

ARITHMETIC REASONING REVIEW

The Arithmetic Reasoning section in the ASVAB includes basic math processes like addition, subtraction, multiplication, and division, and applying these computational operations to solve simple math problems you come across in everyday life. The ability to perform basic math operations and to use computational skills to solve simple math problems is needed for activities at work, school, or home; in shopping and banking; or engaging in social, community, or recreational activities.

A concise review of basic arithmetic follows. It is provided to refresh your memory about basic math operations and give you practice for the math word problems that are on the ASVAB.

Review of Basic Arithmetic

Whole Numbers

| | |
|----------------|----------------------|
| 1. | One |
| 10. | Ten |
| 100. | One hundred |
| 1,000. | One thousand |
| 10,000. | Ten thousand |
| 100,000. | One hundred thousand |
| 1,000,000. | One million |
| 10,000,000. | Ten million |
| 100,000,000. | One hundred million |
| 1,000,000,000. | One billion |

Always start counting from the decimal point. Note that the value of a digit increases when the digit is moved to the left. Each time it is moved farther to the left of the decimal point, the value of a digit is multiplied by ten. To make it easier to read great numbers (numbers containing four or more digits), commas are placed every three spaces as you go left from the decimal point.

If the decimal point is not shown with the whole number, it is understood to be just to the right of the last digit on the right.

24 means 24. 12,528 means 12,528.

Decimals

| | |
|----------|------------------------|
| 0.1 | One tenth |
| 0.01 | One hundredth |
| 0.001 | One thousandth |
| 0.0001 | One ten-thousandth |
| 0.00001 | One hundred-thousandth |
| 0.000001 | One millionth |

Always start counting from the decimal point. Note that the value of a digit decreases when the digit in a decimal is moved to the right. The value of the digit is divided by ten each time it is moved one place farther to the right of the decimal point.

Decimals are also known as decimal fractions, since the denominator is a tenth, hundredth, thousandth, etc.

$$0.1 \text{ is } \frac{1}{10} \quad 0.01 \text{ is } \frac{1}{100} \quad 0.001 \text{ is } \frac{1}{1000}$$

Fractions

A fraction is a number that indicates one or more equal parts. A fraction has a *numerator*, a *division line*, and a *denominator*.

$$\frac{1}{4} \quad \text{or} \quad 1/4$$

The bottom number (*denominator*) shows the number of equal parts into which the whole has been divided.

The top number (*numerator*) shows how many of these equal parts are in the fraction.

A *proper fraction* has a numerator that is less than the denominator. It is also called a *common fraction* or *fraction*.

$$1/3 \text{ or } \frac{1}{3} \quad 3/4 \text{ or } \frac{3}{4} \quad 7/9 \text{ or } \frac{7}{9}$$

An *improper fraction* has a numerator that is equal to or greater than the denominator.

$$3/3 \text{ or } \frac{3}{3} \quad 9/8 \text{ or } \frac{9}{8} \quad 16/15 \text{ or } \frac{16}{15}$$

Subtraction

Subtraction is indicated by the subtraction sign ($-$), the word *minus*, the words *take away*, or the words *find the difference between*. There are three parts to a subtraction problem:

Minuend: Placed on the top of the vertical subtraction. It is the number from which another number is taken away.

Subtrahend: Placed below the minuend in vertical subtraction. It is the number that is taken away.

Difference or remainder: Result of the subtraction or what is left. This result is put at the bottom in vertical subtraction.

| | |
|-------------|-------------------------|
| 581 | minuend |
| <u>-350</u> | subtrahend |
| 231 | difference or remainder |

Subtracting Whole Numbers, Decimals, and Dollars and Cents

As with addition, the numbers in the subtraction are arranged in vertical columns. Units must be placed directly under units, tens under tens, hundreds under hundreds, etc. If there are decimals, place the decimal point directly under the decimal point, tenths under tenths, hundredths under hundredths, etc.

| | | | |
|-------------|------------|---------------|----------------|
| 576 | 385 | 87.647 | \$743.65 |
| <u>-342</u> | <u>-57</u> | <u>-8.350</u> | <u>-418.45</u> |
| 234 | 328 | 79.297 | \$325.20 |

Note that in vertical subtraction of dollars and cents, the \$ is placed to the left of the minuend and to the left of the answer.

