WORK, WELLBEING, & SCARCITY II

PMAP 8141: Economy, Society, and Public Policy

September 26, 2019

Fill out your reading report on iCollege!

PLAN FOR TODAY

XYZ Airlines revisited

Calculus party!!!

Utility and indifference

Maximizing utility

Income and substitution effects

XYZ AIRLINES REVISITED

Are We Running Out of Ideas? (Ep. 310)

November 29, 2017 @ 11:00pm
by **Stephen J. Dubner**
Produced by **Greg Rosalsky**

LISTEN NOW: ART19 00:00 / 37:00

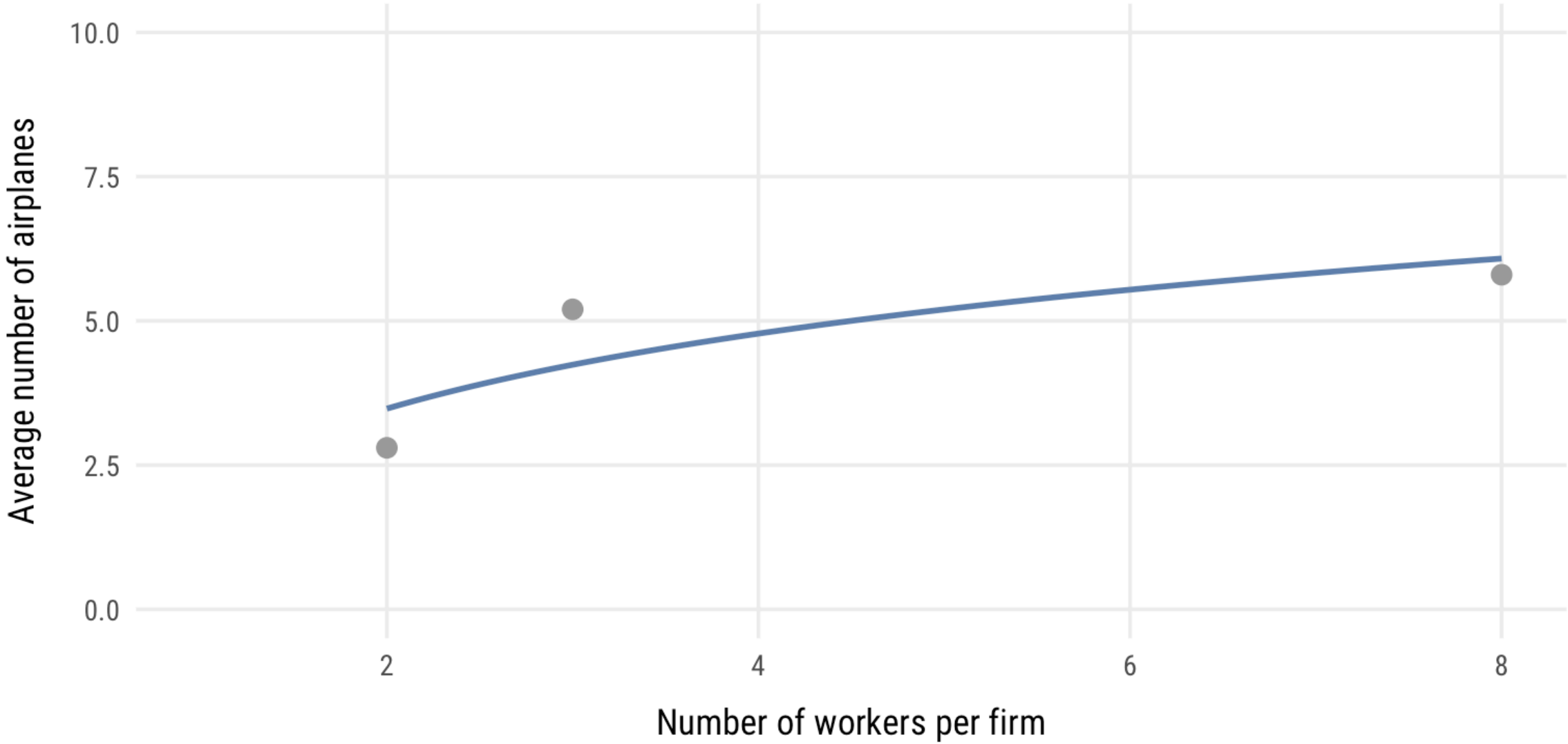
Stuck in a rut: If new ideas spread so easily, why is productivity growth slowing? (Photo: Wikimedia Commons)

Our latest Freakonomics Radio *episode is called "Are We Running Out of Ideas?" (You can subscribe to the podcast at* ***Apple Podcasts*** *or* ***elsewhere****, get the* ***RSS feed****, or listen via the media player above.)*

Economists have a hard time explaining why productivity growth has been shrinking. One theory: true innovation has gotten much harder – and much more expensive. So what should we do next?

