Instructions: You have 30 minutes for this quiz. Show all of your work.

Problem Description: You have been hired to design gift boxes. The boxes are to be constructed from a single sheet of cardboard. The cardboard is measured in inches, and it is 80 inches wide by 150 inches long. You cut out certain $x$ by $x$ squares, then you fold the cardboard into your box. Your diagram below shows your layout for cutting and folding the cardboard.

1. (6) Find a model that describes the volume of the box as a function of $V(x)$, where $x$ is the length of your square cuts.

2. (2) What function arithmetic did you use to construct $V(x)$?
3. (4) Sketch $V(x)$ on the coordinate system below.

4. (4) What are the zeros of $V(x)$?

5. (4) $V(x)$ describes the volume of your gift box. What is its domain? Explain your answer.
6. (4) Suppose you know that at \( x \approx 14.7 \) inches you get a maximum volume of approximately 39,385 in\(^3\). Sketch a graph of \( V(x) \) for your domain. Show graphically how to find the cut or cuts you could make to construct a box of volume 20,000 in\(^3\).

7. (2) How many ways can you construct a box with a volume of 20,000 in\(^3\)?

8. (4) Qualitatively describe the box or boxes you would construct with a volume of 20,000 in\(^3\).