MATH 131, Fall 2019
Quiz 6 Solutions

1. You are making pancakes, ladling batter onto a hot griddle. As you ladle batter to make a pancake, the batter forms a disk, which you may model as a stout circular cylinder whose diameter remains 12 times its height as the disk expands. How fast is the radius of the pancake growing when the diameter is 4 inches if you are ladling 2 cubic inches per second of batter onto the griddle?

Since the pancake is modeled as a cylinder with diameter 12 times the height, if d is the diameter, h is the height, and r is the radius, one has $h = \frac{d}{12} = \frac{2r}{12} = \frac{r}{6}$. Then, using that the volume of a cylinder is $V = \pi r^2 h$, the volume V can be expressed as a function of the radius r alone:

$$V = \frac{\pi}{6} r^3 \,.$$

You are ladling 2 cubic inches per second of batter onto the griddle, so $\frac{\mathrm{d}V}{\mathrm{d}t} = 2\,\mathrm{in/s}$. You want to compute $\frac{\mathrm{d}r}{\mathrm{d}t}$.
Differentiating both sides of the volume equation yields

$$\frac{\mathrm{d}V}{\mathrm{d}t} = \frac{\pi}{2} r^2 \frac{\mathrm{d}r}{\mathrm{d}t} \implies \frac{\mathrm{d}r}{\mathrm{d}t} = \frac{2}{\pi r^2} \frac{\mathrm{d}V}{\mathrm{d}t} \,.$$

To find $\frac{\mathrm{d}r}{\mathrm{d}t}$ when the diameter is 4 inches, take $r = d/2 = 4/2 = 2$ inches as the radius, so

$$\frac{\mathrm{d}r}{\mathrm{d}t} = \frac{2}{\pi(2\,\mathrm{in})^2}(2\,\mathrm{in}^3/\mathrm{s}) = \frac{1}{\pi}\,\mathrm{in/s}\,.$$

Thus the radius expands at a rate of $1/\pi$ inches per second when the pancake is 4 inches in diameter.