

General Physics I–Honors: PHYS 101H (Fall 2023)
Quiz 2

Chris Monahan
William & Mary

Instructions

In this quiz you will apply your understanding of dimensional analysis and problem solving techniques in physics. Read the following instructions carefully.

DO NOT TURN OVER THIS SHEET UNTIL INSTRUCTED.

Please write your name on the quiz.

You have ten minutes to attempt all three multiple-choice questions in this quiz. Indicate your answer clearly by **circling** the correct option.

You may use electronic calculators.

You may **not** use:

- any formula sheets or notes;
- electronic devices, including phones, tablets and laptops (unless previously arranged);
- textbooks or other reference resources;
- course notes or slides.

You may (or may not) find the following table of Taylor series helpful:

$$\begin{aligned}\frac{1}{1+x} &= \sum_{n=0}^{\infty} x^n &&= 1 - x + x^2 - x^3 + \dots \\ \ln(1+x) &= \sum_{n=1}^{\infty} (-1)^{n-1} \frac{x^n}{n} &&= x - \frac{x^2}{2} + \frac{x^3}{3} + \dots \\ e^x &= \sum_{n=0}^{\infty} \frac{x^n}{n!} &&= 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \dots \\ \sin x &= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!} &&= x - \frac{x^3}{6} + \frac{x^5}{120} + \dots \\ \cos x &= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n}}{(2n)!} &&= 1 - \frac{x^2}{2} + \frac{x^4}{24} + \dots \\ \arctan x &= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{2n+1} &&= x - \frac{x^3}{3} + \frac{x^5}{5} + \dots \\ (1+x)^m &= \sum_{n=0}^{\infty} \binom{m}{n} x^n &&= 1 + mx + \frac{m(m+1)}{2} x^2 + \dots\end{aligned}$$

Question 1**4pts**

Write down the three key equations (one each for position, velocity, and acceleration) for a particle undergoing **freefall in one dimension**. Be sure to define all symbols and include your definition of the positive direction of any vectors.

Question 2**4pts**

Explain the difference between the **dot** (or scalar) product and the **cross** (or vector) product of two different vectors. Your answer should be expressed using complete sentences and may include equations.

Question 3**2pts**

Which of the following statements about a particle undergoing **uniform circular motion** is true? Circle the correct response.

- (a) The speed of the particle changes.
- (b) The velocity of the particle changes.
- (c) The magnitude of the acceleration of the particle changes.