Name_____
ID Number_____

Econ 311 –Midterm 1
Professor Jonathan M.V. Davis

Directions/Rules:

1. Do not open the exam until told to do so.
2. Put your name on every page.
3. Show your work. Partial credit will be awarded for short answer and long answer questions.
4. You may use a scientific calculator, but not a graphing calculator.
5. Please don't cheat. You get a zero if you are caught.
6. If you write in pencil and change an answer after the exam is graded, that counts as cheating. I will scan a sample of exams to monitor for this type of cheating.
7. If you ask for a re-grade, I will re-grade the entire exam. Your score could go up or down.
8. Good luck! Don't stress! You've got this! (And the exam is curved, so you can get a great grade even if you find it difficult.)

Score
Multiple Choice (10 questions, 10 points each) _____ /100
Short Answer (6 questions, 10 points each) _____/60
Long Answer (2 questions, 50 points each) _____/100

Total Score_____ / 260

Potentially Useful Calculus Rules

Power Rule: $\frac{\partial X^n}{\partial X} = nX^{n-1}$
Constant Rule 1: $\frac{\partial Cf(X)}{\partial X} = C\frac{\partial f(X)}{\partial X}$ where C is a constant
Constant Rule 2: $\frac{\partial C}{\partial X} = 0$ where C is a constant
Adding and Subtracting Functions: $\frac{\partial}{\partial X}[f(X) + g(X)] = \frac{\partial f(X)}{\partial X} + \frac{\partial g(X)}{\partial X}$

Potentially Useful Algebra Rules

Dividing Exponents: $\frac{X^a}{X^b} = X^{a-b}$

Potentially Useful Equations

$$\frac{MU_X}{MU_Y} = \frac{p_X}{p_Y}$$

$$Elasticity_{A,B} = \frac{\%Change\ in\ A}{\%\ Change\ in\ B}$$

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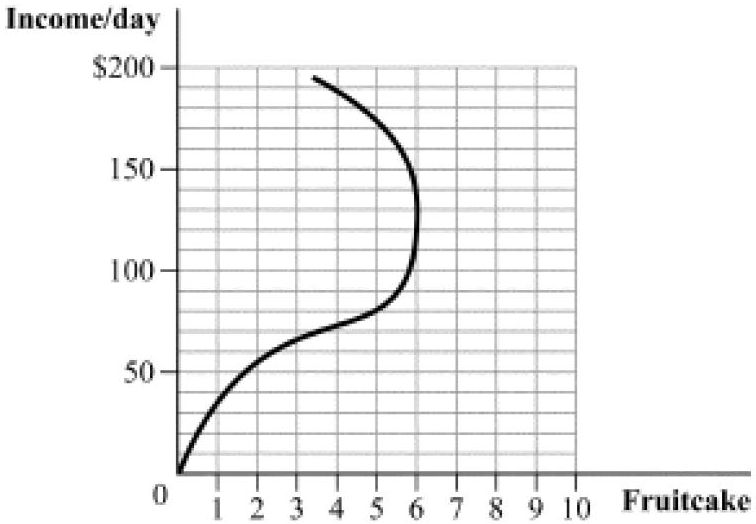
Multiple Choice (10 questions, 10 points each)

1. What kind of utility function is $U(x,y) = 2log(x) + 5y$?

   a. Perfect Complements
   b. Cobb-Douglas
   c. Perfect Substitutes
   d. Quasi-linear

2. Which of the following statements is TRUE?



   a. Fruitcake is an inferior good regardless of income level.
   b. Fruitcake is a normal good regardless of income level.
   c. Fruitcake is a normal good until income reaches $120, and then it becomes an inferior good
   d. Fruitcake is an inferior good until income reaches $120, and then it becomes an normal good

3. Julie spends all of her income on gasoline and pizza. Gasoline costs $4 per gallon and pizza costs $2 per slice. When Julie's income is $50 per week, she purchases 5 gallons of gasoline and 15 slices of pizza. When her income rises to $80 per week, she buys 15 gallons of gasoline and 10 slices of pizza. Which of the following statements is true?

