

8. [5 points] Let  $y = q(x) = \frac{ax}{1+ax}$ , where  $a > 0$  is a positive constant. Find a formula for the function  $q^{-1}(y)$ , showing **all** your work.

*Solution:*

$$y = \frac{ax}{1+ax}$$

$$y(1+ax) = ax$$

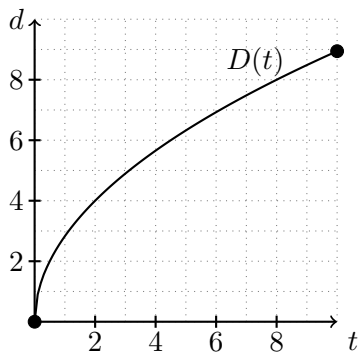
$$y = ax(1-y)$$

$$\frac{y}{1-y} = ax$$

$$x = \frac{y}{a(1-y)}$$

$$q^{-1}(y) = \frac{y}{a(1-y)}.$$

9. [5 points] Consider the function  $D(t)$  with its graph shown below on the left, and the piecewise-defined function  $S(d)$ .



$$S(d) = \begin{cases} 0 & d < 0 \\ -d^2 - 10d + 100 & 0 \leq d \leq 10 \\ 0 & d > 10 \end{cases}$$

- a. [1 point] Is  $S(D(t))$  invertible?

yes      no      not possible to tell

- b. [4 points] Find all solutions  $t$  to the equation  $S(D(t)) = 25$ . Be sure to show **all** your work and, if necessary, estimate any coordinates on the graph of  $D(t)$  to one decimal place.

*Solution:* We first solve the equation  $S(d) = 25$ :

$$25 = -d^2 - 10d + 100$$

$$0 = d^2 + 10d - 75 = (d - 5)(d + 15)$$

$$d = 5, 15.$$

Looking at the graph of  $D(t)$ , the only value of  $t$  for which  $D(t) = 5$  or  $25$  is  $t = 3.1$ .

$$t = \frac{3.1}{}$$