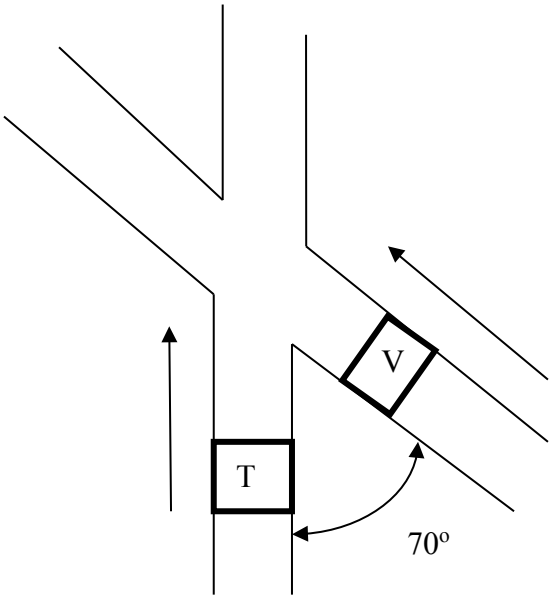
TOPIC

Engineering Mechanics (Statics and Dynamics) – Section VII – Question 15

QUESTION

A truck (T) and a car C approach an intersection on roads that intersect at a $70°$ angle, in the position shown, the velocity of the car is 30 ft/s and the velocity of the truck is 20 ft/s. The speed, in ft/s, of the truck relative to the car most nearly is



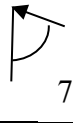
(A) 10.0
(B) 29.8
(C) 36.1
(D) 41.4

HINT

- This is a translating coordinate system problem with the reference frame of a passenger in the car. A person standing on the curve would see velocity of truck as 30 ft/s.
- The relative equation (a vector equation) is: $\overline{v}_T = \overline{v}_C + \overline{v}_{T/C}$.
- Last term is the relative velocity of truck with respect to car. You know you have written the equation correctly because the subscripts alternate. The last subscript is to location of the observation.

SOLUTION:

Equation	$\overline{v}_T = \overline{v}_C + \overline{v}_{T/C}$		
Magnitude	20	30	?

Direction	↑	 70°	?

Break this down into components:

$$\overset{\rightarrow}{+} \quad 0 = -30\,sin\,7\,0 + \left(v_{T/C}\right)_x$$

$$\left(v_{T/C}\right)_x = 28.19$$

$$+\uparrow \quad 20 = 30\,cos\,7\,0 + \left(v_{T/C}\right)_y$$

$$\left(v_{T/C}\right)_y = 9.74$$

$$\left|\overline{v}_{T/C}\right| = speed$$

$$= \sqrt{(28.19)^2 + (9.74)^2}$$

$$= 29.8\text{ft/s}$$

ANSWER

(B)

CONTRIBUTOR

Karim Nohra