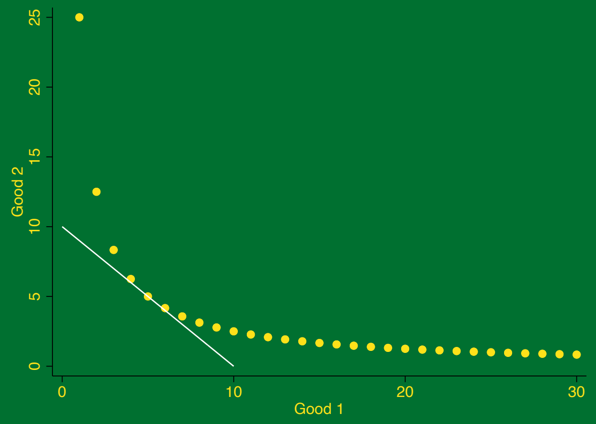
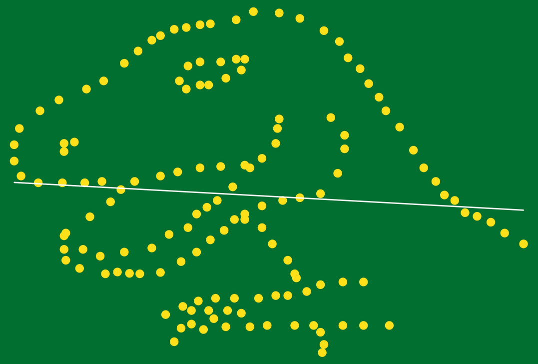
How people make choices 1: Constraints





Prof Jonathan Davis

UNIVERSITY OF OREGON

Announcements

Starting Chapter 4 Material on Consumer Behavior

- Today: Mostly Section 4.3 on Budget Constraints

Budget Constraints and Preferences HW

- Due **Friday, November 12th, 5pm**

Goal is to have exams graded by next Tuesday

Reminder: Office Hours

Fridays: 9-10am on Zoom (access via Canvas)

Mondays: 9-10am, sign up for appointments on Canvas

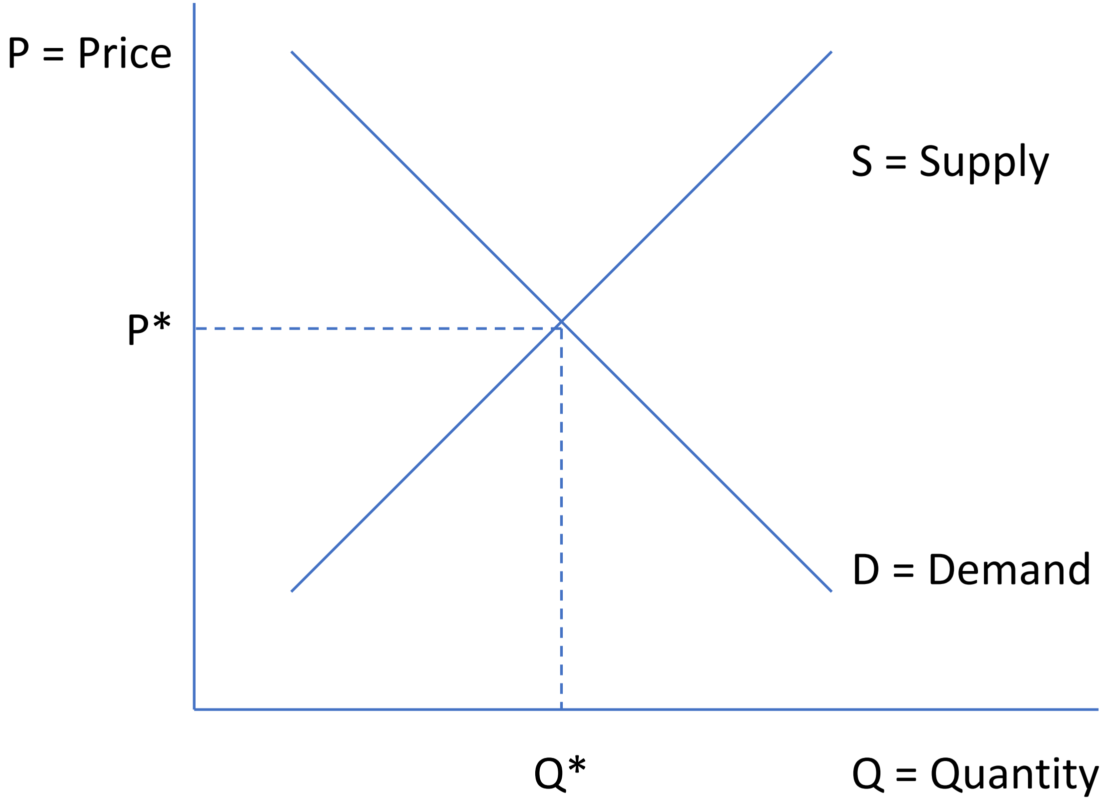
Come discuss questions from class or about homework.

Many of your classmates have already come!

Where we are heading rest of quarter

1. How do consumers decide what to buy?
2. How does this change when prices or income changes?

Where does demand come from?



Where does demand come from?

Imagine that graph represents the market for peanut butter.

Imagine that the only other good that exists in the world is jelly.

Demand for peanut butter is derived from individuals’ choosing how to divide their income between peanut butter and jelly.

Where does demand come from?

Second part of the course is going to go in-depth into that exact problem:

> How do I allocate a finite amount of resources between two goods that I have access to?

Where does demand come from?

There are millions of goods out there, not just PB & J: how is this useful?

Where does demand come from?

But, there are millions of goods out there, not just PB & J: how is this useful?

Imagine a two-good model where:

- You choose between food and durable consumption
- You choose between leisure (not working) and consumption (that you pay for by working)
- You choose between consumption now (borrowing) and consumption later (saving)

Where does demand come from?

It turns out that there are a lot of really important decisions that can be framed as “two-good” decisions.

However, teaching the model is much easier with simple examples, where the only two things that exist that you could possibly consumer are simple objects.

Our Model of Consumer Theory

Our model of how consumers make choices will have two ingredients:

1. Cost (modeled with a constraint)

2. Preferences (given by a **utility function**)

Economics is the study of the allocation of **scarce means** to satisfy **competing ends**.

We model **scarce means**
to satisfy **competing ends** with
constraints.

Constraints

We all have face constraints:

- Limited amounts of money
- Limited time
- Limited energy, focus, etc.

We have to work within these constraints when we make choices!

Budget Constraint

To keep things as simple as possible, we will usually assume there are only two goods, say X and Y.

- X and Y are the quantity of X and Y that you consume
- p_X is the price of X
- p_Y is the price of Y
- M is your income

Budget Constraint

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- X and Y are the quantity of X and Y that you consume
- p_X is the price of X
- p_Y is the price of Y
- M is your income

Then the budget constraint is given by:

$$p_X X + p_Y Y \leq M$$

Example: Pizza and Beer

- Two goods: Pizza (P) and Beer (B)
- Price of Beer, $P_B = \$4/\text{beer}$
- Price of Pizza $P_P = \$2/\text{slice}$
- Income $M = \$20$

Budget:

$$p_B B + p_P P \leq M$$
$$4B + 2P \leq 20$$

Example: Sleep and Studying

- Two goods: Sleep (Z) and Studying (S)
- Price of Sleep, $P_Z = 1$ hour/hour of sleep
- Price of Studying, $P_S = 1$ hour/hour of sleep
- Income $M = 24$ hours per day

Budget:

$$p_Z Z + p_S S \leq M$$
$$Z + S \leq 24$$

iClicker: Cookies (C) cost \$1 each and milk(M) costs \$2.5 per gallon. You have \$10 to spend. What is your budget constraint?

$A.\ 1C + 2.5M \leq 10$

$B.\ 2.5C + 1M \leq 10$

$C.\ 1C + M \leq 10$

$D.\ 1C + \frac{1}{2.5}M \leq 10$

$E.\ \frac{1}{2.5}C + 1M \leq 10$

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iClicker: Cookies (C) cost \$1 each and milk(M) costs \$2.5 per gallon. You have \$10 to spend. What is your budget constraint?

Cookies (C) are \$1 each

Milk (M) is \$2.5 per gallon

You have \$10 to spend (B)

$$p_c C + p_M M \leq B$$

Plugging in the prices and budget:

$$1C + 2.5M \leq 10$$

Will assume the Budget Constraint Binds

In all our applications, we can treat it like an equality instead:

$$p_X X + p_Y Y = M$$

Why?

Will assume the Budget Constraint Binds

In all our applications, we can treat it like an equality instead:

$$p_X X + p_Y Y = M$$

Why?

We will assume people want to consume as much as they can afford.