Average number of airplanes produced by 3 firms

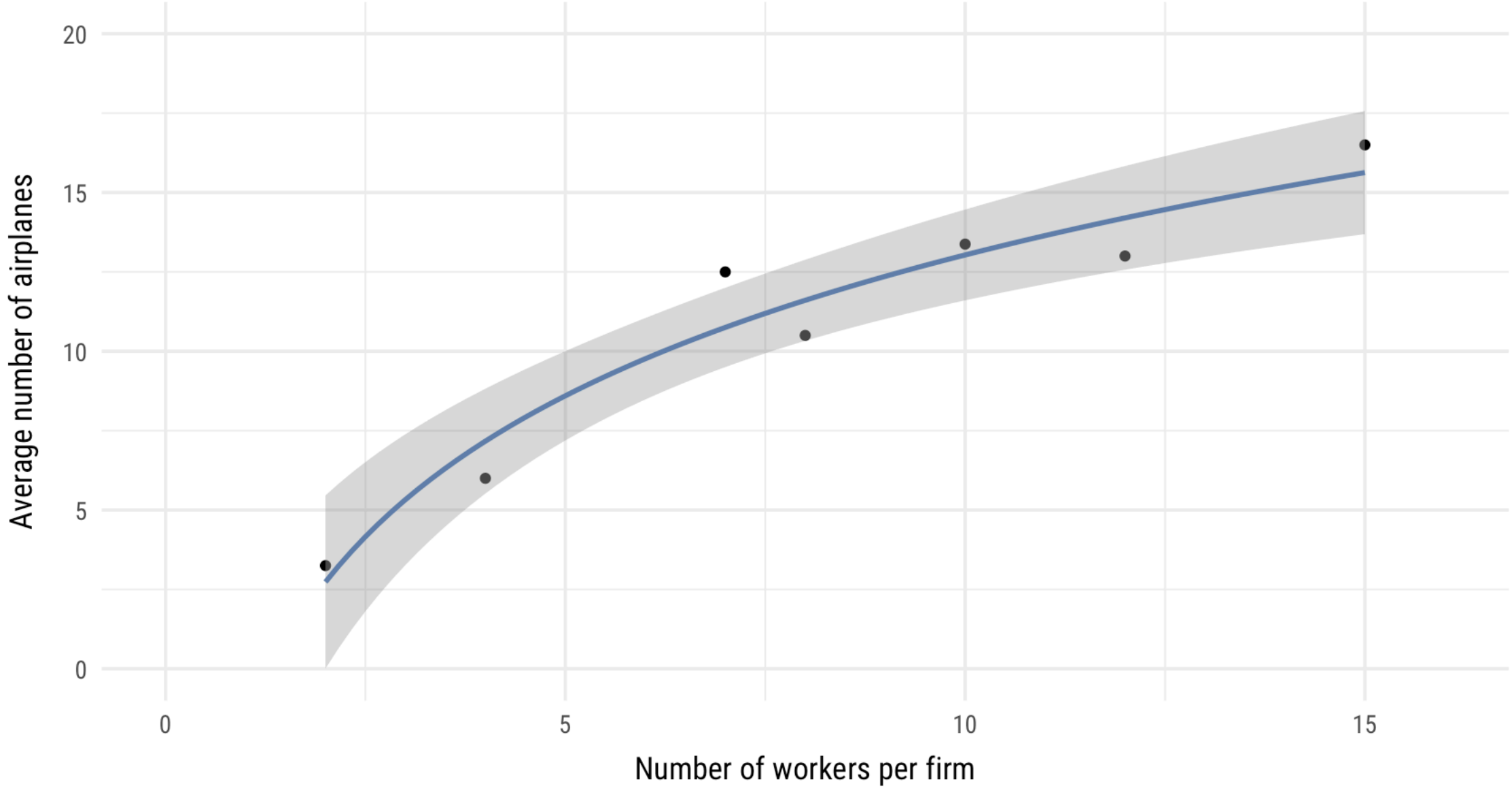
Five rounds played



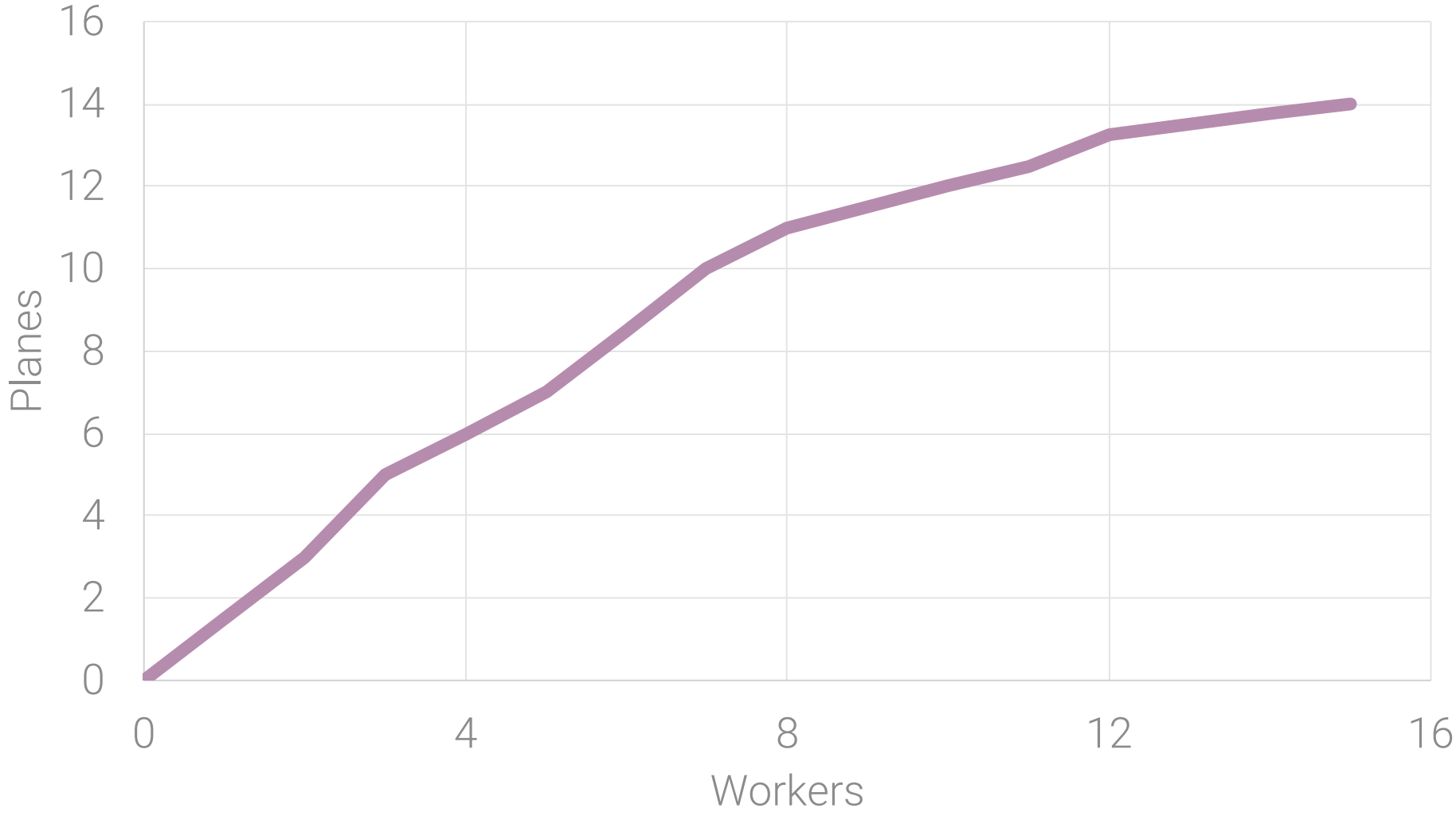
PMAP 8141, Fall 2019
Andrew Young School of Policy Studies
BGeorgia State University

Average number of airplanes produced by 10 firms

Averaged over 4 rounds; firms varied in size



Introductory Microeconomics, 2008
Universidad de los Andes, Colombia



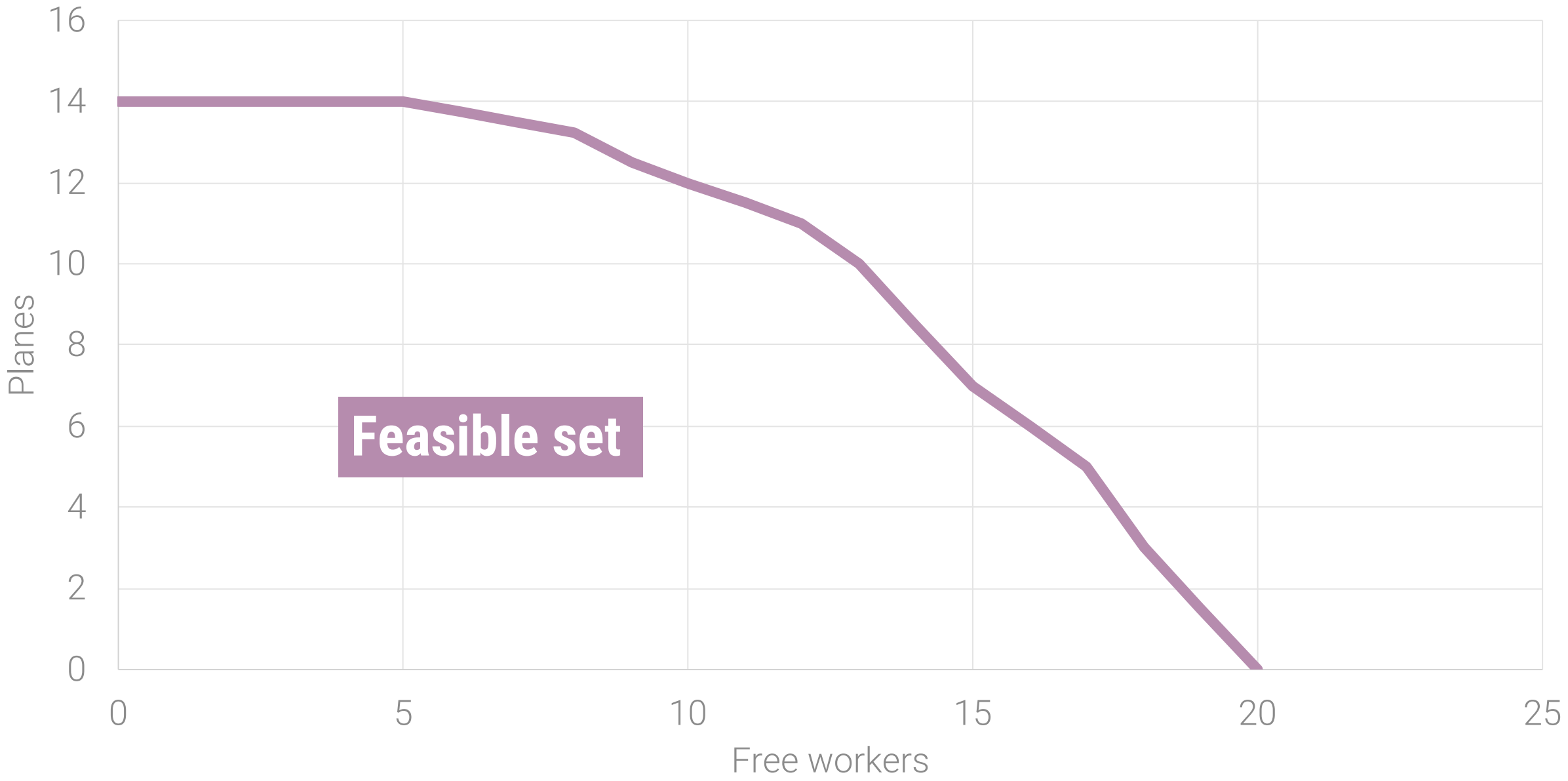
Average product

Planes per worker

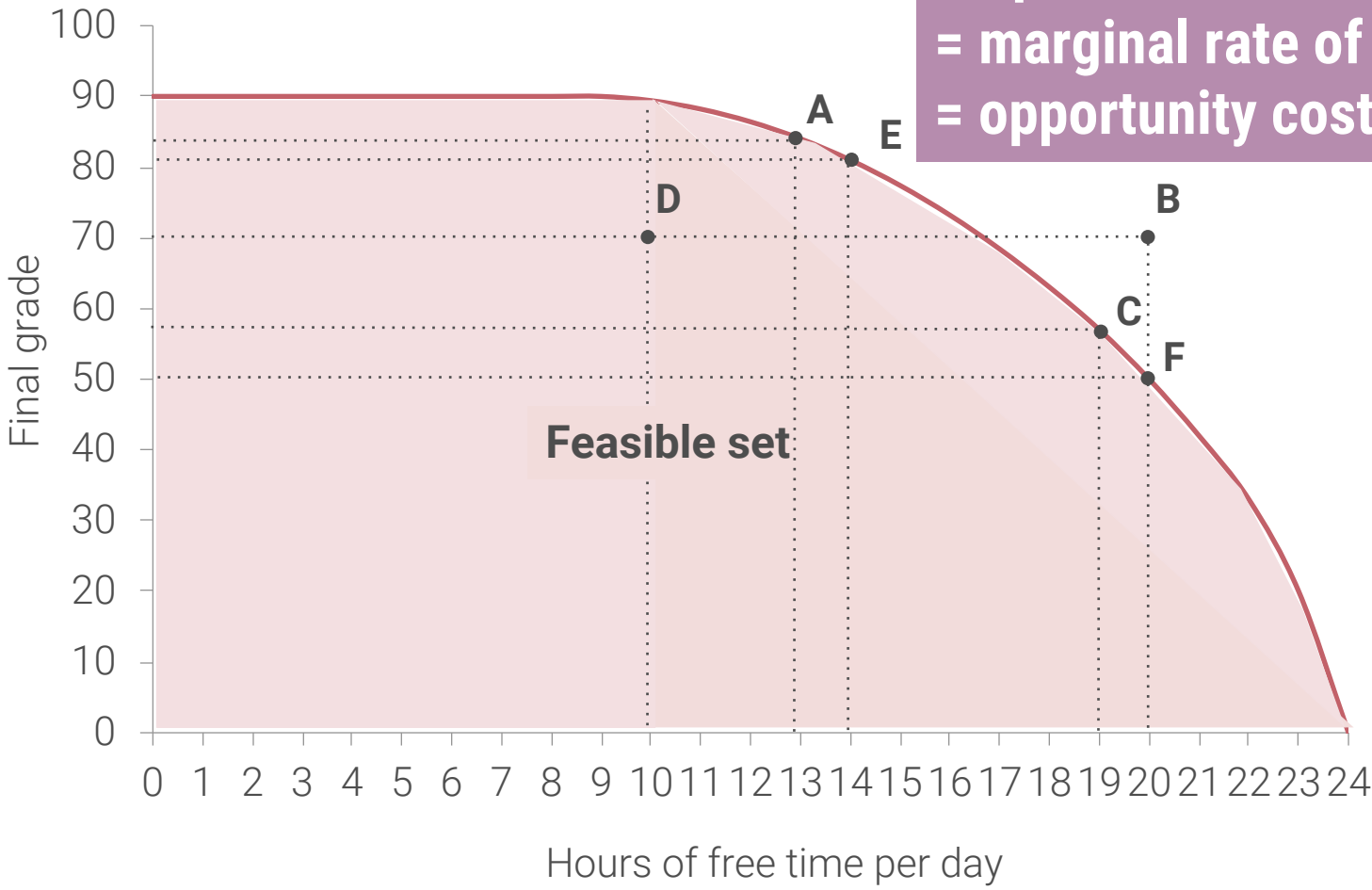
Marginal product

Planes per *additional* worker

Workers	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Planes	0	1.5	3	5	6	7	8.5	10	11	11.5	12	12.5	13.25	13.5	13.75	14


