

Some Calculus problems

1. A man 5 ft tall is walking at a rate of 3ft per second. Behind him is a lightpole that is 15ft tall. How fast is the tip of the man's shadow moving when he is 10ft away from the lightpole?
2. A scientist is watching as the storm is approaching the shore. The storm is travelling north–west–west at 100km per hour. How fast is the scientist's head turning (in radians per hour) when the storm is 1km due south and 3km east of the scientist?
3. An aluminium can has a bottom and a lid of radius r and has a height h . Assuming that the can is very thin, find the dimensions that minimize the amount of material used while maximizing the volume.
4. A piece of wire 1m in length is cut into two. The first part is bent into a circle while the second is bent into a square. Where should the wire be cut in order to minimize or maximize the total area that results?
5. At a price of \$1.00, a dealer can sell 1000 articles that cost him 60 cents each. For each 1cent that he lowers the price, he can increase the number sold by 50. What price will maximize the profit?
6. Grain is pouring from a chute at the rate of $1/4 \text{ m}^3/\text{min}$ and forms a conical pile whose height is always twice its radius. How fast is the height increasing when the pile is 2m high? (remark: $V = \frac{1}{3}\pi r^2 h$)
7. A girl can swim at 20 feet/second and run at 25 feet/secont. If she stands at point A=(0,50) on the edge of a circular swimming pool of radius 50 feet (with its centre at the origin), find her optimum path from A to B=(50,0). (Hint: suppose that she begins by running and then swims the rest of the way).
8. You are an ice-cream cone maker. Given a fixed amount of dough, what should the dimensions of the cone be to maximize the cone's volume?