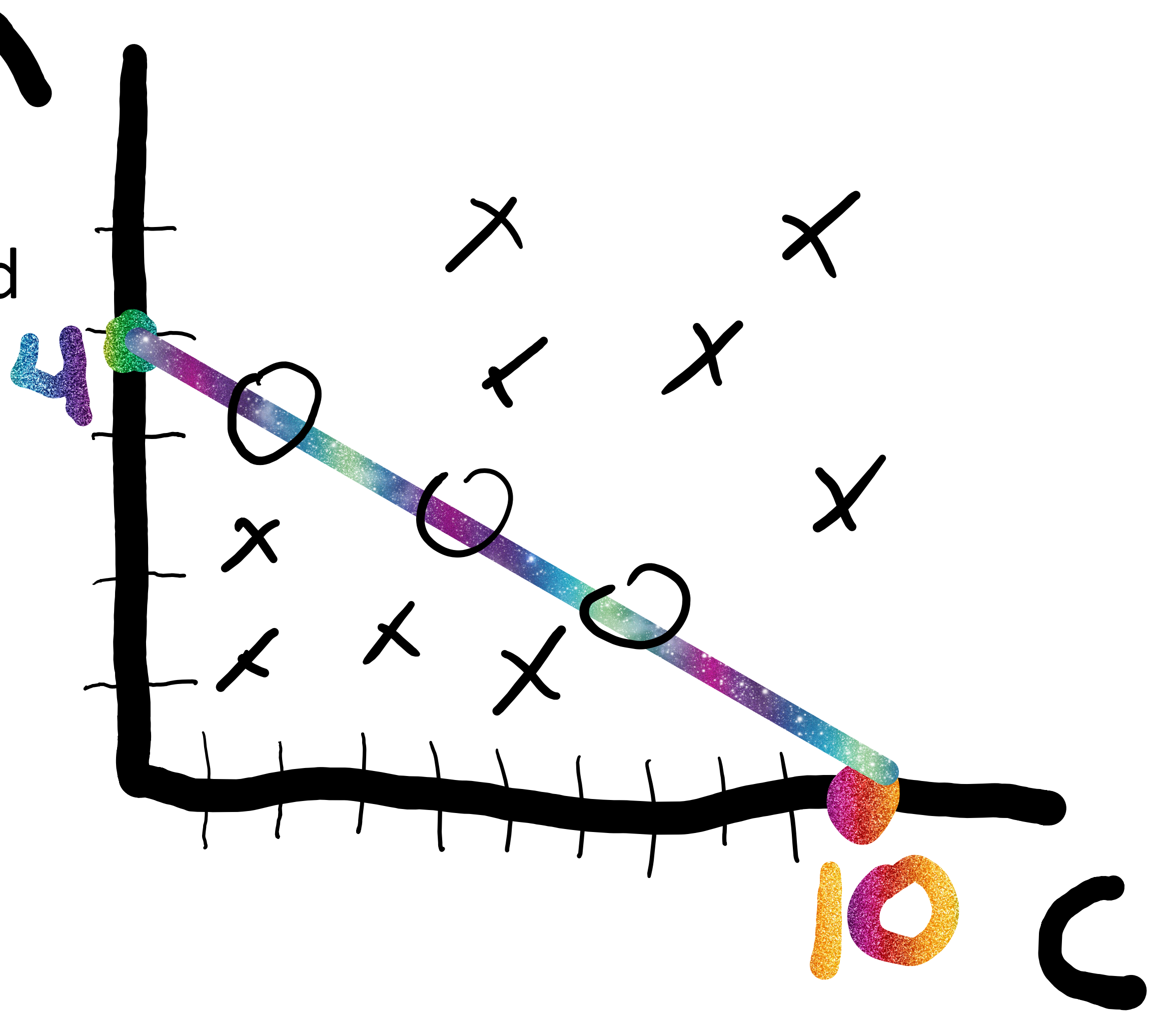
Example: The Budget Constraint Binds

$$1C + 2.5M = 10$$

Budget constraint indicates all combinations agent can exactly afford

Implies people will buy something on budget constraint line

- Can't afford anything above it
- Not satiated if below it



You might be thinking:

“That’s a ridiculous assumption!
I leave the grocery store without having spent all my money every time!”

Another Example: Burgers and Savings

Burgers (b) \$5/burger

Saving (s) costs \$1/dollar saved.

You have \$100.

Then budget constraint is:

$$5b + s = 100$$

“Composite” Goods

In that last example, savings was a “composite” good.

Composite goods have a price of \$1 since *they are measured in dollars in the first place*.

Example: Graphing the budget constraint

$$1C + 2.5M = 10$$

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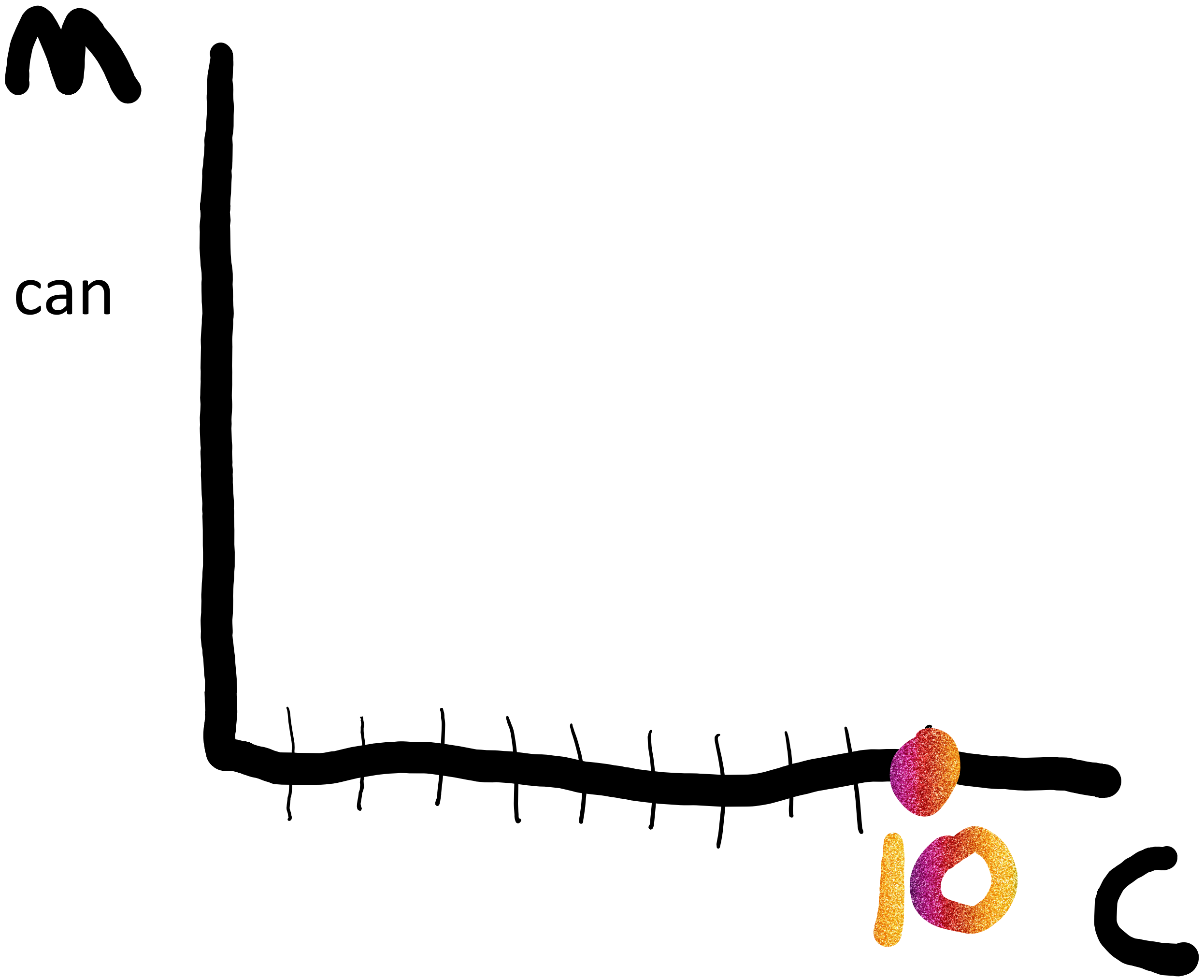
1. Figure out how many cookies can afford if buy only cookies:

$$1C = 10$$
$$\Rightarrow C = 10$$



Example: Graphing the budget constraint

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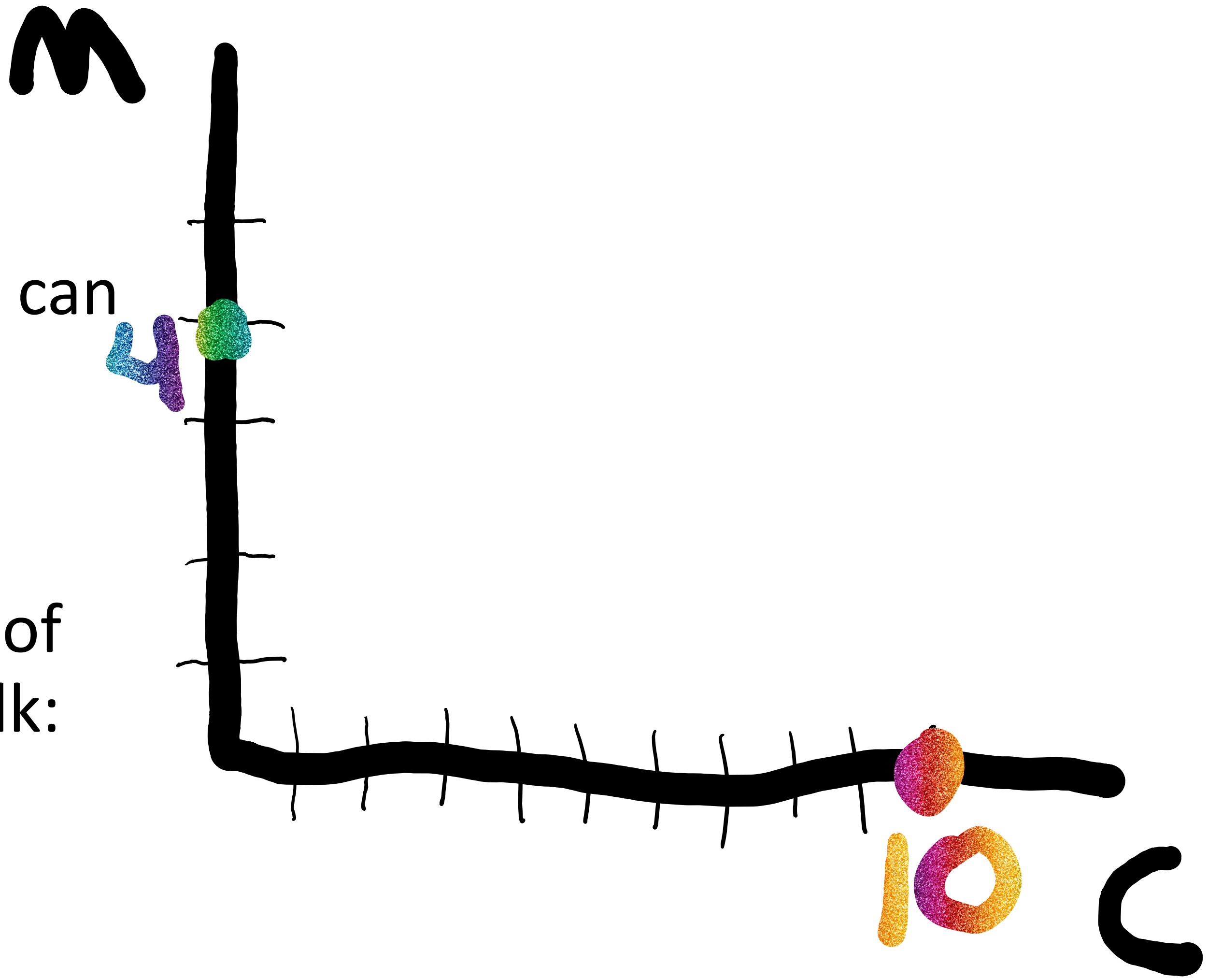