16
14
12
10
8
6
4
2
0
Planes
Feasible set
0
5
10
15
20
25
Free workers

Slope
= marginal rate of transformation (MRT)
= opportunity cost



	A	E	C	F
Free time	**13**	**14**	**19**	**20**
Grade	**84**	**81**	**57**	**50**
Opportunity cost		**3**		**7**

OPPORTUNITY COST

The value of the thing you can't do because of a decision

The value of the forgone option

OPPORTUNITY COST

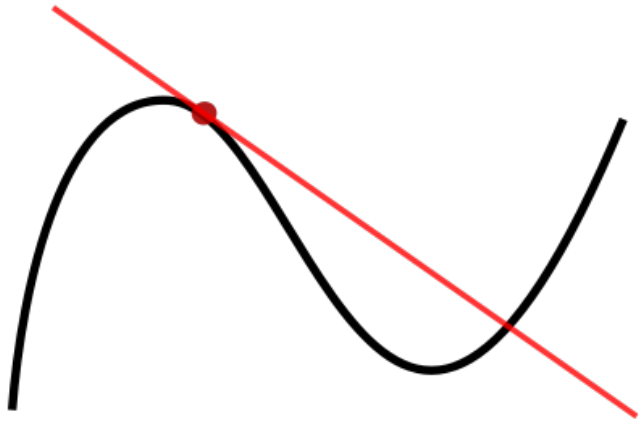
Cost for theater concert	$25	
Value of park concert *to you*	$15	
Economic cost of theater	$40	
Value of theater concert *to you*	$50	$35
Your choice	Theater	Park

CALCULUS PARTY!!!

2 REASONS FOR CALCULUS

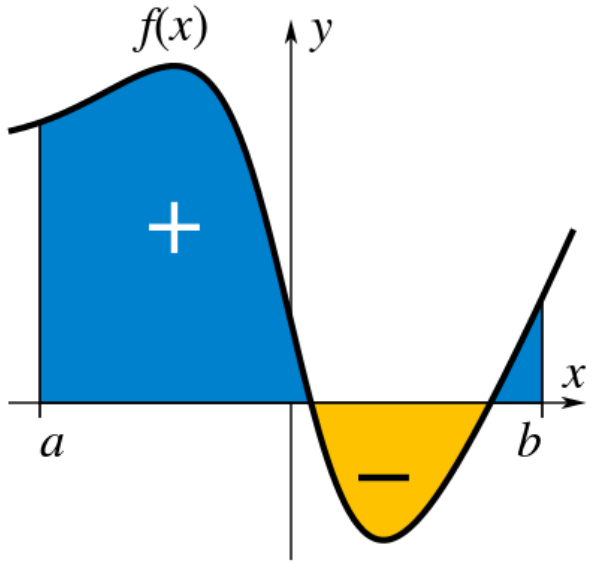
Find the slope of a line

Differential calculus



Find the area under a line

Integral calculus



DRAWING LINES WITH MATH

$$y = mx + b$$

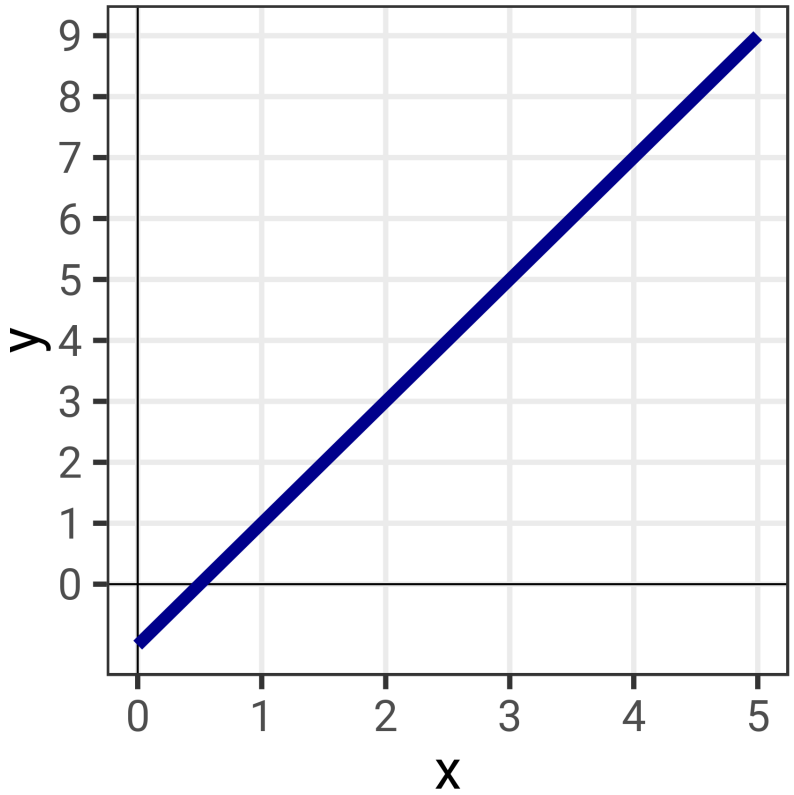
y	A number	
x	A number	
m	Slope	$\frac{rise}{run}$
b	y intercept	

SLOPE

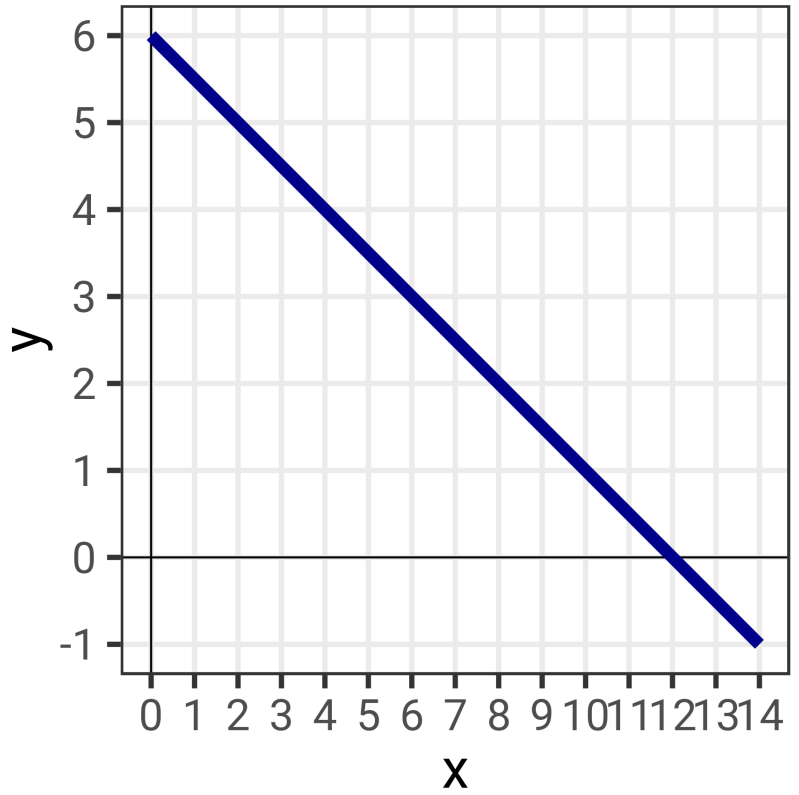
Slope =
rise/run =
how y changes as you change x

