x - Bundles or "Choice Objects"
(in mathematics, uppercase letters are generally sets of things)
X - Feasible Set or "Universe of Choice Objects"

Example. Ice Cream:
X =Set of all possible bowls of ice cream consisting of some amount of chocolate ice cream and some amount of vanilla ice cream.
Some bundles:
x =one scoop of vanilla
$(1, 0)$
y =one scoop of vanilla and one scoop of chocolate
z =three scoops of vanilla
If a bundle x is in the feasible set we write $x \in X$.
$x \in X, y \in X, z \in X$.
If we had a feasible set that was all bowls of ice cream with some amount of vanilla, chocolate, or strawberry ice cream.

$$(1, 0, 0)$$

We can have strange bundles:
$(1.2873, \pi)$
If we restrict our feasible set to have integer scoops then $(1.2873, \pi) \notin X$
$(1, 0) \in X$
For most of the course, we will allow any real amount of any of the things so bundles like $(1.2873, \pi)$ are allowed.
Feasible set: bundles of oranges and apples.
$(1, 0)$ bundle with one orange and zero apples
$(2, 1)$ bundle with two oranges and one apple
The "goods" in this model are oranges and apples.
A bundle is an "amount" of each "good" in your model.
$(1, 1)$ is a bundle with 1 unit of good 1 and 1 unit of good 2.

Feasible set: X (every imaginable bundle)
Budget set: B (every bundle a particular consumer can have. The bundles a particular consumer is being asked to choose among.)
The budget set has to be a subset of the feasible set.

$$B \subseteq X$$

X is the set of all bowls of chocolate and vanilla ice cream.

$$X = \mathbb{R}^2_+$$

$$(1, 1) \in \mathbb{R}^2_+$$

$$(2, 1) \in \mathbb{R}^2_+$$

$$(1.2837, \pi) \in \mathbb{R}^2_+$$

X is the set of all bowls of chocolate and vanilla ice cream.

What are some budget sets in this feasible set.

Finn's Budget. You can have any bowl of ice cream with no more than one total scoop.

$$B = \{(x_1, x_2) \,|\, (x_1, x_2) \in X \& x_1 + x_2 \leq 1\}$$

$$(-1, 2) \notin X$$

$$(-1, 2) \notin B$$

$$(1, 0) \in B$$

$$(2, 0) \notin B$$

Dad's Budget set. Dad has \$15 to spend on ice cream and ice cream costs \$5 scoop.

$$B = \{(x_1, x_2) \,|\, (x_1, x_2) \in X \& 5x_1 + 5x_2 \leq 15\}$$

This kind of budget is called a "Competitive Budget"

Another Budget set. Chris mas m to spend on good 1 and 2 and the price of x_1 is p_1 and the price of x_2 is p_2.

$$B = \{(x_1, x_2) \,|\, (x_1, x_2) \in X \& p_1 x_1 + p_2 x_2 \leq m\}$$

This a "generic" competitive budget set.

p_1, p_2 are "prices"

m is "income"

The only non-trivial thing here is the condition. We call this the "budget set".

$$p_1 x_1 + p_2 x_2 \leq m$$

Budget line is "boundary" of this set.

$$p_1 x_1 + p_2 x_2 = m$$

The slope of the budget line represents "trade-offs"