# Open-Top Box Design Challenge

Rubric and student self-check · Name _____

## Rubric

Five criteria, four points each, twenty points total. The written defence is weighted the same as the algebra on purpose.

| | 4 · Exemplary | 3 · Proficient | 2 · Developing | 1 · Beginning |
|---|---|---|---|---|
| **The model** | V(x) written as a correct product and expanded correctly, with the three dimensions justified from the drawing. | V(x) correct in both forms. Justification is thin or missing. | One structural error, usually subtracting a single x, carried through consistently. | The function does not describe the tray in the picture. |
| **Domain and constraints** | States the correct domain with a reason, converts every rule in the brief into an inequality, and identifies the correct feasible interval. | Domain correct and most rules converted. One inequality missing or reversed. | Domain stated without reasoning, or only one rule handled. | No distinction between what the function allows and what a sheet allows. |
| **Evidence: table and graph** | Table complete and accurate, graph plotted on the domain with the peak and the feasible interval both marked. If the version being used calls for refinement, it is narrowed to at least two decimal places. | Table and graph complete with minor arithmetic slips. Refinement present where the version requires it. | Table has gaps, or the graph runs outside the domain, or the required refinement is missing. | Little numerical or graphical evidence. |
| **The design decision** | Chooses the correct cut size, checks it against every rule in the brief, and reports the volume and the cost of the binding constraint in both cubic units and percent. | Chooses the correct cut and checks most rules. Cost of the constraint missing or miscomputed. | Chooses the peak of the curve and does not notice it fails a rule. | No clear design, or a cut size that breaks a rule with no comment. |
| **Argument and precision** | Explains why no allowed cut beats the chosen one, using the shape of the curve over the whole feasible interval rather than only the tested values. Names the tempting wrong answer and the rule it breaks. Units and the required precision are used throughout. | Clear argument resting mainly on the table rather than the whole interval. Units mostly present. | Restates the answer without an argument, or argues only from tested points. | No defence, or a defence that contradicts the student's own numbers. |

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| Criterion | Score |
|---|---|
| The model | |
| Domain and constraints | |
| Evidence: table and graph | |
| The design decision | |
| Argument and precision | |
| **Total out of 20** | |

## Before you hand it in

Tick each line only if you can point at the place in your packet where it happens. If you cannot find it, it is not done.

- ○ My volume function is a product of three factors and I can say where each factor comes from on the drawing.
- ○ I expanded it and my expanded form gives the same value as my factored form for at least one x I tested.
- ○ I wrote the domain as an inequality and I said what goes wrong at each end.
- ○ I turned every rule in the brief into an inequality, not just the one about the walls.
- ○ My graph stops at the ends of the domain instead of running off the grid.
- ○ I marked the peak of the curve and the best allowed cut as two separate points.
- ○ My chosen cut is measured to the precision my worksheet asks for.
- ○ I checked the base width and the base depth against the shelf, separately.
- ○ I said how much volume the shelf rule cost me, in cubic inches and as a percentage.
- ○ My defence explains why every allowed cut loses to mine, not just the ones in my table.
- ○ I named the cut somebody would wrongly pick and the rule it breaks.
- ○ Every number in my packet has a unit attached to it.

**The one that decides the grade**

Find the question in your worksheet that asks you to defend your design, and read your answer to it again. If that answer would still be true with the shelf rule deleted, you have not answered it.