Component Work Problem

#42 p. 625 of Stewart's 5th Edition Pre-Calculus

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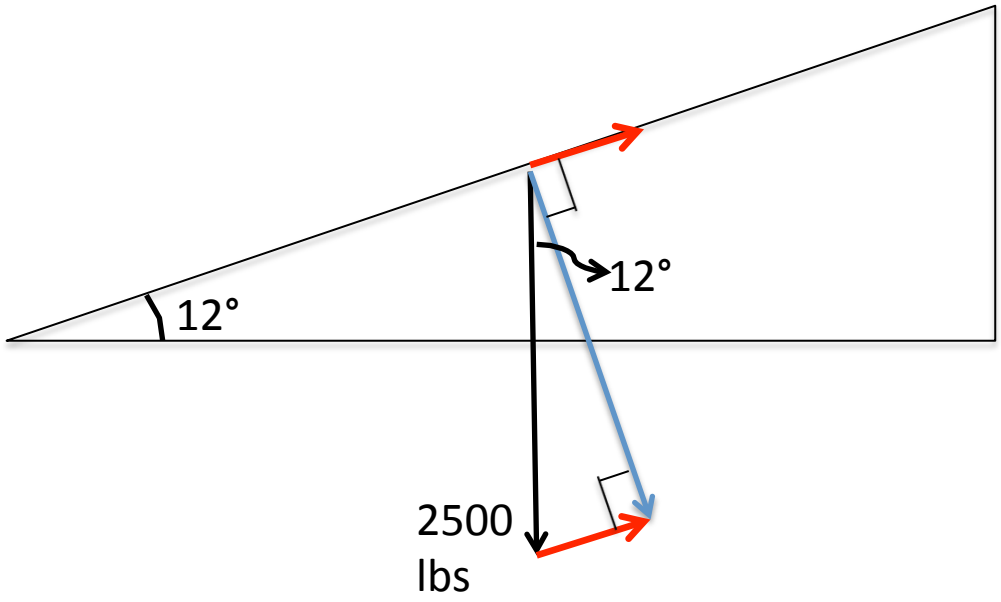
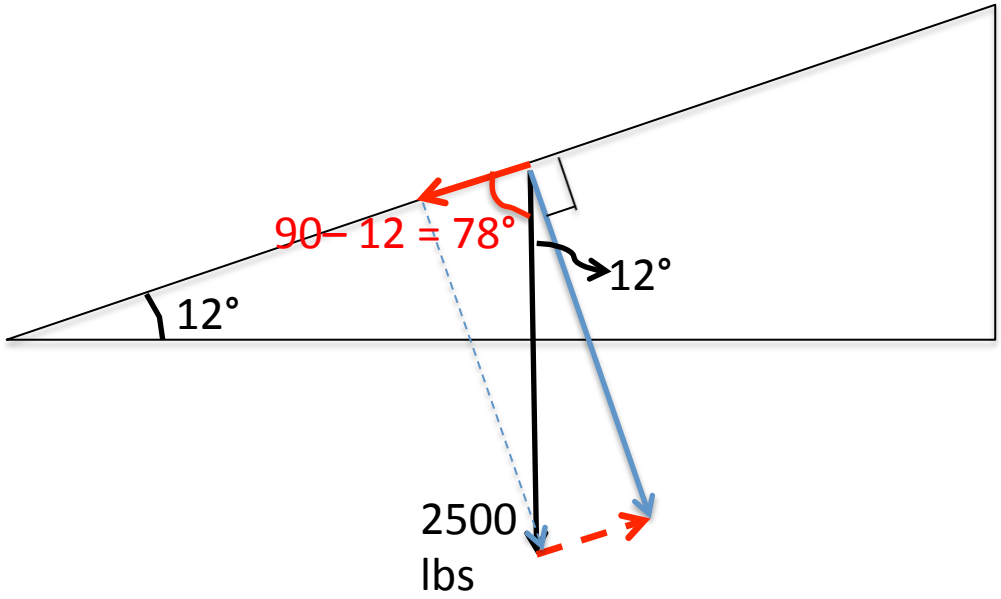
Picture 1st



Your Book's Interpretation

- Your book uses cosine instead of sine and they are using the other triangle. The triangle with the negative red vector along the ramp.



Horizontal Component – *i* component

- cos (90-12)° = adjacent over hypotenuse

  adjacent is the force we wish to find

  hypotenuse is known – 2500 lbs due to gravity.

so, adjacent = 2500 cos 78° ≈ 519.8

Vertical Component – *j* component

- cos (12)° = adjacent over hypotenuse

  adjacent is the force we wish to find

  hypotenuse is known – 2500 lbs due to gravity.

so, adjacent = 2500 cos 12° ≈ 2445.4

Force Components

$$F = 519.8i + 2445.4j$$

Find the Distance Component

- Since the distance is the horizontal component

$$D = 500i + 0j$$

Work = Force • Distance

- The work is the dot product of the force (acting in the same direction) & the distance

$$W = F \bullet D = \langle 519.8, 2445.4 \rangle \bullet \langle 500, 0 \rangle$$

$$= 519.8 \bullet 500 + 2445.4 \bullet 0 = 259900 + 0$$

$$\approx 260{,}000 \text{ ft-lbs.}$$

Note: I didn't keep track of the directions of these vectors. Technically, gravity is negative and works with a -260,000 ft.-lbs force in this direction & the car must work with a positive 260,000 ft.-lbs. force to stay on the incline. I have a new respect for my parking brake & the importance of curbing my wheels – how about you?