Michelle drives a relatively fuel-inefficient vehicle. She's wondering about buying a Tesla. She's spent some time working out all of the details and decides that, with her current car, driving costs her p_d=3 dollars per kilometer. Her utility function for driving (d) and all other goods (x) is U=2xd+300x and she has $1800 per week to devote to driving (d) and other fun activities (x). Her marginal utilities are mu_x=2d+300 and mu_d=(2x). You may assume p_x=1. Which of the following statements are true?

Select all that apply:

- ☐ a. With her current vehicle, Michelle is maximizing her utility driving 250km/week (i.e. d=250). — cross out
- ☐ b. A carbon tax raises the cost of driving, p_d, to $5 per km. With this change, Michelle will drive 120km/week. — cross out
- ☑ c. Michelle is considering buying a Tesla and it would reduce her implicit cost of driving to $2 per km regardless of the carbon price, but it would also reduce her disposable weekly income (Tesla payments aren't cheap!) to $1600 per week. If there is no carbon tax in place, she should still buy the Tesla. — cross out
- ☑ d. With the carbon price in place (i.e. compared to their regular income and p_d=$5), the savings are enough to make Michelle better off with the Tesla despite the lower income of Y=1600. — cross out
- ☐ e. Michelle will drive more with the Tesla but spend less on driving than she would in either of the two cases tested above (i.e. p_d*d will be lower with the Tesla than in the other two cases). — cross out
- ☑ f. The answer to this question would be the same if we assumed that Michelle's utility was U=xd+ 150x. — cross out

D* w/ carbon is 225
D* w/o carbon is 105
U is greater w/ Tesla
U is greater w/ Tesla
PoD w/ Tesla = 650 vs 525 w/ carbon

1) Set up utility max
MRS = MRT and
Y = PoD + x

MRS = MRT ⇒ $d+150 = \frac{x}{p_d}$ or $2d+300 = \frac{2x}{P_D}$

dividing by 2
$d+150 = \frac{x}{P_D}$

Solve for x
$P_D(d+150) = x$

Sub into budget constraint
$Y = P_D(d+150) + P_D d$
$= P_D(2d+150)$

Solve for d
$Y = P_D(2d+150)$

$\frac{Y}{P_D} - 150 = 2d$

$\frac{\frac{Y}{P_D} - 150}{2} = D$

Use $D^* = \frac{\frac{Y}{P_D} - 150}{2}$ to solve for D* in each case, then
$x = Y - P_D D^*$
to get x^*
then $U = \hat{x}D^* + 150x^*$

a) $P_D = 3$, $Y = 1800$
$D^* = 225$, $P_D D = 675$ $x = 1125$
$U = 421,875$

b) $P_D = 5$, $Y = 1800$
$D^* = 105$, $P_D D = 525$ $x = 1275$
$U = 325,125$

c) $P_D = 2$, $Y = 1600$
$D^* = 325$ $P_D D = 650$, $x = 950$
$U = 451,250$