

Physics 1 For Physicists - Common HW Mistakes

December 5, 2022

Homework 3 - Common Mistakes

Question 1

1. Read the question properly! In 1B a lot of students calculated $\vec{r} \times \frac{d\vec{r}}{dt}$ correctly, but then did not calculate the time derivative, i.e. $\frac{d}{dt}(\vec{r} \times \frac{d\vec{r}}{dt})$.
2. In 1B, when calculating the cross product of two vectors, the outcome is also a vector! Don't forget to keep this in mind for future calculations.

Question 2

1. When calculating angular velocity ($\dot{\phi}$) and angular acceleration (α), the units should be $\frac{rad}{sec}$ and $\frac{rad}{sec^2}$ respectively. Some students wrote units of $\frac{m}{sec}$ and $\frac{m}{sec^2}$ which is wrong.

Question 3

1. Almost everyone answered this question without writing any explanations alongside the solution. A full solution must include explanations for the physical considerations that were used throughout the answer.

For example, most of the students did manage to find the correct phrase for x:

$$x = -R \cos(\phi) \pm \sqrt{L^2 - R^2 \sin^2(\phi)}$$

but did not explain why only the square root with the positive sign:

$$x = -R \cos(\phi) + \sqrt{L^2 - R^2 \sin^2(\phi)}$$

is the relevant solution.

It is also crucial to explain why in the final answer for the location of point A, the phrase above seems to be multiplied by -1 :

$$\vec{A} = (R \cos(\phi) - \sqrt{L^2 - R^2 \sin^2(\phi)}, 0)$$

2. In the beginning of the question, you must define in what coordinate system you are working. Once you have defined one, be sure that the angle ϕ is in respect to the positive x axis.
3. Once you have found the location of point, i.e. \vec{A} , you should always make sure that your answer makes sense. For example, if you defined the origin to be located at point O, then it is easy to see that for $\omega t = 0$, your answer should yield

$$\vec{A} = (R - L, 0)$$

and for $\omega t = \pi$, your answer should yield

$$\vec{A} = -(R + L, 0)$$

if your answer doesn't match your expectation, than it can be a great idea to revisit your solution and find out why have you got it wrong.

4. Some students found a final answer with no L in the phrase. This immediately seems wrong and therefore you must revisit your solution to find the mistake.

Question 5

1. When calculating the radius of curvature R , most students wrote the following expression as their final answer:

$$R = \frac{\alpha^2}{\beta t^2}$$

It is important to remember that final answers should include only parameters given in the question. Here, in this question, t is not given and therefore you need to express it with the given parameters, as follows:

$$t = \sqrt{\frac{2s}{\alpha}}$$

plugging it into R one gets:

$$R = \frac{\alpha^3}{2\beta s}$$

This is also true for the final answer of $|\vec{a}|$.