   a. Both gasoline and pizza are normal goods
   b. Gasoline is a luxury good
   c. Pizza is a luxury good
   d. Both gasoline and pizza are inferior goods

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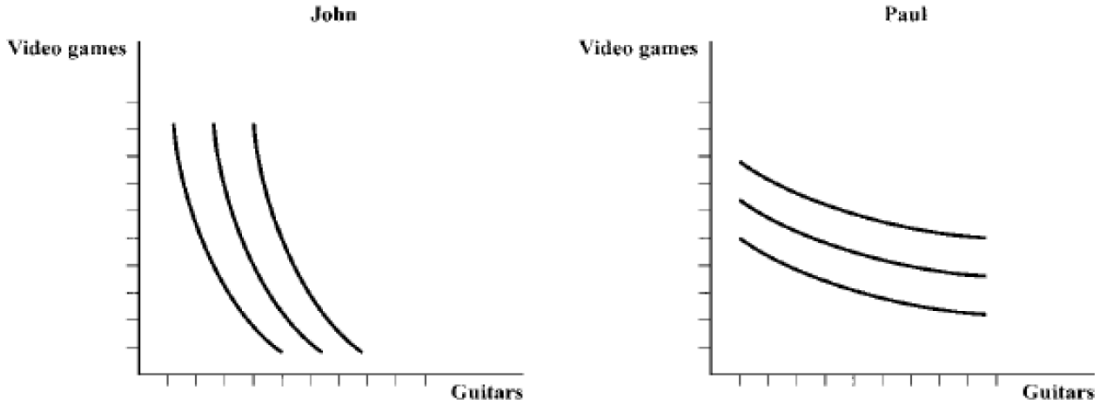
4. The size and direction of the income effect depend on all of the following EXCEPT

a. The amount of good (X) the consumer buys
b. The change in the quantity of X when purchasing power is transformed $\left(\frac{\partial X(P_X,P_Y,M)}{\partial M}\right)$
c. The change in the consumption of X as the price of X changes, holding utility constant
d. Whether the good is normal or inferior

5. Amanda consumes cookies and chocolate. Amanda's utility increases with the consumption of cookies, but her utility neither increases nor decreases with the consumption of chocolate. Assuming chocolate is on the y-axis and cookies is on the x-axis, what do Amanda's indifferent curves look like?

a. Horizontal lines
b. Vertical lines
c. Upward-sloping lines from the origin
d. Downward-sloping lines

6. In the figure below, ____ is willing to give up a lot of guitars for a small number of video games, and ____ is willing to give up a lot of video games for a small number of guitars.



