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3. a.) - short run $\Rightarrow$ $\eta_D = \frac{\%\Delta Q}{\%\Delta P}$

$0.2 = \frac{\%\Delta Q}{\frac{1.8+2.2}{2}}$

$0.2(2) = \%\Delta Q$

$\%\Delta Q = 0.4$

- long run $\Rightarrow$ $\eta_D = \frac{\%\Delta Q}{\%\Delta P}$

$0.7 = \frac{\%\Delta Q}{\frac{1.8+2.2}{2}}$

$0.7(2) = \%\Delta Q$

$\%\Delta Q = 1.4$

$\therefore$ in the long run, the quantity of heating oil is less than in the short run. That means in the long run will have more substitutes of heating oil.

b.) Because when there is more time it affects customer to adjust and can find more substitutes.

7. a.) • income 20,000 $

slope $= \frac{10-8}{32-40} = \frac{2}{-8} = -\frac{1}{4}$

$\rightarrow \eta_D = \frac{1}{\text{slope}} \cdot \frac{P_1+P_2}{Q_1+Q_2}$

$= \frac{1}{-\frac{1}{4}} \cdot \frac{8+10}{40+32}$

$= (-4)\frac{18}{72}$

$\therefore \eta_D = -1$ #

• income 24,000 $

slope $= \frac{10-8}{45-50} = \frac{2}{-5}$

$\rightarrow \eta_D = -\frac{5}{2} \cdot \frac{8+10}{50+45}$

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

$\therefore \eta_D = -\frac{9}{19}$ #

b.) • Price = 12 $

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

$= \frac{\frac{30-24}{24} \times 100}{\frac{24,000-20,000}{20,000} \times 100}$

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

$= \frac{5}{4} = 1.25$ #

• Price = 16 $

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

$= \frac{\frac{12-8}{8} \times 100}{\frac{24,000-20,000}{20,000} \times 100}$

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

$= \frac{5}{2} = 2.5$ #