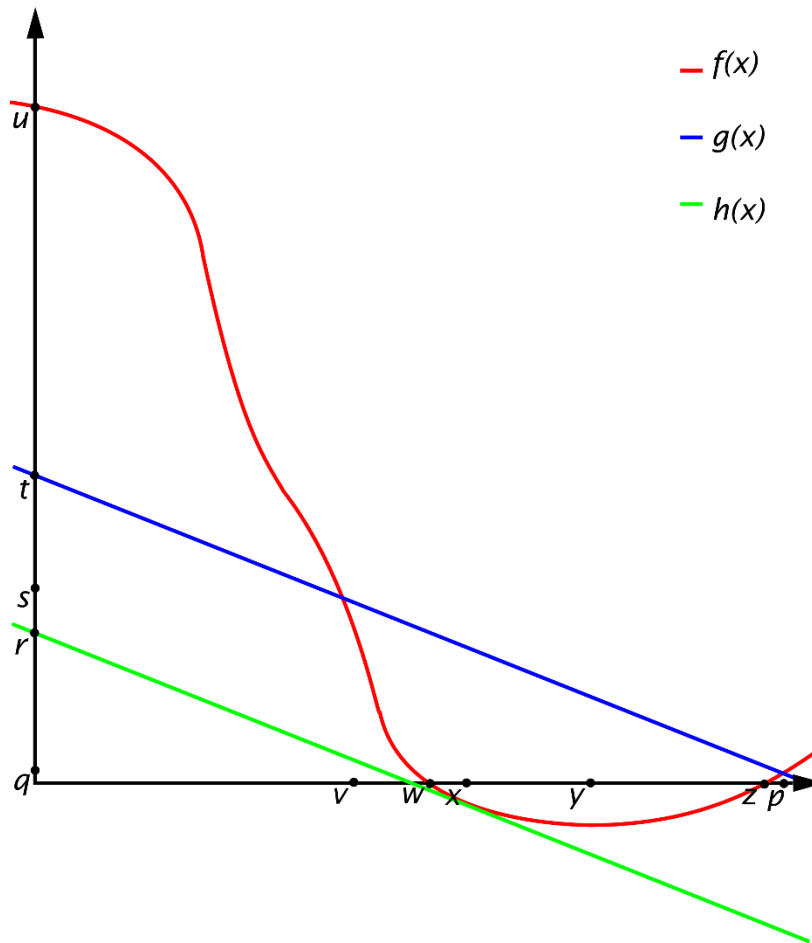


Section 1

For Section 1, please refer to Figure 1, below.



1. Which point corresponds to $f(0)$?
2. Which points, if any, would correspond to roots of the function $f(x)$?
3. Say $g(x)$ and $h(x)$ have exactly the same slope. Express the value of $f'(x)$, that is, the derivative of f at the point labeled x , in terms of points and functions given in the figure above.
4. Give the coordinates, in the form $(x, f(x))$, of any optima found in the figure.
5. What can we say about the value of $f''(y)$?
6. What can we say about the value of $f''(v)$?
7. What can we say about the value of $g''(p)$?

Section 2

8. Let $u, v \in \mathbb{R}^N$. If we are told that the set $\{u, v\}$ spans \mathbb{R}^N , what can we say about N ?
9. Let

$$A = \begin{bmatrix} 5 & 1 \\ 2 & 7 \\ 3 & 8 \end{bmatrix}$$

Are the columns of A^T linearly independent?

10. Let $u, v \in \mathbb{R}^N$. Show that $u^T v = v^T u$.
11. Let

$$W = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$$

Calculate $\sum_{i=1}^2 \sum_{j=1}^2 W_{ij}$.

12. A matrix A is said to be symmetric if, and only if, $A = A^T$. Let A be symmetric and invertible. Show that A^{-1} must also be symmetric.

Section 3

13. A friend of yours was just tested for the presence of a disease. Your friend tells you that the test is 99% accurate at detecting the disease when it's present, but that 10% of the time, the test comes back positive no matter what. Your friend's test came back positive, and the doctor has told him that he has a 9% of chance of having the disease, given the positive result. How common is this disease within the general population?
14. Say we have four possible events A, B, C , and E . Let A, B , and C be disjoint from each other, but not from E . How do we calculate $P(E)$?