a. John; Paul
b. Paul; John
c. Paul; Paul
d. John; John

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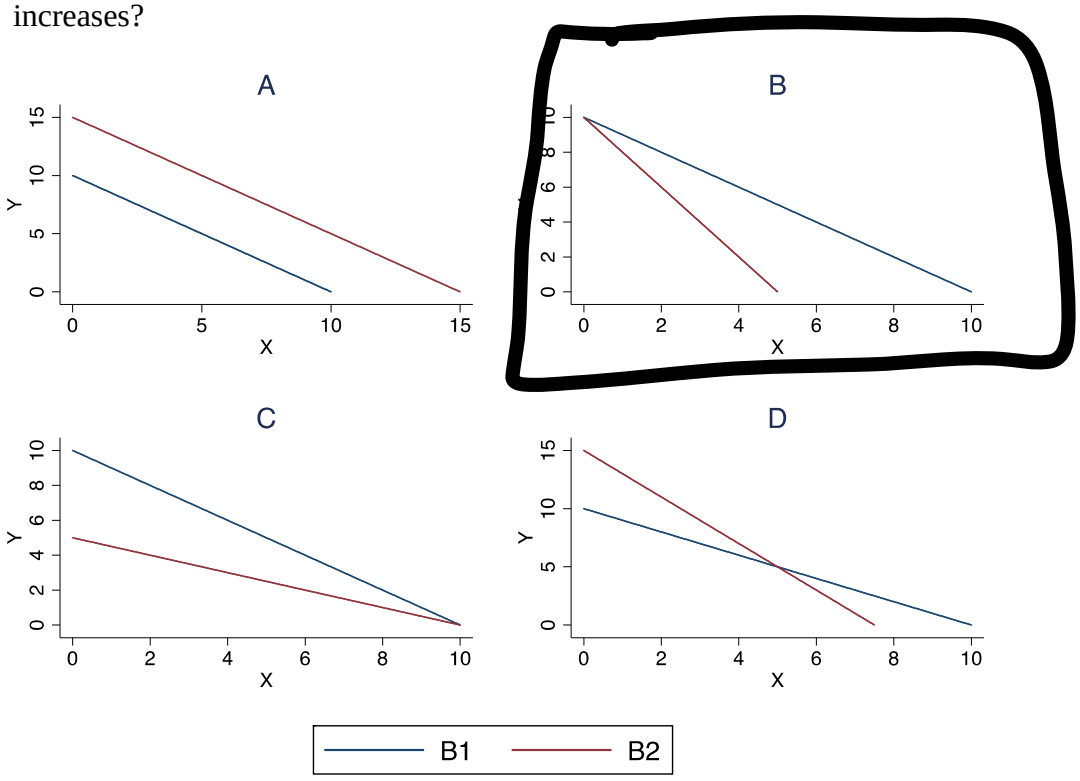
7. Suppose that U=min{2X, 0.5Y}, where X is units of good X and Y is units of good Y. The price of good X is $1 and the price of good Y is $2. What is the minimum expenditure necessary to achieve a utility level of 100?

a. $333.33
b. $550
c. $1,200
d. $450

8. Which of the following figures graphically shows what happens when the price of X increases?



9. Jessica's utility function is given by $U = X^2Y$. By how much does her utility increase if she receives another unit of Y if she already has 2 units of X and 3 units of Y?

a. 0
b. 2
c. 4
d. 12

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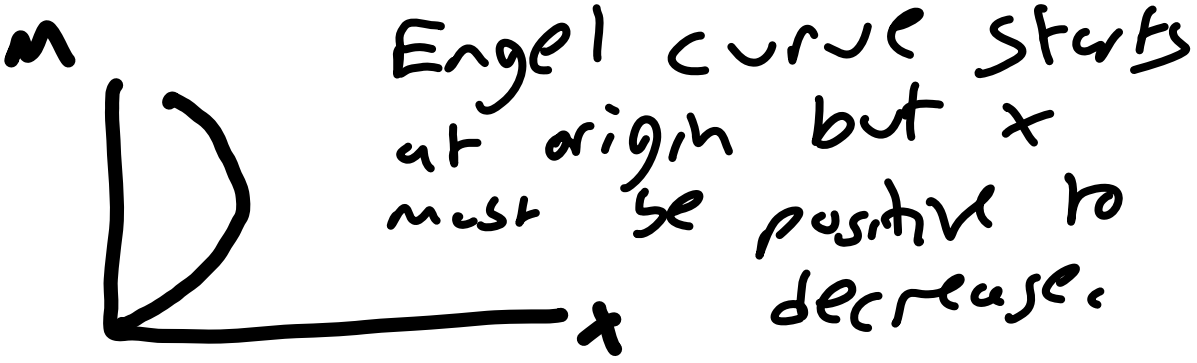
10. Frank's utility function is $U = 10X + 6Y$. Frank has a budget of \$60 to spend on goods X and Y. The price of good X is \$3 and the price of good Y is \$2. How many units of good X and good Y does Frank purchase?

    a. X=20 and Y=0
    b. X=0 and Y=10
    c. X=15 and Y=5
    d. X=10 and Y=20

Short Answer Questions (6 questions, 10 points each)

1. Explain why a good cannot be inferior at all income levels. Showing an example Engel curve may be helpful.



2. Kim's favorite food is toast and Hannah's favorite food is cereal. They both bought at least one loaf of bread for \$3 and at least one box of cereal for \$3 at the grocery store. How many loaves of bread were Kim and Hannah willing to give up for their last boxes of cereal, respectively?

