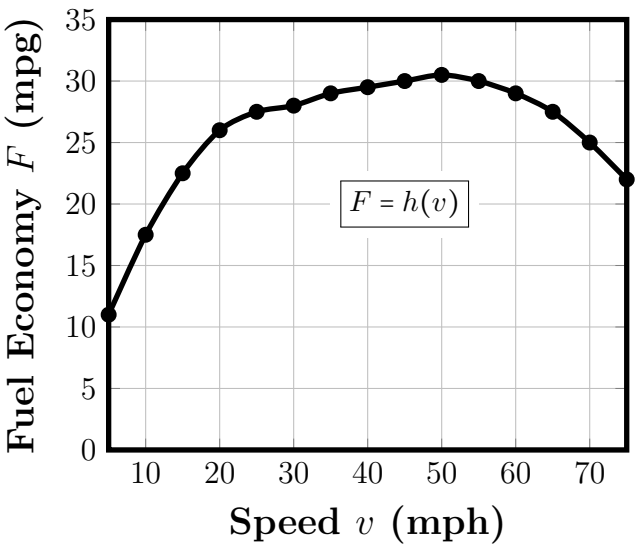
3. [8 points] The website `fueleconomy.gov` gives the graph on to the right to show fuel economy (in miles per gallon or mpg) as a function of speed (in miles per hour or mph) for a particular type of car. We'll call the function defined by this graph $h(v)$.



a. [1 point] What can you say about the concavity of $h(v)$ over the domain $[10, 30]$? *Circle one answer; no explanation necessary.*

CONCAVE UP

[CONCAVE DOWN]

NEITHER

b. [1 point] $h(v)$ is not an invertible function. Explain in 1–2 sentences how we know.

Explanation: Since the graph does not pass the horizontal line test, it cannot be invertible. That is, there is an output value with two different input values, so the function cannot be inverted.

c. [1 point] If we wanted to restrict the domain of $h(v)$ so that is *was* an invertible function, what would be a good domain to use?

Domain: $[5, 50]$ **or** $[50, 75]$

Another function $c(F)$, which is invertible, gives the cost of gas in dollars per mile when we have a fuel economy of F mpg.

d. [4 points] Write a sentence or phrase that gives the meaning of each of the following equations or expressions. Or, if it does not make sense in context, explain why not.

i. $c(h(80)) = 0.22$ When this particular car is going 80 miles per hour, the cost of gas is 0.22 dollars per mile.

ii. $c^{-1}(0.18)$ This is the fuel economy (in mpg) when the cost of gas is 0.18 dollars per mile.

e. [1 point] In this context, what is a reasonable domain for $c(F)$? *No explanation necessary.*

Domain: $[0, 50]$

Solution: There are many different ways we could give a reasonable domain for c. One thing we know is that it shouldn't include negative numbers, since a negative fuel economy doesn't make sense. On the other hand, we know that any domain for c should include at least the range of fuel economy we see in the graph of $F = h(v)$. In particular, it should include at least $[11, 30]$.