SLOPES AND INTERCEPTS

$$y = 2x - 1$$



$$y = -0.5x + 6$$



GRAPH THESE

$y = 5x + 2$

$y = x - 1$

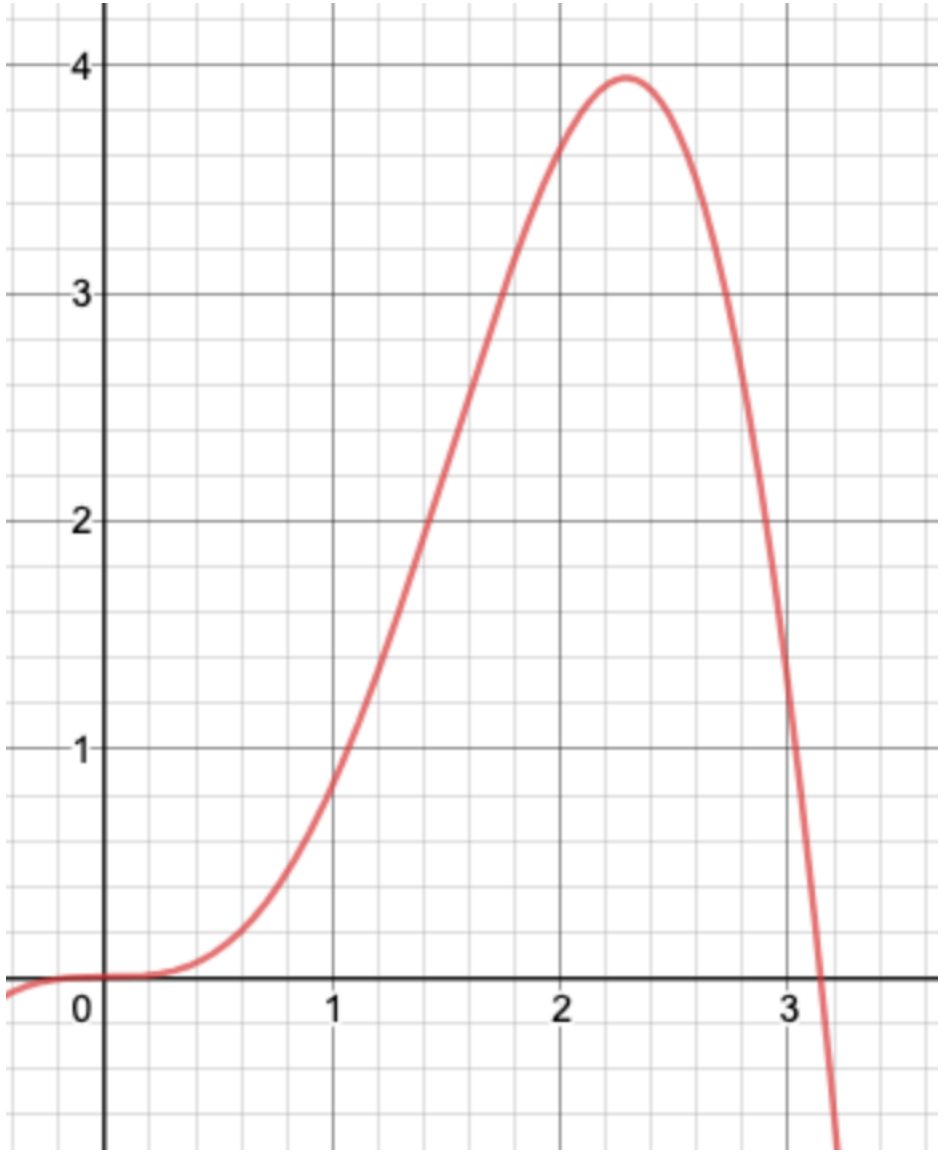
$y = -2x + 11$

$y = 6 - 2x$

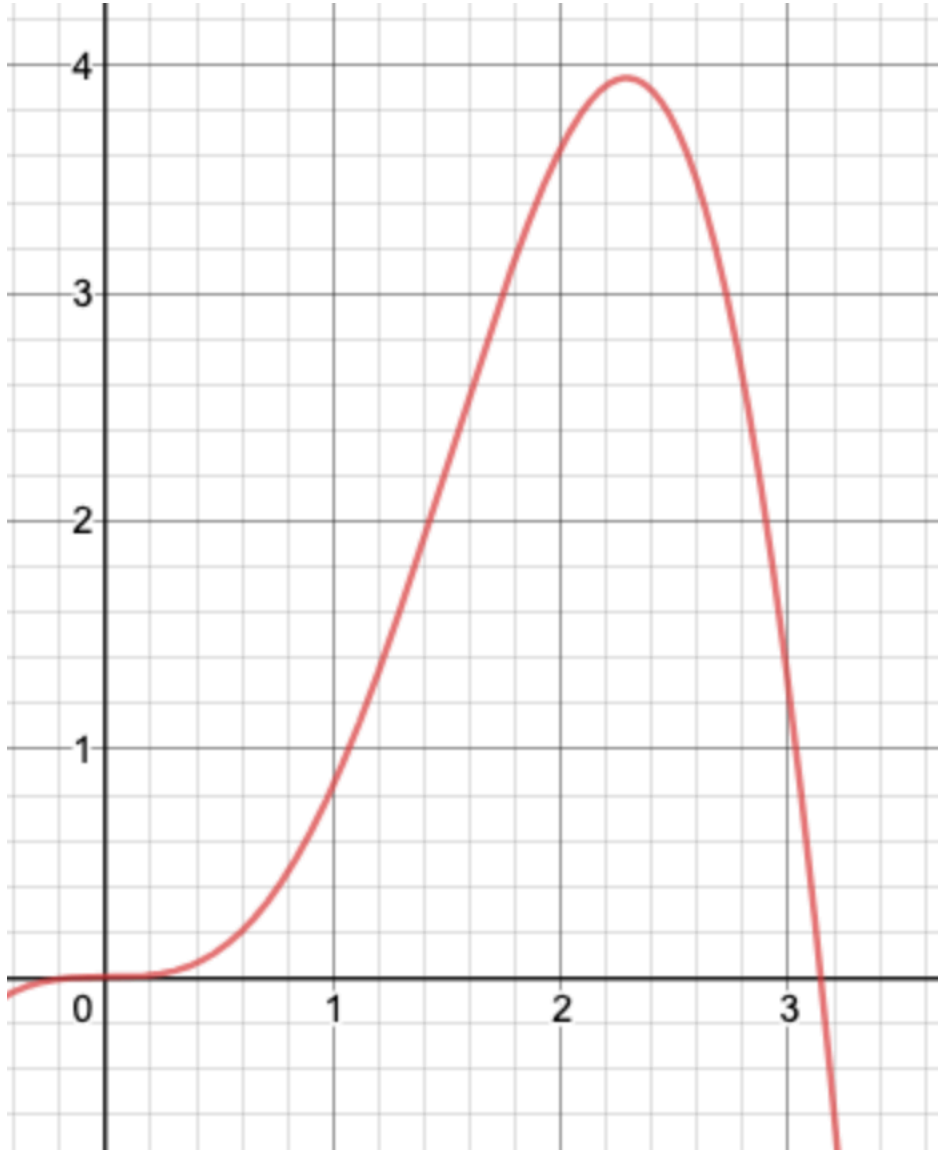
$y = 0.33x - 1$

$y = 0.75x - 3$

WHAT ABOUT CURVY LINES?



