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?

$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?
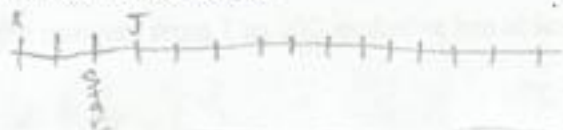
3

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

$6 + 12 + 8$

26

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

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

$6\frac{2}{3}$

$2\frac{3}{16}$

$3\frac{3}{7}$

16500

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?

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?

Start

S       N    I

U    Y

*[handwritten: SUNNY]*
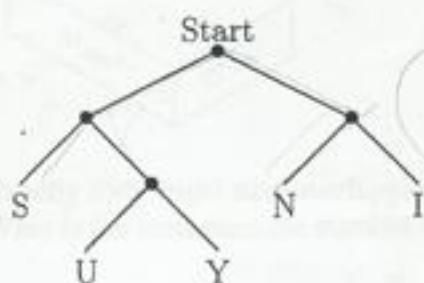
*[handwritten: 70 / 79 / 10 / 10 / 21]*

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

*[handwritten: 7,17, 27, 37, 47, 57, 67, 71,73,87,97]*

*[handwritten: 10/100 (10%)]*

*[handwritten: 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?

*[handwritten: 6 times]*
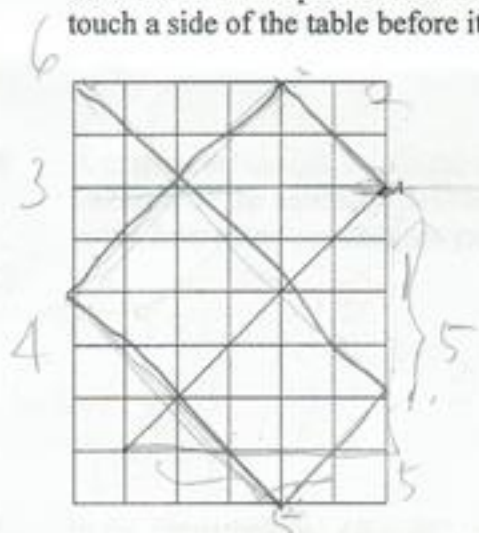
*[handwritten: 33 40 48 27 9 15 2]*

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

*[handwritten: 1,2,3, 5, 7  4,6,8, 9, 10, 12 10]*

*[handwritten: 11]*

*[handwritten: 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?

*[handwritten: 9999 / 999]*

*[handwritten: 6]*

*[handwritten: (1000-1)(10000-1)]*

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?

70 cm²
30 cm²
21 cm²

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?

$6 \times 8 \quad P = 28$
$4 \times 12 \quad P = 32$
$3 \times 16 \quad P = 38$
$2 \times 24 \quad P = 52$
$1 \times 48 \quad P = 98$

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?

432
3

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?

17
62

541  540
.543
542

30

532
531
530

521
520
510

421
.432  420
431  410
430

15. In the figure below, $AB = BC$, $m\angle ABD = 30°$, $m\angle C = 50°$, and $m\angle CBD = 80°$. What is the number of degrees in the measure of angle $A$?
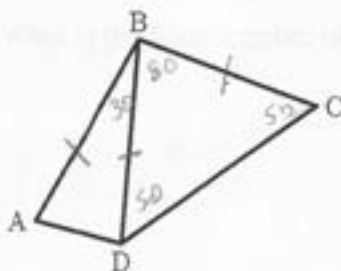
B
80
35
50
50
A
D
50 C

75°

432 - 431 - 430
421 - 420
410

543 - 42 - 71 - 40
32 - 31 - 30
21 - 20
10

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?

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

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

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

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?

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

*[handwritten work:]*

$2(7!)$

$2!,$

22. Evaluate $\dfrac{1}{2!+1}+\dfrac{2}{3!-1}+\dfrac{3}{4!+1}$. Express your answer as a common fraction.

*[handwritten work:]*

$\dfrac{1}{3}+\dfrac{2}{5}+\dfrac{3}{25}$

$\dfrac{13}{25}$

$\dfrac{25}{75}+\dfrac{39}{75}=\dfrac{64}{75}$

Ans $\dfrac{64}{75}$

23. A square is divided into three congruent rectangles. Then, it is divided diagonally as shown. If the area of the shaded trapezoid is 24 square centimeters, how many centimeters are in the perimeter of the original square?

*[handwritten work:]*

$\dfrac{1}{2}\cdot\dfrac{x}{3}(x)=24$

$x^2=144$

$x=12$

$12$

24. If $a:b:c=3:5:6$ and $c:d=1:5$, then what is the ratio of $b$ to $d$? Express your answer as a common fraction.

*[handwritten work:]*

$\dfrac{1}{6}$

$5/6$

$\dfrac{b}{c}=\dfrac{5}{6}$   $\dfrac{c}{d}=\dfrac{1}{5}$

25. The length of a rectangle is increased by 25%. To keep the area of the rectangle the same, by what percent must the width be decreased?

*[handwritten work:]*

$1.25$   $0$   $20$

26. Given that $9a^2 - 8b^2 = 1800$ and $\dfrac{a}{b} = \dfrac{4}{3}$, what is the value of the product $ab$?

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

$9\left(\dfrac{16}{9}\right) - 8b^2 = 1800$

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

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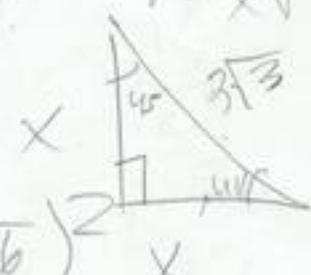
| 0  | 24 | 1  | 8  | 15 |
|----|----|----|----|----|
| 23 |    | 7  | 14 | 16 |
| 4  | 6  | 13 |    |    |
| 10 | 12 | n  | 21 | 3  |
| 11 |    | 25 |    | 9  |

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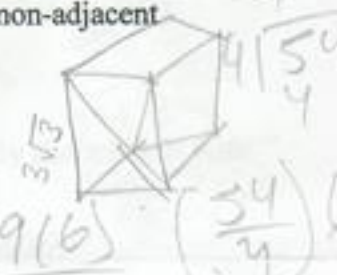
30. The sum of the first twenty-one terms of an arithmetic series is 273. The fifth term is 7. What is the 49th term?