Math 1823 homework

Instructions: Work the assigned problems. Book problems shown in **boldface** should be written up formally and turned in no later than the due date.

1. (due 8/31) Section 1.3 # 1, 2, 3, **6, 7**, 9, 10, **11-16**, 17-21, **22-24, 28**, 37-40, 45-50, **52-55, 57-59, 61-64**

2. (due 9/7) Let $f(x) = x^3$. Calculate the slopes of the tangent lines to the graph of $y = x^3$ as follows.

   (a) Let m_{sec} be the function of h that is the slope of the secant line between (x_0, x_0^3) and $(x_0 + h, (x_0 + h)^3)$. Calculate m_{sec}, obtaining the expresssion
   $$m_{sec} = (3x_0^2 + 3hx_0 + h^2)\frac{h}{h} .$$
   (b) In the h-y plane (horizontal coordinate h and vertical coordinate y), carefully graph the equation $y = m_{sec}$ (completing the square to obtain $h^2 + 3x_0h + 3x_0^2 = (h + \frac{3x_0}{2})^2 + \frac{3x_0^2}{4}$ might be a useful preliminary step). The graph will be a parabola, except that the point where the parabola meets the y-axis is missing.
   (c) If your graph is correct, the y-coordinate of the missing point is $3x_0^2$. Explain, as clearly as you can, why that number is the slope of the tangent line to $y = x^3$ at the point (x_0, x_0^3). Clarity can be enhanced by using pictures of secant lines for some different values of h.

3. (due 9/7) Let $f(x) = x^3$. Calculate the slopes of the tangent lines to the graph of $y = x^3$ as follows.

   (a) Let m_{sec} be the function of x that is the slope of the secant line between (x_0, x_0^3) and (x, x^3). Calculate m_{sec}, obtaining the expresssion
   $$m_{sec} = \left(x^2 + xx_0 + x_0^2\right) \frac{x - x_0}{x - x_0} .$$
   (b) In the x-y plane, carefully graph the equation $y = m_{sec}$ (completing the square to obtain $x^2 + xx_0 + x_0^2 = (x + \frac{x_0}{2})^2 + \frac{3x_0^2}{4}$ might be a useful preliminary step). The graph will be a parabola, except that the point where the parabola meets the line $x = x_0$ is missing.
   (c) If your graph is correct, the y-coordinate of the missing point is $3x_0^2$. Make sure you can explain clearly why that number is the slope of the tangent line to $y = x^3$ at the point (x_0, x_0^3).

4. 2.2 # 1-10.

5. (due 9/7) 2.3 # 17, **19, 20**, 21, **22, 24, 26, 28**, 35, 36, **37, 38, 55-57**.

6. (due 9/14) 2.4 # 3-6, **13**, 15, **16, 20**, 22-25, **26, 32, 38, 39**.