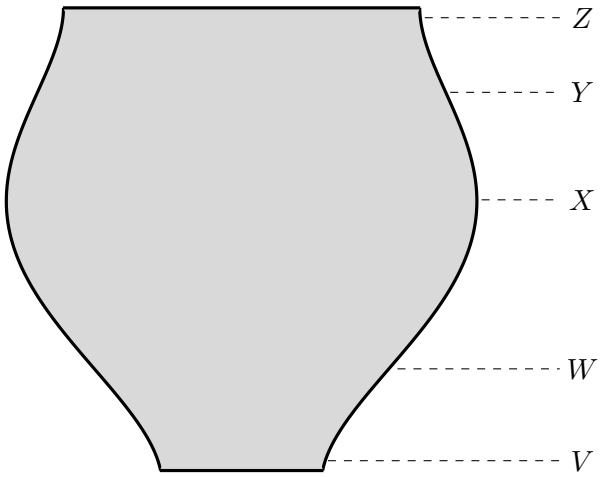
10. [8 points] Water is pouring at a constant positive rate into a circular planter of height 40 inches, whose profile from the side is displayed below. For $0 \le t \le 10$, let $D(t)$ be the depth in inches of the water in the planter t minutes after water first starts pouring into the planter.

Assume the first and second derivatives of $D(t)$ exist and are continuous on the interval $(0, 10)$. We know that it takes exactly ten minutes for the water to fill the planter completely, so $D(0) = 0$ and $D(10) = 40$.

Let v, w, x, y, z be the times, in minutes, that it takes the water level in the planter to reach the heights V, W, X, Y, and Z, respectively, that are shown in the figure. So, for instance, $Y = D(y)$. Note that X is the height at which the planter is the widest, and heights W and Y correspond to inflection points in the curve that gives the profile of the planter.



a. [2 points] Determine whether each statement below is true or false. Indicate your answer by clearly writing TRUE or FALSE on the blank before each statement.

(i) ____TRUE____ The function $D(t)$ is increasing on the interval $[0, 10]$.

(ii) ____TRUE____ The function $D(t)$ is invertible on the interval $[0, 10]$.

b. [1 point] How does $D(5)$ compare with 20? Circle the correct statement below.

$D(5) < 20$ $\quad$ $D(5) = 20$ $\quad$ $\boxed{D(5) > 20}$

c. [1 point] Circle all points below at which the derivative $D'(t)$ attains a global **maximum** on the interval $[v, z]$.

$\boxed{v}$ $\quad$ w $\quad$ x $\quad$ y $\quad$ z $\quad$ NONE OF THESE

d. [1 point] Circle all points below at which the derivative $D'(t)$ attains a global **minimum** on the interval $[v, z]$.

v $\quad$ w $\quad$ $\boxed{x}$ $\quad$ y $\quad$ z $\quad$ NONE OF THESE

e. [1 point] Circle all intervals below on which the derivative $D'(t)$ is **increasing**.

(v, w) $\quad$ (w, x) $\quad$ $\boxed{(x, y)}$ $\quad$ $\boxed{(y, z)}$ $\quad$ NONE OF THESE

f. [1 point] Circle all intervals below on which the function $D(t)$ is **concave up**.

(v, w) $\quad$ (w, x) $\quad$ $\boxed{(x, y)}$ $\quad$ $\boxed{(y, z)}$ $\quad$ NONE OF THESE

g. [1 point] Circle all **inflection points** of the function $D(t)$ on the interval $(0, 10)$.

v $\quad$ w $\quad$ $\boxed{x}$ $\quad$ y $\quad$ z $\quad$ NONE OF THESE