1. Figure out how many cookies can afford if buy only cookies:
$$1C + 2.5(0) = 10$$
$$\Rightarrow C = 10$$

2. Figure out how many gallons of milk can afford if buy only milk:
$$1(0) + 2.5M = 10$$
$$M = 4$$

Example: Graphing the budget constraint

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2. Figure out how many gallons of milk can afford if buy only milk:
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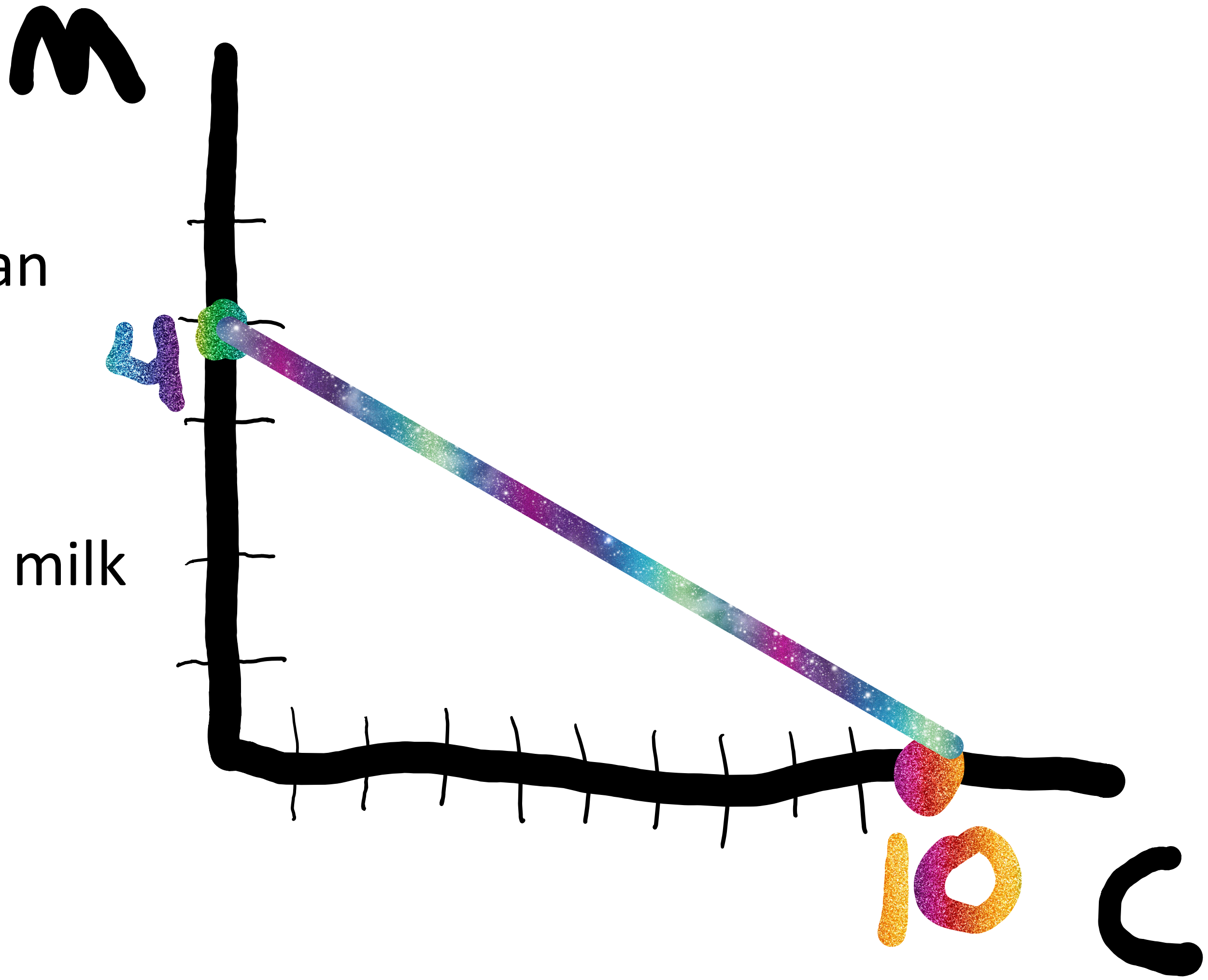
$$M = 4$$

3. Connect the two points.



Example: Graphing the budget constraint

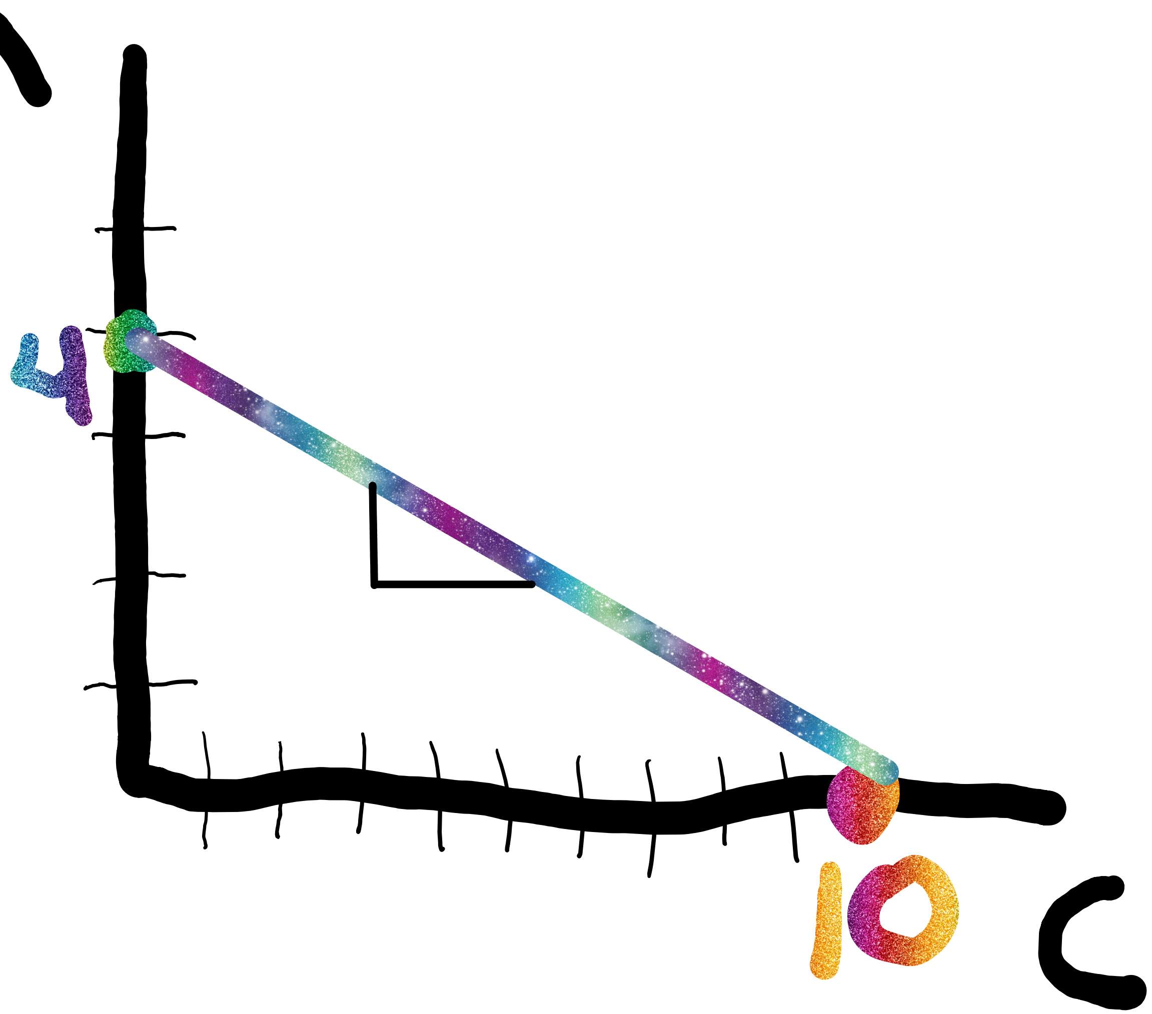
$$1C + 2.5M = 10$$

What's the slope?

$$\frac{4-0}{0-10} = -\frac{4}{10} = -\frac{1}{2.5} = -0.4$$

What does this tell us?