NO SINGLE SLOPE

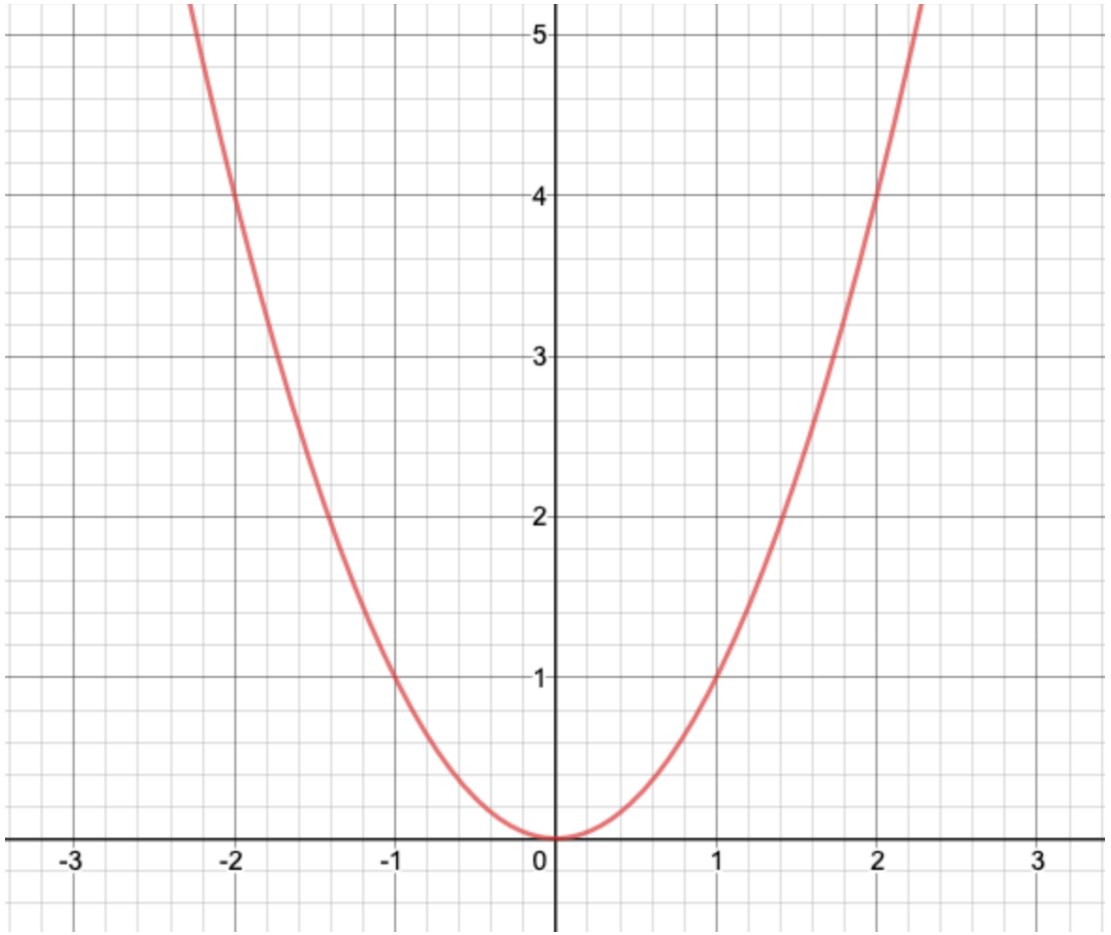


Slope is different at every x

Slope will be a formula, not a single number

Derivative

DERIVATIVES



$$y = x^2$$

Power rule

Move exponent down to coefficient, reduce exponent by 1

$$y' = 2x$$

$$y = 3x^3 - 4x^2 + 6x - 1$$
$$y' = 9x^2 - 8x^1 + 6$$

$$y = 5x + 2$$
$$y' = 5$$

YOUR TURN

$$y = 3x^2 - 4x + 8$$

$$y = -2x^4 - 2x + 100$$

$$y = 7x + 2$$

PARTIAL DERIVATIVES

Power rule only works with 1 variable

$$u = xy$$

PARTIAL DERIVATIVES

Do the x part first, then do the y part

x part / y part

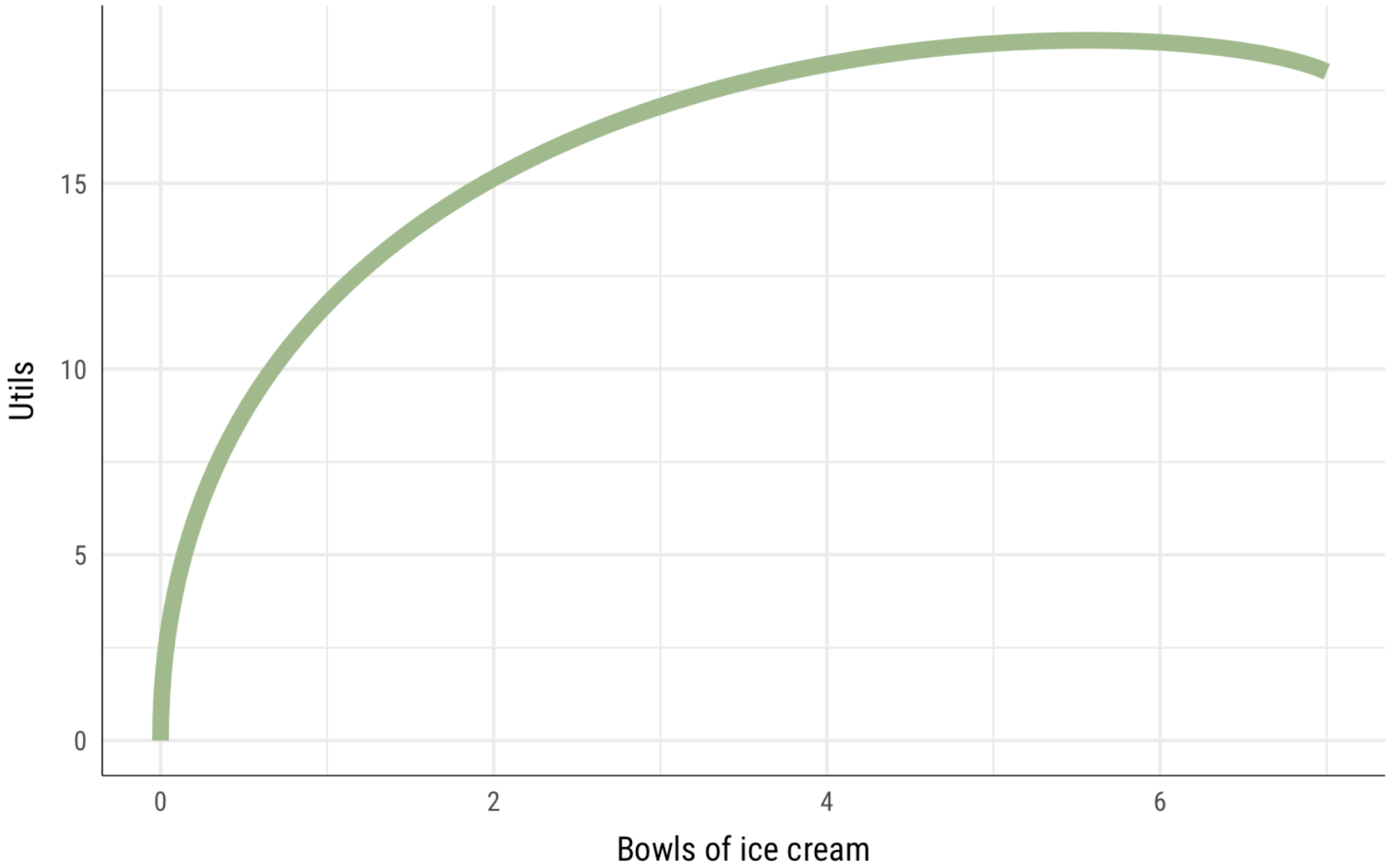
$$u = xy \qquad u' = \frac{y}{x}$$

UTILITY & INDIFFERENCE

UTILITY

Happiness points

Diminishing marginal utility



UTILITY BUNDLES

Theoretical combination of goods that provide same level of utility

$$u(x_1, x_2)$$

$$u(x_1, x_2) = x_1 x_2$$

UTILITY BUNDLES

$$u(x_1, x_2) = x_1 x_2$$

$u(1, 2)$ **2**

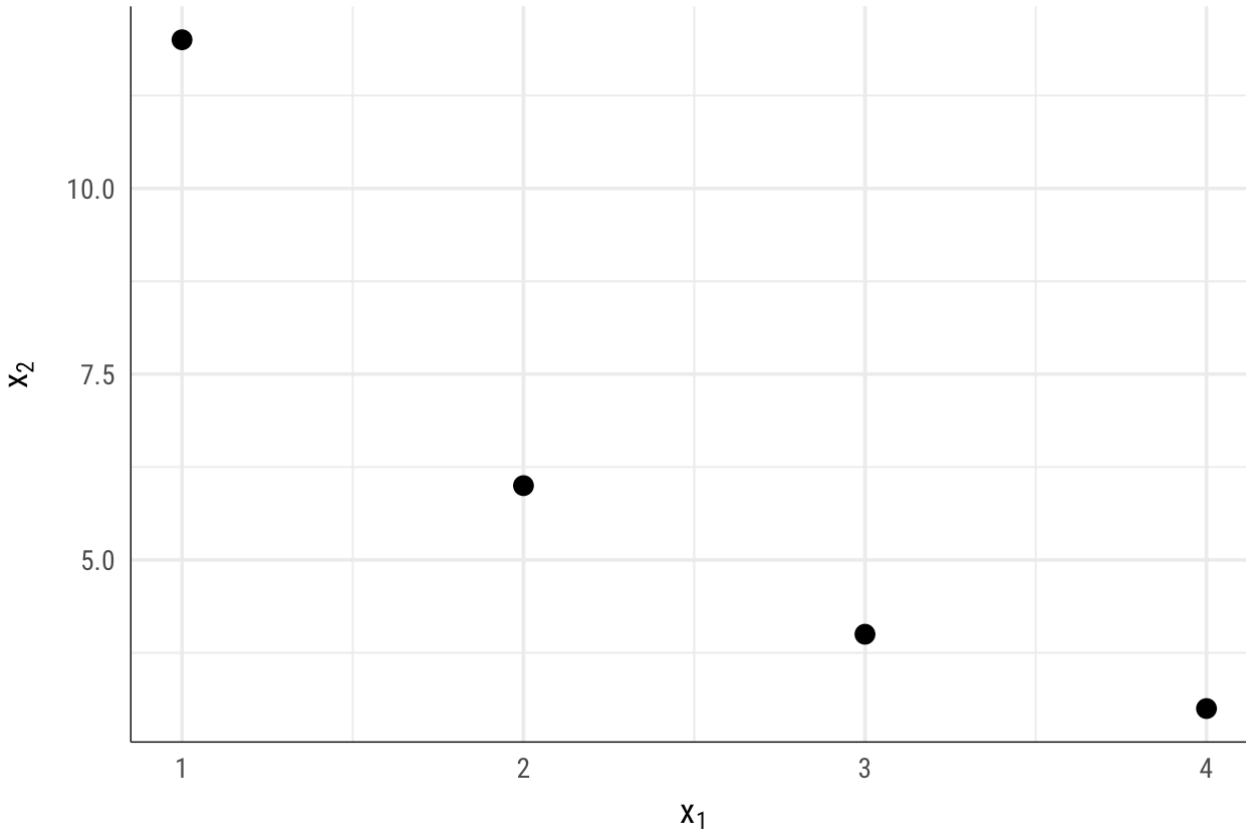
$u(100, 3)$ **300**

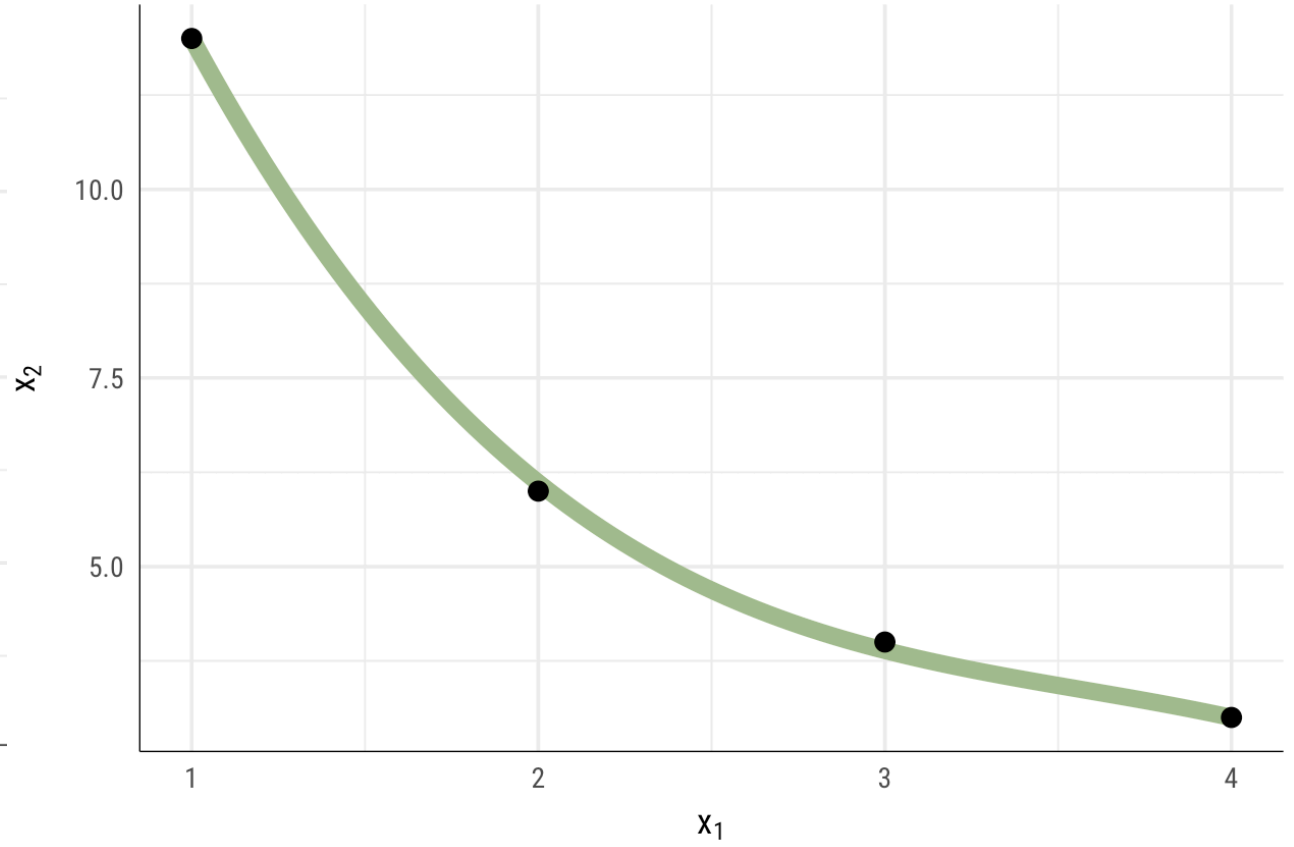
$u(4, 1)$ **4**

What combinations of inputs will produce 12 utils?

