#1 Abby Murrane

The apocalypse is coming. The pressure of the magma under the earths crust is making the earth expand. If its expanding at 2mm/hr, at what rate is the radius of the earth expanding at the radius of 5,000 mm?

$\frac{dr}{dt} = ? = 5{,}000$ mm

$\frac{dV}{dt} = 2$

$\frac{dr}{dt} = 6.37 \times 10^{-9}$ mm/hr

$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$

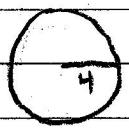
$V = \frac{4}{3}\pi r^3 \Big|_{0}^{5{,}000} = 5.24 \times 10^{11}$ mm

$2 = 4\pi (5{,}000)^2 \frac{dr}{dt}$

$\frac{2}{4\pi (5{,}000)^2} = \frac{dr}{dt}$

#1 Lauren Janning

The volume of an orange is growing at a rate of 7 cubic inches per second. At what rate is the radius increasing when the radius is 4 inches?



$7 \text{ in}^3/s$ $\quad \frac{dr}{dt}$ when $r = 4$

$\frac{4}{3}\pi r^3$ $\quad 4\pi r^2 \frac{dr}{dt} = \frac{dV}{dt}$

$4\pi (4)^2 \frac{dr}{dt} = 7$

$7/201.1 = 0.035 \text{ in}^3/s = \frac{dr}{dt}$

#1 Breanna Kroeger

The radius of an apple pie is increasing at a rate of 9 mm per minute. Find the rate of change in the area when when the radius is 52 mm.

$\frac{dA}{dt} = ?$ when $r = 52$ $\qquad r = 52$ $\quad \frac{dr}{dt} = 9$

$\pi r^2 = A$ $\qquad 2\pi r \frac{dr}{dt} = \frac{da}{dt}$

$2\pi (52)(9) = \frac{da}{dt}$ $\qquad \frac{da}{dt} = 2940.5$ mm/min

#1 Jessica Cheney

In space, a spherical star is starting to form and its radius is expanding at a rate of 20 miles per second. At what rate will its volume be increasing when the radius is 1000 miles?

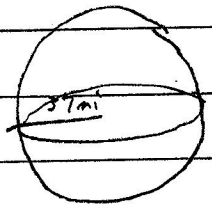
20 mi/s $\quad \frac{dV}{dt} = ?$ when $r = 1000$ mi

$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$ $\qquad (4\pi)(1000^2)(20) = 2.513 \times 10^8 \text{ mi}^3/s$

#1 Zena Olberding

An ordinary hedgehog (curled up) has a radius increasing 5mi/s. Find the rate of change in the volume when the radius is 37 mi. (He'll be rolling along)

$V = \frac{4}{3}\pi r^3$



$\frac{dr}{dt} = 5 mi/s$

$\frac{dV}{dt} = ?$ @ $r = 37 mi$

$\frac{dV}{dt} = 4\pi r^2 \left(\frac{dr}{dt}\right)$

$\frac{dV}{dt} = 4\pi (37)(5)$

$\frac{dV}{dt} = 2324.79 mi/s$

#1 Daric Teske

If a ball is growing at a rate of 628.3 cubic inches per minute and the radius is increasing at 2 inches per minute, what is the size of the radius?

$\frac{4}{3}\pi r^3 = V$

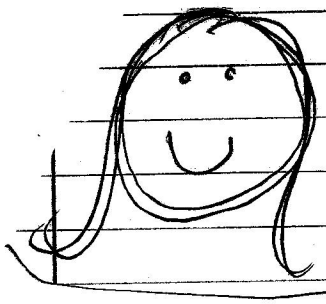
5in

$4\pi r^2 2 = 628.3$

$r = 5$ or 4.999

#1 Emily Peters

Kennedy was told on September 27th that she was really pretty. She was told the same thing a week later. Kennedy's head is growing at a rate of 5 cubic inches per minute. Find the rate of change of the radius when the radius of Kennedy's head equals 2.5 inches.



