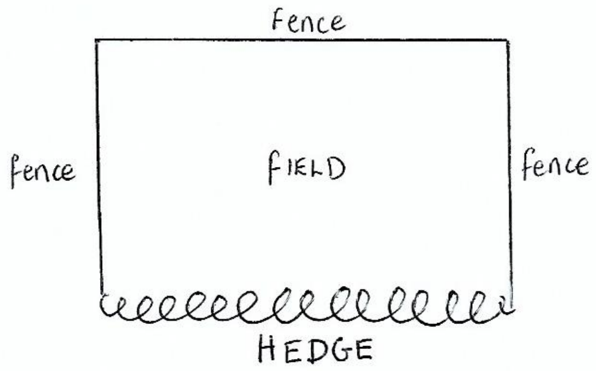
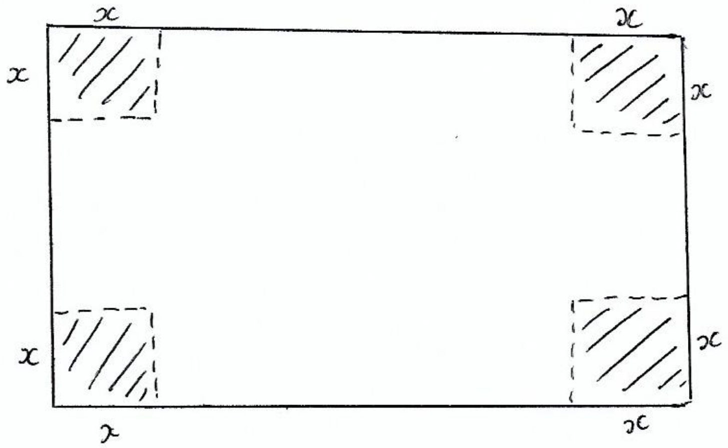
Using Stationary Points with Optimisation

1. A farmer has 100m of electric fence to use in the construction of a field. The field is in the form of a rectangle with one side being a hedge and the three other sides being the electric fence.



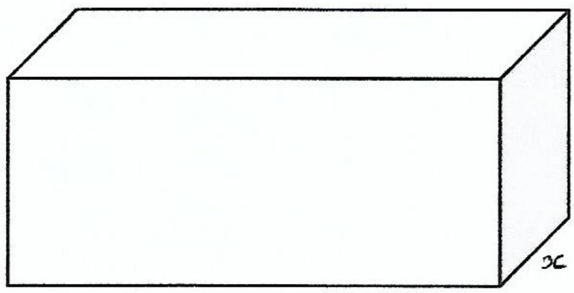
Calculate the maximum possible area that the field could cover and identify the length and width of the field which give this maximum area.

2. A rectangular piece of cardboard measuring 80cm x 50cm has square corners cut out as shown. After removing the corners, a net of an open cuboid box remains.



Calculate the maximum volume of the box and find the dimensions that will give this maximum volume.

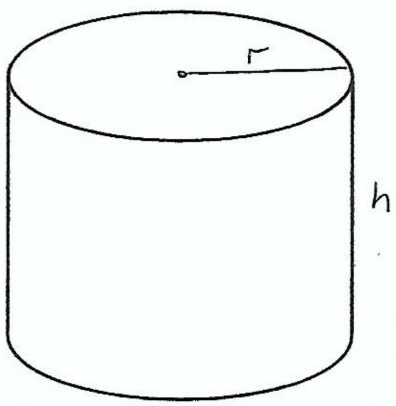
3. The diagram shows a closed box in the form of a cuboid where the length is twice the width. The volume of the box is $9000cm^3$ and the total surface area of the box is denoted by S.



a) Find an expression for S in terms of x, if x is the width of the box.

b) Find the minimum value possible for S which can give a volume of $9000cm^3$

4. A drinks retailer wants to construct a cylindrical metal can which can hold 440ml of juice. Calculate the dimensions of the can such that the minimum possible amount of metal is used. (Hint: you need to find the minimum amount of area of metal that can be used to create a can that holds 440ml)



5. A ship is to make a voyage of 200km at constant speed. When the speed of the ship is v km/h the cost to make the journey is £($v^2 + 4000/v$) per hour. Find the speed at which the ship should travel to keep the cost to a minimum.