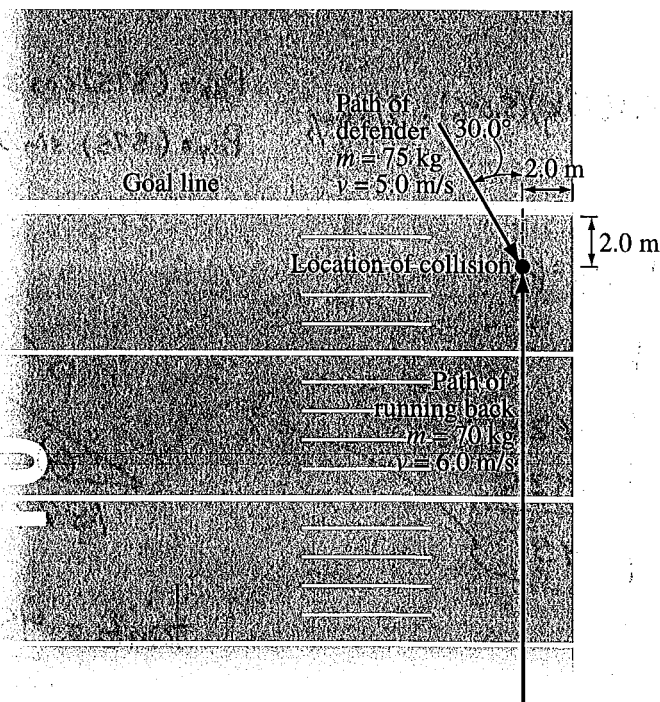


Summative Assessment Items

Two-dimensional Vector Skills Written Response

Use the following information to answer this two-dimensional vector-skills question.

In a high school championship football game, a running back is carrying the football north, running 2 m from the sidelines toward the end zone. The defending team's safety sees the running back coming in and runs toward him. The velocities and masses of the two players are shown in the diagram below.



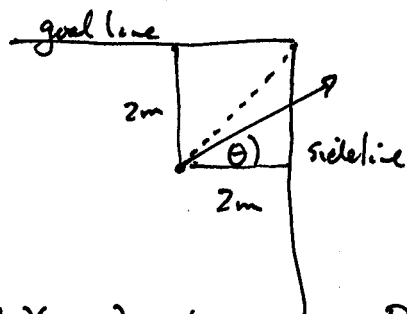
Written Response—10 marks

1. **Determine** if the running back scores a touchdown by crossing the goal line or if the defender knocks him out of bounds before crossing the goal line. In your response, **sketch** an arrow showing the expected path of the two players immediately after the collision, **explain** how you determined the direction, **sketch** a vector addition diagram consistent with the vector analysis method you choose, and state all necessary physics principles and formulas.

Marks will be awarded based on your vector diagrams, the physics that you use, and on the mathematical treatment that you provide.

my thinking...

- Collision occurs at one corner of a 2×2 m box



- if the angle θ is smaller than 45° , the two will land out of bounds ... greater than 45° = cross the goal line.
- So need to calc θ .

$$m_r = 70 \text{ kg} \\ v_r = 6.0 \text{ m/s} [90^\circ] \rightarrow p_r = (70 \text{ kg})(6.0 \text{ m/s}) = 420 \text{ kg}\cdot\text{m/s}$$

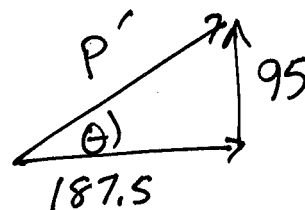
$$p_{rx} = (420) \cos 90^\circ = 0 \\ p_{ry} = (420) \sin 90^\circ = 420 \text{ kg}\cdot\text{m/s}$$

$$m_d = 75 \text{ kg} \\ v_d = 5.0 \text{ m/s} [300^\circ] \rightarrow p_d = (75 \text{ kg})(5.0 \text{ m/s}) = 375 \text{ kg}\cdot\text{m/s}$$

$$p_{dx} = (375) \cos 300^\circ = 187.5 \text{ kg}\cdot\text{m/s} \\ p_{dy} = (375) \sin 300^\circ = -325 \text{ kg}\cdot\text{m/s}$$

$$p_x = p'_x \text{ and } p_y = p'_y$$

	x	y
before		
m_r	0	420
m_d	187.5	-325
after	187.5	95



$$\tan \theta = \frac{95}{187.5}$$

$$\theta = 26.9^\circ \text{ N of E}$$

θ is smaller than 45° , therefore the players will go out of bounds before they reach the goal line ... no touchdown!