Multiplication

Multiplication is indicated by the multiplication sign (\times), the word *multiply*, or the word *times*. There are three main parts to multiplication problems:

1. *Multiplicand*: Number being multiplied.
2. *Multiplier*: Number by which you multiply.
3. *Product*: Answer obtained by multiplying the multiplicand by the multiplier.

| | | | |
|------------------------------|--------------|-------------------------------|------------------------------------|
| 12 | multiplicand | 483 | multiplicand |
| <u>$\times 9$</u> | multiplier | <u>$\times 24$</u> | multiplier |
| 108 | product | 1932 | partial product (4×483) |
| | | <u>966</u> | partial product (2×483) |
| | | 11592 | product |

Division

Division is indicated by the division sign (\div), the fraction sign ($\frac{\quad}{\quad}$ or $/$), the words *divided by*, the short-division symbol $\overline{) \quad}$, or the long-division symbol $\overline{) \quad}$. Division problems have four parts:

1. *Dividend*: Number being divided.
2. *Divisor*: Number by which you divide.
3. *Quotient*: Answer to division.
4. *Remainder*: Number that is left if division is not exact.

Dividing Whole Numbers

If the divisor is a single-digit number, use either short division or long division. If the divisor has more than one digit, use long division.

Short division

| | | |
|---------|---------------------|----------|
| Divisor | $3 \overline{)867}$ | Dividend |
| | 289 | Quotient |

1. 8 divided by 3 is 2 with a remainder of 2, change 6 to 26.
2. Record the 2 in the quotient under 8.
3. 26 divided by 3 is 8 with a remainder of 2, change 7 to 27.
4. Record the 8 in the quotient under 6.
5. 27 divided by 3 is 9 exactly.

To check if the division is correct, multiply the quotient by the divisor. If no error was made, the product should be the same as the dividend.

Check: 289

$$\begin{array}{r} \times 3 \\ \hline 867 \end{array}$$

Long division:

$$\begin{array}{r} 35 \\ 26 \overline{)910} \\ \underline{-78} \\ 130 \\ \underline{-130} \\ 0 \end{array}$$

Check: 48.13

$$\begin{array}{r} \times 8 \\ \hline 385.04 \end{array}$$

To divide by a decimal, first rename the divisor as a whole number by moving the decimal point to the right of the last digit on the right. Then move the decimal point in the dividend to the right the same number of places. If necessary, add zeros. Finally, complete the division as you ordinarily would with a whole number as a divisor.

| | | |
|--------------|---------------|-------------|
| $.6)2.4$ | is changed to | $6)24$ |
| $.6)24.$ | is changed to | $6)240$ |
| $2.4)3.12$ | is changed to | $24)31.2$ |
| $2.46)3.198$ | is changed to | $246)319.8$ |
| $.005)30.$ | is changed to | $5)30000$ |

Note that in all the above changes, the quotient is unchanged as both the divisor and the dividend are multiplied by the same amount.

Decimal division is also used when the division involves dollars and cents or just cents alone.

$$\frac{\$9.60}{3} = \$3.20 \quad \frac{\$.75}{15} = \$.05$$

Note that when dollars or cents are divided by a number, the answer is in dollars or cents.

$$\frac{\$150}{\$5} = 30 \quad \frac{\$5.50}{\$25} = 22$$

Note that when dollars are divided by dollars or when dollars and cents are divided by dollars and cents, the answer is a number.

Multiplication

6. Multiply 36

$$\times 8$$

The product is

- 6-A 246
6-B 262
6-C 288
6-D 368
7. Multiply 312.77 by .04 and round the result to the nearest hundredth.
- 7-A 12.51
7-B 12.511
7-C 12.518
7-D 12.52

Division

8. Divide $5 \overline{)455}$

The quotient is

- 8-A 81
8-B 84
8-C 91
8-D 94
9. $7.95 \div 0.15 =$
- 9-A 0.53
9-B 5.3
9-C 53
9-D 530

Additional Sample Arithmetic Problems Encountered in Everyday Life

10. Which of the following amounts of money has the greatest value?
- 10-A 3 quarters
10-B 8 dimes
10-C 15 nickels
10-D 79 pennies

