

M 408C
September 27, 2010

1. Show that the following curves $2x^2 + y^2 = 3$ and $x = y^2$ are orthogonal.
2. Find equations of all tangent lines to the ellipse $x^2 + 4y^2 = 36$ that pass through $(12, 3)$.
3. Water is leaking out of an inverted conical tank at a rate of $10,000 \text{ cm}^3/\text{min}$ at the same time that water is being pumped into the tank at a constant rate. The tank has height 6 m and the diameter at the top is 4 m. If the water level is rising at a rate of $20 \text{ cm}/\text{min}$ when the height of the water is 2 m, find the rate at which water is being pumped into the tank.
4. Two sides of a triangle are 4 m and 5 m in length, and the angle between them is increasing at a rate of $0.06 \text{ rad}/\text{s}$. Find the rate at which the area of the triangle is increasing when the angle between the sides of fixed length is $\pi/3$.
5. In the previous problem, suppose that each of the sides given are also changing. If at that instant they both are shrinking at a rate of $0.5 \text{ m}/\text{s}$, what is the rate at which the triangle is changing?
6. Find the absolute minimum and maximum of the function $f(x) = 2x^3 + 3x^2 + 8$ on the interval $[-2, 1]$.
7. Find the absolute minimum and maximum of the function $f(x) = x\sqrt{x - x^2}$.
8. Double Rainbow: Check out the Applied Project after Section 4.1 and answer the question, "What does it mean?"