$\frac{dV}{dt} = 5 in^3/m$ $\frac{dr}{dt} = ?$ $r = 2.5$

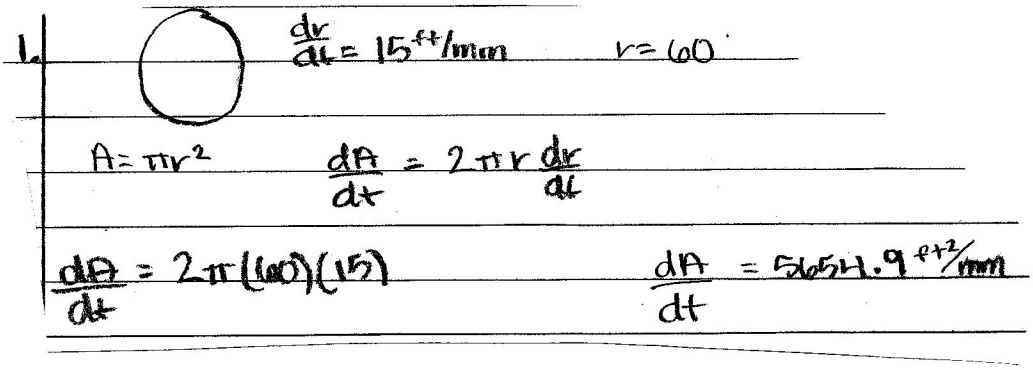
$r = 2.5in$

$4\pi r^2 \frac{dr}{dt} = 5 = 4\pi(3)^2 \frac{dr}{dt}$

$\frac{dr}{dt} = \frac{5}{4\pi(3)2}$

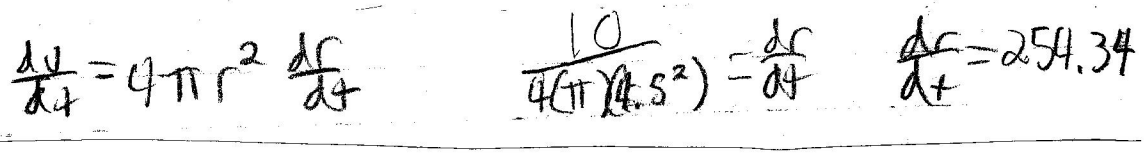
#1 Jessica Pottebaum([redacted])

A wheel has a radius that is increasing by 15 ft/minute, what is the rate of change in the area when the radius is 60ft?



