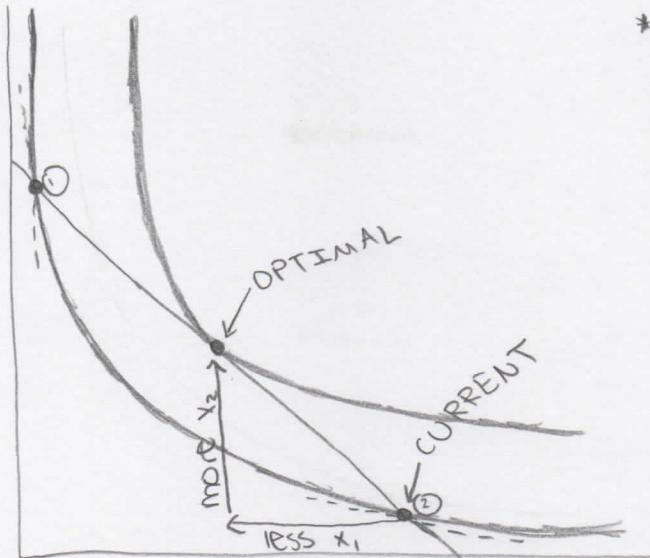


1. My preferences are Cobb-Douglas. Currently my MRS = 3 and the price ratio = 4. What can I do to make myself happier? Assume that my current consumption bundle is on the budget constraint.
- Consume more of both goods
 - Consume less of good 2 and more of good 1
 - Consume more of good 2 and less of good 1
 - Nothing; utility is already maximized
 - Consume all of good 1

Current consumption
could be at two
possible points (1) and
(2). At (1), $MRS > \frac{P_1}{P_2}$

At (2), $MRS < \frac{P_1}{P_2}$

Therefore, since
 $MRS = 3$ and $\frac{P_1}{P_2} = 4$,
we must be at (2)



* $MRS \neq \text{price ratio}$
⇒ must be on a
lower IDC than
tangency point

2. Assume the following is true about a single utility function:

X	Y	U(x, y)
3	0	9
2	0	4
1	0	1
0	0	0
0	1	2
0	2	4
0	3	6

Which of the following is false?

- X is a monotonic good for values between 1 and 3 $x \uparrow \Rightarrow u \uparrow$ ✓
- Y is a monotonic good for values between 1 and 3 $y \uparrow \Rightarrow u \uparrow$ ✓
- X has increasing marginal utility for values between 1 and 3 $x \uparrow \Rightarrow MU_x \uparrow$ ✓
- Y has decreasing marginal utility for values between 1 and 3 $y \uparrow \Rightarrow MU_y \downarrow$
- None of the above

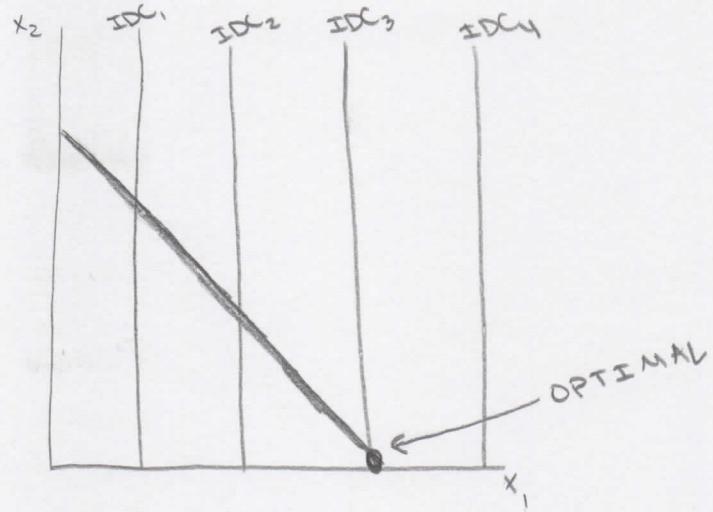
X MU_x <hr/> 1 $U(2,0) - U(1,0)$ $= 4 - 1$ $= 3$ 2 $U(3,0) - U(2,0)$ $= 9 - 4$ $= 5$	Y MU_y <hr/> 1 $U(0,2) - U(0,1)$ $= 4 - 2$ $= 2$ 2 $U(0,3) - U(0,2)$ $= 6 - 4$ $= 2$
--	--