- Have to give up 0.4 gallons of milk for every cookie we buy

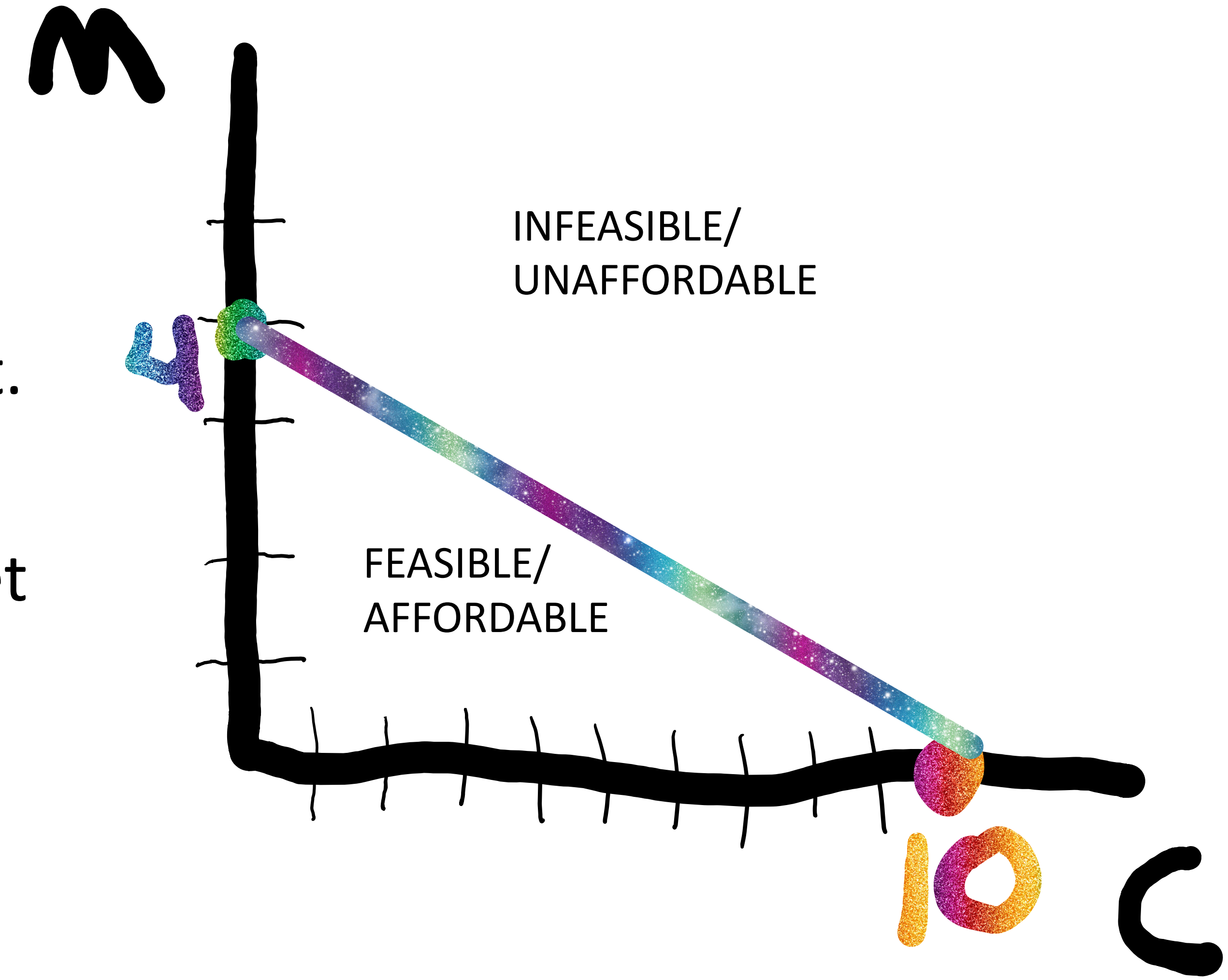


Example: Graphing the budget constraint

$$1C + 2.5M = 10$$

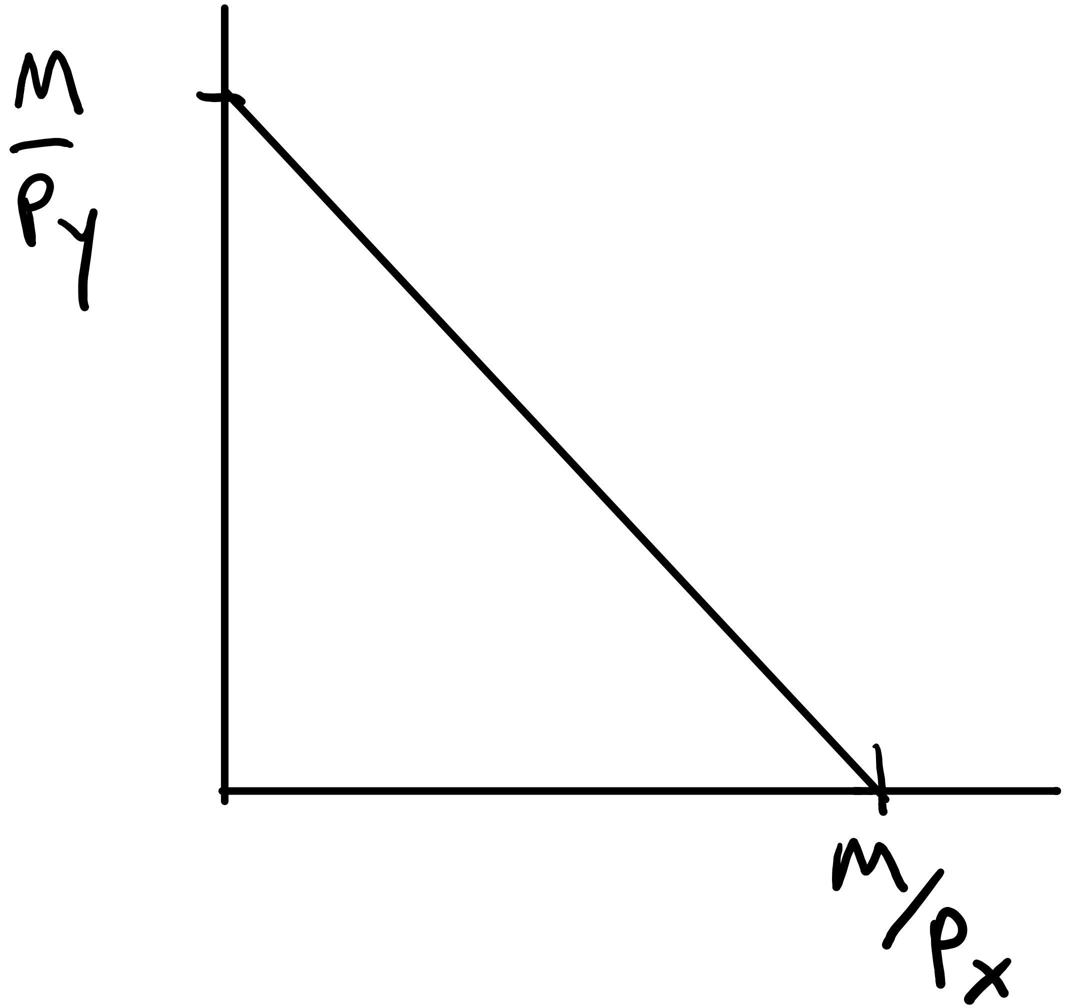
Note we assume will choose a bundle on the budget constraint.

But all bundles below the budget constraint are feasible.



Graphing the Budget Constraint, General Case

- Y-intercept is amount of Y you can afford if you spend all your money n Y
- X-intercept is amount of X you can afford if you spend all your money on X
- Slope is $-\frac{p_x}{p_y}$ which tells us how much Y we have to give up to get a unit of X

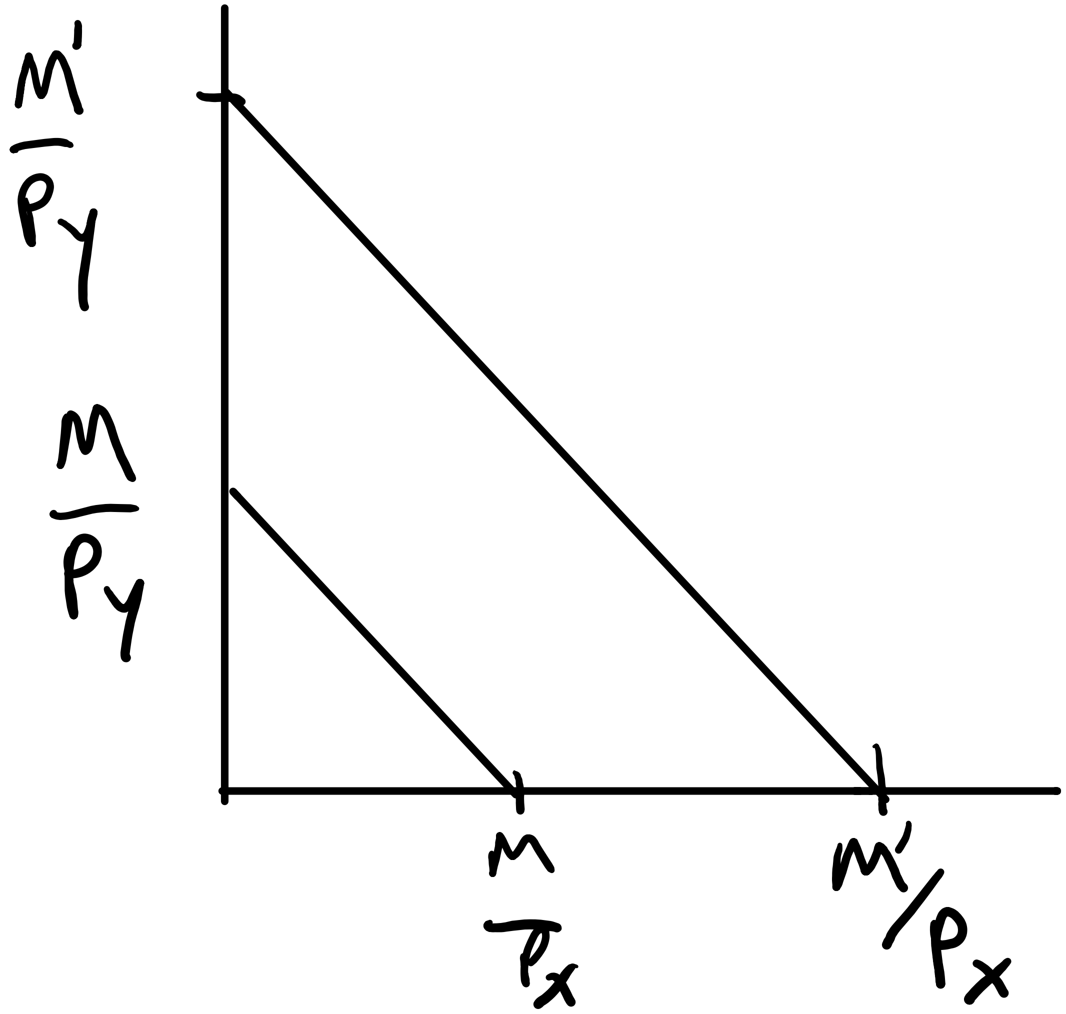


iClicker: What happens to the budget constraint if your income increases?

A. Nothing
B. Pivots so X-intercept is further from origin.
C. Pivots so Y-intercept is further from origin.
D. It shifts outward from origin, but slope stays the same.
E. It shifts towards origin, but slope stays the same.

Affect of Increasing Income on Budget Constraint

If income increases from M to M' then budget constraint shifts out parallel to original budget constraint.



Why?

- Amount of Y can afford increases
- Amount of X can afford increases
- No change in rate you have to exchange Y for X.

iClicker: What happens to the budget constraint if the price of X falls?

