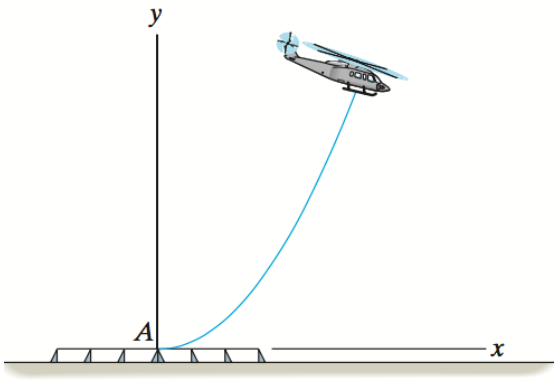
Quiz 01: Chapter 12

Due: Tuesday 23 Jan 24

Examine the solved problem below. There are four errors in the solution below. Your task is to locate and identify those errors, then correct them and calculate the proper result. If the same error occurs more than once, only count it as a single error, even if you have to correct it in more than one instance.

Each correctly identified error is worth 4 points, and the re-calculated result is worth 4 points as well. You must save your work in pdf format and submit via the Quiz 01 Assignment in the Chapter 12 folder in the Quizzes folder of the Online Classroom in Blackboard. Please do not use any other file format than pdf.

The flight path of the helicopter as it takes off from A is defined by the parametric equations $x = (2t^2)\text{m}$ and $y = (0.04t^3)\text{m}$, where t is the time in seconds. Determine the distance (not the displacement!) the helicopter is from point A and the magnitudes of its velocity v and acceleration a when $t = 10\text{s}$.



A) Calculate the x– and y–coordinates of the helicopter when $t = 10\text{s}$.

$$x = (2t^2)\text{m} = [2(10)]^2\text{m} = 400\text{m}$$
$$y = (0.04t^3)\text{m} = [0.04(10)]^3\text{m} = 40\text{m}$$

B) Calculate the distance d from point A:

$$d = \sqrt{x^2 + y^2} = \sqrt{(400\text{m})^2 + (40\text{m})^2} = 402\text{m}$$

C) Calculate the velocity components v_x and v_y at $t = 10\text{s}$.

$$v_x = \dot{x} = 4t = 4(10) = 40\tfrac{\text{m}}{\text{s}}$$

$$v_y = \dot{y} = 1.2t^2 = 1.2(10)^2 = 120\tfrac{\text{m}}{\text{s}}$$

D) Calculate the magnitude v and direction θ_v of the velocity.

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{\left(40\tfrac{\text{m}}{\text{s}}\right)^2 + \left(120\tfrac{\text{m}}{\text{s}}\right)^2}$$
$$v = \sqrt{16{,}000}\tfrac{\text{m}}{\text{s}} = 126\tfrac{\text{m}}{\text{s}}$$

$$\theta_v = \tan^{-1}\left(\frac{v_x}{v_y}\right) = \tan^{-1}\left(\frac{40}{120}\right)$$
$$\theta_v = 18.4°$$

E) Calculate the acceleration components a_x and a_y at $t = 10\text{s}$.

$$a_x = \ddot{x} = 4\tfrac{\text{m}}{\text{s}^2}$$

$$a_y = \ddot{y} = 2.4t = 2.4(10) = 24\tfrac{\text{m}}{\text{s}^2}$$

F) Calculate the magnitude a and direction θ_a of the acceleration.

$$a = \sqrt{a_x^2 + a_y^2} = \sqrt{\left(4\tfrac{\text{m}}{\text{s}^2}\right)^2 + \left(24\tfrac{\text{m}}{\text{s}^2}\right)^2}$$
$$a = \sqrt{592}\tfrac{\text{m}}{\text{s}^2} = 24.3\tfrac{\text{m}}{\text{s}^2}$$

$$\theta_a = \tan^{-1}\left(\frac{a_y}{a_x}\right) = \tan^{-1}\left(\frac{24}{4}\right)$$
$$\theta_a = 1.41°$$