11. Two weeks, five days plus three weeks, four days equals
- 11-A 5 weeks, 1 day.
 - 11-B 5 weeks, 2 days.
 - 11-C 6 weeks, 1 day.
 - 11-D 6 weeks, 2 days.
12. Subtract: 2 feet, 4 inches
 -1 foot, 6 inches
- 12-A 8 inches
 - 12-B 10 inches
 - 12-C 1 foot
 - 12-D 1 foot, 2 inches
13. Of the 36 students registered in a class, $\frac{2}{3}$ of them are females. How many males are registered in the class?
- 13-A 12
 - 13-B 18
 - 13-C 24
 - 13-D 30
14. If a 200-mile trip takes 4 hours to complete, the average speed is
- 14-A 30 miles per hour.
 - 14-B 40 miles per hour.
 - 14-C 50 miles per hour.
 - 14-D 60 miles per hour.
15. How many pounds are in 24 ounces?
- 15-A $\frac{1}{2}$
 - 15-B 1
 - 15-C $1\frac{1}{2}$
 - 15-D 2
16. The sales tax of 8% on a purchase of \$12 is
- 16-A \$0.86
 - 16-B \$0.96
 - 16-C \$1.06
 - 16-D \$1.60

17. A dozen oranges cost \$1.35. The cost per orange is most nearly
- 17-A 11¢
 - 17-B 12¢
 - 17-C 13¢
 - 17-D 14¢
18. A \$75 fund is available for a holiday party. If 75% of the available money is spent for food and beverages, how much is left for other expenses?
- 18-A \$18.75
 - 18-B \$28.75
 - 18-C \$46.25
 - 18-D \$56.25
19. A certain employee is paid at the rate of \$6.74 per hour with time-and-a-half for overtime. The regular work week is 40 hours. During the past week, the employee put in 44 working hours. What were the employee's gross wages for that week?
- 19-A \$269.60
 - 19-B \$296.56
 - 19-C \$310.04
 - 19-D \$444.84
20. It takes 4 men 14 days to do a certain job. How long should it take 7 men working at the same rate to do the same job?
- 20-A 5 days
 - 20-B 6 days
 - 20-C 7 days
 - 20-D 8 days
21. If one quart of floor wax covers 400 square feet, how many gallons of wax are needed to wax the floor of a 6,400-square-foot office?
- 21-A 4 gallons
 - 21-B 8 gallons
 - 21-C 12 gallons
 - 21-D 16 gallons
22. A pole 15 feet high casts a shadow 5 feet long. A 6-foot man standing nearby would cast a shadow
- 22-A $1\frac{1}{2}$ feet long.
 - 22-B 2 feet long.
 - 22-C $2\frac{1}{2}$ feet long.
 - 22-D 3 feet long.

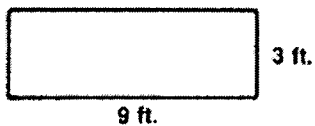
23. If 1 foot of chain costs 17¢, then 4 yards of this chain would cost
- 23-A \$0.68
 - 23-B \$1.53
 - 23-C \$2.04
 - 23-D \$2.75
24. Tires regularly priced at \$44 each are on sale for \$37. How much would a truck owner save by buying four tires at the sale price?
- 24-A \$7
 - 24-B \$28
 - 24-C \$49
 - 24-D \$81
25. How many 32-passenger buses are needed to transport 180 persons?
- 25-A 4
 - 25-B 5
 - 25-C 6
 - 25-D 7
26. If a service station greased 270 vehicles in a 31-day period, the daily average of vehicles greased is most nearly
- 26-A 6
 - 26-B 7
 - 26-C 8
 - 26-D 9
27. To check on a shipment of 500 articles, a sampling of 50 articles was carefully inspected. Of the sample, 4 articles were defective. On this basis, what is the probable percentage of defective articles in the original shipment?
- 27-A .04%
 - 27-B 4%
 - 27-C 8%
 - 27-D 10%
28. If the total area of a four-room apartment is 3,600 square feet, the average area of each room is
- 28-A $\frac{1}{4}$ of the total area.
 - 28-B $\frac{1}{3}$ of the total area.
 - 28-C $\frac{1}{2}$ of the total area.
 - 28-D $\frac{3}{4}$ of the total area.

Geometry

Area, Perimeter, and Volume

Area

Area is the space enclosed by a plane (flat) figure. A *rectangle* is a plane figure with four right angles. Opposite sides of a rectangle are of equal length and are parallel to each other. To find the area of a rectangle, multiply the length of the base of the rectangle by the length of its height. Area is always expressed in square units.

