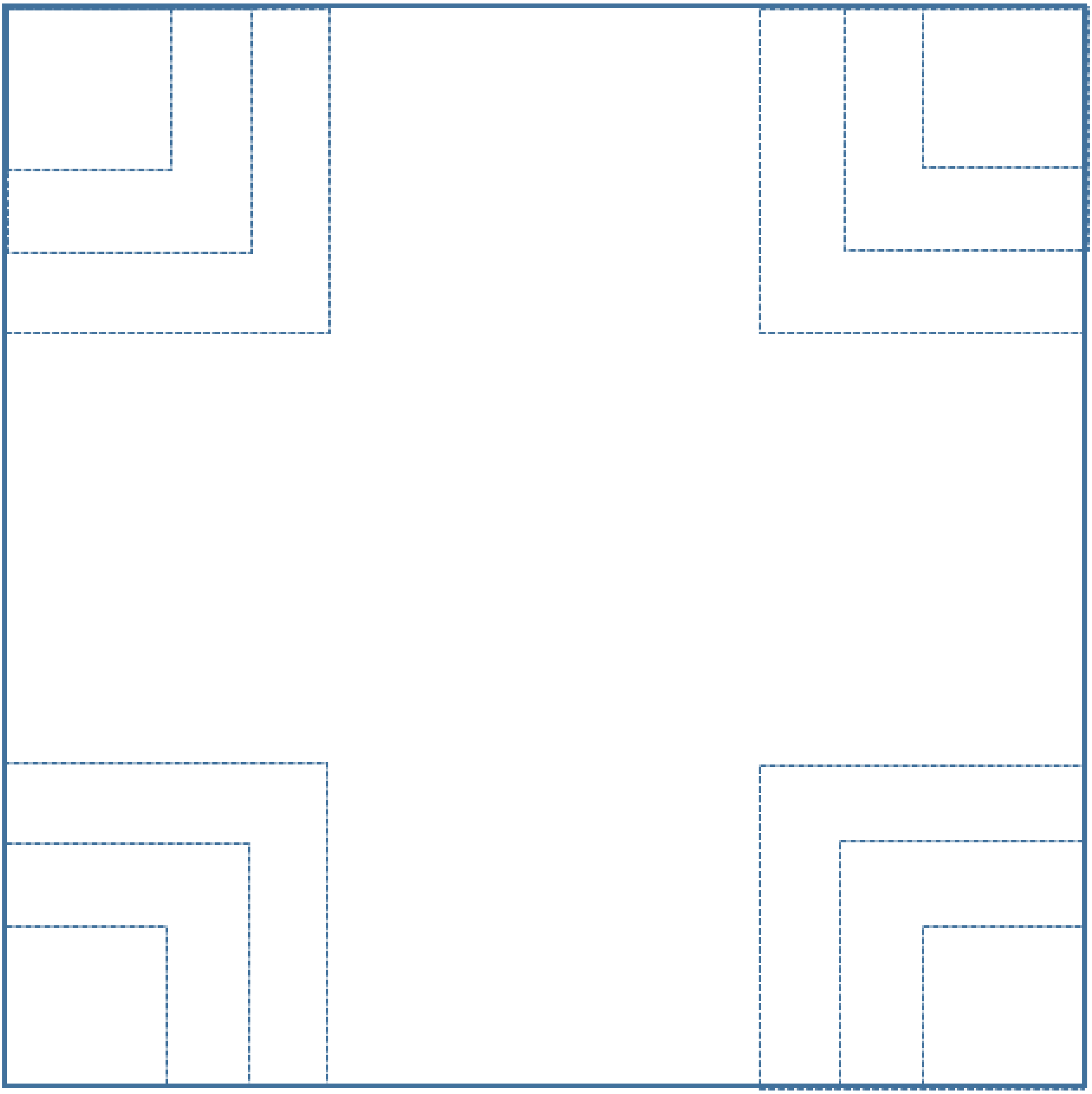
Max Box Problem

Your task is to design an open top box by removing a square cut out from the corner of this square to make the net of an open box with the **largest possible volume**. The square is 20cm x 20cm, cut out a smaller square from each corner, then fold up the edges to make your box.



