

Answer the questions fully to your best ability. Use the space provided. If you run out of room, use the backsides. No partial credit will be given if you do not show the steps of your calculations! **Write as neatly as possible!**

Name: _____

1. Find stationary points for these functions and identify if it is a maximum, a minimum or inflection point:

(2) (a) $y = 2x^2 - 3x + 4$

Solution: $y' = 0 \Rightarrow 4x - 3 = 0 \Rightarrow x^* = 3/4$
 $y'' = 4 > 0$, thus x^* is a minimum.

(2) (b) $y = 10x \cdot e^{\ln x} + 4x$

Solution: First of all $y = 10x \cdot x + 4x = 10x^2 + 4x$. Thus $y' = 0 \Rightarrow 20x + 4 = 0$. So that $x^* = -1/5$. $y'' = 4$, thus x^* is a minimum.

(2) (c) $y = x^{-5}$

Solution: $y' = 0 \Rightarrow -5x^{-6} = 0$. There is no x^* that would satisfy this condition. Thus there is no stationary point for this function!

2. Let's say that your score (S) you will get on this quiz is a function of time (t_S) that you spent at home studying: $S = -4t_S^2 + 5t_S$. But you also like watching TV the same way you like getting high test grades. Your happiness (H) that you get from watching TV is a function of time also: $H = 2t_{TV} - 5$. Thus you are actually indifferent between getting a 0 on this quiz and watching TV for 2.5 hours, because it yields same satisfaction for you.

- (2) (a) How much time should you allocate for studying? [Hint: equate marginal benefit of studying to marginal benefit of watching TV.]

Solution: Marginal benefit of studying: $MS = \frac{dS}{dt_S} = -8t_S + 5$
 Marginal benefit of watching TV: $MH = \frac{dH}{dt_{TV}} = 2$
 Optimality is reached when MBs are equal: $MS = MH$:
 $-8t_S + 5 = 2$ so that $t_S^* = 3/8$

Question 2 continues on the next page...

- (2) (b) Now assume $H = M_H \cdot t - 5$, where a M_H is marginal happiness from extra hour of TV time. Derive your demand for study time. [Hint: You should find t_S as a function of M_H]

Solution: Marginal benefit of studying: $MS = \frac{dS}{dt_S} = -8t_S + 5$
Marginal benefit of watching TV: $MH = \frac{dH}{dt_{TV}} = M_H$
Optimality is reached when MBs are equal: $MS = MH$:
 $-8t_S + 5 = M_H$ so that $t_S^* = -1/8M_H + 5/8$

- (2) (c) Find the study time elasticity with respect to your marginal happiness of watching TV. [Hint: Demand elasticity!]

Solution: Demand for study time is: $t_S^* = -1/8M_H + 5/8$
Demand elasticity is: $\epsilon_{t_S, H_M} = \frac{dt_S}{dM_H} \cdot \frac{M_H}{t_S}$
Thus $\epsilon_{t_S, H_M} = -1/8 \cdot \frac{M_H}{-1/8M_H + 5/8} = \frac{M_H}{M_H - 5}$