= 220 \\ 2x + 4x - 40 &= 220 \\ 6x - 40 &= 220 \\ 6x &= 260 \\ x &= \frac{260}{6} \end{aligned}$$

$$\begin{aligned} y &= x - 10 \\ 2x + 4(x - 10) &= 220 \\ 2x + 4x - 40 &= 220 \\ 6x - 40 &= 220 \\ 6x &= 260 \\ x &= \frac{260}{6} \end{aligned}$$

28. If $\left(\frac{3}{2-x} + \frac{2}{y+3}\right) = 1$ and $\frac{2}{2-x} + \frac{8}{y+3} = 2$, what is the value of x ?

$$\begin{aligned} \frac{19}{10} &= \frac{3}{2-x} + \frac{2}{y+3} \\ \frac{6}{2-x} + \frac{4}{y+3} &= 1 \\ \frac{1}{2-x} + \frac{1}{y+3} &= \frac{1}{2} \\ \frac{1}{2-x} &= \frac{1}{2} - \frac{1}{y+3} \\ \frac{1}{2-x} &= \frac{y+3-2}{2(y+3)} \\ \frac{1}{2-x} &= \frac{y+1}{2(y+3)} \end{aligned}$$

29. There are 12 red marbles and 12 black marbles in a jar. What is the least number of marbles that must be removed so that the ratio of red to black marbles remaining in the jar is 4 to 3?

30. Susie has $5Q+1$ quarters, and Richard has $Q+5$ quarters. If they were to each exchange their quarters for the same amounts of money in dimes, how many more dimes than Richard would Susie have? Express your answer in terms of Q .

dime $\rightarrow 10$

$5Q+1$

$Q+5$

.25

.25

.25

$19 \left(\frac{.19}{.25} \right)$

$\frac{1}{10} \cdot \frac{1}{25}$