Patrick drives a relatively fuel-inefficient vehicle. He's wondering about buying a Tesla. He spends some time working out all of the details and he decides that, with his current truck, his weekly driving costs him $p\_d=3$ dollars per kilometer. His utility function for driving (d) and all other goods (x) is $U=((xd)/25)+4x$ and he has \$1800 per week to devote to driving (d) and other fun activities (x). His marginal utilities are $mu\_x=(d/25)+4$ and $mu\_d=(x/25)$. Which of the following statements are true?

Select all that apply:

☐ a. With his current vehicle, Patrick is maximizing his utility driving 350km/week (i.e. d=350).   cross out

☐ b. A carbon tax raises the cost of driving, p_d, to \$5 per km. With this change, Patrick will drive 150km.   cross out

☑ c. Patrick is considering buying a Tesla and it would reduce his implicit cost of driving to \$2 per km regardless of the carbon price, but it would also reduce his disposable weekly income (Tesla payments aren't cheap!) to \$1600 per week. If there is no carbon tax in place, he should still buy the Tesla.   cross out

☑ d. With the carbon price in place, and the alternative being p_d=\$5, the savings are enough to make him better off with the Tesla.   cross out

☐ e. Patrick will drive more with the Tesla but spend less on driving (i.e. p_d*d will be lower with the Tesla than in the other two cases).   cross out

☐ f. Patrick's own-price demand for driving is inelastic.   cross out

Optimization

$$\frac{D}{25}+4 = \frac{\frac{x}{25}}{P_D}$$

$$P_D\left(\frac{D}{25}+4\right) = \frac{x}{25}$$

$$\times 25 \quad P_D(D+100) = x$$

Budget

$$Y = X + P_D D$$

$$Y = P_D(D+100) + P_D D$$

$$Y = P_D(2D+100)$$

$$\frac{Y}{P_D} - 100 = 2D$$

$$\frac{Y}{2P_D} - 50 = D$$

a) $\frac{1800}{2\cdot3} - 50 = D = 250$

$x = Y - P_D D = 1800 - 250(3)$
$= 1050$

$U = \frac{1050\cdot250}{25} + 4\cdot1050$

$= 14700$

b) $\frac{1800}{2\cdot5} - 50 = 130 = D$

$x = 1800 - 5(130) = 1150$

$U = \frac{1150\cdot130}{25} + 4\cdot1150 = 10\,580$

c) $\frac{1600}{2\cdot2} - 50 = 350$

$x = 1600 - 350(2) = 900$

$U = \frac{900\cdot350}{25} + 4(900) = 16200$

d) no tax, $P_D D = 750$, $D = 250$

tax $P_D D = 650$ $D = 130$

Tesla $P_D D = 700$ $D = 350$

Drives more, but spends more than other case

e) Inelastic $\Rightarrow \frac{\% \text{ change in } Q}{\% \text{ change in } P}$

change in Q is

$250 \to 130$ -48%

change in P is

$3 \to 5$ $+66\%$

Q response is smaller then price change $\Rightarrow$ inelastic