3. $U(x_1, x_2) = 2x_1$

Assume prices and income are unknown, but are all positive numbers. Which of the following is the demand function for x_2 ?

- a. $x_2^* = m / p_2$
- b. $x_2^* = 0$
- c. x_2^* between 0 and m / p_2
- d. Not enough information

x_2 is a neutral (as x_2 increases, utility remains the same) \Rightarrow always spend all money on x_1



4. Which of the following is **not** a monotonic transformation of $U(x_1, x_2) = -2x_1x_2$?

a. $U(x_1, x_2) = -2x_1x_2 + 100$

ADD a constant ✓

b. $U(x_1, x_2) = -0.5(x_1x_2)$

MULTIPLIED by a POSITIVE # ✓ $(-2x_1x_2 * \frac{1}{4} = -0.5x_1x_2)$

c. $U(x_1, x_2) = (-x_1x_2)^3$

Entire function PUT to POSITIVE, odd exponent ✓

d. $U(x_1, x_2) = (-2x_1x_2)^2$

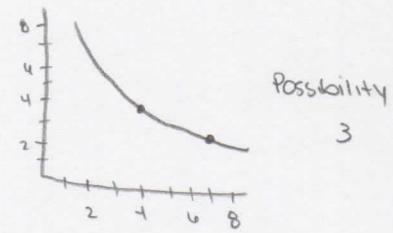
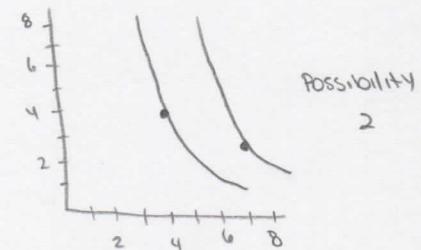
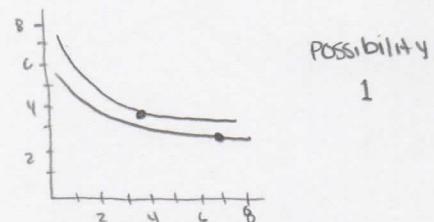
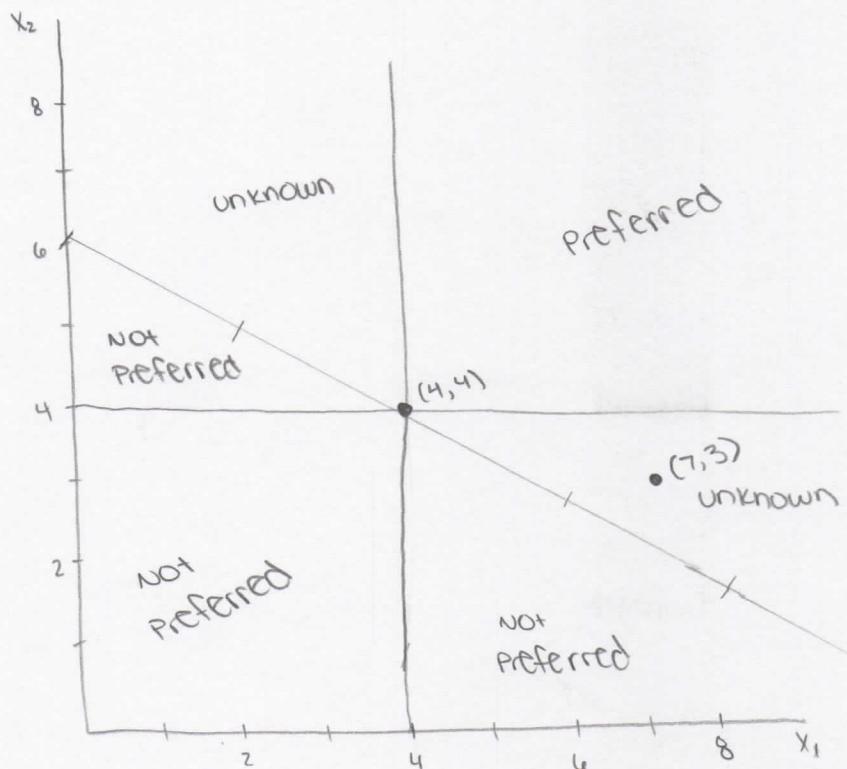
Even power gets rid of negative sign, NOT a monotonic transformation

