Math Required for Physics 2414

A complete understanding of physics requires both a qualitative and a quantitative ability to solve problems. Some students find physics difficult because they do not feel comfortable with the mathematics required. I recommend that you spend some time on your own during the first week of classes reviewing the mathematics required for this class. Appendix A and Appendix B in the back of your textbook is a good starting place. You should have a good understanding of exponents, scientific notation and powers of ten, significant figures, algebra, solving simultaneous linear equations, logarithms, quadratic equations, plane geometry, and trigonometry. The following is an exercise to help you determine how much review you may need. **If you can not solve <u>all</u> of these problems easily and quickly, your math skills are probably not adequate to succeed in Physics 2414.**

1. Write the following numbers using scientific notation.
   a. 983244.6
   b. 0.000435
   c. $(4.6 \times 10^{8})(9.3 \times 10^{9})$
   d. $(3.0 \times 10^{7})(6.0 \times 10^{-12})$
   e. $\dfrac{(75 \times 10^{-11})}{(5.0 \times 10^{-3})}$
   f. $\dfrac{(3 \times 10^{6})(8 \times 10^{-2})}{(2 \times 10^{17})(6 \times 10^{5})}$

2. Solve the following equations for x.
   a. $a = 1/(1+x)$
   b. $3x - 5 = 13$
   c. $ax - 5 = bx + 2$
   d. $\dfrac{5}{2x+6} = \dfrac{3}{4x+8}$

3. Solve the following equations.
   a. $3^2 \times 3^3$
   b. $x^5 \, x^{-8}$
   c. x^{10} / x^{-5}
   d. $5^{1/3}$
   e. $(x^4)^3$

4. Solve the following quadratic equations.
   a. $x^2 = 4$
   b. $x^2 + 2x - 3 = 0$
   c. $2x^2 - 4x - 9 = 0$

5. Solve for the two variables in the following simultaneous equations. (*It is essential that you can do these types of problems quickly and easily*).
   a. $5x + y = -8$
      $2x - 2y = 4$
   b. $98 - T = 10a$
      $T - 49 = 5a$
   c. $3s = 15 + 3v$
      $2s = 3 - 5v$
   d. $6x + 2y = 6$
      $8x - 4y = 28$

6. Solve the following equations for θ.

a. $\cos\theta = 0.32$

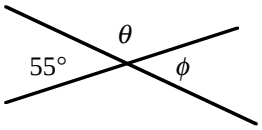
b. $\sin \theta/2 = 0.8$

c. $\sin^2\theta = 0.45$

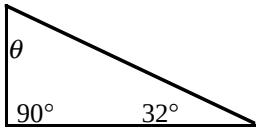
d. $\sin\theta = \cos\theta$

7. In each of the following diagrams, determine the unknown angles θ and/or ϕ (figures are not drawn to scale).

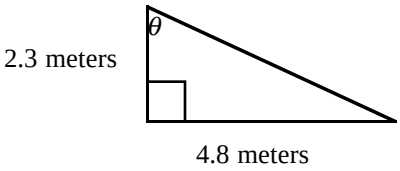
a.



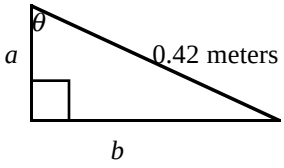
b.



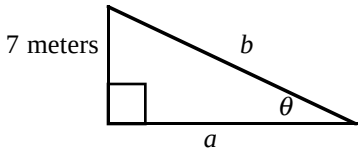
8. Determine $\sin\theta$, $\cos\theta$, and $\tan\theta$ in the following right triangle. The lengths of two of the sides are given.



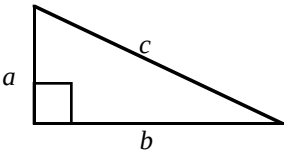
9. Determine the lengths of the sides a and b in the following triangle if $\cos\theta = 0.29$.



10. Determine the lengths of the sides a and b in the following triangle if $\sin\theta = 0.44$.



11. What is the length of the sides a if $b = 4.00$ cm and $c = 6.00$ cm?



ANSWERS: 1a: 9.832446×10^5, 1b: 4.35×10^{-4}, 1c: 4.3×10^{18}, 1d: 1.8×10^{-4}, 1e: 1.5×10^{-7}, 1f: 2×10^{-18},
2a: $x = (1-a)/a$, 2b: $x = 6$, 2c: $x = 7/(a - b)$, 2d: $x = -11/7$, 3a: 243, 3b: x^{-3}, 3c: x^{15}, 3d: 1.71, 3e: x^{12}
4a: $x = +2$ or $x = -2$, 4b: $x = 1$ or $x = -3$, 4c: $x = 1 + \sqrt{22}/2$ or $x = 1 - \sqrt{22}/2$,
5a: $x = -1$, $y = -3$, 5b: $T = 65$, $a = 3.3$, 5c: $s=4$, $v=-1$, 5d: $x = 2$, $y = -3$,
6a: $\theta = 71°$, 6b: $\theta = 106°$, 6c: $\theta = 42°$, 6d: $\theta = 45°$, 7a: $\theta = 125°$, $\phi = 55°$, 7b: $\theta = 58°$,
8: $\sin\theta = 0.90$, $\cos\theta = 0.43$, $\tan\theta = 2.1$, 9: $a = 0.12$ m, $b = 0.40$ m, 10: $a = 14$ m, $b = 16$ m,
11: $a = \sqrt{20}$ cm = 4.47 cm