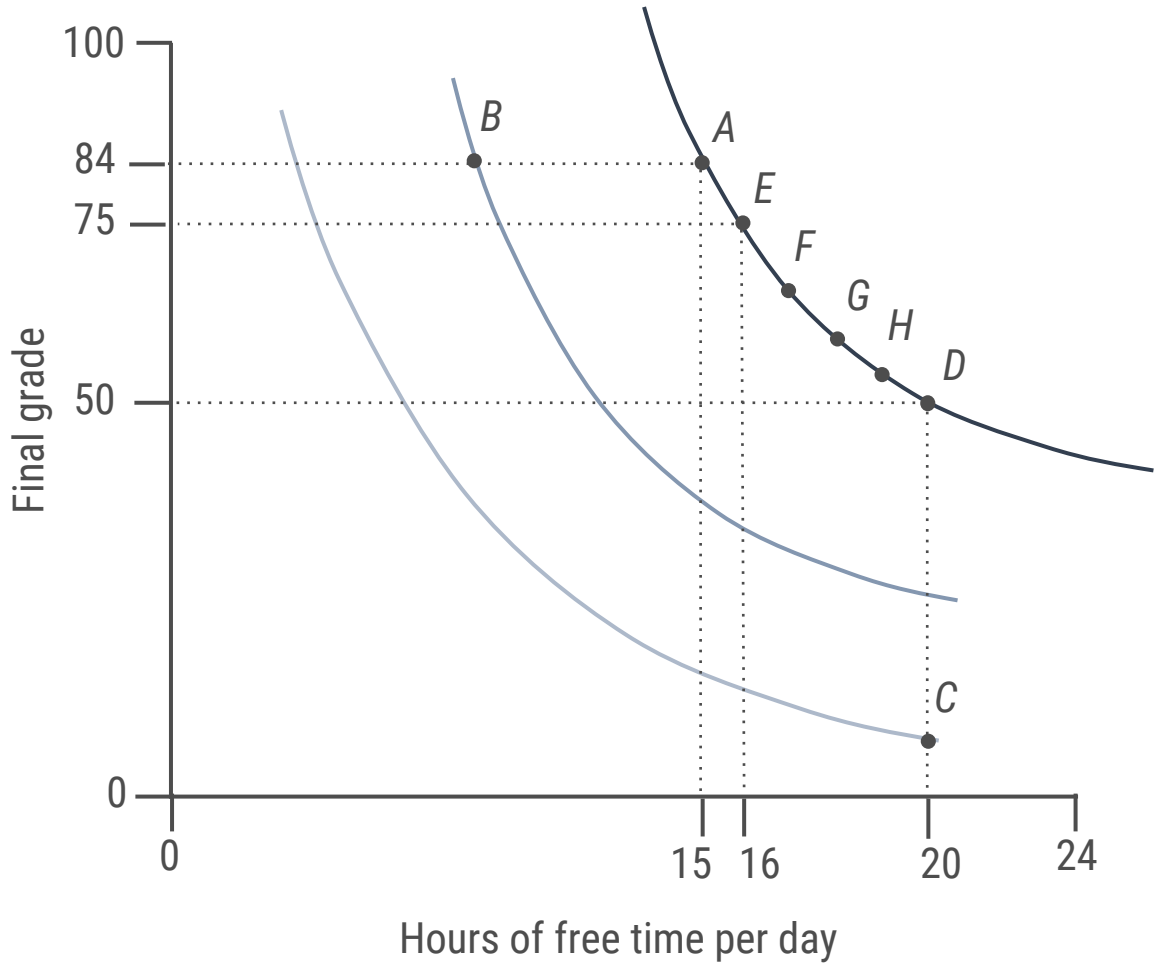
$$u(x_1, x_2) = x_1 x_2$$

$$u(x_1, x_2) = x_1 x_2$$





INDIFFERENCE CURVES

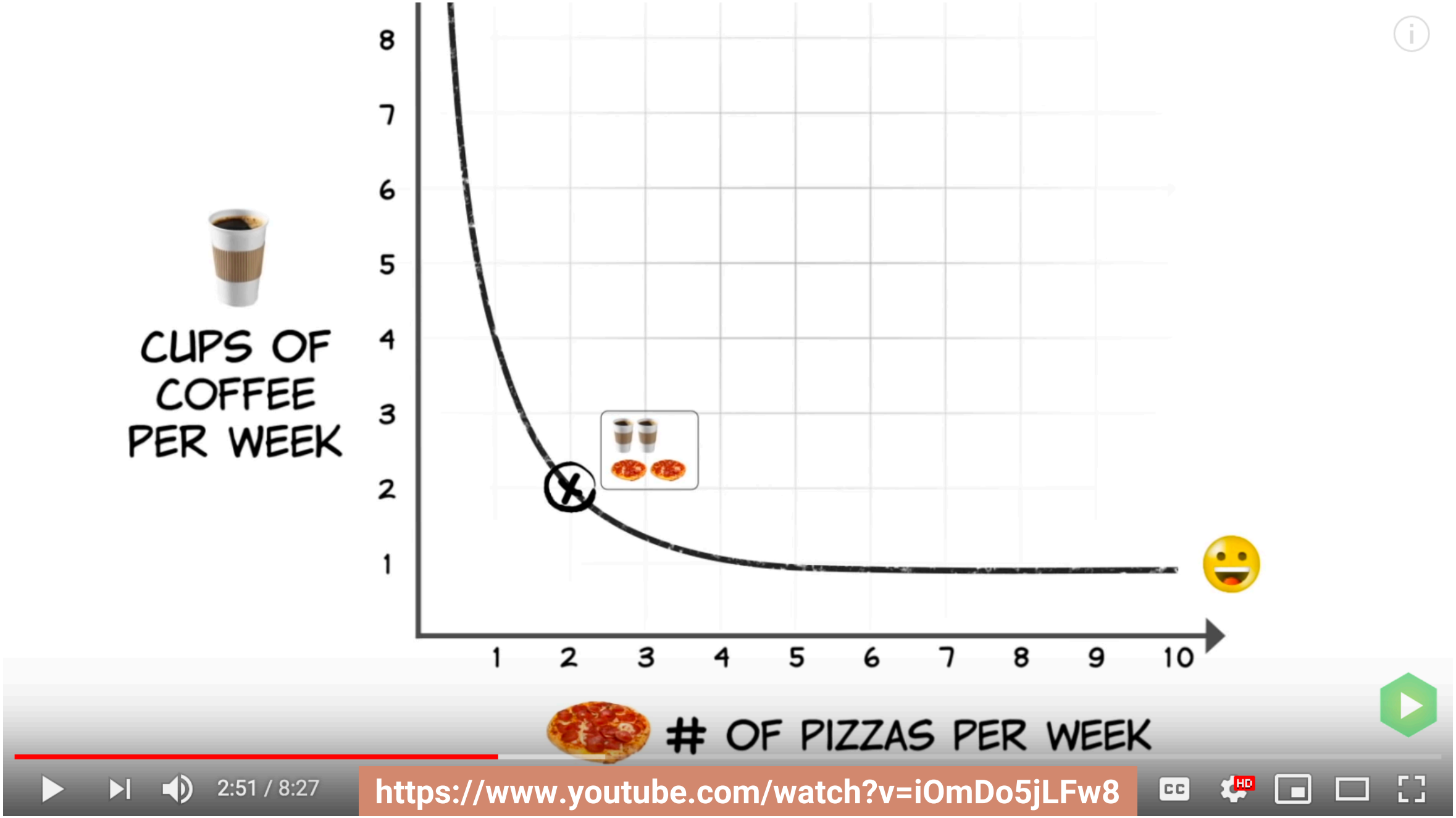


INDIFFERENCE CURVES

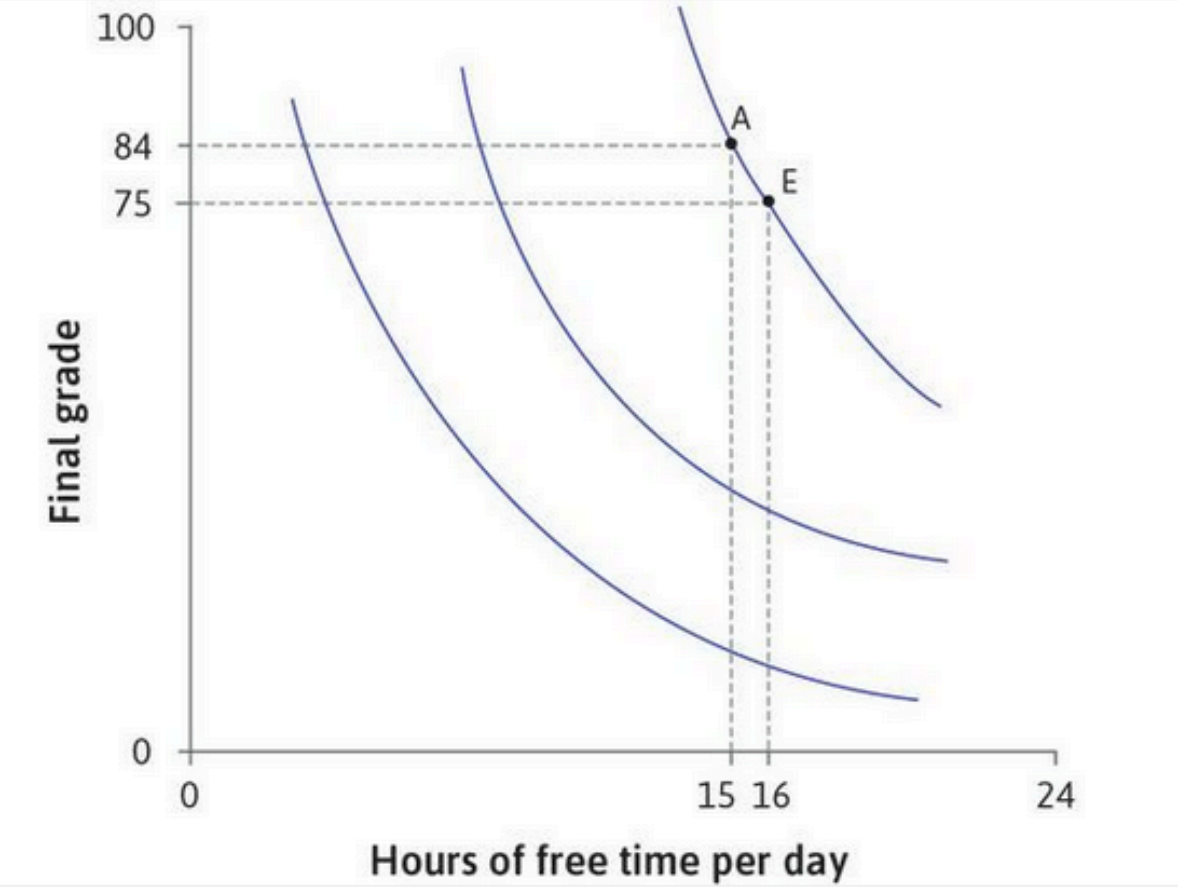
Theoretical points where we're equally happy with a mix of goods

Measured in utility (or "utils", or happiness points)

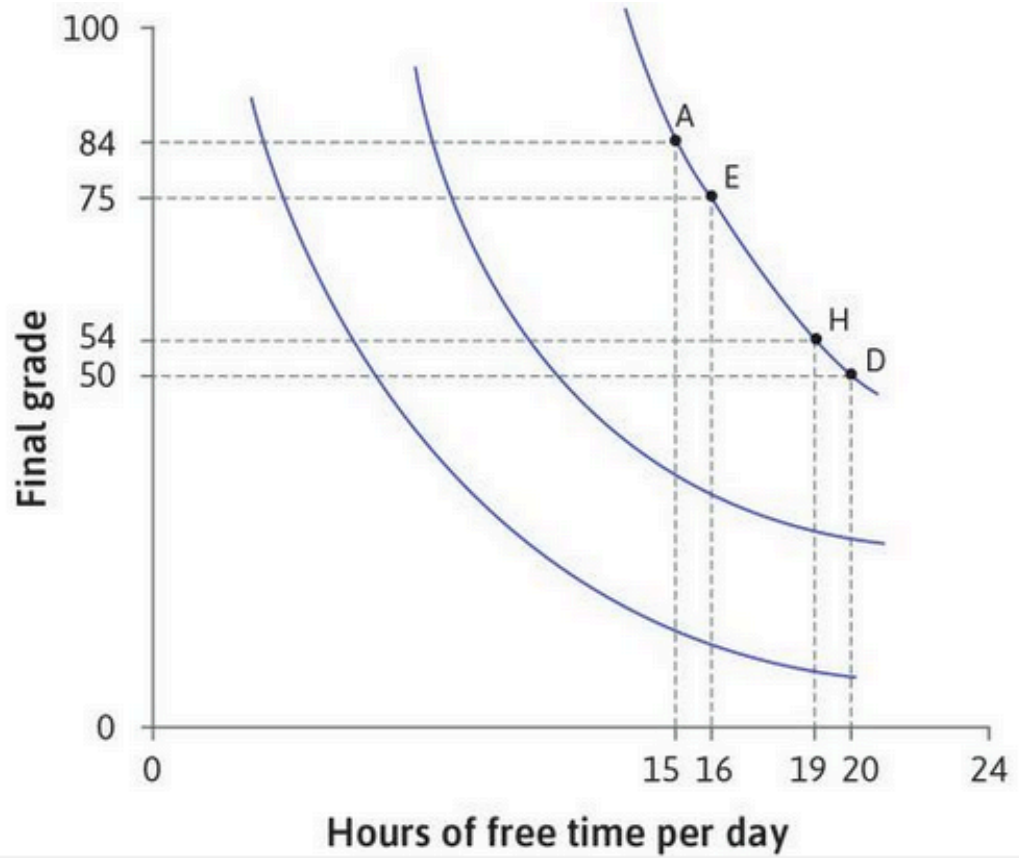
Higher curves = more utils


CUPS OF COFFEE PER WEEK
8
7
6
5
4
3
2
1
1 2 3 4 5 6 7 8 9 10
OF PIZZAS PER WEEK
2:51 / 8:27
https://www.youtube.com/watch?v=iOmDo5jLFw8

