# Midterm 2 Review Session

**1.** The Super Cheap Golf Ball Company currently makes a golf ball of radius 2 cm. Taking into account the different cost of the core material and the cover, their accounting department has figured out that it costs $r^3 + 2r^2$ cents to make a golf ball of radius $r$ cm, so their current ball costs 16 cents to make. Hoping that no one will notice, they plan to make a smaller ball that only costs 15 cents to make. Use tangent line approximation to estimate the radius of their new ball.

**2.** Sand is being dumped from a conveyor belt at a rate of $10\pi$ ft$^3$/min, forming a conical pile of sand. Five minutes after the pile starts, the radius of the base is 5 ft and the height is 6 ft, and at that time the height is increasing at a rate of 1 ft/min. How fast is the radius of the base changing five minutes after the piles starts?
(Equation for volume of a cone: $V = \frac{\pi}{3}r^2h$)

**3.** The flow of blood (in cm$^3$/sec) through a blood vessel of radius $r$ can be estimated by $F = kr^4$, where $k$ is some constant. If the radius of the blood vessel is increased by 3%, by what percent will the flow of blood increase?

**4.** The Pyramid at Kufu in Egypt is 480 ft tall and has a square base measuring 750 ft on each side. Suppose that when the partially built pyramid was 240 ft tall, its height was increasing at a rate of approximately 2 ft/year. If the pyramid was built entirely out of rocks that measured 6 ft $\times$ 2 ft $\times$ 3 ft, about how many of these massive blocks was being added to the pyramid per year?
(A partially completed pyramid is called a frustum and has a square top and bottom and trapezoidal sides. If $A$ is the area of the top square and $B$ is the area of the base, the volume of a frustum is $V = \frac{1}{3}h(A + B + \sqrt{AB})$. You will also need to know that if $s$ is the length of one of the sides of the top square, then $s = \frac{25}{16}(480 - h)$. There is a lot of information here, so define your variables carefully!)

**5.** (Just for fun) Take the derivative of this function:

$$\sin^2\left[\ln\left((\cos(e^x)) + \tan^{-1}(2x)\sqrt{52x}\right]\right.$$