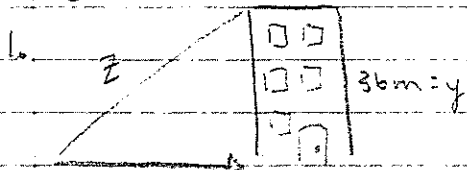


6.4 Related Rates - Part One Page 284 1-12



- 60 m/min

$$\left(\frac{dx}{dt}\right)$$

$$x = 27$$

$$\frac{dz}{dt} = ?$$

$$\frac{dz}{dt}$$

$$z^2 = x^2 + 36^2$$

$$2z \frac{dz}{dt} = 2x \frac{dx}{dt} + 0$$

$$z \frac{dz}{dt} = x \frac{dx}{dt}$$

$$(45) \frac{dz}{dt} = (27)(-60)$$

$$\frac{dz}{dt}$$

$$\frac{dz}{dt}$$

$$\frac{dz}{dt}$$

$$-36 \text{ m/min}$$

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

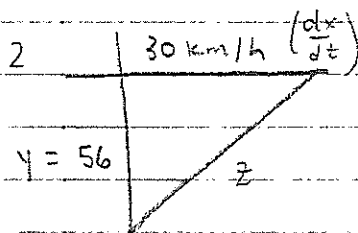
$$z^2 = (27)^2 + (36)^2$$

$$z^2 = 729 + 1296$$

$$z^2 = 2025$$

$$z = 45$$

It is decreasing at a rate of 36 m/min.



$$y = 56$$

$$x = 33$$

$$\frac{dz}{dt} = ?$$

$$\frac{dz}{dt}$$

$$z^2 = x^2 + 56^2$$

$$2z \frac{dz}{dt} = 2x \frac{dx}{dt} + 0$$

$$z \frac{dz}{dt} = x \frac{dx}{dt}$$

$$65 \frac{dz}{dt} = 33(30)$$

$$\frac{dz}{dt}$$

$$\frac{dz}{dt}$$

$$\frac{dz}{dt}$$

$$15.23 \text{ km/h}$$

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

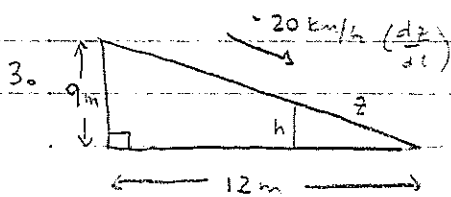
$$z^2 = (33)^2 + (56)^2$$

$$z^2 = 1089 + 3136$$

$$z^2 = 4225$$

$$z = 65$$

It is increasing at a rate of 15.23 km/h.



3.

9m

12m

$$9 = h$$

$$15 = z$$

$$9z = 15h$$

$$9 \frac{dz}{dt} = 15 \frac{dh}{dt}$$

$$\frac{dz}{dt}$$

$$9(20) = 15 \frac{dh}{dt}$$

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

$$z^2 = 9^2 + 12^2$$

$$z^2 = 225$$

$$z = 15$$

$$\frac{dh}{dt} = ?$$

$$\frac{dh}{dt}$$

decreasing

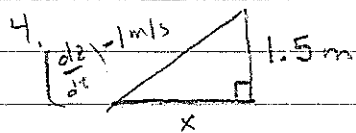
at

(towards)

$$-12 \frac{\text{km}}{\text{h}} = \frac{dh}{dt}$$

It is decreasing at a rate of 12 km/h.

6.4- Continued



$$z^2 = x^2 + 1.5^2$$

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

$$z^2 = 1.5^2 + 4.0^2$$

$$z^2 = 18.25$$

$$z = 4.27 \text{ m}$$

$x = 4.0$

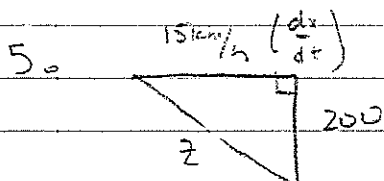
$\frac{dz}{dt} = ?$

$$z \frac{dz}{dt} = x \frac{dx}{dt}$$

$$(4.27)(-1) = (4.0) \left(\frac{dx}{dt} \right)$$

$$\frac{-1.07 \text{ m}}{\text{s}} = \frac{dx}{dt}$$

Approaching at a rate of 1.07 m/s.



$$z^2 = x^2 + 200$$

$$2z \frac{dz}{dt} = 2x \frac{dx}{dt} + 0$$

$$z^2 = x^2 + 4^2$$

$$400^2 = x^2 + 200^2$$

$$x = 346.41$$

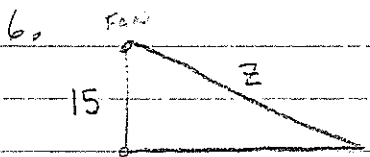
$z = 400$

$\frac{dz}{dt} = ?$

$$z \frac{dz}{dt} = x \frac{dx}{dt}$$

$$(400) \frac{dz}{dt} = (346.41)(15)$$

$$\frac{dz}{dt} = \frac{12,990 \text{ km}}{\text{h}}$$



$$z^2 = x^2 + 15^2$$

$$2z \frac{dz}{dt} = 2x \frac{dx}{dt} + 0$$

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

$$z^2 = 20^2 + 15^2$$

$$z^2 = 625$$

$$z = 25$$

Receiver 8 m/s $\left(\frac{dx}{dt} \right)$

$$z \frac{dz}{dt} = x \frac{dx}{dt}$$

$x = 20$

$$25 \left(\frac{dz}{dt} \right) = 20(8)$$

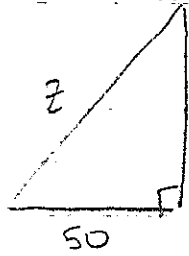
$\frac{dz}{dt} = ?$

$$\frac{dz}{dt} = 6.4 \text{ m/s}$$

Increasing at a rate of 6.4 m/s.

