

## Math Skills Needed for Conceptual Physics

NOTE: Conceptual Physics is an applied math class. If your student struggles in math, more than likely they will struggle in conceptual physics.

### Big Picture:

1. Understand place value.
2. Know your multiplication facts.
3. Know how to add, subtract, multiply, and divide fractions.
4. Know how to add, subtract, multiply, and divide negative numbers.

### PRE-ALGEBRA Skills:

5. Know the order of operations:
  - 1<sup>st</sup>: parentheses
  - 2<sup>nd</sup>: exponents
  - 3<sup>rd</sup>: multiply/divide (whichever operation comes first, left to right)
  - 4<sup>th</sup>: add/subtract (whichever operation comes first, left to right).
6. Understand reciprocal or inverse.  
The inverse of 2 is  $\frac{1}{2}$ . The inverse of  $\frac{1}{3}$  is 3
7. Understand Greatest Common Multiple (GCM) and Least Common Factor (LCF).
8. Know how to average a set of numbers.
9. Know how to add, subtract, multiply, and divide decimals.
10. Be able to convert from a % to a decimal and from a decimal to a %.

PRE-ALGEBRA, ALGEBRA I, and ALGEBRA II Skills:

11. Understand that the 'number one' can be written as a fraction of two equal values like  $2.5\text{cm} = 1\text{ inch}$ , therefore  $2.5\text{cm}/1\text{ inch} = 1$ . Any number multiplied by such a fraction (that equals one) is the same number.

Ex.  $1/3 \times 6/6 = 6/18$  which still equals  $1/3$ .

Ex.  $5\text{cm} \times (1\text{ inch}/2.5\text{cm}) = 2\text{ inches}$ . Therefore,  $5\text{cm} = 2\text{ inches}$ .

12. Understand metric prefixes and be able to convert from one metric unit to another.  $100\text{ cm} = 1\text{ m}$

13. Understand exponents.  $A^2 = A \times A$      $4 = 2^2$      $8 = 2^3$      $9 = 3^2$

$$10^6 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1,000,000$$

$$(1/2)^3 = 1/2 \times 1/2 \times 1/2 = 1/8$$

14. Know what to do with exponents when multiplying or dividing.

$$2 \times 10^3 \times 12 \times 10^2 = 24 \times 10^{(3+2)} = 24 \times 10^5$$

$$(12 \times 10^4) / (6 \times 10^2) = 2 \times 10^{(4-2)} = 2 \times 10^2$$

15. Understand scientific notation.

$$3.16 \times 10^4 = 31,600$$

$$3.16 \times 10^{-4} = 0.000316$$

ALGEBRA I and ALGEBRA II Skills:

16. Be comfortable using your scientific calculator correctly.

ALGEBRA I Skills:

17. Understand negative exponents.  $A^{-2} = 1 / A^2$

$$10^{-6} = 1 / (10 \times 10 \times 10 \times 10 \times 10 \times 10) = 0.000001$$

18. Understand how to read and obtain information from a table and from a line graph.

19. Draw a graph. Give it a title, axis labels (with units), decide its scale, etc.

20. Find the slope of a line from a graph.

21. Know Pythagorean's theorem and how to use it.  $a^2 + b^2 = c^2$

22.  $A = B/C$

Given any two of the three variables, solve for the third.

$$C = B/A$$

$$B = AxC$$

23.  $F = \frac{m(v_2 - v_1)}{t}$

Solve for  $v_2$ :  $Ft = m(v_2 - v_1)$

$$\frac{Ft}{m} = (v_2 - v_1)$$

$$\frac{Ft}{m} + v_1 = v_2$$

#### ALGEBRA II Skills:

24. Understand the concept of 'directly proportional' - as one variable increases, so does the other variable. Ex. the sale of new automobiles in the city is directly proportional to the income of the families in the city.

25. Understand the concept of 'inversely proportional' - as one variable increases, the other variable decreases. Ex. the older a person gets, the slower he runs.

26. Adding vectors by component (x, y) and by graph.

27. Understand square roots:  $d = \frac{1}{2} vt^2$

$$t^2 = \frac{2d}{v}$$

$$t = \sqrt{2d/v}$$