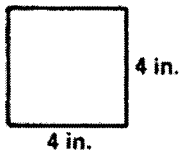


$$A = bh$$

$$A = 9 \text{ ft.} \times 3 \text{ ft.}$$

$$A = 27 \text{ sq. ft.}$$

A *square* is a rectangle in which all four sides are the same length. The area of a square is found by squaring the length of one side, which is exactly the same as multiplying the square's base by its height.

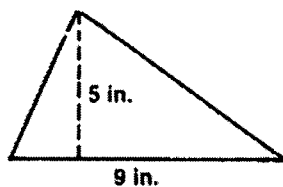


$$A = s^2$$

$$A = 4 \text{ in.} \times 4 \text{ in.}$$

$$A = 16 \text{ sq. in.}$$

A *triangle* is a three-sided plane figure. The area of a triangle is found by multiplying the base by the altitude (height) and dividing by two.



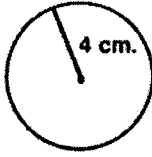
$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2}(9 \text{ in.})(5 \text{ in.}) = \frac{45}{2}$$

$$A = 22\frac{1}{2} \text{ sq. in.}$$

A *circle* is a perfectly round plane figure. The distance from the center of a circle to its rim is its radius. The distance from one edge to the other through the center is its diameter. The diameter is twice the length of the radius.

Pi (π) is a mathematical value equal to approximately 3.14 or $\frac{22}{7}$. Pi is frequently used in calculations involving circles. The area of a circle is found by squaring the radius and multiplying it by π .



$$A = \pi r^2$$

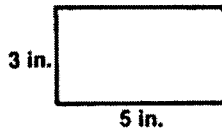
$$A = \pi(4 \text{ cm.})^2$$

$$A = 16\pi \text{ sq. cm.}$$

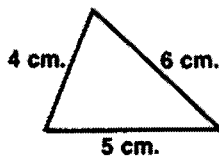
You may leave the area in terms of pi unless you are told what value to assign π .

Perimeter

The perimeter of a plane figure is the distance around the outside. To find the perimeter of a polygon (a plane figure bounded by straight lines), just add the lengths of the sides.

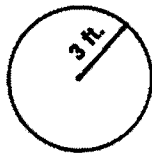


$$\begin{aligned} P &= 3 \text{ in.} + 5 \text{ in.} + 3 \text{ in.} + 5 \text{ in.} \\ &= 16 \text{ in.} \end{aligned}$$



$$\begin{aligned} P &= 4 \text{ cm.} + 6 \text{ cm.} + 5 \text{ cm.} \\ &= 15 \text{ cm.} \end{aligned}$$

The perimeter of a circle is called the *circumference*. The formula for the circumference of a circle is πd or $2\pi r$, which are both, of course, the same thing.

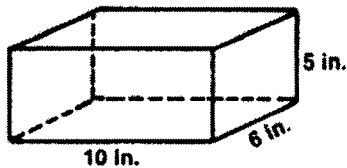


$$C = 2 \cdot 3 \cdot \pi = 6\pi$$

Volume

The volume of a solid figure is the measure of the space within. To figure the volume of a solid figure, multiply the area of the base by the height or depth.

The volume of a rectangular solid is length \times width \times height. Volume is always expressed in cubic units.

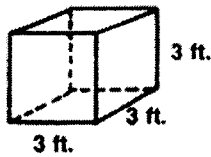


$$V = lwh$$

$$V = (10 \text{ in.})(6 \text{ in.})(5 \text{ in.})$$

$$V = 300 \text{ cu. in.}$$

The volume of a cube is the cube of one side.

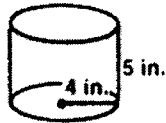


$$V = s^3$$

$$V = (3 \text{ ft.})^3$$

$$V = 27 \text{ cu. ft.}$$

The volume of a cylinder is π times the square of the radius of the base times the height.



$$V = \pi r^2 h$$

$$V = \pi(4 \text{ in.})^2 (5 \text{ in.})$$

$$V = \pi(16)(5) = 80\pi \text{ cu. in.}$$

Sample Questions

Here are sample questions dealing with area, perimeter, and volume. Explanatory answers are located at the end of the Arithmetic Reasoning section.

