Math 1823 homework

6. (9/12) 2.2 # 5, 6, 9, 23-30

7. (9/12) 2.3 # 10, 19–22, 25, 26, 28, 37, 38

8. (9/12) Be able to state the Squeeze Theorem.

9. (9/28) 2.4 # 3, 4, 13, 20, 22, 23

10. (9/28) 2.5 # 17, 19

11. (9/28) 2.4 # 29, 30, 38

12. (9/28) 2.5 # 42-44, 61

13. (9/28) 2.6 # 9, 10, 15, 16

14. (9/28) Consider the area πr^2 of a circle of radius r. Suppose you increase the radius to $r + h$.

    1. Draw the circles of radius r and $r+h$. The region between them is a circular strip of width h. What are its inner and outer circumferences?
    2. If you straighten the circular strip out to a rectangle that has width h and length $2\pi r$, will it crinkle or rip? What is the difference $E(h)$ between the area of the circular strip and the area of the rectangle?
    3. Write $\dfrac{A(r+h) - A(r)}{h}$ in the form $m + \dfrac{E(h)}{h}$. Take the limit as $h \to 0$ to determine the rate of change of A when the radius is r. Can you interpret this geometrically in terms of the area of an expanding circle?
    4. The volume of a sphere is $4\pi r^3/3$. Use $\dfrac{V(r+h) - V(r)}{h}$ to work out the rate of change of the volume as the radius increases. By interpreting this geometrically in terms of the volume of an expanding sphere, can you deduce a formula for the surface area of a sphere?

15. (10/12) Determine the rate of change of the cosine function by drawing a careful diagram of the points $(\cos(a), \sin(a))$ and $(\cos(a+h), \sin(a+h))$ and nearby distances and angles, then using the diagram to argue that for h near 0, $\cos(a+h) - \cos(a)$ is very near $-\sin(a)\,h$, and then (with a bit of hand waving) obtaining $\lim_{h\to 0} \dfrac{\cos(a+h) - \cos(a)}{h}$ from this observation.