

$$\begin{array}{r} 205 \\ \times 1.6 \\ \hline 1230 \\ + 2050 \\ \hline 3280 \end{array}$$

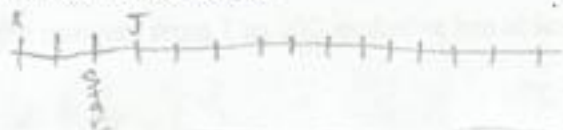
1. Each of three students received a portion of the prize money for a contest. Ann received 160% of the amount Jeff received, and Jeff received  $\frac{1}{4}$  of what Marcia received. Marcia received \$820. What was the total number of dollars of prize money?

$$\begin{aligned} j &= \frac{1}{4} m = 205 \\ m &= 820 \\ a &= 1.6 j = 328 \end{aligned}$$

$$\boxed{\$1353}$$

2. Joan and Kate are both standing at the beginning of a straight pathway and are both facing the same direction. One of Joan's steps is the same length as one of Kate's steps. If Joan takes two steps forward and one step back, and Kate takes three steps forward and five steps back, how many steps will Joan be ahead of Kate?

$$\begin{array}{r} 205 \\ + 820 \\ \hline 1025 \\ + 328 \\ \hline 1353 \end{array}$$



$$\boxed{3}$$

3. What is the sum of the number of faces, edges and vertices of a cube?

$$6 + 12 + 8$$

$$28 \checkmark$$

$$\boxed{26}$$

4. How many cubic units are in the volume of the rectangular prism shown?



$$\begin{array}{r} 336 \\ \times 50 \\ \hline 000 \\ + 1680 \\ \hline 16800 \end{array}$$

$$\left(6\frac{2}{3}\right)\left(3\frac{3}{7}\right)\left(2\frac{3}{16}\right)$$

$$\left(\frac{20}{3}\right)\left(\frac{24}{7}\right)\left(\frac{35}{16}\right)$$

$$\boxed{16500}$$

$$\begin{array}{r} 18 \\ \times 36 \\ \hline 108 \\ + 1080 \\ \hline 648 \end{array}$$

5. Eight women of different heights are at a party. Each woman decides to only shake hands with women shorter than herself. How many handshakes take place?

$$\begin{array}{r} 8250 \\ 2 \overline{) 16500} \\ \underline{1650} \\ 000 \\ \underline{000} \\ 000 \end{array}$$

$$\begin{array}{r} 820 \\ 16 \overline{) 1312} \\ \underline{128} \\ 32 \end{array}$$

$$\begin{array}{r} 4125 \\ 84 \overline{) 33800} \\ \underline{336} \\ 20 \end{array}$$

$$\begin{array}{r} 672 \\ + 84 \\ \hline 756 \end{array}$$

$$\begin{array}{r} 252 \\ + 336 \\ \hline 588 \end{array}$$

$$\begin{array}{r} 1375 \\ 28 \overline{) 38500} \\ \underline{364} \\ 210 \end{array}$$

$$\begin{array}{r} 1375 \\ 28 \overline{) 38500} \\ \underline{364} \\ 210 \end{array}$$

$$\begin{array}{r} 480 \\ \times 33 \\ \hline 1440 \\ + 14400 \\ \hline 15840 \end{array}$$

$$\begin{array}{r} 16500 \\ 116 \overline{) 131200} \\ \underline{1312} \\ 000 \end{array}$$

$$7+6=13$$

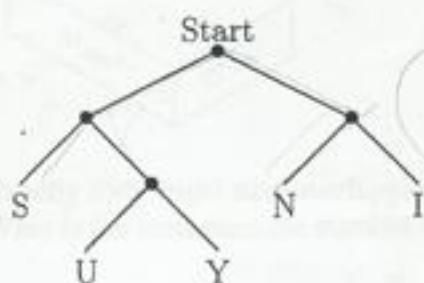
$$\begin{array}{r} 3724 \\ - 667 \\ \hline 3057 \end{array}$$

$$\boxed{6!}$$

$$\begin{array}{r} 21 \\ \times 116 \\ \hline 126 \\ + 2100 \\ \hline 2436 \end{array}$$

$$7+6+5=18$$

6. The tree below is used to convert strings of digits to words. In the string, "0" represents a left branch and a "1" represents a right branch. Notice "010" or left-right-left, gives the letter "U" and "10", or right-left, gives the letter "N". The strings for letters are placed side-by-side to build words. After you reach a letter in the string, return to "Start" and continue. The string "1110" represents "IN". What word does "000101010011" represent?



~~U N I N Y~~  
SUNNY

70 10  
79 10  
21

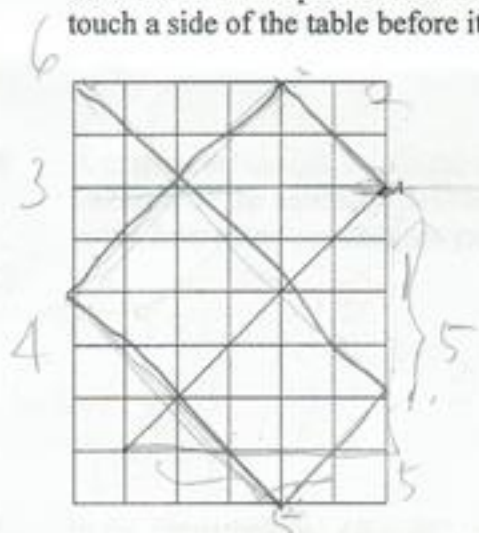
7. What percent of the integers from 1 to 100 inclusive has at least one digit that is a 7?

