

Whole Numbers

Order of Operations

All math problems are based on formulas. Many formulas in industry rely on the idea that everyone does the computations the same way. When a formula involves more than one operation, everyone must agree on the order in which they are done.

A standard Order of Operations has been established so everyone using a certain formula will get the same result.

In other words; if there were no established way to find the result, it would be possible for three people to get three different answers to the same problem!

For example: We must multiply first $(3 \times 4) + 2 = 12 + 2 = 14$

But if we add first, we get... $3 \times (4 + 2) = 3 \times 6 = 18$

Vocabulary:

Formula: A method or procedure

Parentheses: ()

Brackets: []

Braces: { }

Exponent: The *power* to which a number or variable is raised

Multiplication and Division

Addition and Subtraction

Expressions: Symbols that represent numbers or operations.

1. **P**arentheses: Do any operations enclosed by parentheses (), brackets [], or braces { } first. If there are more than one set, such as brackets within parentheses, work from the inside out.
2. Exponents (raised to the **P**ower): Find the value of any exponential values.
3. **M**ultiplication and **D**ivision: If multiplication and division occur next to each other, work from right to left. If they do not occur next to each other, do them at the same time.
4. **A**ddition and **S**ubtraction: This is the last operation and simply work from right to left.

PDE Academic Standards:

2.1.11. A, (Anchors: M11.A.1.1; M11.A.1.2; M11.A.1.3; M11.A.2.1; M11.A.2.2), 2.2.11.A, (M11.A.3.2); 2.4.11.E; 2.5.11. A, B, C, D; 2.9.11.J

Remember:

Pretty **P**lease **M**y **D**ear **A**unt **S**ally

(From left to right; **P**arentheses; **P**ower; **M**ultiply; **D**ivide; **A**dd, **S**ubtract)

Example 1: John wants to add additional space to his inspection bay. The bay measures 24 ft x 24ft. The addition will measure 12 ft x 12 ft. How many square feet will the new bay be?

$$24^2 + 12^2 =$$

$$24^2 = 276sq.ft.$$

$$12^2 = 144sq.ft.$$

$$276sq.ft. + 144sq.ft. = 720sq.ft.$$

Example 2: Jean's electronic temperature gauge is broken; it only reads Celsius (C), but her service manual specifications are in (F). The temperature the of coolant she is measuring is 90° C. What is the temperature in F?

$$F = \left(\frac{9C}{5}\right) + 32$$

$$C = \frac{5(F - 32^{\circ})}{9}$$

Example 3: What is the temperature of the coolant in Celsius if 96° Fahrenheit?

Example 4: Yvonne would like to start her own business she'll need \$100,000 to get started. How much will she have to save each month at 5% monthly interest (.05) to start her business in five years?

PMT = Regular Payment Amount, A = Accumulated Balance, ARP =Annual Percentage Rate, n = Number of Payment Periods Per Year, Y =Years

$$PMT = A \frac{\left(\frac{ARP}{n}\right)}{\left[\left(1 + \frac{ARP}{n}\right)^{(nY)} - 1\right]}$$
$$PMT = A \frac{\left(\frac{.05}{12}\right)}{\left[\left(1 + \frac{.05}{12}\right)^{(12*5)} - 1\right]}$$

Example 5: Carly needs a new car! She has \$2000 for a down payment for a 2003 VW Jetta that she can purchase for \$12,000, including tax and tags. What will monthly payment be at 7.2% APR% for a 4 year loan?

P = Starting Principal

PMT = Regular Payment Amount

$$PMT = \frac{P \times \left(\frac{APR}{n}\right)}{\left[1 - \left(1 + \frac{APR}{n}\right)^{(-nY)}\right]}$$

$$PMT = \frac{10,000 \times \left(\frac{.072}{12}\right)}{\left[1 - \left(1 + \frac{.072}{12}\right)^{(-12 \times 4)}\right]}$$

Example 6: Jimmy wants to fill a 3 inch diameter by 8 inch high glass cylinder with M&Ms. He needs to find out how many bags of candy he'll have to purchase. Each bag of M&Ms is 5" long x 3" wide x 1" tall (deep).

Volume of a cube x^3 Example: the volume of a box 2" square is 8 inches cubed I.E. (2^3)

Volume of a rectangular box: $V = lwh$ (Length x Width x Depth)

Example: The volume of a rectangular box 4" x 5" x 2" is 40 inches cubed ($40in^3$)

The volume of a cylinder: $V = \pi r^2 h$

Example: The volume of a cylinder 6" in diameter and 8" tall is:

$$V = \pi \times 3^2 \times 8$$

$$V = 3.14 \times 3^2 \times 8$$

$$V = 226.194$$

Let's find an answer to Jimmy's problem...

- What is the volume of a bag of candy?
- What is the volume of the cylinder?
- How many bags are needed to fill the cylinder?

Challenge problem for the quick:

Estimate the volume of a single M&M ($1/2" \times 1/2" \times 1/4"$).

There are about 50 M&Ms per package. Calculate how many packages are needed if the container is 4" in diameter and 7" high.