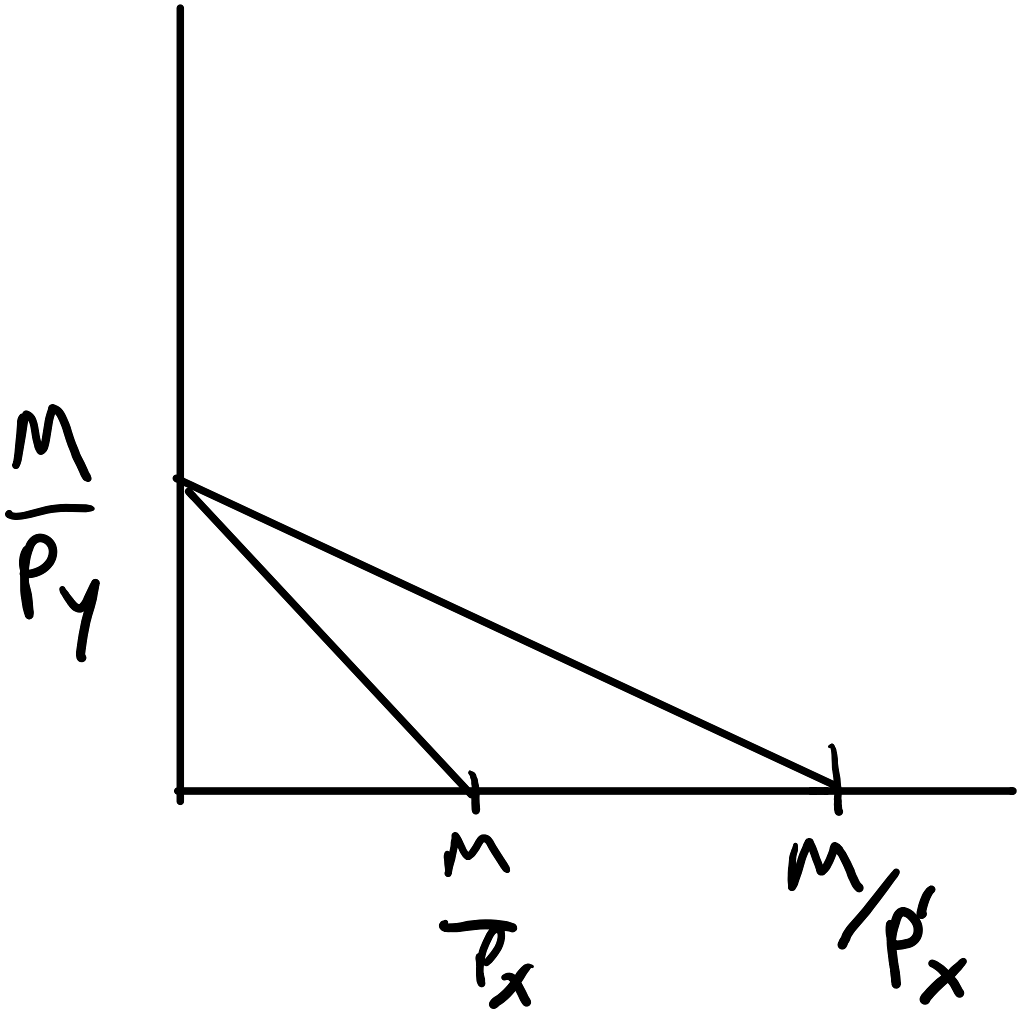
A. Nothing
B. Pivots so X-intercept is further from origin.
C. Pivots so Y-intercept is further from origin.
D. It shifts outward from origin, but slope stays the same.
E. It shifts towards origin, but slope stays the same.

Changing Prices Causes Graph to Pivot

If price of X falls from P_X to $P_X{}'$ then the budget constraint pivots so X-intercept is further from origin.

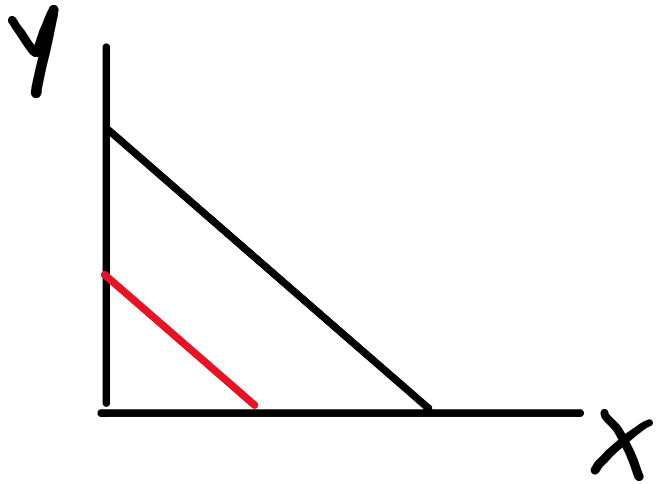
Why?

- No change to income or price of Y, so Y-intercept is same.
- Can afford more X because it is cheaper.
- Note slope is **smaller** because have to give up less Y to get another X.s



iClicker: Which of the following graphs shows the price of Y increased? (Black is original, Red is new)

A.



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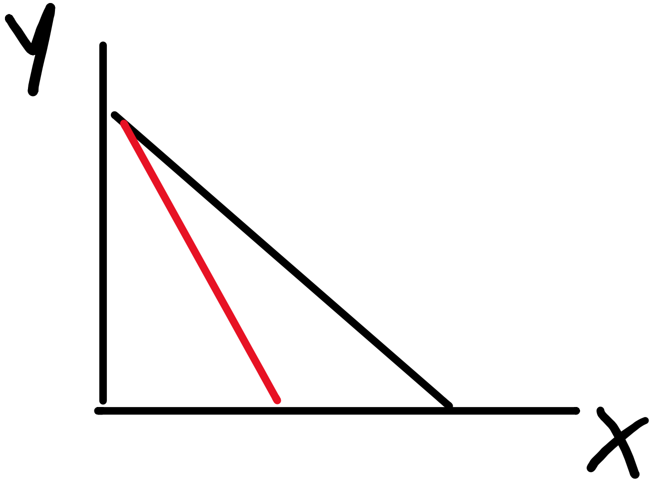

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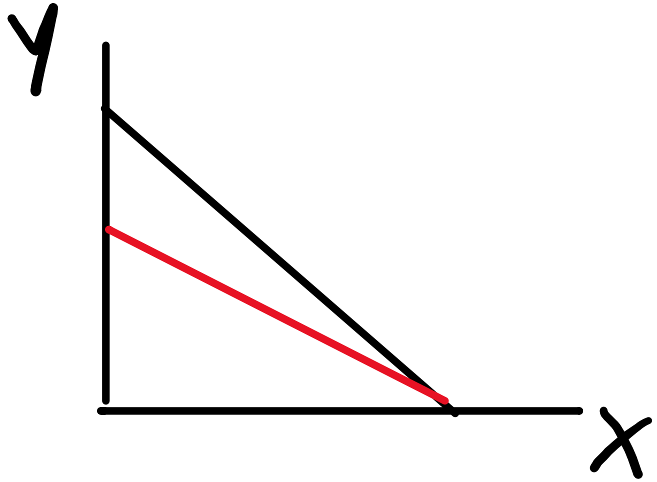
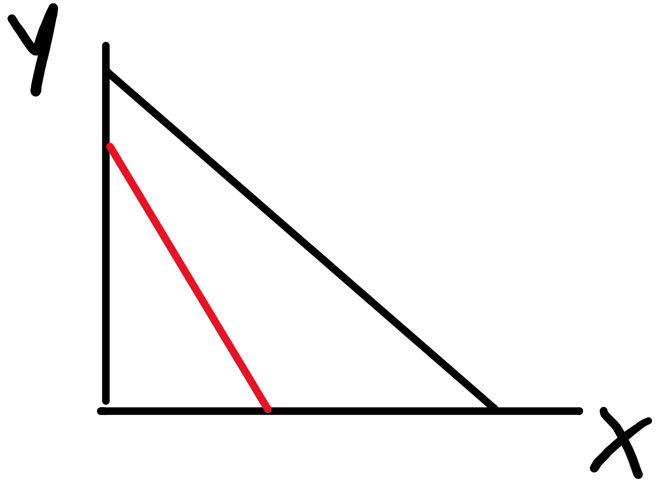


D.



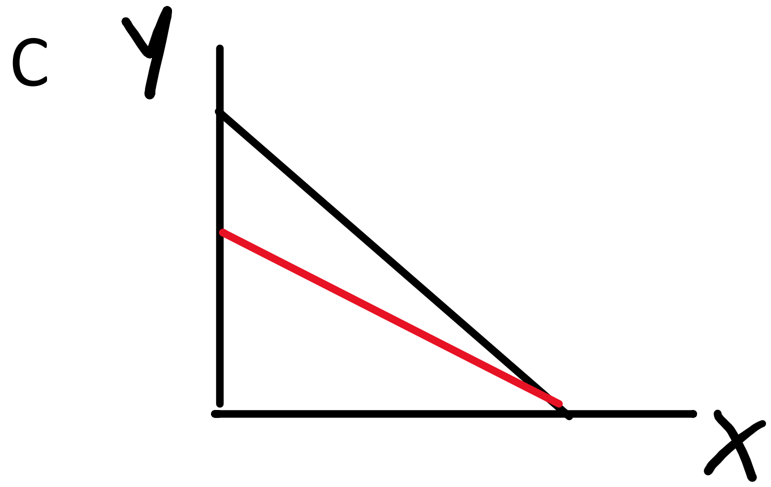
iClicker: Which of the following graphs shows the price of Y increased? (Black is original, Red is new)

Why?

Y is more expensive, so Y-intercept is closer to origin.

No change to X or income, so X-intercept is same.

Slope is flatter because X is relatively cheaper.