7, 17, 27, 37, 47, 57, 67, 77, 87, 97

100  
10%

90

8. A ball is shot from the lower left part of the table along a path of 45 degrees, as shown. After contact with a side, it continues along a path that is a reflection of the path prior to contact. The line of reflection is the line perpendicular to the side of the table the ball hit, at the point of contact. The first point of contact is labeled A. After initially shot, how many times will the ball touch a side of the table before it reaches a corner of the table?



6 times



33 40  
19 27  
48 15  
2

9. What is the sum of the fifth prime number, the sixth composite number, and the third perfect square?

11

1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97  
4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25, 26, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 40, 42, 44, 45, 46, 48, 49, 50, 51, 52, 54, 55, 56, 57, 58, 60, 62, 63, 64, 65, 66, 68, 69, 70, 72, 74, 75, 76, 77, 78, 80, 81, 82, 84, 85, 86, 87, 88, 90, 91, 92, 93, 94, 95, 96, 98, 99  
1, 4, 9, 16, 25, 36, 49, 64, 81, 100  
11 + 12 + 9 = 28

10. What is the greatest possible number of digits in the product of a 4-digit whole number and a 3-digit whole number?

6

9999  
999

(1000-1)(1000-1)





11. Three faces of a rectangular prism have the areas shown. What is the number of cubic centimeters in the volume of the rectangular prism?



12. Exactly forty-eight non-overlapping square tiles, each 1 inch by 1 inch, fit within a rectangle. What is the least possible number of inches in the perimeter of the rectangle?

$$\begin{aligned}
 6 \times 8 & \quad P = 28 \\
 4 \times 12 & \quad P = 32 \\
 3 \times 16 & \quad P = 38 \\
 2 \times 24 & \quad P = 52 \\
 1 \times 48 & \quad P = 98
 \end{aligned}$$

13. In a sequence, each term after the first is four more than three times the previous term. The fifth term is 403. What is the first term?

Handwritten work for problem 13:

$$\begin{aligned}
 & 432 \\
 & 3 \\
 & \text{---} \\
 & 3
 \end{aligned}$$

14. A graphic art designer's annual salary is a whole number of dollars between \$62,400 and \$62,600. If the hundreds, tens and units digits in her salary are all different and in descending order, how many possibilities exist for her salary?

Handwritten work for problem 14:

17

62

541, 540, 543, 542

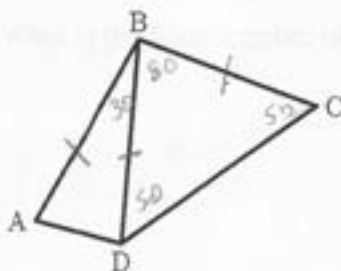
310

532, 531, 530

521, 520, 510

421, 420, 431, 410, 430

15. In the figure below,  $AB = BC$ ,  $m\angle ABD = 30^\circ$ ,  $m\angle C = 50^\circ$ , and  $m\angle CBD = 80^\circ$ . What is the number of degrees in the measure of angle A?



Handwritten work for problem 15:

$$75^\circ$$

Handwritten work for problem 15:

$$\begin{aligned}
 & 432 - 431 - 430 \\
 & 421 - 420 \\
 & 410 \\
 & 543 - 42 - 715 - 40 \\
 & 32 - 31 - 30 \\
 & 21 - 20 \\
 & 10
 \end{aligned}$$

16. What is the minimum number of United States coins Samantha needs (pennies, nickels, dimes, quarters, half-dollars) to ensure she is capable of making change for any amount of money from one cent to 99 cents?

40

1 Q  
2 D  
4 P  
1 H

1 A

= 100

17. What is the ratio of  $x$  to  $y$  given that  $4(5x+3y)=3(x+7y)$ ? Express your answer as a common fraction.

$$\frac{17}{9}$$

$$\frac{7x}{2}$$

$$20x + 12y = 3x + 21y$$

$$17x = 9y$$

18. The measures of the three angles of a triangle form an arithmetic sequence. If the smallest angle measures  $45^\circ$ , what is the number of degrees in the measure of the largest angle?

$$45 + 45 + x + 45 + 2x$$

$$75^\circ$$

$$45 + 45 + x + 45 + 2x$$

$$135 + 3x = 180$$

$$3x = 45$$

1 nickel  
4 pennies  
1 quarter  
1 half d.  
2 dimes

19. Solve for  $x$ :  $3^3 \times 9^3 \times 27^3 \times 81^3 = 9^{3^x}$

$$15$$

$$27^6 \quad 3^9 \quad 9^6$$

$$\begin{array}{r} 1545 \\ 30 \\ \hline 75 \end{array}$$

20. A jar contains 10 red, 7 blue and 5 yellow marbles. Blue marbles are then added in order to change the probability of randomly selecting a blue marble from the jar to "greater than  $\frac{1}{2}$ ." What is the least number of blue marbles that must be added?