Max Box Problem

Design approach 1 – inspection

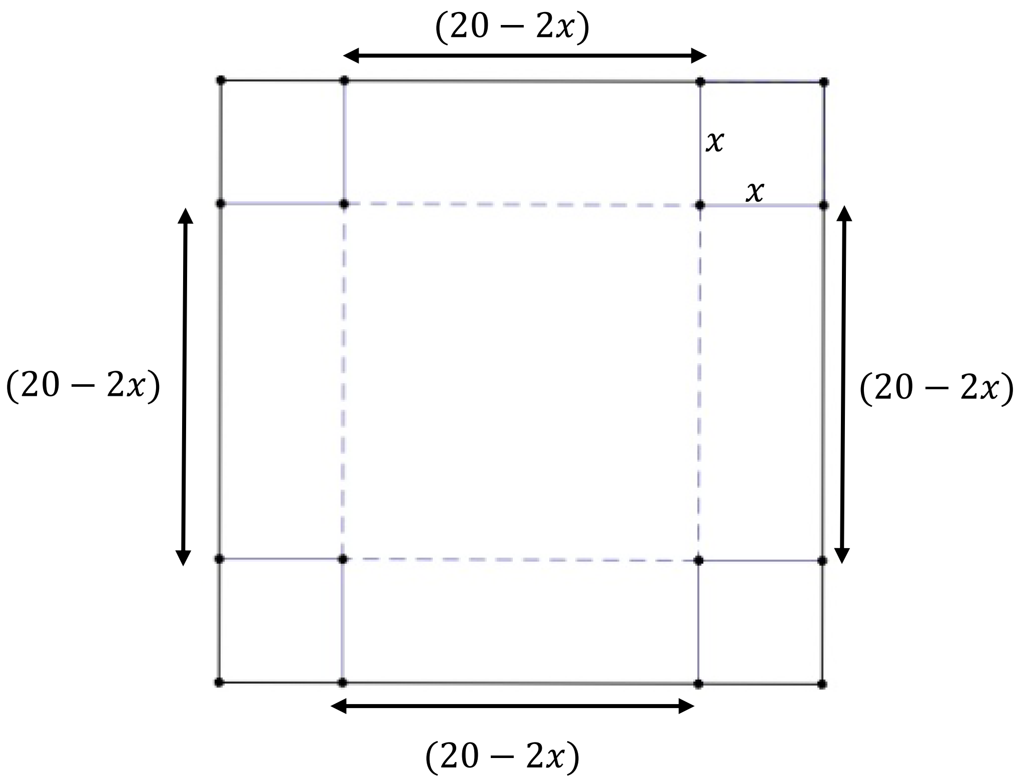
Size of square cut out		
Length of box		
Width of box		
Depth of box		
Volume of box		

Compare your results with others, which size of cut out seems to give the maximum box volume?

Max Box Problem

Design approach 2 – graphical

Consider the general net of your box shown below.



Using algebra, an expression for the volume of this box, in terms of x, is given as follows. Expand these brackets to get a cubic expression for the volume of the box.

$$V = (20-2x)(20-2x)x$$

V =

V =

Using the graph of this function, can you tell what size of square should be cut out to maximise the box volume?

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Design approach 3 – Calculus

We should have found that an expression for the volume of our box is as follows.

$$V = 4x^3 - 80x^2 + 400x$$

Calculus is a powerful mathematical technique which allows us to analyse this expression and find which x value maximises V.

How to differentiate a polynomial function. • Multiply each term by the power of x. For example, if the term is $3x^2$ you will multiply 3 by 2 = 6, this gives the new coefficient for that term. • Reduce the power on each term by 1. For example if the term is x^2 it will become x. • Simplify each term.

Use this guide to differentiate your function for volume.

$$\frac{dV}{dx} =$$

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To find the maximum value of our function we need to solve the equation $\frac{dV}{dx} = 0$

What value of x, gives the maximum box volume?

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What is the maximum box volume?