e. Multiple answers above are correct

5. At the point $(4, 4)$, my MRS is $-1/2$. Determine how I would rank the bundles $(4, 4)$ and $(7, 3)$.

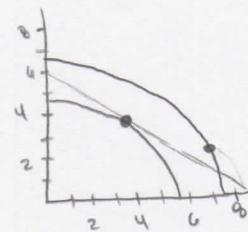
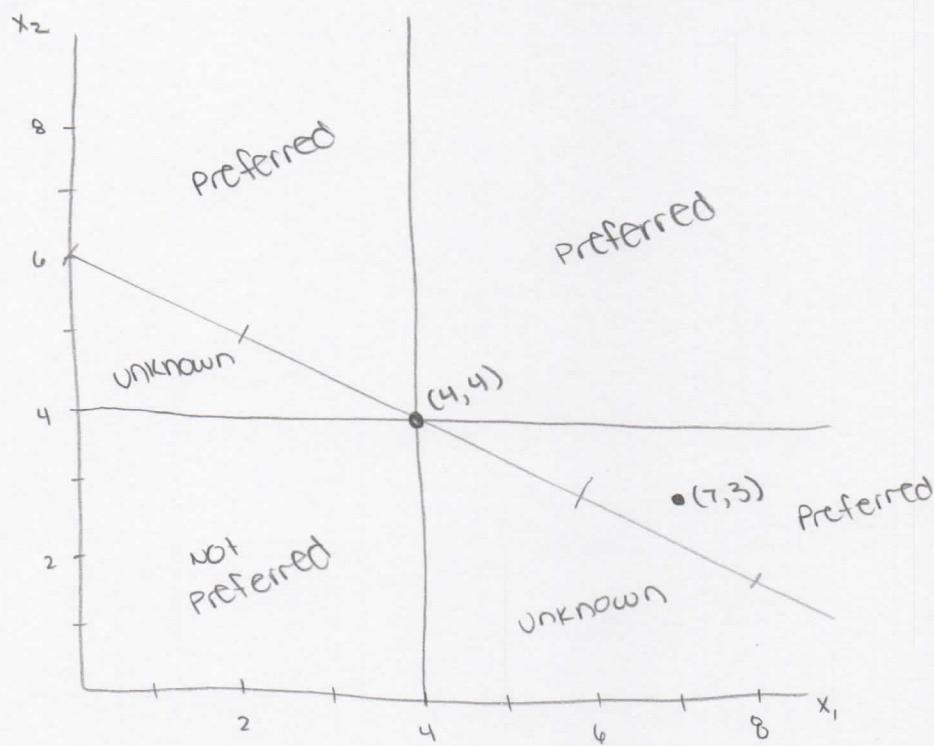
a. Assume my IDC's have a strictly diminishing MRS

