2. The demand for organic carrots is given by the following equation:

$$Q_O^D = 75 - 5P_O + P_C + 2I$$

where P_O is the price of organic carrots, P_C is the price of conventional carrots, and I is the average consumer income. Notice how this isn't a standard demand curve that just relates the quantity of organic carrots demanded to the price of organic carrots. This demand function also describes how other factors affect demand—namely, the price of another good (conventional carrots) and income.

a. Draw the demand curve for organic carrots when $P_C = 5$ and $I = 10$.

b. Using the demand curve drawn in (a), what is the quantity demanded of organic carrots when $P_O = 10$?

c. Using the demand curve drawn in (a), what is the quantity demanded of organic carrots when $P_O = 5$?

d. Now, suppose $P_O = 10$ and $P_C = 15$ (I remains at 10). What is the quantity demanded of organic carrots? Compared with your answer in (b), has there been a change in demand or quantity demanded? Demonstrate using a graph.

e. What happens to the demand for organic carrots when the price of conventional carrots increases? Are organic and conventional carrots complements or substitutes?

f. What happens to the demand for organic carrots when the average consumer income increases? Are carrots a normal or an inferior good?

g. Show that the law of demand holds using calculus.

h. Use calculus to argue whether conventional carrots are substitutes or complements to organic carrots, and show that your answer is the same as in part (e).

i. Use calculus to argue whether organic carrots are normal or inferior goods, and show that your answer is the same as in part (f).