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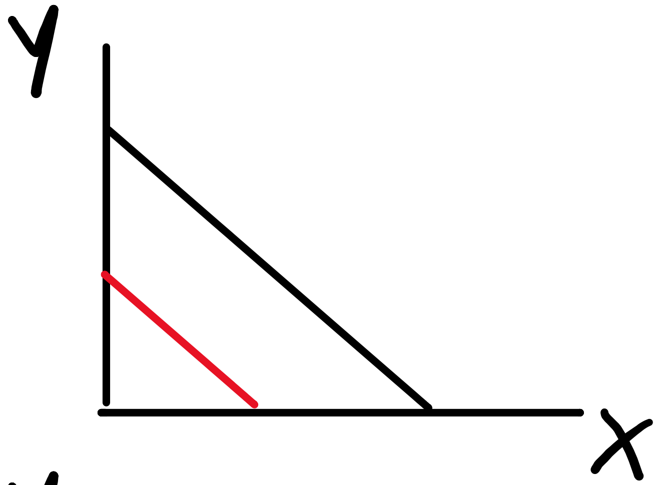

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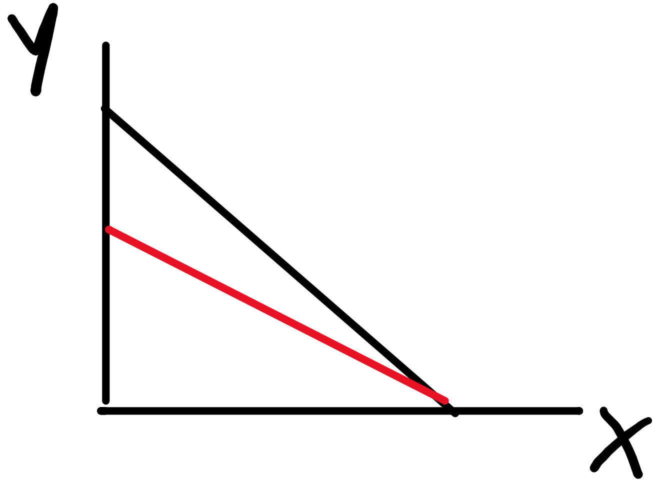

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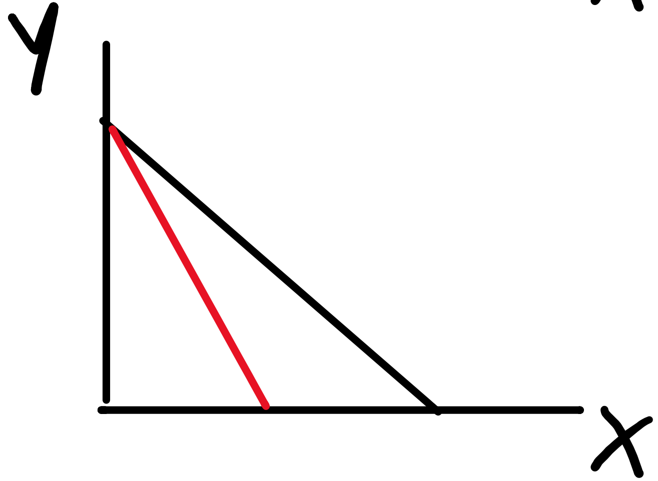

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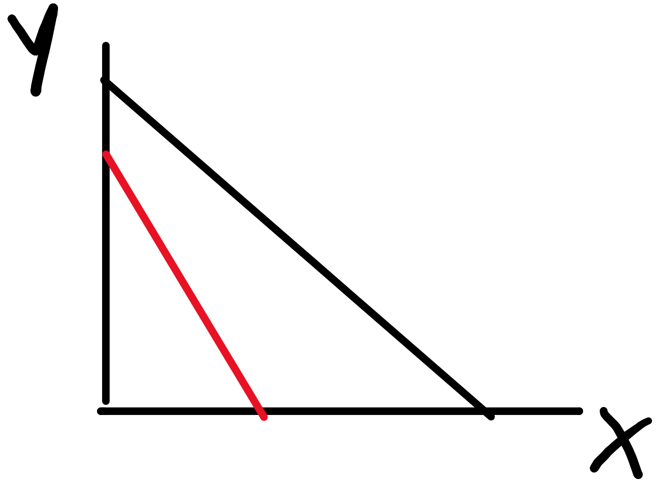

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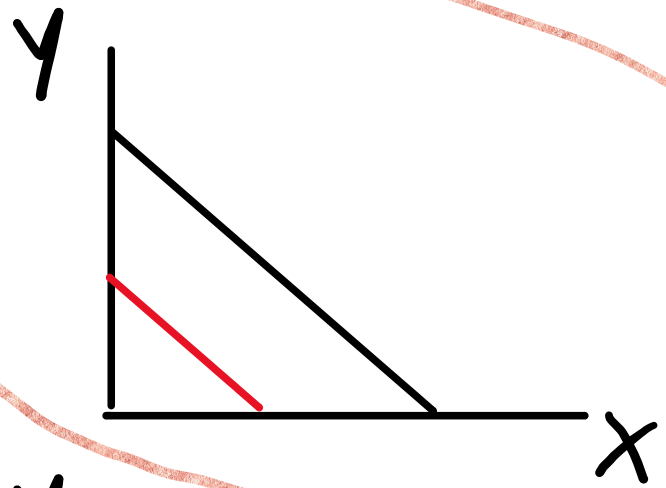

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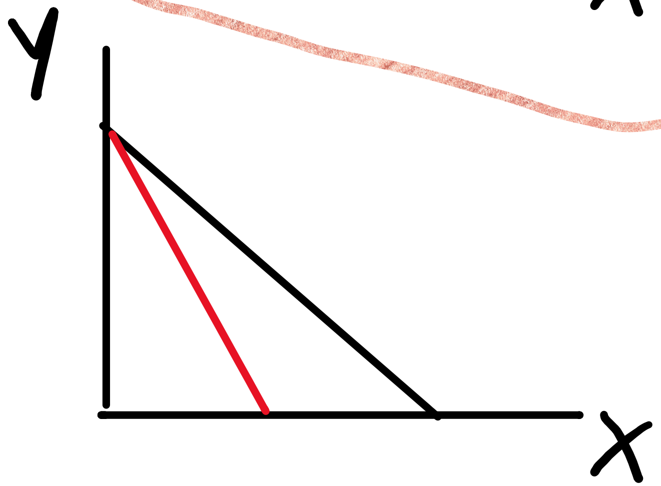

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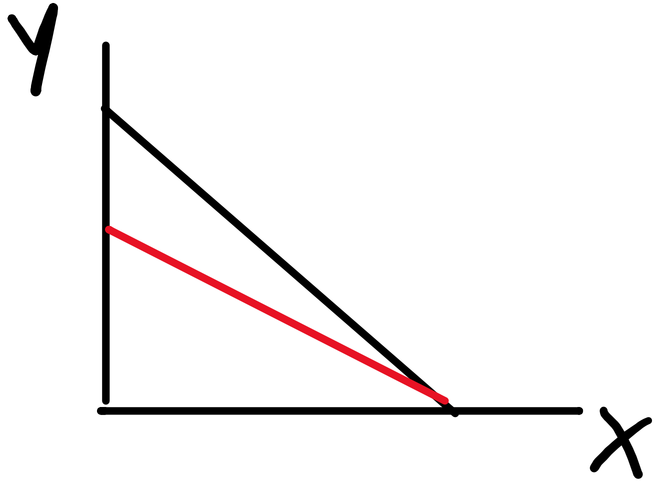

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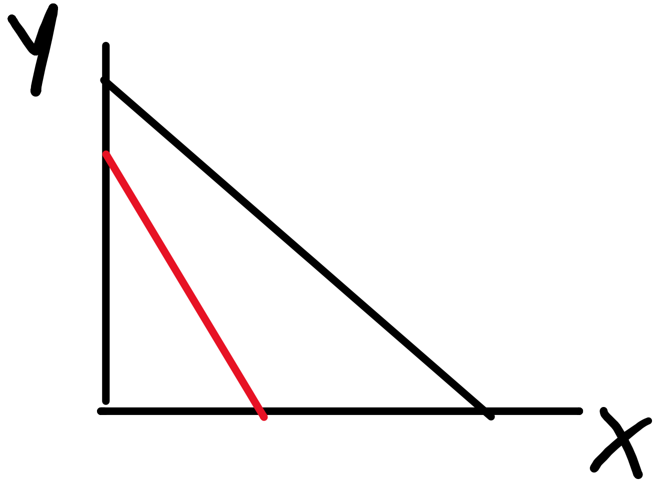

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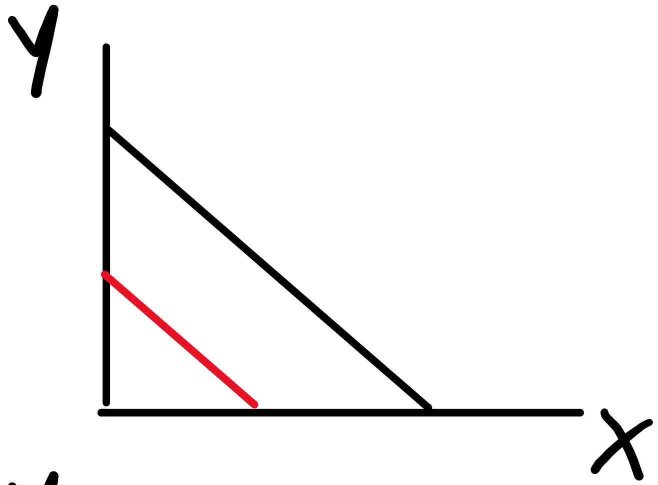

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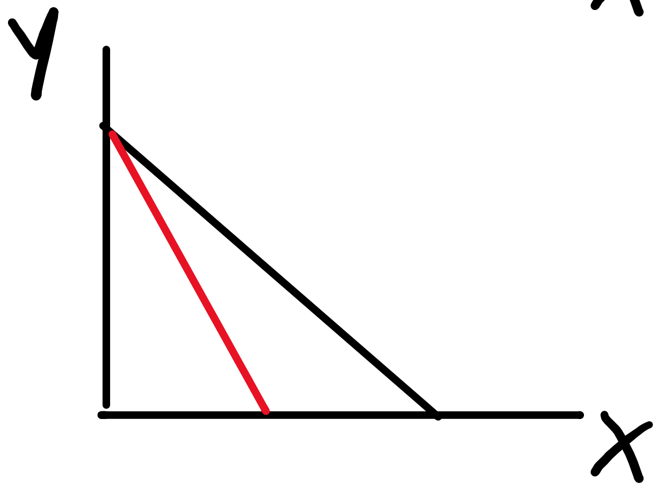

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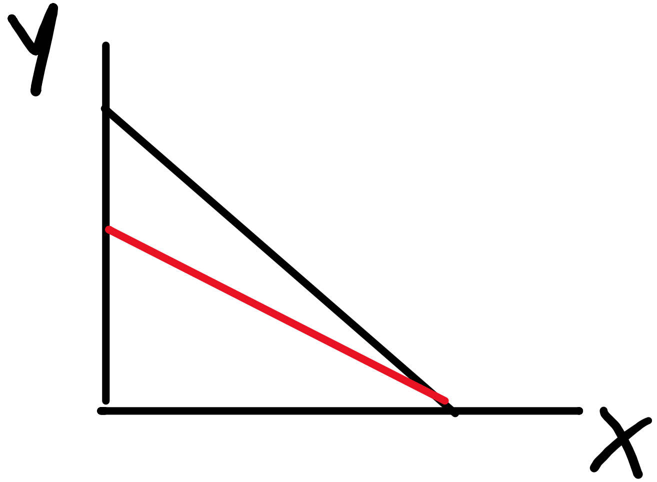