UNKNOWN



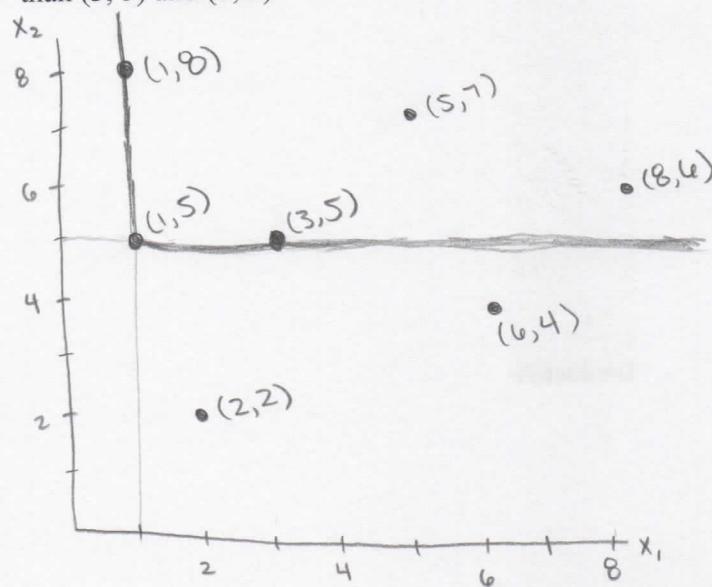
b. Assume my IDC's have a strictly increasing MRS

$(7, 3) > (4, 4)$



6. My utility is equal at the points $(3, 5)$ and $(1, 8)$. My IDC's are L-shaped.

- a. Write one point that brings more utility than $(3, 5)$ and $(1, 8)$ and one point that brings less utility than $(3, 5)$ and $(1, 8)$



- Equal utility \Rightarrow $(3, 5)$ and $(1, 8)$ on the same IDC
- Any point above the IDC brings higher utility
i.e. $(5, 7); (8, 6)$
- Any point below the IDC brings lower utility
i.e. $(2, 2); (6, 4)$

- b. Write a utility function that describes my preferences (there are many possible answers here)

$$U(x_1, x_2) = A \min \left[\frac{x_1}{a}, \frac{x_2}{b} \right]$$

monotonic transformation

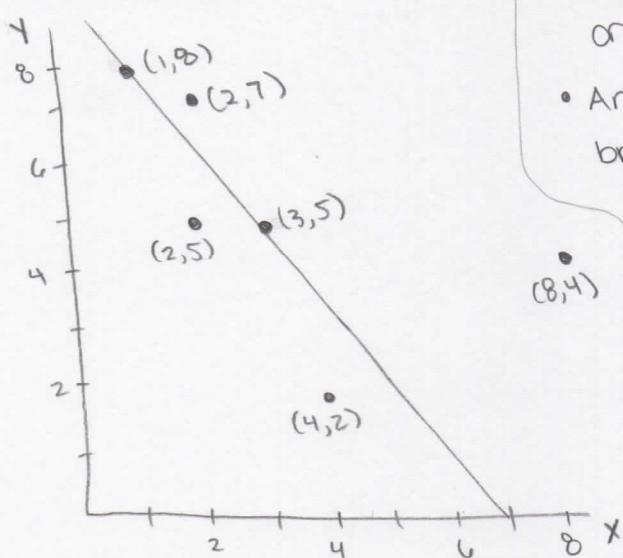
kink point coordinates; in this case, $a=1$ and $b=5$

$$U(x_1, x_2) = A \min \left[x_1, \frac{x_2}{5} \right]$$

*Any value plugged in for "A" would be correct because utility is unknown

7. My utility is equal at the points $(3, 5)$ and $(1, 8)$. My IDC's are linear.

- a. Write one point that brings more utility than $(3, 5)$ and $(1, 8)$ and one point that brings less utility than $(3, 5)$ and $(1, 8)$



