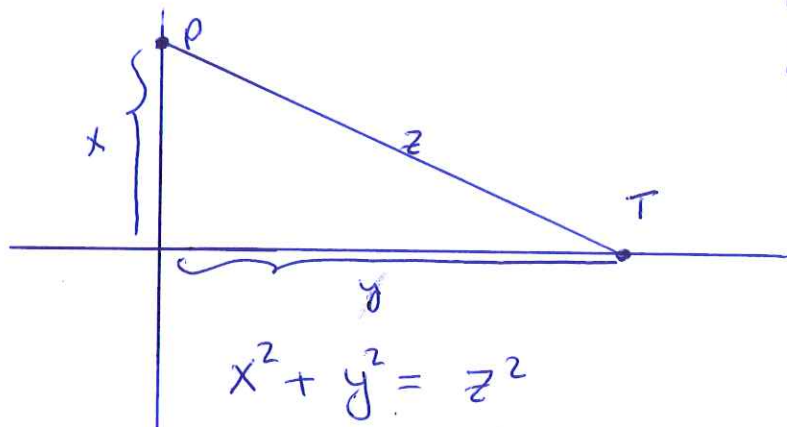


Present neatly. Justify for full credit. No Calculators.

Name \_\_\_\_\_ Score \_\_\_\_\_ ~6 minutes / A

A police car traveling south toward Sioux Falls at 160 km/h pursues a truck traveling east away from Sioux Falls, Iowa, at 140 km/h. At time  $t = 0$ , the police car is 20 km north and the truck is 30 km east of Sioux Falls. Calculate the rate at which the distance between the vehicles is changing: a) at time  $t = 0$  b) 5 minutes later.



P = police T = truck

$$\frac{dz}{dt} \Big|_{t=0} = ? \quad \frac{dz}{dt} \Big|_{t=\frac{1}{12}} = ?$$

$$\frac{dx}{dt} = -160 \text{ km/h}$$

$$\frac{dy}{dt} = 140 \text{ km/h}$$

$$x^2 + y^2 = z^2$$

$$2x \frac{dx}{dt} + 2y \frac{dy}{dt} = 2z \frac{dz}{dt}$$

$$\frac{dz}{dt} = \frac{x \cdot \frac{dx}{dt} + y \cdot \frac{dy}{dt}}{z}$$

$$\text{@ } t=0, x=20, y=30 : \quad z = \sqrt{13} \cdot 10 \quad \frac{dz}{dt} = \frac{20 \cdot (-160) + 30 \cdot 140}{10\sqrt{13}} = \frac{-320 + 420}{\sqrt{13}} = \frac{100}{\sqrt{13}} \frac{\text{km}}{\text{hr.}}$$

$$\approx 27.735 \frac{\text{km}}{\text{hr.}}$$

$$\text{@ } t=\frac{1}{12}, x = 20 - \frac{1}{12} \cdot 160 = \frac{20}{3} \text{ km} \quad \frac{dz}{dt} = \frac{\frac{20}{3}(-160) + \frac{125}{3}(140)}{\frac{5}{3}\sqrt{641}} =$$

$$= \frac{-640 + 3500}{\sqrt{641}} = \frac{2860}{\sqrt{641}} \frac{\text{km}}{\text{hr.}}$$

$$z = \frac{5}{3} \sqrt{641} \quad \approx 112.963 \frac{\text{km}}{\text{hr.}}$$