29. A floor that is 9 feet wide and 12 feet long measures how many square feet?

- 29-A 12
- 29-B 21
- 29-C 108
- 29-D 118

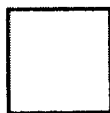
30. The area of a room measuring 12 feet by 15 feet is

- 30-A 9 square yards.
- 30-B 12 square yards.
- 30-C 15 square yards.
- 30-D 20 square yards.

31. The circumference of a circle that has a radius of 70 feet is most nearly

- 31-A 220 feet.
- 31-B 440 feet.
- 31-C 660 feet.
- 31-D 690 feet.

32. Find the perimeter of the following square.



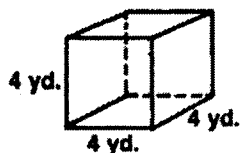
1 in.

- 32-A 1 inch
- 32-B 2 inches
- 32-C 3 inches
- 32-D 4 inches

33. A swimming pool has an average depth of 4 feet and is 25 feet long and 15 feet wide. What is the volume of the pool?

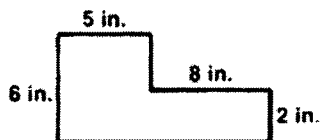
- 33-A 375 cubic feet
- 33-B 1,000 cubic feet
- 33-C 1,500 cubic feet
- 33-D 4,500 cubic feet

34. Find the volume of the following cube.



- 34-A 12 cubic yards
- 34-B 16 cubic yards
- 34-C 46 cubic yards
- 34-D 64 cubic yards

35. Find the perimeter of the following figure.



- 35-A 21 inches
- 35-B 25 inches
- 35-C 33 inches
- 35-D 38 inches

Answers and Explanations

- 1-B The sum of the two numbers is 124.

$$\begin{array}{r} 75 \\ +49 \\ \hline 124 \end{array}$$

- 2-D Arrange the five amounts in proper vertical columns and add. The sum is \$271.88.

$$\begin{array}{r} \$51.75 \\ 172.50 \\ 39.00 \\ 8.54 \\ + 0.09 \\ \hline \$271.88 \end{array}$$

- 3-B Arrange numbers in proper vertical columns and then subtract. The difference is 47,949.

$$\begin{array}{r} 57,697 \\ -9,748 \\ \hline 47,949 \end{array}$$

- 4-A Arrange numbers in proper vertical columns and then subtract. The difference is \$593.47.

$$\begin{array}{r} \$1581.06 \\ -987.59 \\ \hline \$593.47 \end{array}$$

- 5-A This question consists of an addition and a subtraction. The sum of the first two amounts is \$103.61. \$25.75 from \$103.61 gives us an answer of \$77.86.

$$\begin{array}{r} \$72.07 \\ +31.54 \\ \hline \$103.61 \\ -25.75 \\ \hline \$77.86 \end{array}$$

- 6-C The product of the two numbers is 288.

$$\begin{array}{r} 36 \\ \times 8 \\ \hline 288 \end{array}$$

- 7-A** Multiply the two numbers and fix the decimal point in the answer to conform with the total number of digits to the right of the decimal points in both the multiplicand and the multiplier. Round off the product to the nearest hundredth.

$$\begin{array}{r} 312.77 \\ \times .04 \\ \hline 12.5108 \end{array}$$

- 8-C** This is simple short division, and the quotient is 91.

$$\begin{array}{r} 5)455 \\ \hline 91 \end{array}$$

- 9-C** Rename the divisor as a whole number and move the decimal point in the dividend the same number of places to the right. Complete the division. The quotient is 53.

$$\begin{array}{r} 0.15 \overline{)7.95} = \\ \underline{15} \overline{)795} \\ \underline{-75} \\ 45 \\ \underline{-45} \\ 0 \end{array}$$

- 10-B** By computing the value of the coins in each option, we find that choice B has the greatest value.

$$3 \times 25\text{¢} = 75\text{¢}$$

$$8 \times 10\text{¢} = 80\text{¢}$$

$$15 \times 5\text{¢} = 75\text{¢}$$

$$79 \times 1\text{¢} = 79\text{¢}$$

- 11-D** The sum of the two time periods is 5 weeks and 9 days, which is equivalent to 6 weeks and 2 days.

$$\begin{array}{r} 2 \text{ weeks, } 5 \text{ days} \\ +3 \text{ weeks, } 4 \text{ days} \\ \hline 5 \text{ weeks, } 9 \text{ days} \end{array}$$

- 12-B** Two feet, four inches is equal to one foot, 16 inches. This amount less one foot, six inches equals 10 inches.

$$\begin{array}{r} 1'16'' \\ -1'6'' \\ \hline 10'' \end{array}$$

13-A Two thirds of 36 is 24, the number of females. This number subtracted from 36 gives the number of males.

