Solution

Math 133, Quiz #2

1. Which of the following functions are one-to-one ?

   (a) $f(x) = 2x + 1$

   (b) $f(x) = x^4$

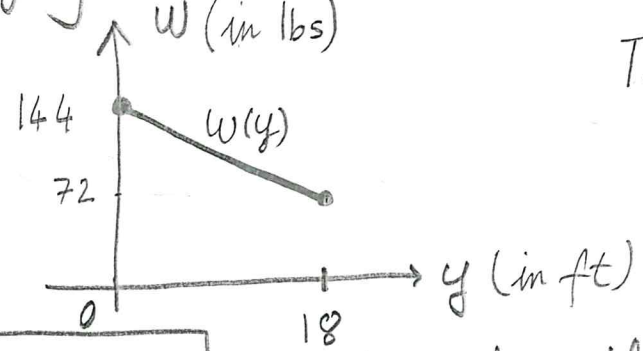
   (c) $f(x) = \sqrt{x}\ ,\ x \geq 0$

   (d) $f(x) = x^2\ ,\ x \geq 0$

   (e) $f(x) = \cos x$

2. A bag of sand originally weighing 144 lb was lifted at a constant rate. As it rose, sand also leaked out at a constant rate. The sand was half gone by the time the bag had been lifted to 18 ft. How much work was done lifting the sand this far ? (Neglect the weight of the bag)

Let's find the weight of the sandbag $W(y)$, as a function of its distance from the ground, y. Since $W(y)$ was changing at a constant rate, it is a linear function of y.



The slope is $m = \frac{72-144}{18-0} = -4$

Thus $\boxed{W(y) = -4y + 144}$

Therefore, the work needed is

$$W = \int_0^{18} (-4y + 144)\, dy = \left(-2y^2 + 144y\right)\Big|_0^{18} = \boxed{144(18) - 2(18)^2 \text{ ft·lb.}}$$