- Equal utility $\Rightarrow (3, 5)$ and $(1, 8)$ on the same IDC
- Any point above the IDC brings higher utility
i.e. $(2, 7); (8, 4)$
- Any point below the IDC brings lower utility
i.e. $(2, 5); (4, 2)$

b. Write a utility function that describes my preferences (there are many possible answers here)

$$U(x_1, x_2) = A(3x_1 + 2x_2)$$

↓
monotonic transformation

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$(x_1, y_1) \quad (x_2, y_2)$$

$$(3, 5) \quad (1, 8)$$

$$= \frac{8 - 5}{1 - 3} = \frac{3}{-2}$$

$$U(x_1, x_2) = A(3x_1 + 2x_2)$$

* Any value plugged in for "A" would be correct because utility is unknown

8. For parts a and b, assume $p_1 = 4$, $p_2 = 0.5$, and $m = 12$.

a. $U(x_1, x_2) = 2x_1 + x_1^2$ x_2 is neutral ($x_2 \uparrow \rightarrow U -$) → spend no money on x_2 , none on

Solve for demands for x_1 and x_2

x_1 is always a good ($x_1 \uparrow \rightarrow U \uparrow$ always)

→ spend all money on x_1

$$x_2^* = 0$$

$$x_1^* = \frac{m}{P_1} = \frac{12}{4} = 3$$

b. $U(x_1, x_2) = 2x_1 - x_1^2$ x_2 is neutral → spend no money on x_2

Solve for demands for x_1 and x_2

$$x_2^* = 0$$

x_1 is a good and a bad; effect $x_1 \uparrow$ has on utility depends on value of x_1 . We want to stop consuming x_1 when it becomes a bad, so we must first find the point where x_1 switches from good to bad (where MU₁ switches from positive to negative)

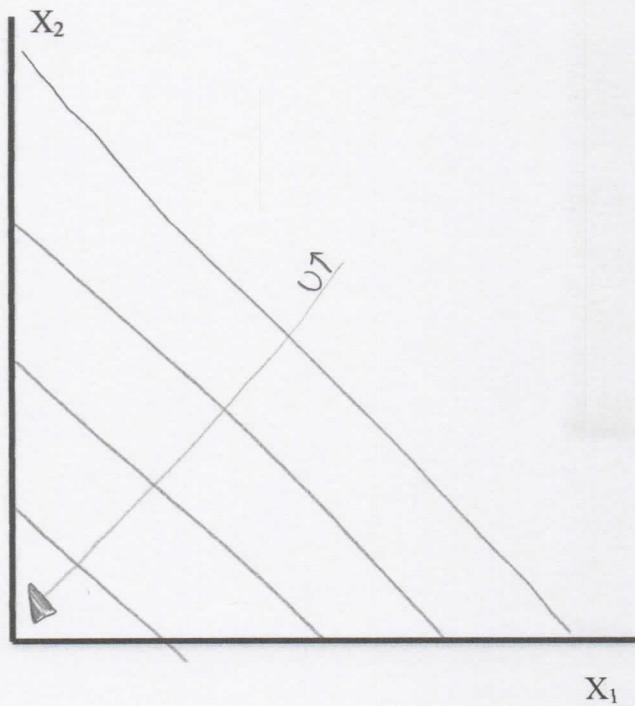
$$MU_1 = 2 - 2x_1 \rightarrow 2 - 2x_1 = 0$$

