1. Suppose it costs minerva c dollars each to manufacture and distribute water bottles. If the bottles sell at x dollars each, the quantity of bottles sold is given by

$$q = \frac{a}{x-c} + b(100-x),$$

where a and b are positive constants. What selling price will bring a maximum profit ?
Answer: $(100+c)/2$.

2. Siva and his brother Vishnu, each, want a piece of wire of Length L. Vishnu wants to make a square and Siva an equilateral triangle. How should they cut the wire

   (a) if the sum of the two areas is a minimum ?
   Answer $\frac{4L}{4+3\sqrt{3}}$ for the square.

   (b) if the sum of the areas is a maximum ?
   Answer Vishnu gets it all.

3. Consider two vertical poles of heights 9 and 6 meters which are 20 meters apart. Use calculus to find the shortest length of rope that can reach from the top of one pole to a point on the ground between the poles and then to the top of the other pole.
Answer: $25m$.

4. Show that the volume of the largest right circular cylinder that can be inscribed in a given right circular cone is $\frac{4}{9}$ the volume of the cone.
Facts:
Volume of a cylinder of height h and radius r is equal to $V = \pi r^2 h$.
Volume of a cone of height h and radius r is equal to $V = \frac{1}{3}\pi r^2 h$.

5. A storage shed is to be built in the shape of a box with a square base. It is to have a volume of 150 cubic metres. The concrete for the base costs \$4 per square metre, the material for teh roof costs \$2 per square metre, and the material for the sides cost \$2.50 per square metre. Find the dimensions of the most economical shed.
Answer: $5 \times 5 \times 6$.

[1] **Office hours:** Monday: 1:45-3:15pm, Tuesday:3:30-4:30pm, Wednesday 10:30-11:30am,2:15-3:15pm