14-C Dividing the distance (200) by the number of hours (4) gives the average speed.

15-C There are 16 ounces in a pound; therefore, 24 ounces would be equivalent to one pound, 8 ounces or $1\frac{1}{2}$ pounds.

16-B 8% of \$12 is 96 cents.

$$\begin{array}{r} \$ 12 \\ \times .08 \\ \hline \$.96 \end{array}$$

17-A The price of a dozen oranges divided by 12 gives the cost per orange. \$.1125 to the nearest cent is 11¢.

$$\begin{array}{r} .1125 \\ 12 \overline{)1.3500} \\ \underline{-12} \\ 15 \\ \underline{-12} \\ 30 \\ \underline{-24} \\ 60 \\ \underline{-60} \\ 0 \end{array}$$

18-A The amount of money spent is .75 times \$75, which equals \$56.25. The fund available minus the amount spent equals the amount left. \$75 minus \$56.25 = \$18.75.

19-C $1\frac{1}{2} \times 6.74 = \10.11

$$\begin{array}{r} \$6.74 \text{ times } 40 \text{ equals } \$269.60 \\ \$10.11 \text{ times } 4 \text{ equals } \underline{+40.44} \\ \$310.04 \end{array}$$

20-D 4 men times 14 days equals 56 man-days

7 men times ? equals 56 man-days

56 divided by 7 = 8.

- 21-A** There are four quarts to a gallon. Therefore, 16 quarts divided by 4 equals 4 gallons.
- 22-B** The correct answer is 2 feet.
- $$15 : 5 :: 6 : x$$
- $$15x = 30$$
- $$x = 2$$
- 23-C** The correct answer is \$2.04.
- $$4 \text{ yards} = 12 \text{ feet}$$
- $$1 : .17 :: 12 : x$$
- $$x = 2.04$$
- 24-B** \$44 minus \$37 equals \$7, the savings on each tire.
- $$\$7 \text{ times } 4 \text{ equals } \$28, \text{ the savings on four tires.}$$
- 25-C** The number of persons to be transported divided by the number of persons the bus can carry will give the number of buses needed. 180 divided by 32 equals 5.6.
- 26-D** The number of vehicles greased divided by the number of days gives the daily average $270/31 \approx 8.71$. The correct answer is 9.
- 27-C** If 4 out of 50 sampled articles were defective, the fraction $4/50$ multiplied by 100 equals the percentage of defective articles in the sampling. Because 8% of the articles in the sample were defective, the probable percentage of defective articles in the original shipment would also be 8%.
- 28-A** The total area divided by the number of rooms gives the average area of each room. As there are four rooms, the total area divided by four gives the average area of each room.
- 29-C** $9 \text{ feet} \times 12 \text{ feet} = 108 \text{ square feet.}$
- 30-D** $12 \text{ feet} = 4 \text{ yards; } 15 \text{ feet} = 5 \text{ yards; } 4 \times 5 = 20 \text{ square yards.}$
- 31-B** Perimeter or circumference = $2\pi r$; $r = 70 \text{ feet; } P = 2 \times \frac{22}{7} \times 70$;
- $$P = 440 \text{ feet.}$$
- 32-D** Each side is 1 inch. Perimeter = $1 + 1 + 1 + 1 = 4 \text{ inches.}$
- 33-C** The volume is obtained by multiplying length times width times depth—25 feet times 15 feet times 4 feet. The answer is 1,500 cubic feet.
- 34-D** The volume of the cube is the cube of one side. $V = (4 \text{ yds.})^3$. $V = 64 \text{ cubic yards.}$
- 35-D** The perimeter = $5 + (6 - 2) + 8 + 2 + 13 + 6 =$
- $$5 + 4 + 8 + 2 + 13 + 6 = 38 \text{ inches.}$$