Slope of indifference curve = marginal rate of substitution (MRS)



MRS at A = 9



MRS at H = 4

INDIFFERENCE CURVES

$$u = xy$$

$$u = \sqrt{xy}$$

$$u = x^2y^2$$

$$u = x^2y$$

MAXIMIZING UTILITY

Marginal rate of substitution (MRS)

Theoretical tradeoff between inputs

Slope of indifference curve

$$MRS = \frac{dy}{dx} = \frac{\Delta y}{\Delta x} = \frac{P_x}{P_y} = \frac{MU_x}{MU_y} = \frac{\partial u/\partial x}{\partial u/\partial y}$$

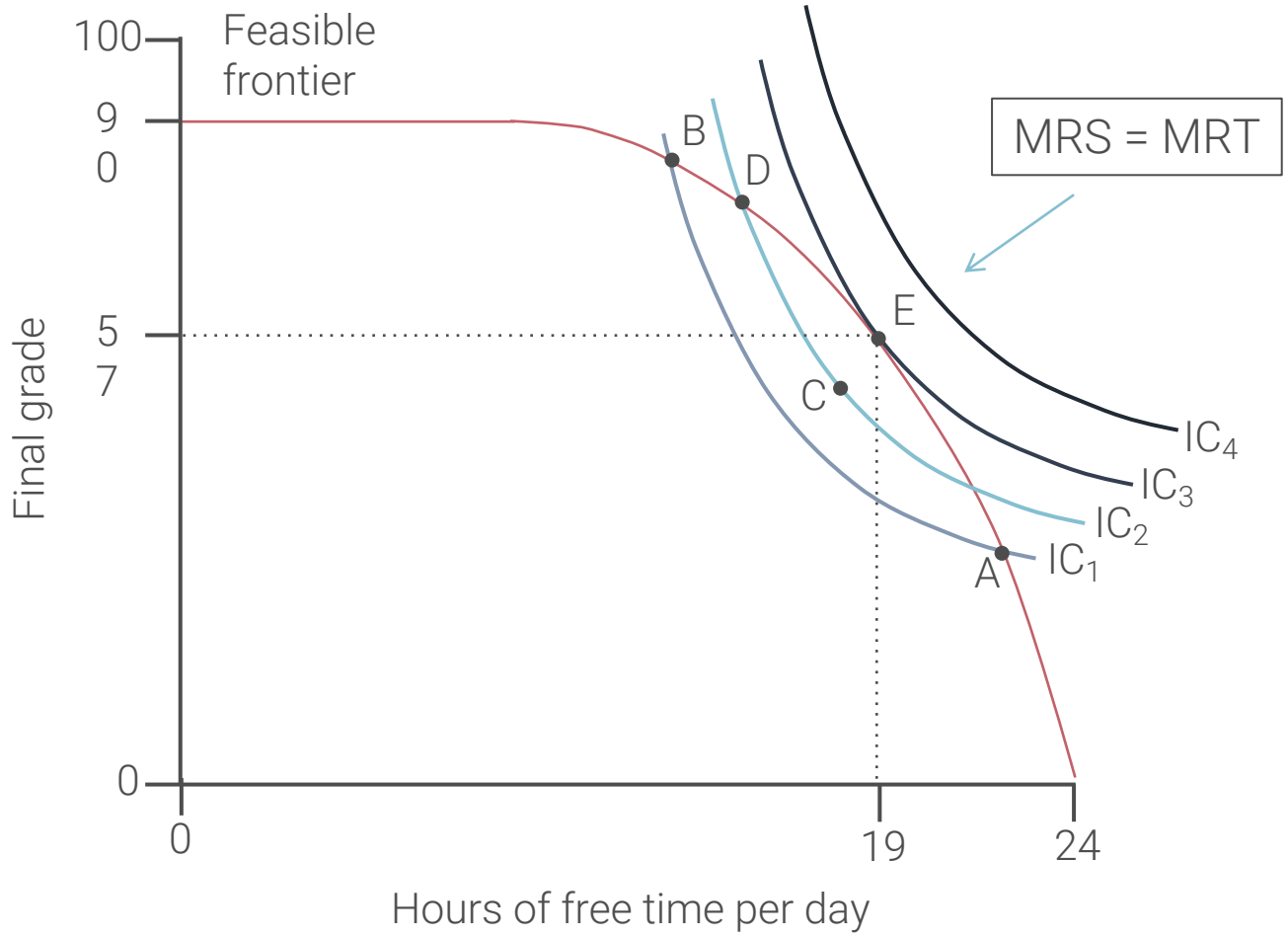
Marginal rate of transformation (MRT)