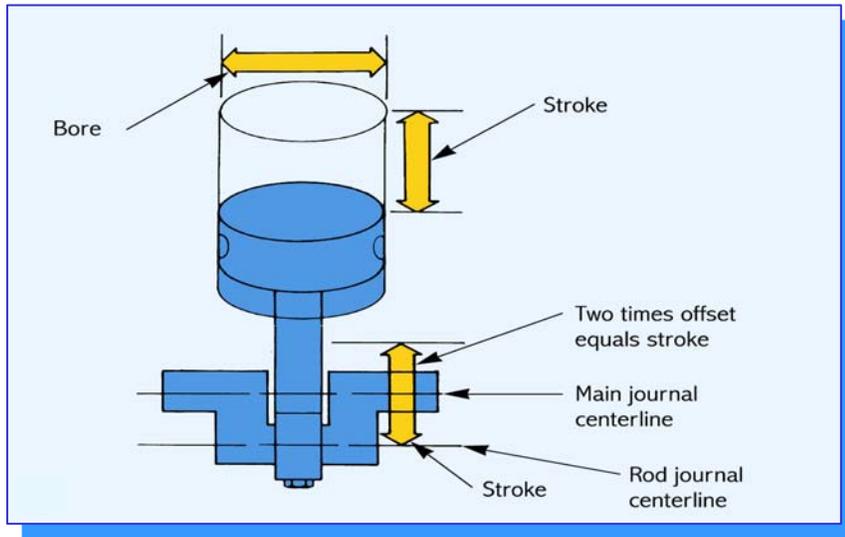
Example 7: Clyde needs to determine the cubic inch displacement of a small block V-8 engine. The formula to determine the cubic displacement of an engine is:

Volume the piston displaces as it travels from BDC to TDC
 Found by comparing cylinder diameter and piston stroke

$$\text{Engine Displacement} = (\text{number of cylinders}) \times \pi \times \left(\frac{1}{2} \times \text{bore}\right)^2 \times \text{stroke}$$

OR

$$\text{Engine Displacement} = (\text{number of cylinders}) \frac{\text{Bore}^2 \times \pi \times \text{stroke}}{4}$$



Let's say we had a bore of 4 inches, a stroke of 3 inches...what would be the size of one cylinder?

What if you had a V8 engine?

$$\frac{4^2 \times \pi \times 3}{4} = \frac{16 \times 3.14 \times 3}{4} = \frac{150.72}{4} = 37.68$$

$$37.68 \times 8 \text{ cylinders} = 301.44^3$$

Example 8: $6 + 2 \times 3 \div (7 - 4) + 5 =$

Example 9: $240 \div (18 + 6 \times 2) - 2$

North Montco Technical Career Center
Math-In-CTE

Worksheet – Whole Numbers/Order of Operations

Name: _____ AM-1: _____ PM _____ Date: _____

Please show all your work!

1. A painter orders 3 gallons of white latex paint for \$18 a gallon and 5 gallons of white oil-based enamel for \$20 a gallon. Write out a mathematical statement giving the total cost of the paint and calculate the amount of money spent to purchase the paint.

2. On a certain landscaping job, Steve charged a customer \$468 for labor and \$90 each for 8-flats of plants. Write out a single mathematical statement giving the total cost of this job and calculate the cost.

3. An electrician purchased 12 dimmer switches at \$11 each and received a \$9 credit for each of the five power outlets he returned. Write out a mathematical statement that gives the amount he spent and cost, then calculate the total.

4. $54 \div (8 - 3 \times 2)$

5.
$$\frac{36 - (7 - 4)}{5 + 3 \times 2}$$

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Homework – Whole Numbers/Order of Operations

Name: _____ AM-1: _____ PM _____ Date: _____

Please show all your work!

1. Find the piston displacement for a 4-cylinder engine with a $3\frac{3}{4}$ " bore and a $3\frac{1}{2}$ " stroke. Convert fractions to decimals.

2. Find the increase in Piston Displacement if an 8-cylinder engine with a 3.25" bore and a 3.75" stroke is increased to a 3.50" bore.

3. Find the volume of a cylinder with a diameter of 36 inches and a height of 6 inches.

4. A masonry contractor is preparing an estimate for building a stone wall and gate. He estimates the job will take a 40-hour work week to complete. He plans to have two laborers at \$10/hr and three masons at \$18/hr. He'll need \$2140 worth of materials and wishes to make a profit of \$500. Write out a mathematical statement that gives the amount of the job; then calculable the total

5. At the beginning of the day on Monday, the parts department has on hand 520 spark plugs. Technicians in the service department estimate they need about 48 plugs per day. A new shipment of 300 will arrive on Thursday. Write out a mathematical statement that gives the number of plugs in hand on Friday. Calculate the total.

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6. What is the temperature of the water in Celsius if 150° Fahrenheit?

7. James has always wanted to go on a cruise to the Caribbean islands. The cruise cost \$3500.00, plus he'll need an additional \$1500.00 to cover other costs—such as sight seeing tours, souvenirs, etc.

a. How much will James have to save each week (52 weeks in a year) at 4% monthly interest (.04) to take the cruise in three years?

b. Four years?

PMT = Regular Payment Amount, A = Accumulated Balance, ARP = Annual Percentage Rate
n = Number of Payment Periods Per Year, Y = Years

$$PMT = A \frac{\left(\frac{ARP}{n}\right)}{\left[\left(1 + \frac{ARP}{n}\right)^{(nY)} - 1\right]}$$

8. $(4 \times 3 + 8) \div 5$

9. $\frac{36 - 27}{9 - 6}$

10. $18 \div (3 \times 2)$