$$x_1 = 1$$

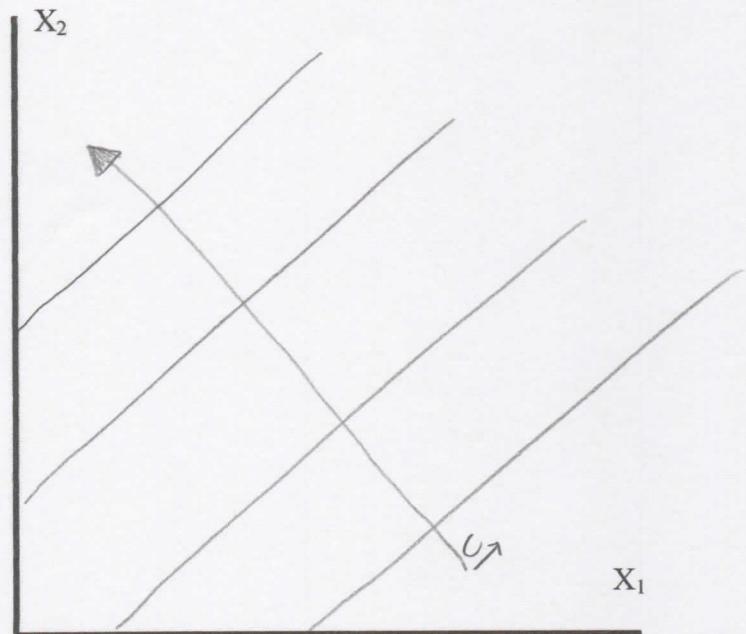
x_1 switches to a bad after one unit. NEVER want to consume more than one unit. can afford 3 units but, will only consume one

$$x_1^* = 1$$

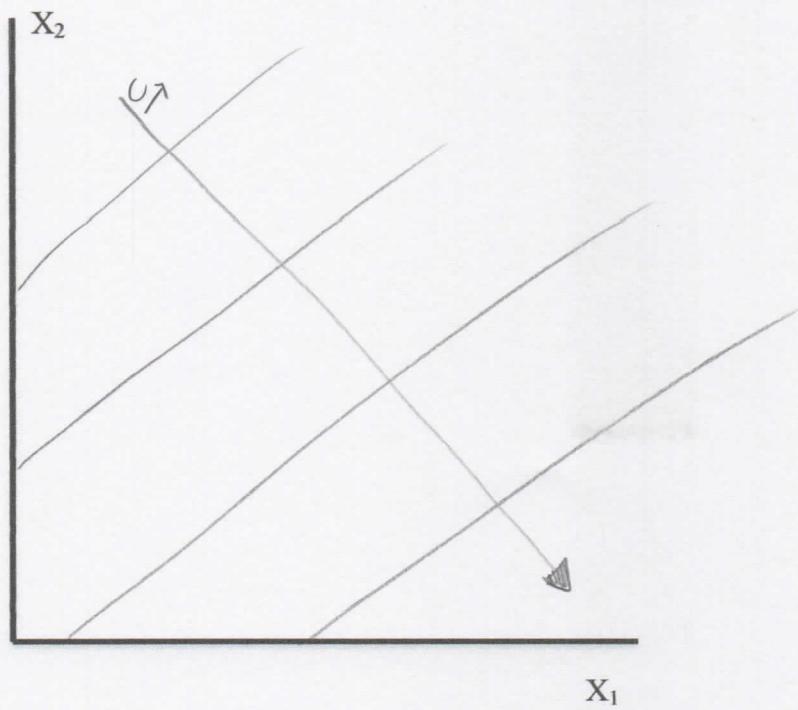
9. Sketch indifference curves such that x_1 and x_2 are both goods.



