Example 3:

$A = \pi r^2$ $\quad dr/dt = 2\,ft/s$

Assume that oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2ft/sec. How fast is the area of the spill increasing when the radius of the spill if 60ft?

$\frac{dA}{dt} = ?$ $\quad r = 60\,ft.$

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt} \rightarrow \frac{dA}{dt} = 2\pi(60)(2) = \boxed{240\pi\,ft^2/s}$

Example 4

The length of *l* of a rectangle is decreasing at the rate of 2 cm/sec while the width *w* is increasing at the rate of 2 cm/sec, When *l* = 12 and *w* = 5, find the rates of change of

$\frac{dL}{dt} = -2\,cm/s$ $\quad \frac{dw}{dt} = 2\,cm/s$ $\quad L = 12\,cm$ $\quad W = 5\,cm$

a) The area

$A = L \cdot W$

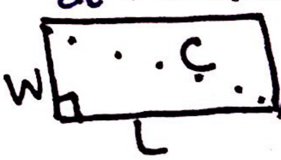
$\frac{dA}{dt} = L\,dw/dt + w\,dL/dt$ $\quad \frac{dA}{dt} = 12(2) + (5)(-2) = \boxed{14\,cm^2/s}$

b) The perimeter

$P = 2L + 2W$

$\frac{dP}{dt} = 2\,dL/dt + 2\,dw/dt$ $\quad \frac{dP}{dt} = 2(-2) + 2(2) = \boxed{0\,cm/s}$

c) The length of the diagonal of the rectangle



$w^2 + L^2 = c^2$

$\cancel{2}w\frac{dw}{dt} + \cancel{2}L\frac{dL}{dt} = \cancel{2}c\frac{dc}{dt}$

Find c: $12^2 + 5^2 = c^2$

$13 = c$

$5(2) + 12(-2) = 13\frac{dc}{dt}$

$\boxed{-14/13\,cm/s = \frac{dc}{dt}}$

Example 5

A 13-ft ladder is leaning against a house when its base starts to slide away. By the time the base is 12 ft from the house, the base is moving at the rate of 5 ft/sec.

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

$b = 12$

$\frac{db}{dt} = 5\,ft/s$

a) How fast is the top of the ladder sliding down the wall at that moment?

Find a: $a^2 + 12^2 = 13^2$

$a = 5\,ft.$

$a^2 + b^2 = c^2 \rightarrow \cancel{2}a\,da/dt + \cancel{2}b\,db/dt = \cancel{2}c\,dc/dt$

$5\frac{da}{dt} + 12(5) = 13(0)$

$5\frac{da}{dt} = -60$

$\boxed{\frac{da}{dt} = -12\,ft/s}$

b) At what rate is the area of the triangle formed by the ladder, wall, and ground changing at that moment?

c) At what rate is the angle between the ladder and the ground changing at that moment?

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