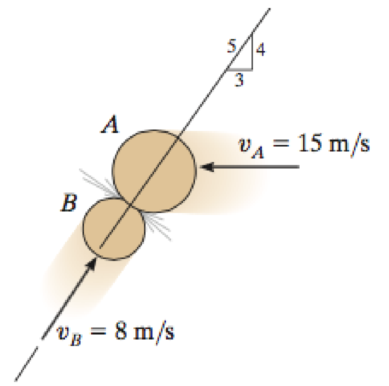
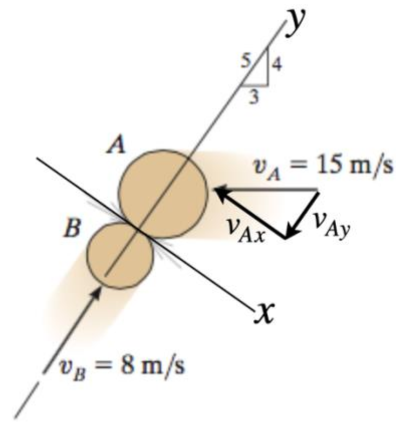
Quiz 10: Chapter 15 Due: Friday 24 Feb 23

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 results are worth 4 points as well. You must save your work in pdf format and submit via the Quiz 10 Assignment in the Chapter 15 folder of the in the Quizzes folder in the Online Classroom in Blackboard. Please do not use any other file format than pdf.

Two smooth disks A ($m_A = 4\text{kg}$) and B ($m_B = 2\text{kg}$) have the initial velocities shown just before they collide. Determine their speeds just after impact if the coefficient of restitution is $e = 0.8$.





A) Write velocity vectors $\overrightarrow{v_A}$ and $\overrightarrow{v_B}$ just before the collision:

$$\overrightarrow{v_A} = \left(15\frac{\text{m}}{\text{s}}\right)\left[-\frac{3}{5}\hat{\mathbf{i}} - \frac{4}{5}\hat{\mathbf{j}}\right] = (-9\hat{\mathbf{i}} - 12\hat{\mathbf{j}})\frac{\text{m}}{\text{s}}$$

$$\overrightarrow{v_B} = \left(8\frac{\text{m}}{\text{s}}\right)\hat{\mathbf{j}}$$

B) Conserve momentum in the x–direction:

$$\sum p_{0x} = \sum p_{1x}$$

$$m_A v_{Ax} + m_B v_{Bx} = m_A v_{Afx} + m_B v_{Bfx}$$

$$(4\text{kg})\left(-9\frac{\text{m}}{\text{s}}\right) + 0 = (4\text{kg})v_{Afx} + (2\text{kg})v_{Bfx}$$

$$-36 = 4v_{Afx} + 2v_{Bfx}$$

C) Apply coefficient of restitution in the x–direction:

$$e = \frac{v_{Afx} - v_{Bfx}}{v_{Bx} - v_{Ax}} \qquad 0.8 = \frac{v_{Afx} - v_{Bfx}}{0 - (-9)}$$

D) Solve the system:

Using Wolfram α:

$$-36 = 4v_{Afx} + 2v_{Bfx} \qquad v_{Afx} = -8.4\frac{\text{m}}{\text{s}}$$

$$-7.2 = v_{Afx} - v_{Bfx} \qquad v_{Bfx} = -1.2\frac{\text{m}}{\text{s}}$$

E) Conserve momentum in the y–direction:

$$\sum p_{0y} = \sum p_{1y}$$

$$m_A v_{Ay} + m_B v_{By} = m_A v_{Afy} + m_B v_{Bfy}$$

$$(4\text{kg})\left(-12\frac{\text{m}}{\text{s}}\right) + (2\text{kg})\left(8\frac{\text{m}}{\text{s}}\right) = (4\text{kg})v_{Afy} + (2\text{kg})v_{Bfy}$$

$$-32 = 4v_{Afy} + 2v_{Bfy}$$

F) Apply coefficient of restitution in the y–direction:

$$e = \frac{v_{Afy} - v_{Bfy}}{v_{By} - v_{Ay}}$$

$$0.8 = \frac{v_{Afy} - v_{Bfy}}{-12 - (+8)}$$

$$-16 = v_{Afy} - v_{Bfy}$$

G) Solve the system:

Using Wolfram α:

$$-32 = 4v_{Afy} + 2v_{Bfy} \qquad v_{Afy} = -10.7\frac{\text{m}}{\text{s}} \qquad \overrightarrow{v_A} = (-8.4\hat{\mathbf{i}} - 10.7\hat{\mathbf{j}})\frac{\text{m}}{\text{s}}$$

$$-16 = v_{Afy} - v_{Bfy} \qquad v_{Bfy} = -5.33\frac{\text{m}}{\text{s}} \qquad \overrightarrow{v_B} = (-1.2\hat{\mathbf{i}} - 5.33\hat{\mathbf{j}})\frac{\text{m}}{\text{s}}$$