Problem 3: Particle Kinematics II
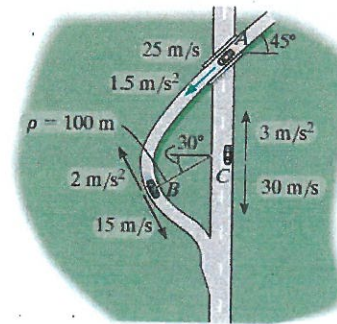Car B is traveling along the curved road with a speed of 15 m/s while decreasing its speed at 2 m/s². At the same instant car C is traveling along the straight road with a speed of 30 m/s while decelerating at 3 m/s². Determine the velocity and acceleration of car B relative to car C.

$$\vec{V}_B = \vec{V}_C + \vec{V}_{B/C}$$

$$\searrow_{60°} = \downarrow_{30\,m/s} + \nearrow^{(v_{B/C})_y}_{(v_{B/C})_x}$$
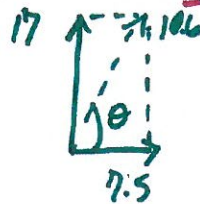
15 m/s

$$x \rightarrow \quad 15\cos60 = 0 + (V_{B/C})_x$$
$$(V_{B/C})_x = 7.5\ m/s \rightarrow$$

$$y \uparrow \quad -15\sin60 = -30 + (V_{B/C})_y$$
$$(V_{B/C})_y = 17.0\ m/s \uparrow$$

$$|\vec{V}_{B/C}| = \sqrt{7.5^2 + 17.0^2}$$
$$= 18.6\ m/s$$

$$\theta = \tan^{-1}\frac{17}{7.5} = 66.2°$$

17 ↑ — — 74.106

7.5

$$\vec{a}_B = \vec{a}_C + \vec{a}_{B/C}$$

$$2m/s^2 \nwarrow_{30°} \quad \nearrow_{60°} \frac{15^2}{100} = 2.25 \quad = \uparrow_{3m/s^2} + \nearrow^{(a_{B/C})_y}_{(a_{B/C})_x}$$
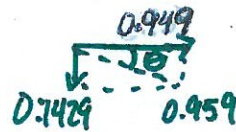
$$x \rightarrow \quad -2\sin30 + 2.25\sin60 = 0 + (a_{B/C})_x$$
$$(a_{B/C})_x = 0.949\ m/s^2 \rightarrow$$

$$y \uparrow \quad 2\cos30 + 2.25\cos60 = 3 + (a_{B/C})_y$$
$$(a_{B/C})_y = -.1429 = 0.1429\ m/s^2 \downarrow$$

$$|\vec{a}_{B/C}| = \sqrt{0.949^2 + 0.1429^2}$$
$$= 0.959\ m/s^2$$

0.949

0.1429   0.959

$$\theta = \tan^{-1}\frac{.1429}{.959}$$
$$\theta = 8.57°$$