NAME _____ DATE _____

Scenario

In a game of football, two players find themselves running towards each other. A wide receiver is running east with velocity v_w. A distance x_c ahead the wide receiver sees a cornerback heading directly towards him at a different velocity, v_c. The wide receiver and cornerback continue running toward each other at constant speeds. The location where the cornerback tackles the wide receiver x_T is measured from the wide receiver's initial position $x = 0$.

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PART A: Draw a diagram of the situation described above. Label the given quantities on the diagram.

PART B: If the cornerback runs faster, would the location at which the cornerback tackles the wide receiver (x_T) increase, decrease, or remain the same?

_____ Increase _____ Decrease _____ Remain the same

Briefly explain your reasoning, without manipulating equations. Consider using the terms speed, velocity, distance, and time in your reasoning.

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PART C: Two students, Angela and Blake, attempt to develop an equation that relates the given variables to predict the location at which the wide receiver and cornerback tackle each other. The equations were developed so that only the magnitude of the velocity of each player gets substituted. Each of their equations is given below.

$$\text{Angela: } x_T = \frac{x_c v_w}{v_w + v_c} \qquad\qquad \text{Blake: } x_T = \frac{x_c (v_w - v_c)}{2 v_w}$$

Regardless of whether the above equations are correct, which student's equation agrees with your qualitative reasoning from Part B?

_____ Angela _____ Blake _____ Both _____ Neither

Justify your reasoning.

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PART D: A third student, Carlos, notices that Blake's equation cannot be correct for reasons not described by the reasoning given in Part B. Without deriving the correct equation, how can you tell if Carlos's claim is correct? In other words, describe why Blake's equation does not make physical sense.

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PART E: In terms of the variables given in the scenario, quantitatively demonstrate that Angela's equation is correct. (Substitute the given quantities to derive the equation.)