Hint: the volume of a sphere exists ☺

Chocolate

#1) George left his large ball of chocolate in the sun so that its radius is decreasing at the rate of 2 inches per minute. How fast is the volume decreasing at the moment when the radius is 3 inches?

Gallstones

#2) A gallstone is forming in George's gallbladder so that its radius is growing at the rate of 1 centimeter per year. How fast is its volume growing at the moment when the radius is 2 centimeters?

Sentence Answer:

Sentence Answer:

Gumball

#3) George is entering a chewed gumball contest. The radius of his spherical gumball is growing by ½ centimeter per week. Find how rapidly the volume is increasing at the moment when the radius is 4 centimeters.

Pig Feet

#4) George's profit from selling x boxes pig feet is $P = 1000x - \frac{1}{2}x^2$ dollars. If sales are growing at the rate of 20 per day, find how rapidly profit is growing (in dollars per day) when 600 boxes have been sold.

Sentence Answer:

Sentence Answer:

Tons of Feathers

#5) George's revenue from selling x tons of feathers is given as $R = 1000x - x^2$ dollars. If sales are increasing at the rate of 80 per day, find how rapidly revenue is growing (in dollars per day) when 400 tons have been sold.

Accidents

#6) The number of traffic accidents George's stench causes per year in a population p is predicted to be $T = 0.002p^{3/2}$. If the population is growing by 500 people per year, find the rate at which traffic accidents will be rising when the population is 40,000.
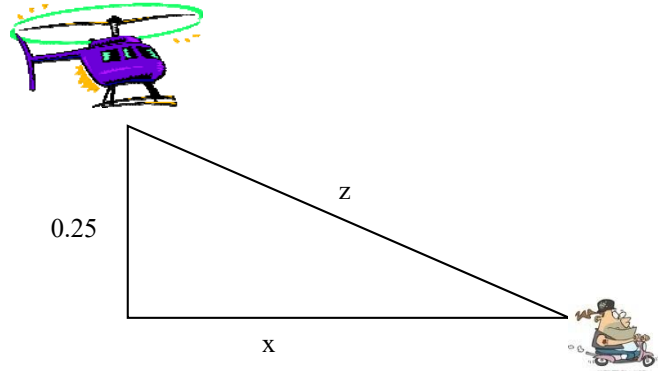
Sentence Answer:

Sentence Answer:

Carnival Slaying

#7) George is a carny and witnesses many types of crimes. The number of slayings at George's carnival of population p is expected to be $W = 0.003p^{4/3}$. If the population is growing by 1000 people per year, find the rate at which the number of carnival slayings will be increasing when the population is 1,000,000.

Speeding

#8) A traffic patrol helicopter is stationary a quarter of a mile directly above a highway, as shown in the diagram below. Its radar detects George's moped whose line-of-sight distance from the helicopter is half a mile and is increasing at the rate of 57 mph. Is the moped exceeding the highway's speed limit of 60 mph?


0.25   z   x

Sentence Answer:

Sentence Answer:

#1) At the moment the radius is 3 inches, the volume is decreasing by $72\pi \approx 226\ in^3$ in per hour.

#2) When the radius is 2 mm, the volume is growing at $16\pi \approx 50.27\ mm^3$ per minute.

#3) When the radius is 4 cm, the volume of the tumor is growing at $32\pi \approx 101\ cm^3$ per weak.

#4) When 600 units have been sold, the profit is growing by $8000 per day.

#5) When 400 units have been sold, the revenue is growing by $16,000 per day.

#6) When the population is 40,000 people, traffic accidents will be rising by 300 accidents per year.

#7) When the population is 1,000,000 people, the number of carnival slayings is increasing by 400 cases per year.

#8) The car is traveling at 65.8 mph, so yes the car is speeding.

#8)

0.25

z

x
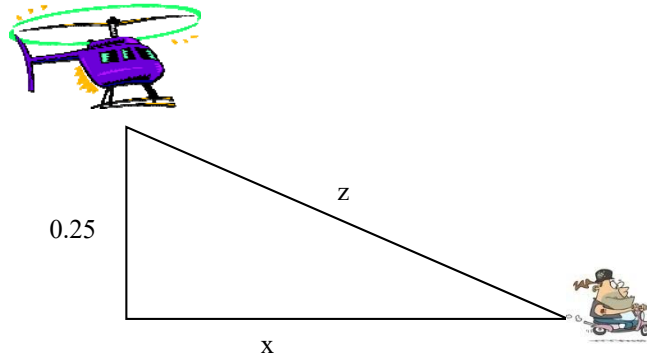
Facts:

z = line of sight distance in miles

x = horizontal distance in miles

$\dfrac{dz}{dt} = 57$ miles/hour

Find $\dfrac{dx}{dt}$ evaluated at z = .5 miles

From Pythagoras

$x^2 + 0.25^2 = z^2$

$x^2 + 0.25^2 = 0.5^2$

$x^2 + 0.0625 = 0.25$

$x^2 = .1875$

$x \approx 0.433$

From Pythagoras

$x^2 + 0.25^2 = z^2$

$\dfrac{d}{dt} x^2 + \dfrac{d}{dt} 0.25^2 = \dfrac{d}{dt} z^2$ Found $\dfrac{d}{dt}$

$2x \dfrac{dz}{dt} + 0 = 2z \dfrac{dz}{dt}$ Simplified

$2x \dfrac{dz}{dt} = 2z \dfrac{dz}{dt}$ Simplified

$\dfrac{dz}{dt} = \dfrac{2z}{2x} \dfrac{dz}{dt}$ Solving for $\dfrac{dz}{dt}$, I divided by 2x

$= \dfrac{z}{x} \dfrac{dz}{dt}$ The 2's canceled, because 2 / 2 = 1

$\dfrac{dz}{dt}$ evaluated $\approx \dfrac{0.5}{.433} 57$ Substituted $\dfrac{dz}{dt} = 57$, z = .5, x ≈ 0.433

$\approx \dfrac{0.5(57)}{.433}$ Simplified

≈ 65.8 miles per hour   Simplified

Yes, the moped is exceeding the highway's speed of 60 mph. George is traveling at a rate of approximately 65.8 mph.