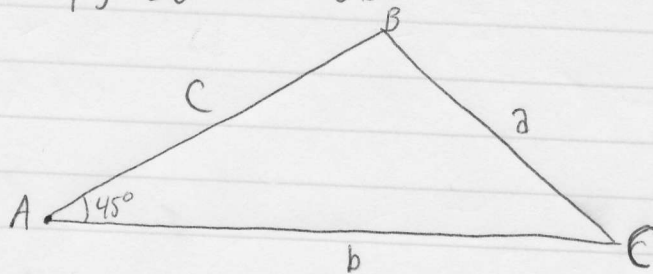


Pg 269 #36



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\frac{db}{dt} = 3 \text{ mi/hr}$$

$$\frac{dc}{dt} = 2 \text{ mi/hr}$$

After 15 minutes

$$b = \frac{15}{20} = 0.75 \text{ miles}$$

$$c = \frac{15}{30} = 0.5 \text{ miles}$$

Solve for a

$$a^2 = (0.75)^2 + (0.5)^2 - 2(0.75)(0.5) \cos(45^\circ)$$

$$a^2 = 0.5625 + 0.25 - 0.530$$

$$a^2 = 0.2825$$

$$a = \sqrt{0.2825} = 0.53 \text{ miles}$$

Take derivative

$$2a \frac{da}{dt} = 2b \frac{db}{dt} + 2c \frac{dc}{dt} - (2bc)' \left( \frac{\sqrt{2}}{2} \right)$$

$$2a \frac{da}{dt} = 2b \frac{db}{dt} + 2c \frac{dc}{dt} - 2(b'c + bc') \left( \frac{\sqrt{2}}{2} \right)$$

$$2a \frac{da}{dt} = 2b \frac{db}{dt} + 2c \frac{dc}{dt} - 2 \left( c \frac{db}{dt} + b \frac{dc}{dt} \right) \left( \frac{\sqrt{2}}{2} \right)$$

$$\text{solve for } \frac{da}{dt} = \frac{2b \frac{db}{dt} + 2c \frac{dc}{dt} - 2 \left( c \frac{db}{dt} + b \frac{dc}{dt} \right) \left( \frac{\sqrt{2}}{2} \right)}{2a}$$

$$\frac{da}{dt} = \frac{(2(0.75)(3)) + (2(0.5)(2)) - 2(0.5)(3) + (0.75)(2) \left( \frac{\sqrt{2}}{2} \right)}{2(0.53)}$$

$$\frac{(4.5 + 2) - 4.24}{1.06}$$

$$\frac{6.5 - 4.24}{1.06}$$

$$1.06$$

$$2.13 \text{ miles/hr}$$