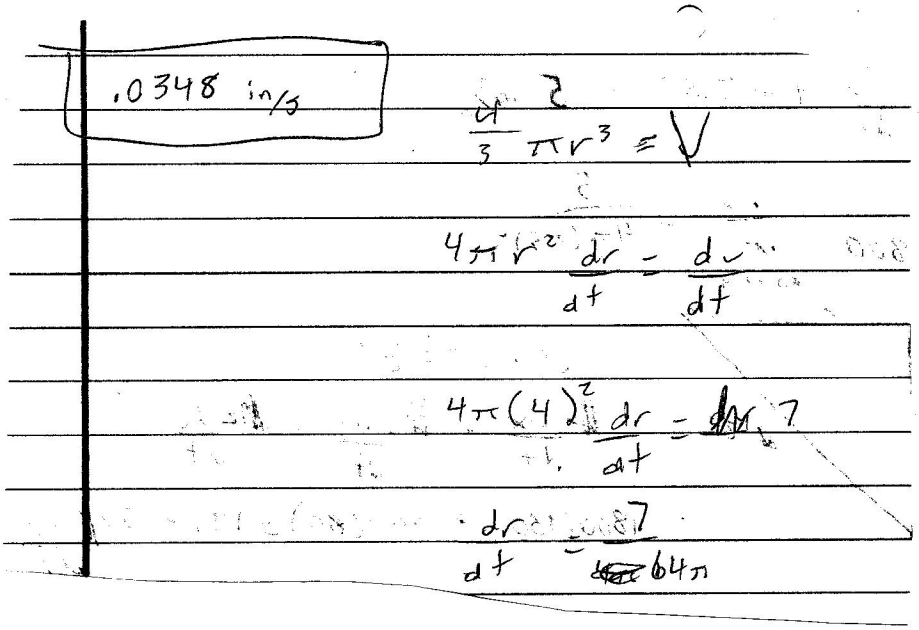
#1 Caleb Horsley

A spherical basketball in being inflated, the volume is increasing at a rate of 10 cubic inches per minute. When the radius is 4.5 inches, what is the rate?



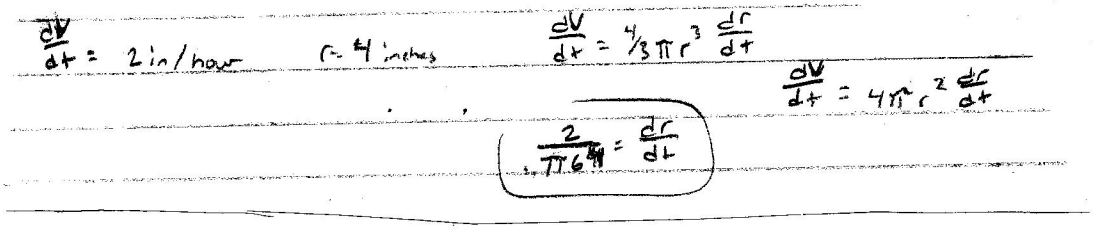
#1 Addison Ross

Alex Stenbo is blowing up a balloon as fast as he can for fun. The volume of the balloon is increasing at the rate of 7 cubic inches per second. What is the rate of increase for the radius when it is at 4 in?



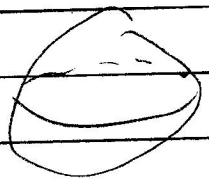
#1 Trent Lux

Alex Stenbo is throwing a men's shot put as its volume is expanding at a rate of 2 inches per hour. What is the rate at which the radius is increasing at 4 inches?



#1 Sterling Schaefer

The volume of a sphere is expanding at 6 cubic inches per second. At what rate is the radius expanding when the radius is at 3 inches?



$\frac{dV}{dt} = 6\ in^3/s$

$\frac{dr}{dt} = ?$ $\quad r = 3$

$V = \frac{4}{3}\pi r^3$

$6 = 4\pi(4)\frac{dr}{dt}$

$\frac{1}{6\pi} = \frac{dr}{dt}$

#1 Brent Wernimont

If the volume of a ball is expanding at a rate of 5 cubic inches per second. At what rate is the radius expanding when the radius is 4 inches?

$\frac{dr}{dt} = ?$ $\quad$ when $r = 4$ $\quad \frac{dV}{dt} = 5$

$\frac{5}{64\pi} = \frac{dr}{dt} = .025\ in/s$

$V = \frac{4}{3}\pi r^3$

$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$

$5 = 4\pi(4)^2 \frac{dr}{dt}$

$\frac{5}{64\pi} = \frac{dr}{dt}$

#1 Colton Thompson

Addison is filling a spherical container with purple drank. If the volume is increasing at 10 cubic inches per second, what is the rate at which the radius is increasing when the radius is 4 inches?

$\frac{1}{3}\pi r^2 h$ $\quad \frac{4}{3}\pi r^3$ $\quad V =$ $\quad 4\pi r^2$

$\frac{dV}{dt} = 10\ in^3/s$ $\quad \frac{dr}{dt}$

$\frac{5}{32\pi}$ inches/min $\quad \pi r^2 h$

$\frac{10}{\quad}$ $\quad \frac{dV}{dt} = 4\pi r^2$ $\quad 10 = 4\pi 16$

$\frac{\quad}{64\pi}$

#1 Alex Stenbo

A ball is growing at a rate of 45 cubic inches per minute. What is the rate of change for the radius when the radius 15 inches.

