12.11) Modelling with differentiation

Worked example	Your turn
Given that the area, $A\ cm^2$, of an expanding circle is related to its radius, $r\ cm$, by the formula $A = \pi r^2$, find the rate of change of area with respect to radius at the instant when the radius is $10\ cm$.	Given that the volume, $V\ cm^3$, of an expanding sphere is related to its radius, $r\ cm$, by the formula $V = \frac{4}{3}\pi r^3$, find the rate of change of volume with respect to radius at the instant when the radius is $5\ cm$. $314\ cm^3$ per cm

Worked example	Your turn
A cuboid is to be made with volume 81 cm^3. The cuboid has a rectangular cross-section where the length of the rectangle is equal to twice its width, x cm. The volume of the cuboid is 81 cm^3. a) Show that the total length, L, of the twelve edges of the cuboid is given by $L = 12x + \frac{162}{x^2}$ b) Given that x can vary, use differentiation to find the maximum or minimum value of L c) Justify that the value of L you have found is a minimum	A cuboid is to be made from 54m² of sheet metal. The cuboid has a horizontal base and no top. The height of the cuboid is x metres. Two of the opposite vertical faces are squares. a) Show that the volume, V m³, of the tank is given by $V = 18x - \frac{2}{3}x^3$. b) Given that x can vary, use differentiation to find the maximum or minimum value of V. c) Justify that the value of V you have found is a maximum a) Shown b) $V = 36$ c) $\frac{d^2V}{dx^2} = -4x\,;\, x = 3, \frac{d^2V}{dx^2} = -12 < 0$