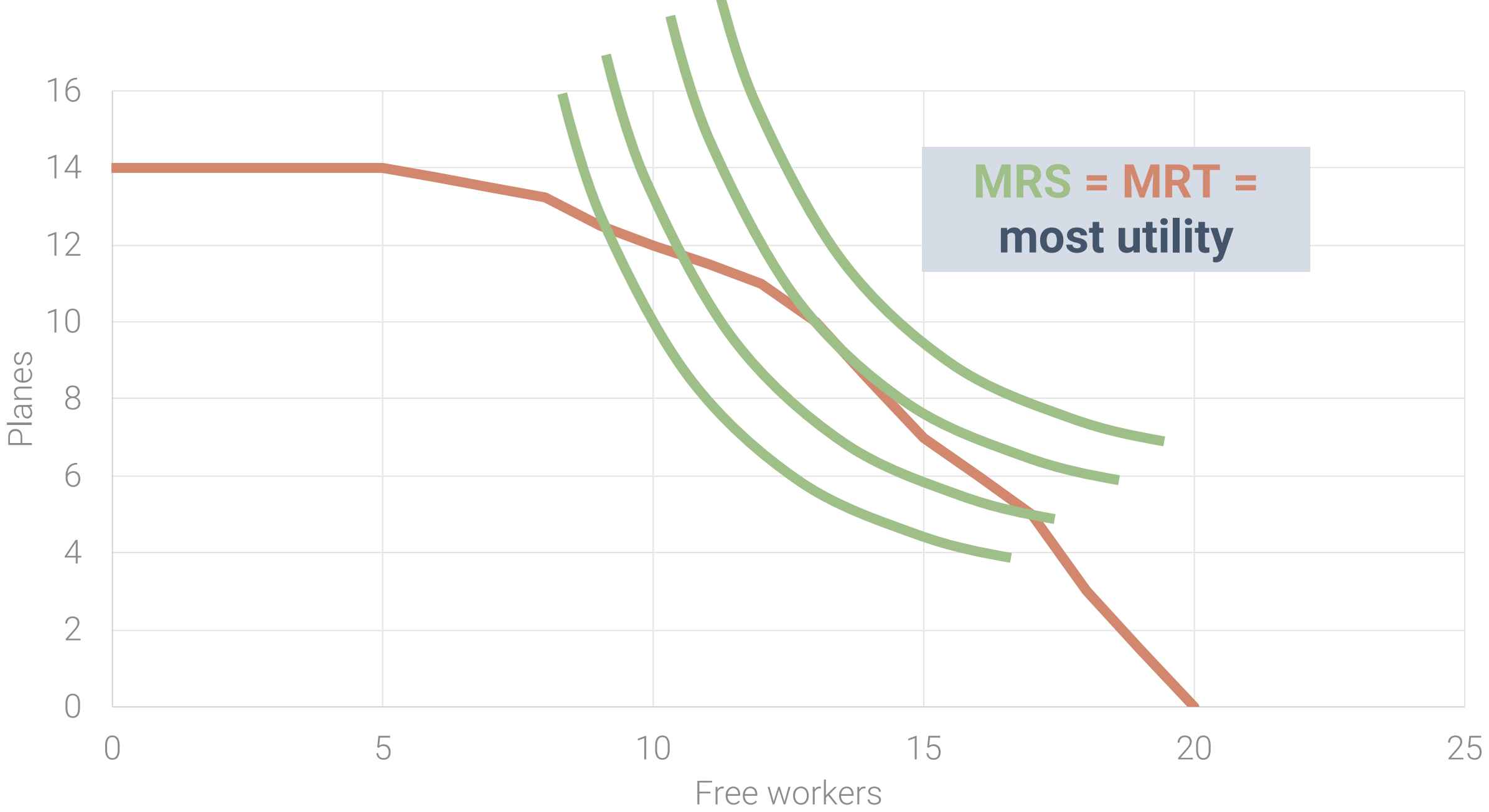
Actual tradeoff between inputs constrained by feasible frontier

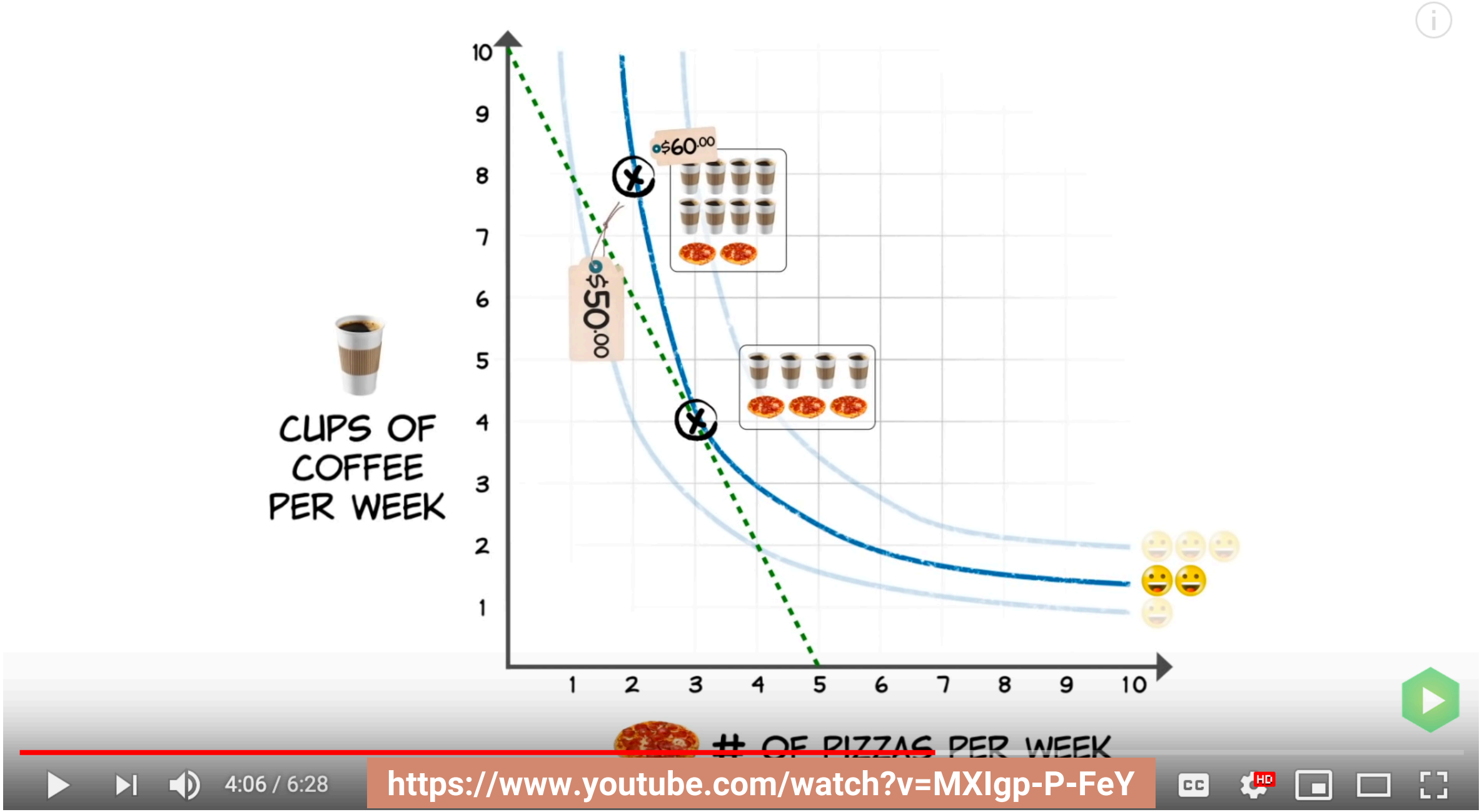
Slope of feasible frontier

What’s the best number of workers to use / planes to make?

What’s the best combination of hours studied / free time?


100
90
57
0
Final grade
Feasible
frontier
B
D
E
C
A
MRS = MRT
IC4
IC3
IC2
IC1
0
19
24
Hours of free time per day


MRS = MRT =
most utility
Planes
Free workers
0
2
4
6
8
10
12
14
16
0
5
10
15
20
25


CUPS OF COFFEE PER WEEK
10
9
8
7
6
5
4
3
2
1
$60.00
$50.00
1 2 3 4 5 6 7 8 9 10
OF PIZZAS PER WEEK
4:06 / 6:28
https://www.youtube.com/watch?v=MXIgp-P-FeY

UTILITY MAXIMIZATION

0. Plot indifference curve

1. Figure out feasible set or MRT
(budget line)

2. Use calculus and prices to figure out ideal MRS
(Δy/Δx = price x / price y = MUx / MUy)

3. MRT = MRS and solve for x and y

Waffles (x)	$1
Calzones (y)	$2
Utility	$u = xy$
Budget	$20