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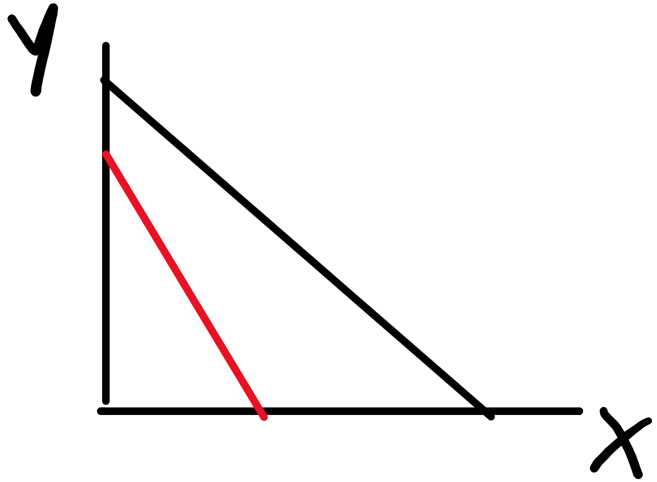

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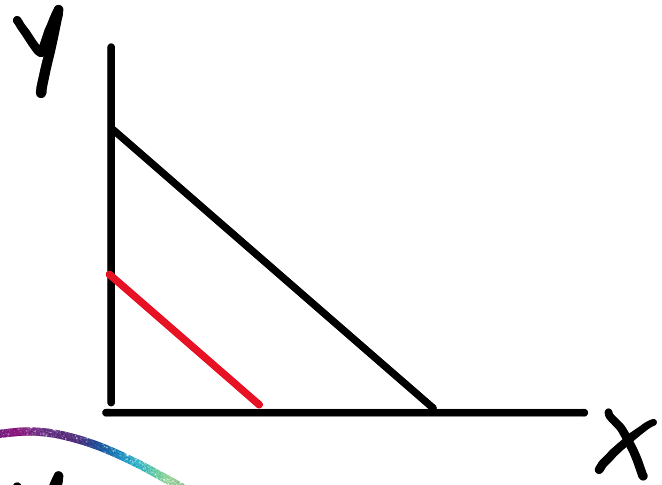

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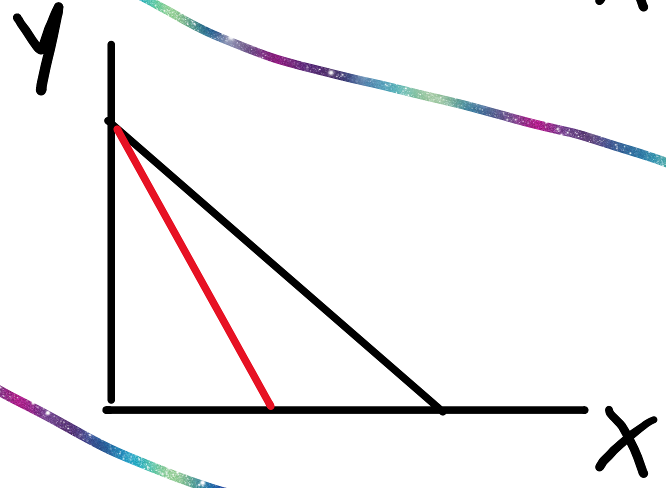

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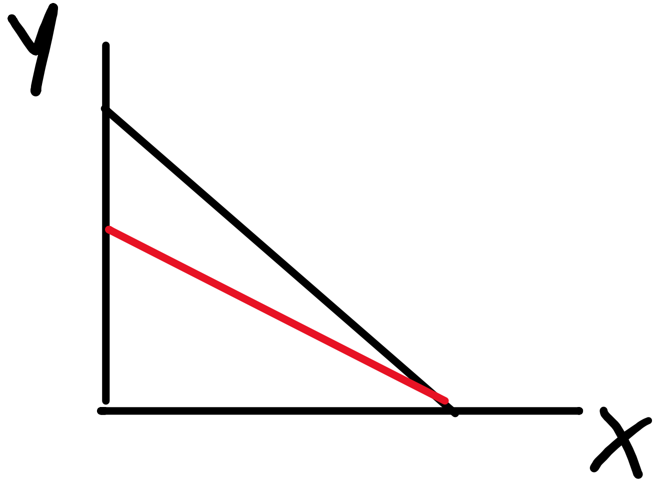

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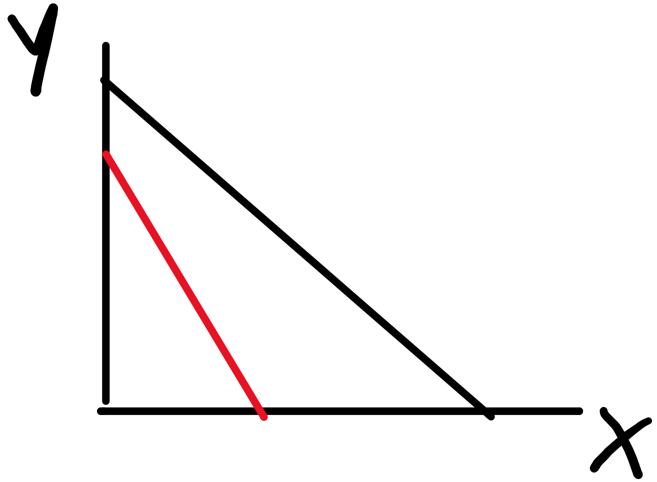
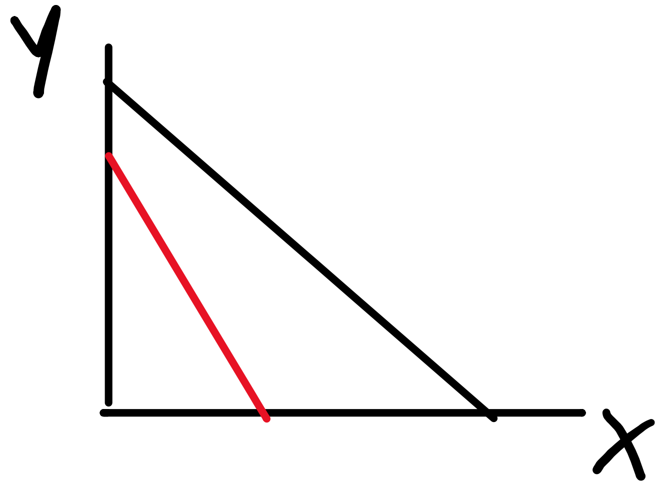


What about this one?

At least two changes happened, but can’t tell which:

Can afford less of both goods, so consistent with:

- Price of both goods increasing
- One price increasing and income falling



What prices tell us

Currency is a convenient unit of exchange.

But could just as well normalize everything by one good, e.g.

$$M = p_X X + p_Y Y$$

Gives exactly the same information as:

$$\frac{M}{p_X} = X + \frac{p_Y}{p_X} Y$$

In both cases: how much X I need to give up to get Y and vice versa.

iClicker: What impact would 10% inflation (prices and income increasing by 10%) have on the budget constraint?

A. No effect.
B. Same as a reduction in income.
C. Same as an increase in income.
D. Same as a price increase in X.
E. Same as a price decrease in Y.

Inflation

Suppose all prices and income increase by π (the inflation rate).

Then the new budget constraint is:

$$(1+\pi)M = (1+\pi)p_X X + (1+\pi)p_Y Y$$

Can divide both sides by $(1+\pi)$ and equation is still true!

$$M = p_X X + p_Y Y$$

Inflation doesn't affect budget constraint!

iClicker: Which budget constraint corresponds to a 10% proportional sales tax on good X?

A. $M = p_X X + p_Y Y$

B. $M = (1 + 0.1)p_X X + p_Y Y$

C. $M = p_X X + (1 + 0.1)p_Y Y$

D. $0.9M = p_X X + p_Y Y$

E. $M = (1 + 0.1)p_X X + (1 + 0.1)p_Y Y$

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D. $0.9M = p_X X + p_Y Y$

E. $M = (1 + 0.1) p_X X + (1 + 0.1) p_Y Y$

Taxes

Suppose a proportional sales tax of τ is levied on good X.

Then the budget constraint can be written:

$$M = (1 + \tau)p_X X + p_Y Y$$

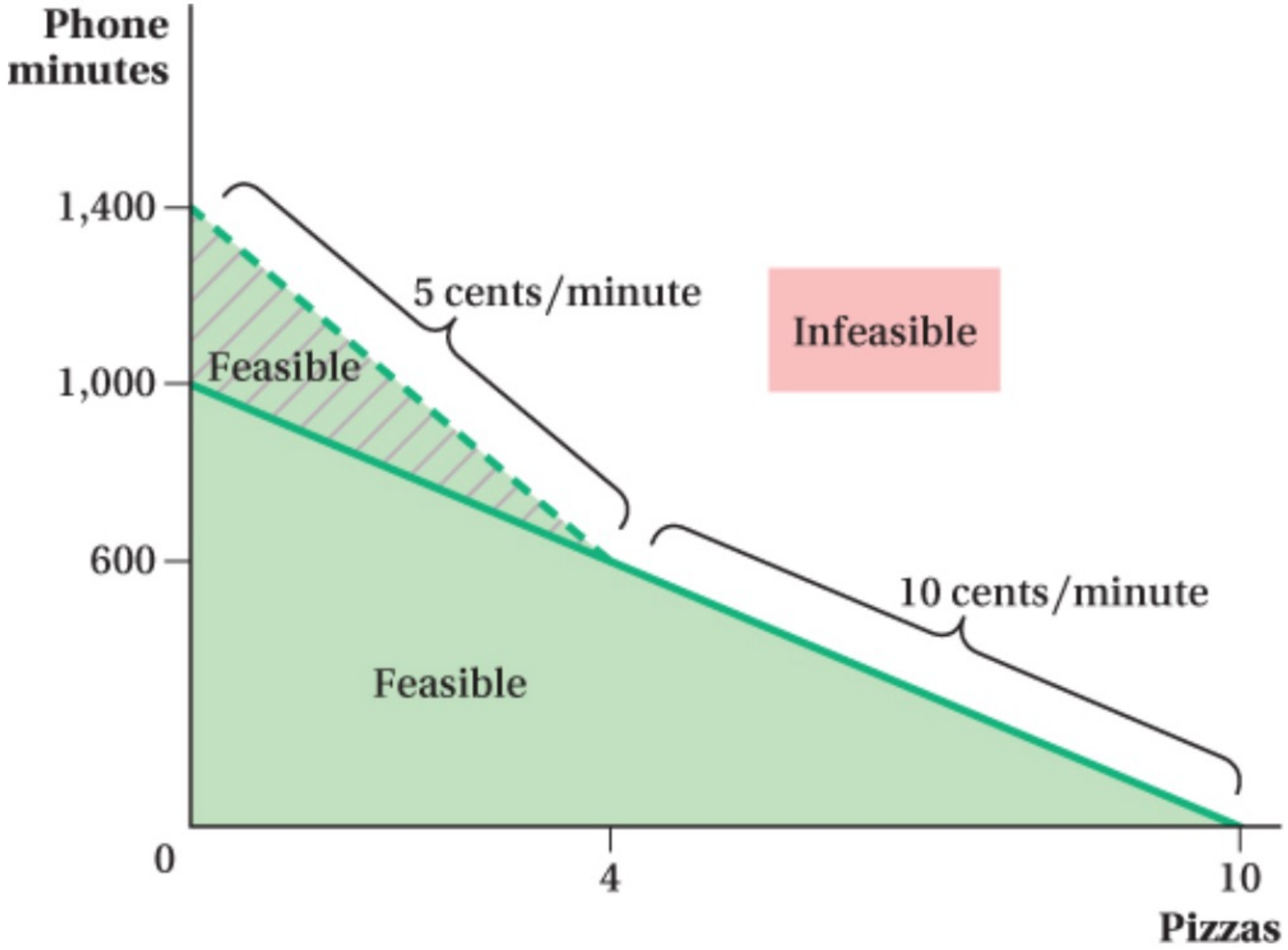
X is more expensive because of the tax.

