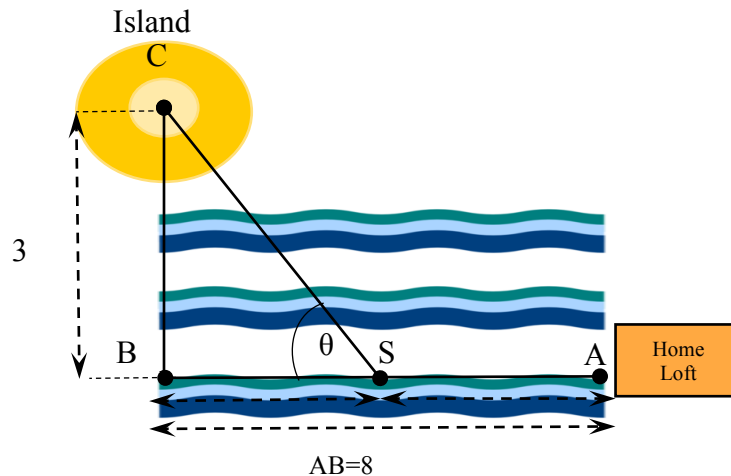


EG02021 Mathematics
Class 4: Differentiation

3.5 Maximum-Minimum Problems

Exercise:

Flights of Homing Pigeons. It is known that homing pigeons tend to avoid flying over water in the daytime, perhaps because the downdrafts of air over water make flying difficult. Suppose a homing pigeon is released on an island at **point C**, which is **3 mi** directly out in the water from **point B** on the shore. Point B is **8 mi** down shore from the pigeon's home loft at **point A**. Assume that a pigeon requires twice the amount of energy per mile to fly over water than to flying over land. At what angle θ should the pigeon fly toward the shore in order to minimize the total energy required to get to its home loft?



3.7 Implicit differentiation and Relative Rates

Implicit differentiation

Exercise: For $y^3 + x^2 \cdot y^5 - x^4 = 27$

- Find $\frac{dy}{dx}$ using implicit differentiation.
- Find the slope of the tangent line to the curve at the point $(0, 3)$.

Related Rates**Exercise 1**

Plant Growth: In one season, the Victoria Water Lily grows circular lily pads with diameters up to 8 ft. suppose the radius r of a Victoria Lily pad is growing at the rate of 0.4 ft per month at the moment that the radius is 2 ft. At that moment, how fast is the area of the lily pad increasing?

Exercise 2

Photosynthesis: Through photosynthesis, a plant converts carbon dioxide into organic matter. In a tropical rain forest, trees annually produce approximately 2200 g of organic matter for every square meter. Suppose that the productivity P (organic matter for every square meter) of a forest is currently 2200 g/m^2 and that the forest currently covers an area A of $200,000,000 \text{ m}^2$. Let the forest is losing $1,000,000 \text{ m}^2$ each year, but the productivity is increasing by $1.5 \text{ g/ (m}^2\text{-yr)}$. What is the rate of change of the quantity of organic matter produced by the trees of the forest?