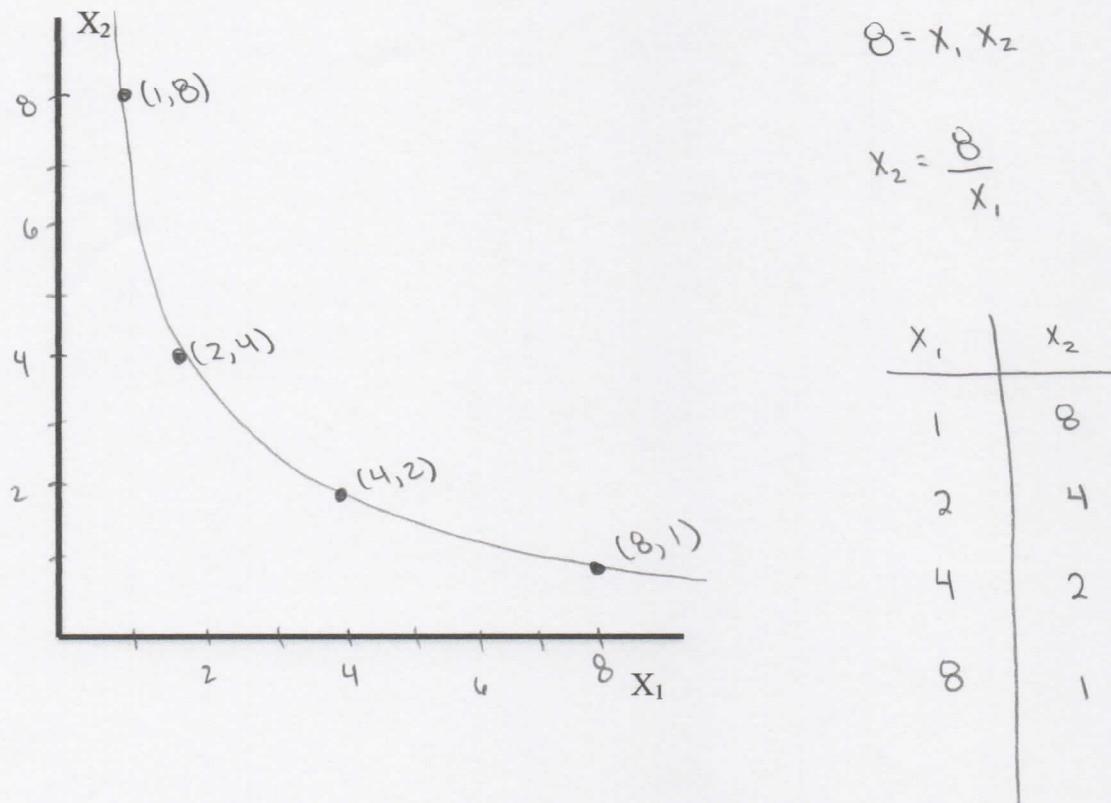
10. Sketch indifference curves such that x_1 is a bad and x_2 is a good.



11. Sketch indifference curves such that x_1 is a good and x_2 is a bad.



12. $U(x_1, x_2) = x_1x_2$ Sketch the indifference curve where $U = 8$



13. For each of the following demand functions, put a "check" if the category applies and an "x" if it does not apply. (Specify if your answer is affected by the level of income and prices)

	<u>ORD.</u>	<u>GIFFEN</u>	<u>SUBS.</u>	<u>COMPS.</u>	<u>NOR.</u>	<u>INF.</u>
	<u>OWN PRICE</u>		<u>CROSS PRICE</u>		<u>INCOME</u>	
①	$X_1^* = (m - p_1) / p_1$	✓	✗	✗	✓	✗
②	$X_2^* = p_1 / p_2$	✓	✗	✓	✗	✗
③	$A^* = (10m / p_A) - m^2 / p_A^2$	if $p_A > \frac{m}{5}$	if $p_A < \frac{m}{5}$	✗	✗	if $m < 5p_A$ if $m > 5p_A$
④	$Z^* = m / (p_y + p_z)$	✓	✗	✗	✓	✓

$$\boxed{① X_1^* = \frac{m - p_1}{p_1} = \frac{m}{p_1} - 1}$$

OWN PRICE

$$p_1 \uparrow \rightarrow x_1^* \downarrow \quad \text{OR} \quad \frac{\partial x_1^*}{\partial p_1} = -\frac{m}{p_1^2} < 0$$

Ordinary

CROSS PRICE

$$p_2 \uparrow \rightarrow x_1^* - \text{OR} \quad \frac{\partial x_1^*}{\partial p_2} = 0$$

INCOME

$$m \uparrow \rightarrow x_1^* \uparrow \quad \text{OR} \quad \frac{\partial x_1^*}{\partial m} = \frac{1}{p_1} > 0$$

