5.2.89

Exercise 5.2.89 Taking into account reaction time, the distance d (in feet) that a car requires to come to a complete stop while traveling r miles per hour is given by the function $d(r) = 6.97r - 90.39$.

(a) Express the speed r at which the car is traveling as a function of the distance d required to come to a complete stop.

(b) Verify that $r = r(d)$ is the inverse of $d = d(r)$ by showing that $r(d(r)) = r$ and $d(r(d)) = d$.

(c) Predict the speed that a car was traveling if the distance required to stop was 300 feet.

Solution

(a) We find the inverse of $d = d(r) = 6.97r - 90.39$. So we solve for r in terms of d:

$d + 90.39 = 6.97r$ or $r = (d + 90.39)/6.97$.

So $\boxed{r = r(d) = (d + 90.39)/6.97}$.

(b) Notice that domains of $d(r)$ and $r(d)$ are both $\mathbb{R} = (-\infty, \infty)$ (disregarding any physical meaning), and we have

$$d(r(d)) = d(((d + 90.39)/6.97)$$
$$= 6.97\,((d + 90.39)/6.97) - 90.39$$
$$= (d + 90.39) - 90.39 = d,$$

5.2.89 continued

and $r(d(r)) = r(6.97r - 90.39)$

$$= \frac{(6.97r - 90.39) + 90.39}{6.97} = \frac{6.97r}{6.97} = r. \quad \square$$

(c) The question is $r = ?$ when $d = 300$ feet.

From $r(d) = (d + 90.39)/6.97$ we have

$$r(300) = \frac{(300) + 90.39}{6.97} = \frac{390.39}{6.97} \simeq \boxed{56 \frac{\text{miles}}{\text{hour}}} \quad \square$$