$DV/DT = 45\ in^3/per\ min$

$V = 4/3\ \pi r^3$

$R = 15$ when $DR/DT = ?$

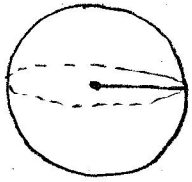
$45 = 4\pi(15)^2\ DR/DT$

$\frac{45}{900\pi} = DR/DT$

$\frac{1}{20\pi} = DR/DT$

#1 Stephanie Schneider

An eyeball is swelling from an infection. The radius is increasing 2 mm per minute. Find the rate of change in the volume when the radius is 35 mm.



$r = 35mm$

$\frac{dr}{dt} = 2mm/min$

$\frac{dV}{dt} = ?$ $r = 35mm$ Volume $= \frac{4}{3}\pi r^3$

$$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$$

$$\frac{dV}{dt} = 4\pi(35)^2 \cdot 2$$

$$\boxed{\frac{dV}{dt} = 9800\pi \, mm/min}$$

#1 Allison Baumhover

A hamster ball is expanding in volume at 2 cubic inches per minute. At what rate is the radius of the hamster ball increasing when the radius is 5 inches?

$\frac{dv}{dt} = 2 \, in^3/min$ $\frac{dr}{dt} = ?$ $r = 5in$

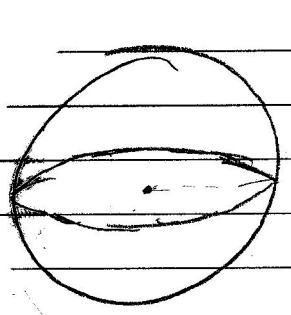
$$\frac{Dv}{dt} = 4\pi r^2 \cdot \frac{dr}{dt}$$

$$\frac{2}{4\pi \cdot 5^2} = \frac{4\pi \cdot 5^2}{4\pi \cdot 5^2} \frac{dr}{dt}$$

$$\frac{dr}{dt} = \boxed{.00.64 \frac{in^3}{min}}$$

#1 Ryan Elmquist

If Daric's head is growing (assume it is in the shape of a sphere) at a rate of 3 cubic centimeters per second, what is the rate at which the radius is increasing when the radius is 15 centimeters?



$\frac{dr}{dt}$? when $r=15$

$\frac{4}{3}\pi r^3$

$4\pi r^2 \frac{dr}{dt} = \frac{dV}{dt}$

$4\pi(15)^2 \frac{dr}{dt} = 3$

$\frac{dr}{dt} = \frac{3}{900\pi}$

$\frac{dr}{dt} = .00106$ cm/sec

#1 Shannon O'Leary

Allison and Steph have developed a new soccer ball that expands and shrinks in size to accommodate for the size of the players. Because they are playing soccer with 5th graders, the ball needs to shrink so that its radius is 5 inches. The ball is shrinking at a rate of .4 inches per second. Find the rate of change of the radius.

$\frac{dr}{dt}$ = ? when $r = 5$ inches

$V = \frac{4}{3}\pi r^3$

$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$

$.4 = 4\pi \cdot 5^2 \cdot \frac{dr}{dt}$

$\frac{dr}{dt} = .0013$ in/sec

#1 Kennedy Reid

A golf ball has a radius that is increasing at a rate of 2 cm/minute. Find the rate of change in the area when the radius is 10 cm.

$\frac{dr}{dt} = 2$ $\quad \frac{dA}{dt} = ?$, $r = 10$

$A = 4\pi r^2$

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$ $\quad \frac{dA}{dt} = 2\pi(10)(2)$

$\frac{dA}{dt} = 40\pi = 125.7$ cm^2/min