$$3^3 \times 3^4 \times 3^9 \times$$

$$\frac{7}{22}$$

$$\frac{8}{73}$$

$$\frac{9}{24}$$

$$\frac{13}{26}$$

$$\frac{14}{28}$$

$$\frac{15}{30}$$

$$\frac{10}{25}$$

$$\frac{11}{22}$$

$$\frac{12}{24}$$

21. Evaluate  $\sqrt[3]{(7!)(7!)(8!)}$

Handwritten work for problem 21:  $2(7!)$ ,  $0800 \overline{) 6720}$ ,  $2 \times 3360$ ,  $0000$ ,  $2 \times 1680$ ,  $0000$ ,  $2 \times 840$ ,  $0000$ ,  $2 \times 420$ ,  $0000$ ,  $2 \times 210$ ,  $0000$ ,  $2 \times 105$ ,  $0000$ ,  $2 \times 52.5$ ,  $0000$ ,  $2 \times 26.25$ ,  $0000$ ,  $2 \times 13.125$ ,  $0000$ ,  $2 \times 6.5625$ ,  $0000$ ,  $2 \times 3.28125$ ,  $0000$ ,  $2 \times 1.640625$ ,  $0000$ ,  $2 \times 0.8203125$ ,  $0000$ ,  $2 \times 0.41015625$ ,  $0000$ ,  $2 \times 0.205078125$ ,  $0000$ ,  $2 \times 0.1025390625$ ,  $0000$ ,  $2 \times 0.05126953125$ ,  $0000$ ,  $2 \times 0.025634765625$ ,  $0000$ ,  $2 \times 0.0128173828125$ ,  $0000$ ,  $2 \times 0.00640869140625$ ,  $0000$ ,  $2 \times 0.003204345703125$ ,  $0000$ ,  $2 \times 0.0016021728515625$ ,  $0000$ ,  $2 \times 0.00080108642578125$ ,  $0000$ ,  $2 \times 0.000400543212890625$ ,  $0000$ ,  $2 \times 0.0002002716064453125$ ,  $0000$ ,  $2 \times 0.00010013580322265625$ ,  $0000$ ,  $2 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26. Given that  $9a^2 - 8b^2 = 1800$  and  $\frac{a}{b} = \frac{4}{3}$ , what is the value of the product  $ab$ ?

$$9a^2 - 8b^2 = 1800$$

$$9\left(\frac{4b}{3}\right)^2 - 8b^2 = 1800$$

$$12$$

$$9/16$$

$$4b = 3a$$

$$\frac{4b}{3} = a$$

$$\frac{4}{3}b = a$$

27. A bowl contains fewer than 50 marbles, and each is either red, green, or blue. The probability of drawing a red marble is  $\frac{2}{5}$  and the probability of drawing a green marble is  $\frac{3}{7}$ . If two marbles are drawn without replacement, what is the probability that both are blue? Express your answer as a common fraction.

$$\frac{b}{35}$$

$$x < 50$$

$$\frac{2}{5}$$

$$\frac{3}{7}$$

$$\frac{14}{35}$$

$$\frac{15}{35}$$

$$\frac{14}{35} \cdot \frac{15}{35} = \frac{21}{125}$$

28. The magic square shown is an array of the positive integers 1-25 such that the sum of the numbers in any row, any column, and any diagonal is the same. What is the value of  $n$  in the magic square?

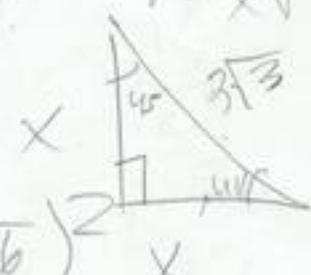
0	24	1	8	15
23		7	14	16
4	6	13		
10	12	$n$	21	3
11		25		9

$$+24$$

$$\frac{15}{45}$$

$$\frac{116}{08}$$

$$\frac{x\sqrt{2}}{\sqrt{2}} = \frac{3\sqrt{3}}{\sqrt{2}}$$

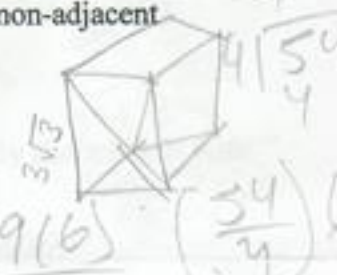


$$51+x = x = \frac{3\sqrt{3}}{\sqrt{2}}$$

$$8+x = 116+n$$

29. What is the number of square inches in the surface area of a cube with a space diagonal of length  $3\sqrt{3}$  inches? (A space diagonal of polyhedron is a segment connecting two non-adjacent vertices that do not lie on the same face of the polyhedron.)

$$6 \cdot 3\sqrt{3}$$



30. The sum of the first twenty-one terms of an arithmetic series is 273. The fifth term is 7. What is the 49th term?

$$7$$

$$21 \quad 273$$

$$\frac{3}{2}$$

$$82$$