Homework Math 140
Lecture 16, 17, 18, 19
Will be Quizzed on April 25

Problem 1 *(page 180) If V is the volume of a cube with edge length x and the cube expands as time passes, find $\frac{dV}{dt}$ in terms of $\frac{dx}{dt}$.*

Problem 2 *(page 180) Each side of a square is increasing at a rate of 6cm/s. At what rate is the area of the square increasing when the area of the square is 16 cm^2?*

Problem 3 *(page 180) The radius of a ball is increasing at a rate of 4 mm/s. How fast is the volume increasing when the diameter is 80mm?*

Problem 4 *(page 181) A street light is mounted at the top of a 4.5m tall pole. A man 180 cm tall walks away from the pole at a speed of 5km/h along a straight path. How fast is the tip of his shadow moving when he is 12m from the pole?*

Problem 5 *(page 181) A boat is pulled into a dock by a rope attached to the bow of the boat and passing through a pulley on the dock that is 1m higher than the bow of the boat. If the rope is pulled in at a rate of 1m/s, how fast is the boat approaching the dock when it is 8m from the dock?*

Problem 6 *(page 182) A Ferris wheel with a radius of 10m is rotating at a rate of one revolution every 2 minutes. How fast is a riding rising when his seat is 16 m above ground level?*

Problem 7 *(page 183) The minute hand on a watch is 8mm long and the hour hand is 4mm long. How fast is the distance between the tips of the hands changing at one' clock?*

Problem 8 *(page 205) Find the absolute maximum and absolute minimum values of f on the given interval.*

1. $f(x) = 12 + 4x - x^2$, $x \in [0, 5]$.
2. $f(x) = 5 + 54x - 2x^3$, $x \in [0, 4]$.
3. $f(x) = 2x^3 - 3x^2 - 12x + 1$, $x \in [-2, 3]$.
4. $f(x) = x^3 - 6x^2 + 5$, $x \in [-3, 5]$.
5. $f(x) = 3x^4 - 4x^3 - 12x^2 + 1$, $x \in [-2, 3]$.
6. $f(x) = (x^2 - 1)^3$, $x \in [-1, 2]$.
7. $f(x) = x + \frac{1}{x}$, $x \in [0.2, 4]$.
8. $f(x) = \frac{x}{x^2 - x + 1}$, $x \in [0, 3]$.
9. $f(t) = t\sqrt{4 - t^2}$, $x \in [-1, 2]$.
10. $f(t) = \sqrt[3]{t}(8 - t)$, $x \in [0, 8]$.
11. $f(t) = 2\cos t + \sin(2t)$, $x \in [0, \frac{\pi}{2}]$.
12. $f(t) = t + \cot(t/2)$, $x \in [\frac{\pi}{4}, \frac{7\pi}{4}]$.

Problem 9 *(page 257) Find the dimensions of a rectangle with area 1000 m^2 whose perimeter is as small as possible.*

Problem 10 *(page 257) Find the dimensions of a rectangle with area 1000 m^2 whose perimeter is as small as possible.*

Problem 11 *(pages 256-259) A box with an open top is to be constructed from a square piece of cardboard, 1m wide, by cutting out a square from each of the four corners and bending up the sides. Find the largest volume that such a box can have.*

Problem 12 *(pages 256-259) A right circular cylinder is inscribed in a sphere of radius r. Find the largest possible volume of such a cylinder.*

Problem 13 *(pages 256-259) A cone-shaped drinking cup is made from a circular piece of paper of radius r by cutting out a sector and joining the edges OA and OB. Find the maximum capacity of such a cup.*