64 - Continued

7.



2.4 m/s

$$y = 125$$

$$\frac{dz}{dt} = ?$$

$$z^2 = 50^2 + y^2$$

$$2z \frac{dz}{dt} = 0 + 2y \frac{dy}{dt}$$

$$z \frac{dz}{dt} = y \frac{dy}{dt}$$

$$(134.63) \frac{dz}{dt} = (125)(2.4)$$

$$\frac{dz}{dt} = 2.23 \text{ m/s}$$

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

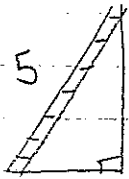
$$z^2 = 50^2 + 125^2$$

$$z^2 = 13125$$

$$z = 134.63$$

Increasing at a rate of 2.23 m/s.

8.



$$-12 \text{ cm/s} \left(\frac{dx}{dt} \right)$$

$$x = 4$$

$$\frac{dy}{dt} = ?$$

$$5^2 = x^2 + y^2$$

$$0 = 2x \frac{dx}{dt} + 2y \frac{dy}{dt}$$

$$0 = x \frac{dx}{dt} + y \frac{dy}{dt}$$

$$0 = (4)(-12) + (3) \left(\frac{dy}{dt} \right)$$

$$-16 \text{ cm/s} = \frac{dy}{dt}$$

Decreasing at a rate of 16 cm/s.

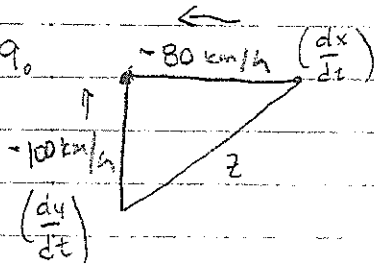
$$z^2 = x^2 + y^2$$

$$5^2 = 4^2 + y^2$$

$$25 = 16 + y^2$$

$$3 = y$$

9.



$$\frac{dz}{dt} = ?$$

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

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

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

$$(170) \left(\frac{dz}{dt} \right) = (154)(-80) + (72)(100)$$

$$\frac{dz}{dt} = -114.92 \text{ km/h}$$

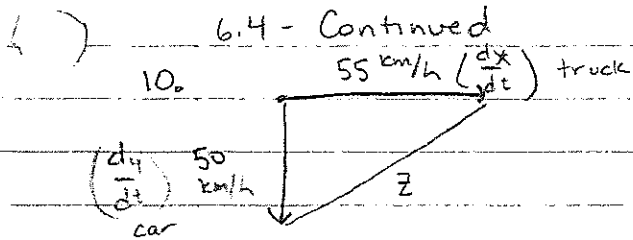
Decreasing at a rate of 114.92 km/h.

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

$$z^2 = 154^2 + 72^2$$

$$z^2 = 23900$$

$$z = 170$$



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

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

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

$$z^2 = (133)^2 + (156)^2$$

$$z^2 = 42025$$

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

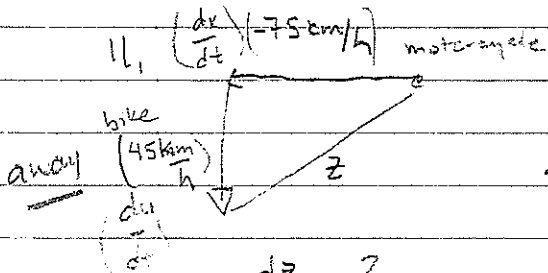
$$z = 205$$

$$\frac{dz}{dt} = ?$$

$$(205) \left(\frac{dz}{dt} \right) = (133)(55) + (156)(50)$$

$$\frac{dz}{dt} = 73.73 \text{ km/h}$$

Increasing at a rate of 73.73 km/h



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

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

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

$$z^2 = 56^2 + 90^2$$

$$z^2 = 11236$$

$$z = 106$$

$$\frac{dz}{dt} = ?$$

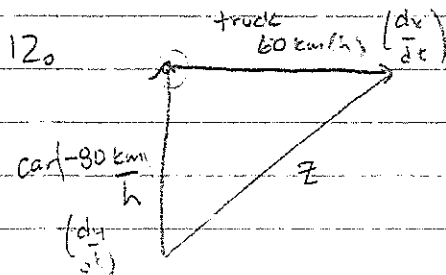
$$z \frac{dz}{dt} = x \frac{dx}{dt} + y \frac{dy}{dt}$$

$$(106) \frac{dz}{dt} = (56)(75) + (90)(45)$$

$$(106) \frac{dz}{dt} = -4200 + 4050$$

$$\frac{dz}{dt} = -1.42 \text{ km/h}$$

Decreasing at a rate of 1.42 km/h



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

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

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

$$z^2 = 52^2 + 39^2$$

$$z^2 = 4225$$

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

$$z = 65$$

$$(65) \left(\frac{dz}{dt} \right) = (52)(60) + (39)(80)$$

$$(65) \frac{dz}{dt} = 5120 - 3120$$

$$(65) \frac{dz}{dt} = 0$$

$$\frac{dz}{dt} = 0$$

neither increasing or decreasing