Both are willing to give up 1 loaf for 1 box of cereal.
B/C: $\frac{MU_x}{MU_y} = \frac{P_x}{P_y} = 1$

3. Suppose you wanted to model how much someone should spend today or save for later. Which class of utility functions from this class would be most appropriate to use for this model?

Quasi-linear

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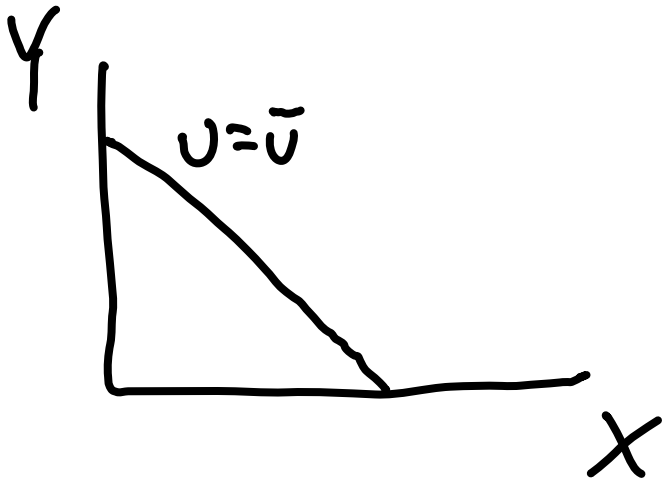
4. Suppose Jasmine's utility function is given by $U(X,Y) = XY + X + Y$. What is Jasmine's marginal utility from good Y?

$MU_Y = X + 1$

5. Sketch an example of a perfect substitutes indifference curve.



6. On the chapter 4 homework, we learned that three-legged Orks, space creatures from the universe Warhammer, wear 1 right shoe and 2 left shoes. Lisa is a three-legged Ork who has $36. Right shoes cost $6 each and left shoes cost $3 each. What should Lisa buy?

$U = \min(2R, L)$

$\Rightarrow 2R^* = L^*$

$36 = 6R + 3L = 6R + 6R$

$= 12R$

$\Rightarrow \boxed{R^* = 3,\ L^* = 6}$

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Long Answer Questions (2 questions, 50 points each)

1. Professor Davis likes to drink coffee and save money. His utility function is given by $U(C,S) = 3log(C) + S$. He's allowed to spend \$10 a day. Coffee is \$3.

A. (10 points) What is Professor Davis's marginal utility from coffee if he has already had 2 cups of coffee?

$MU_C = \frac{3}{C}$ so if had 2 cups

$MU_C = \frac{3}{2} = 1.5.$

B. (10 points) How much is Professor Davis willing to pay for his third cup of coffee?

$MRS = \frac{MU_C}{MU_S} = \frac{3}{C}.$

WTP for 3rd cup is \$1.5.