Normal

Neutral to cross price

$$\boxed{② X_2^* = \frac{p_1}{p_2}}$$

OWN PRICE

$$p_2 \uparrow \rightarrow x_2^* \downarrow \quad \text{OR} \quad \frac{\partial x_2^*}{\partial p_2} = -\frac{p_1}{p_2^2} < 0$$

Ordinary

CROSS PRICE

$$p_1 \uparrow \rightarrow x_2^* \uparrow \quad \text{OR} \quad \frac{\partial x_2^*}{\partial p_1} = \frac{1}{p_2} > 0$$

Substitutes

INCOME

$$m \uparrow \rightarrow x_2^* - \quad \text{OR} \quad \frac{\partial x_2^*}{\partial m} = 0$$

Neutral to income

$$(3) A^* = \frac{10m}{P_A} - \frac{m^2}{P_A^2}$$

OWN PRICE

$P_A \uparrow \rightarrow A^* ?$

use derivative instead

$$\frac{\partial A^*}{\partial P_A} = -\frac{10m}{P_A^2} + \frac{2m^2}{P_A^3}$$

Ordinary if $\frac{\partial A^*}{\partial P_A} < 0$

CROSS-PRICE

$$P_B \uparrow \rightarrow A^* - \quad \text{OR} \quad \frac{\partial A^*}{\partial P_B} = 0$$

Neutral to cross-price

$$-\frac{10m}{P_A^2} + \frac{2m^2}{P_A^3} < 0$$

$$\frac{2m^2}{P_A^3} < \frac{10m}{P_A^2}$$

$$2m^2 P_A^2 < 10m P_A^3$$

$$\frac{m}{5} < P_A$$

INCOME

$m \uparrow \rightarrow A^* ?$

use derivative instead

normal if $\frac{\partial A^*}{\partial m} > 0$

$$\frac{\partial A^*}{\partial m} = \frac{10}{P_A} - \frac{2m}{P_A^2}$$

inferior if $\frac{\partial A^*}{\partial m} < 0$

$$\frac{10}{P_A} - \frac{2m}{P_A^2} > 0$$

$$\frac{10}{P_A} > \frac{2m}{P_A^2}$$

$$10P_A^2 > 2mP_A$$

$$5P_A > m$$

$$\frac{10}{P_A} - \frac{2m}{P_A^2} < 0$$

$$\frac{10}{P_A} < \frac{2m}{P_A^2}$$

$$10P_A^2 < 2mP_A$$

$$5P_A < m$$

Giffen if $\frac{\partial A^*}{\partial P_A} > 0$

$$-\frac{10m}{P_A^2} + \frac{2m^2}{P_A^3} > 0$$

$$\frac{2m^2}{P_A^3} > \frac{10m}{P_A^2}$$

$$2m^2 P_A^2 > 10m P_A^3$$

$$\frac{m}{5} > P_A$$

INCOME

$$m \uparrow \rightarrow z^* \uparrow \quad \text{OR} \quad \frac{\partial z^*}{\partial m} = \frac{1}{P_Y + P_Z} > 0$$

normal

OWN-PRICE

$$P_Z \uparrow \rightarrow z^* \downarrow \quad \text{OR} \quad \frac{\partial z^*}{\partial P_Z} = (-1)m(P_Y + P_Z)^{-2}(1)$$

$$z^* = m(P_Y + P_Z)^{-1}$$

$$= -\frac{m}{(P_Y + P_Z)^2} < 0$$

Ordinary

CROSS-PRICE

$$P_Y \uparrow \rightarrow z^* \downarrow \quad \text{OR} \quad \frac{\partial z^*}{\partial P_Y} = (-1)m(P_Y + P_Z)^{-2}(1)$$

$$z^* = m(P_Y + P_Z)^{-1}$$

$$= \frac{-m}{(P_Y + P_Z)^2} < 0$$

complements