Complicated Budget Constraints

Budget constraints can be more complicated!

Examples:

- Quantity Discounts



First 10 Free

This question totally tripped me up when I took intermediate micro.

Graph the following budget constraint.

Good $X costs $1 each.

The first 10 units of Y are free, but cost $1 after that.

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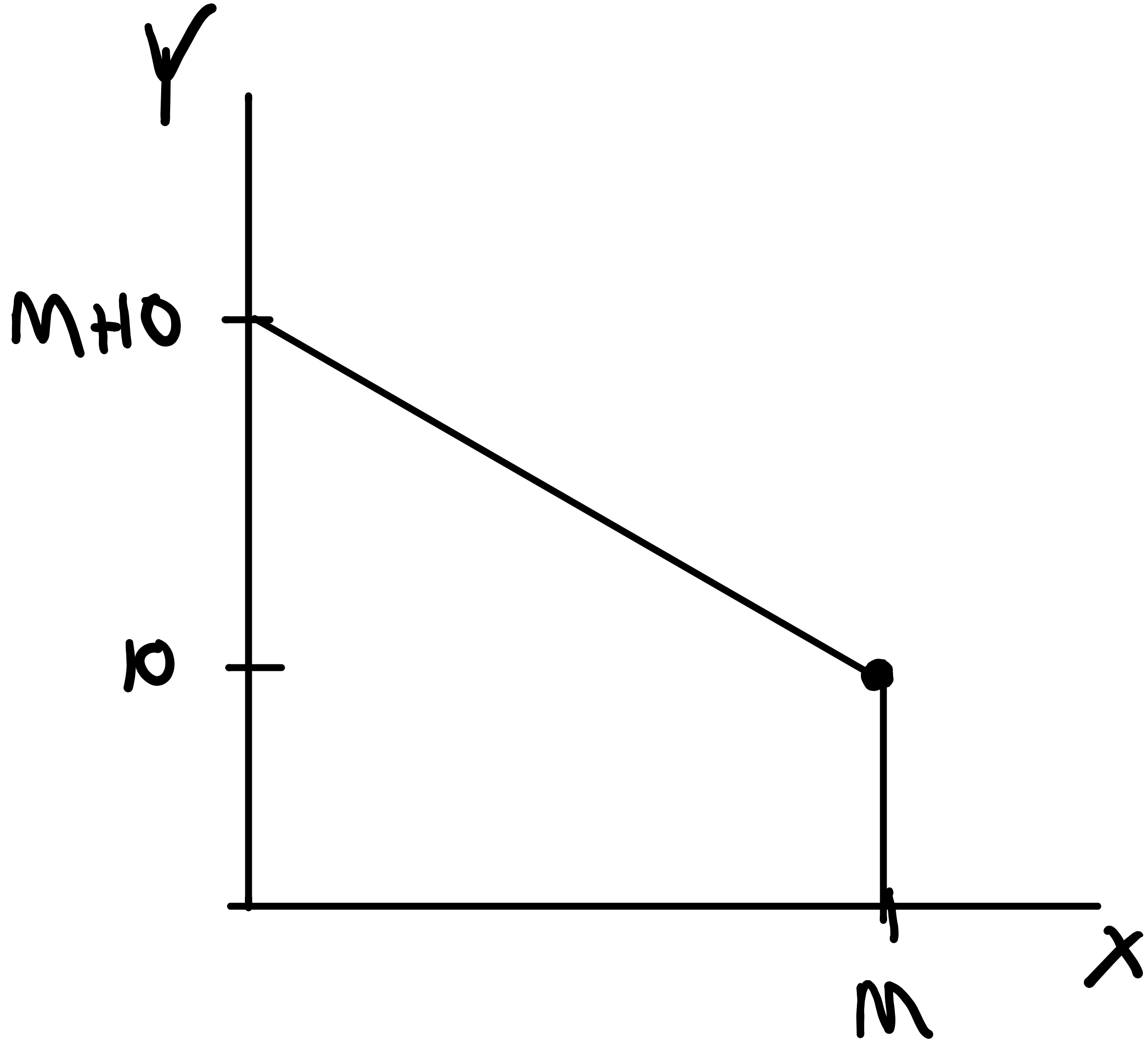


First 10 Free

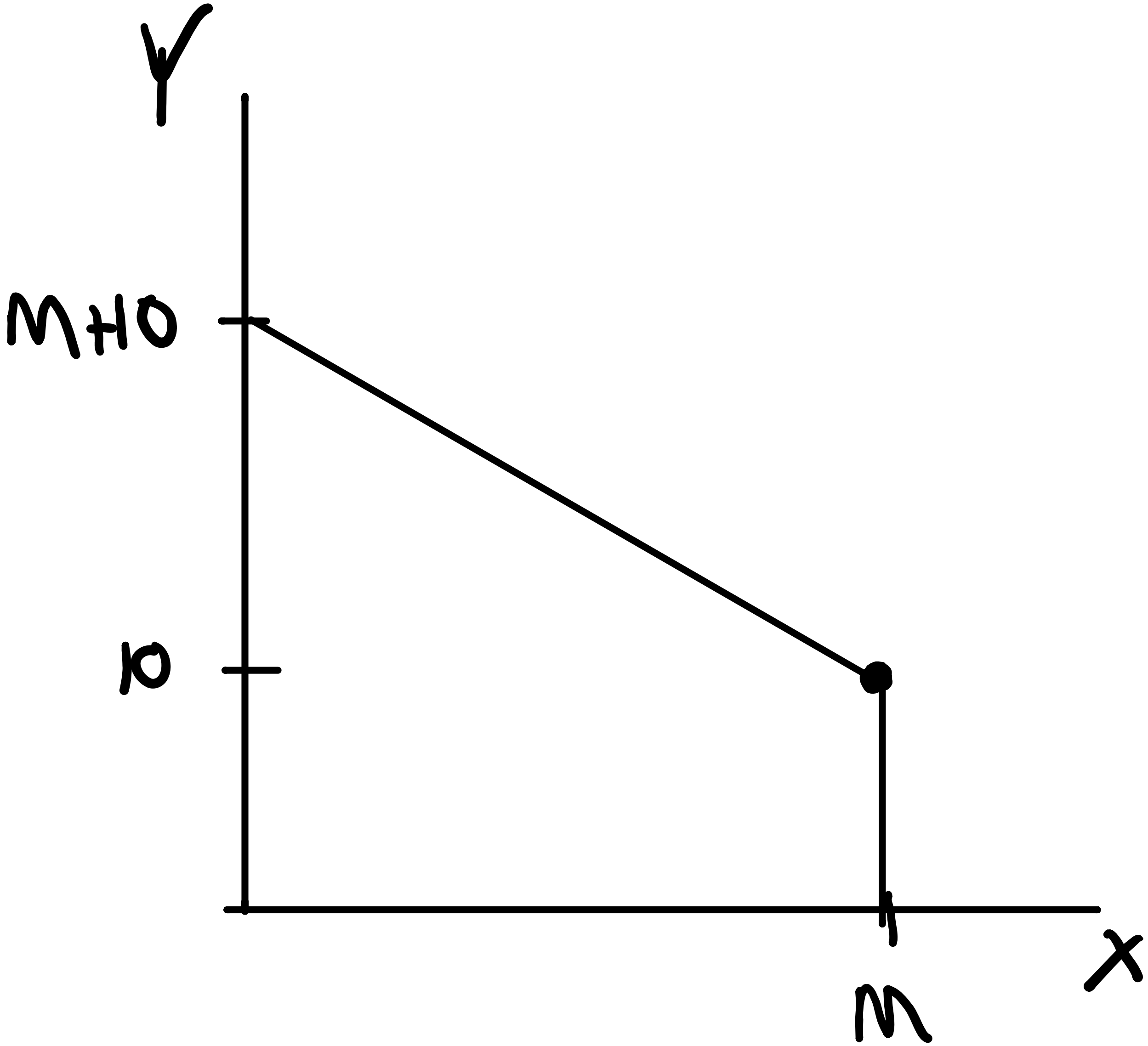
Basically given 10 units of Y

So shift origin to (0,10) and graph as usual.

Spend all your income on X, get

M units of X and 10 units of Y

Spend all your income on Y, get M+10 units of Y



Budget Constraint Recap

$$M = p_X X + p_Y Y$$

Slope is $-\frac{p_X}{p_Y}$. How much Y you have to give up to get another X.
Y intercept is $\frac{M}{p_Y}$.
X intercept is $\frac{M}{p_X}$.

How does graph change if income changes?
How does graph change if p_X changes?
How does graph change if p_Y changes?