Suppose that the demand for a product is given by the following demand function:

$$Q = 500 - 3P$$

Where $P$ = the price in dollars.
$Q$ = the quantity sold per year.

(a) To sell 200 units, what price should you charge?

Solve the demand equation for $P$ to get, $P = 500/3 - Q/3$.

$$P = 500/3 - (200)/3 = \$100$$

(b) If you set a price at $100 per unit, how many units will you sell?

$$Q = 500 -3(100) = 200.$$

(c) What is the price elasticity of demand if price equals $100.

$$-3(100/200) = 1.5$$

(d) At what price, if any, will the price elasticity of demand equal one?

This can be solved by recognizing the price elasticity of demand equals one at the half way point along a linear demand curve. The price elasticity of demand equals one at a price of $83.33 and a quantity of 250 units.
(2) Suppose that further analysis indicates that the demand for your product is given by the following:

\[ Q = 500 - 3P + 2P_r + .1I + .05A \]

Where:  
P_r = the price of a rival product.  
I = average income of consumers.  
A = annual advertising expenditures.  
Currently, P = $10, P_r = $20, I = $55,000, A = $50,000.

(a) Interpret the coefficients of P, P_r, I and A.

\[ \frac{\Delta Q}{\Delta P} = 3. \] A one dollar increase in price results in a 3 unit decrease in quantity demanded.

\[ \frac{\Delta Q}{\Delta P_r} = 2. \] A one dollar increase in the price of the rival product results in a 2 unit decrease in quantity demanded.

\[ \frac{\Delta Q}{\Delta I} = .1. \] A one dollar increase in income results in a .1 unit decrease in quantity demanded.

\[ \frac{\Delta Q}{\Delta A} = .05. \] A one dollar increase in advertising results in a .05 unit decrease in quantity demanded.

(b) What is the own price elasticity of demand for the product? Interpret.

\[ \frac{\Delta Q}{\Delta P} \frac{P}{Q} = \frac{3 \cdot 10}{8510} = .0035 \]

(c) What is the cross price elasticity of demand? Interpret.

\[ \frac{\Delta Q_1}{\Delta P_2} \frac{P_2}{Q_1} = \frac{2 \cdot 20}{8510} = .0047 \]

(d) What is the income elasticity of demand? Interpret.

\[ \frac{\Delta Q}{\Delta I} \frac{I}{Q} = \frac{.1 \cdot 55,000}{8510} = .646 \]

(e) What is the advertising elasticity of demand? Interpret.

\[ \frac{\Delta Q}{\Delta A} \frac{A}{Q} = .05 \frac{50,000}{8510} = .294 \]