Homework No. 01 (Spring 2026)

PHYS 205A-001: UNIVERSITY PHYSICS

School of Physics and Applied Physics, Southern Illinois University–Carbondale
Due date: Friday, 2026 Jan 16, Noon, on D2L

Instructions

- You are encouraged to use any of the resources to complete this homework. However, the extent to which you depend on resources while doing this homework is a measure of how much extra work you need to put in to master the associated concepts. Solutions should be the last resource.

- Links to solutions are provided.

- Practice problems are available at Binapani Academy. It is a free service and requires a one-time registration. (Code: SIUC2025)

- Describe your thought process in detail and organize it clearly. Make sure your answer has units and right number of significant digits.

- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assessments → Assignments). You can replace your PDF file as many times as you like. Only the last file is graded. The deadline has an (undisclosed) buffer period, so do not hesitate to try submissions after the deadline.

Problems

1. (**10 points.**) The corners of a square lie on a circle of radius R. Find the area of the square as a function of R.

   [**Solution**]

2. (**10 points.**) What can you deduce about the physical quantity c in the famous equation

   $$E = mc^2, \tag{1}$$

   if the energy E has the dimensions ML^2T^{-2} and mass m has the dimension M. In particular, what is the dimension of c? That is, given

   $$[c] = M^\alpha L^\beta T^\gamma, \tag{2}$$

   determine α, β, and γ.

   [**Solution**]

3. (**10 points.**) Consider the mathematical expression

$$x = vt + \frac{1}{2!}at^2 + \frac{1}{3!}bt^3 + \frac{1}{4!}ct^4, \tag{3}$$

where x is measured in units of distance and t is measured in units of time. Determine the dimension of the physical quantity represented by the symbol b. That is, given

$$[b] = M^\alpha L^\beta T^\gamma, \tag{4}$$

determine α, β, and γ.

[**Solution**]

4. (**10 points.**) Consider the mathematical expression

$$x = Ae^{-\omega t}, \tag{5}$$

where x is measured in units of distance and t is measured in units of time. Evaluate $\frac{dx}{dt}$. Then, determine the dimension of ωA. That is, given

$$[\omega A] = M^\alpha L^\beta T^\gamma, \tag{6}$$

determine α, β, and γ.

[**Solution**]

5. (**10 points.**) Complete the operations and express your answer in scientific notation with correct number of significant digits.

   (a) 345×72

   (b) $55 \div 11$

   (c) $34.3456 + 42.1$

   (d) $46.32 - 56.92345$

   (e) $15600 - 12$

[**Solution**]