C. (10 points) How many cups of coffee should Professor Davis buy? How much does he save?

$MRS = 3$

$\Rightarrow \frac{3}{C} = 3$

$\Rightarrow C^* = 1$

$10 = 3C + S$

$\Rightarrow S = 10 - 3C$

$S^* = 10 - 3 \cdot 1$

$S^* = 7$

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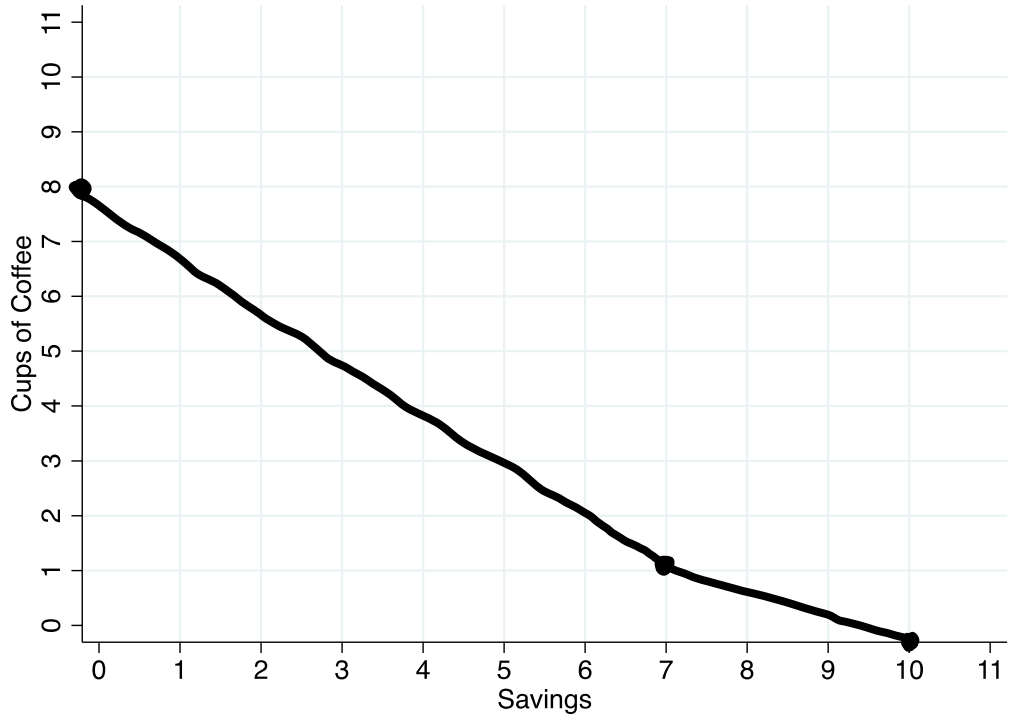
He often buys coffee at a coffee shop that charges $3 for the first coffee but $1 for refills the rest of the day.

D. (10 points) Draw Professor Davis's budget constraint.



E. (10 points) How many cups of coffee should Professor Davis buy given the coffee shop's pricing and how much money does he save?

Marginal cost of coffee after 1st cup is $1. So:

$$\frac{3}{C} = 1 \rightarrow C^* = 3$$

$$S^* = 10 - 3 \cdot 1 - 1 \cdot 2 = 5.$$

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2. The demand function for good X for someone with Cobb-Douglas utility $U = X^{\alpha}Y^{\beta}$ is given by $X^{*} = \frac{\alpha}{\alpha+\beta}\frac{M}{p_X}$. In this problem, we will use this to derive

A. (15 points) What is the equation for the Engel Curve for this good? Sketch it or describe what kind of function the Engel Curve is in words.

$$M = \frac{\alpha+\beta}{\alpha} X p_x$$

Linear line

B. (15 points) What is the equation for the demand curve for the good? Is it an ordinary or a Giffen good?

$$p_x = \frac{\alpha}{\alpha+\beta}\frac{M}{X}$$

Ordinary

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C. (15 points) Suppose $p_Y = 1$. There are 1,000 people in the market with income 20 for whom $\alpha = 3$ and $\beta = 1$ (so $U = X^3Y$). What is market demand curve for X?

$$X = \frac{\alpha}{\alpha+\beta}\frac{m}{p_x} = \frac{15}{p_x}$$

$$Q^D = 1000 \cdot X^* = \frac{15000}{p_x}$$

$$p_x = \frac{15000}{Q^D}$$

D. (5 points) Suppose instead there were 500 people in the market with income 20 and another 500 people with income ~~45~~ 60 but $\alpha = 3$ and $\beta = 1$ for everyone.

$$X_1 = \frac{15}{p_x} \qquad X_2 = \frac{45}{p_x}$$

$$Q^D = 500X_1 + 500X_2$$

$$X_1 = \frac{7500}{p_x} + \frac{22500}{p_x}$$

$$p_x = \frac{30000}{X_1}$$