3. Suppose the price elasticity of demand for heating oil is 0.2 in the short run and 0.7 in the long run.

   a. If the price of heating oil rises from $1.80 to $2.20 per gallon, what happens to the quantity of heating oil demanded in the short run? In the long run? (Use the midpoint method in your calculations.)

   b. Why might this elasticity depend on the time horizon?

a)

short $\eta_d = \frac{\%\Delta Qd}{\%\Delta P}$

$0.2 = \frac{\%\Delta Qd}{22\%}$

$\%\Delta Qd = 4.4$

$\%\Delta P = \frac{2.20-1.80}{1.8} \times 100$

$= \frac{0.4}{1.8} \times 100$

$= 22\%$

Long $\eta_d = \frac{\%\Delta Qd}{\%\Delta Pd}$

$0.7 = \frac{\%\Delta Qd}{22\%}$

$\%\Delta Qd = 15.4$

b) Short run can not change because enough time

long run can change everything

7. Suppose that your demand schedule for pizza is as follows:

Price	Quantity Demanded (income = $20,000) ($Q_0$)	Quantity Demanded (income = $24,000) ($Q_1$)
$8	40 pizzas	50 pizzas
10	32	45
12	24	30
14	16	20
16	8	12

a. Use the midpoint method to calculate your price elasticity of demand as the price of pizza increases from $8 to $10 if (i) your income is $20,000 and (ii) your income is $24,000.

b. Calculate your income elasticity of demand as your income increases from $20,000 to $24,000 if (i) the price is $12 and (ii) the price is $16.

a) i) At $ 20,000

$$\eta_s = \frac{\%\Delta Q_s}{\%\Delta P}$$

$$= \frac{(Q_1-Q_0)/(Q_1+Q_0)}{(P_1-P_0)/(P_1+P_0)}$$

$$= \frac{1}{\text{slope}} \frac{(P_1+P_0)}{(Q_1+Q_0)}$$

$$= -\frac{1}{4} \times \left(\frac{10+8}{40+32}\right)$$

$$= -\frac{1}{4} \times \frac{18}{72}$$

$$= -0.1$$

ii) At $ 24,000

$$\eta_s = \frac{\%\Delta Q_s}{\%\Delta P}$$

$$= \frac{(Q_1-Q_0)/(Q_1+Q_0)}{(P_1-P_0)/(P_1+P_0)}$$

$$= \frac{1}{\text{slope}} \frac{(P_1+P_0)}{(Q_1+Q_0)}$$

$$= \frac{1}{-\frac{5}{2}} \times \frac{(10+8)}{(45+50)}$$

$$= \frac{-2}{5} \times \frac{18}{95}$$

$$= -\frac{36}{475}$$

$$= -0.0757$$

b) I.

$$\eta_I = \frac{\%\Delta Q_D}{\%\Delta I}$$

$$= \frac{\frac{30-24}{24} \times 100}{\frac{24000-20000}{20000} \times 100}$$

$$= \frac{\frac{1}{4}\frac{6}{24} \times 100}{\frac{1}{5}\frac{4000}{20000} \times 100}$$

$$= \frac{25}{20}$$

$$= 1.25$$

II

$$\eta_I = \frac{\%\Delta Q_D}{\%\Delta I}$$

$$= \frac{\frac{12-8}{8} \times 100}{\frac{24000-20000}{20000} \times 100}$$

$$= \frac{\frac{4}{8} \times 100}{\frac{1}{5} \times 100}$$

$$= \frac{50}{20}$$

$$= 2.5$$