Period 1: Maths & Stats – Lecture 1

Maths & Stats Foundation Year (M.J. Dragt)

NYENRODE
NEW BUSINESS SCHOOL
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Course overview

Week	Topic
1	Basic sums (Ch. 2)
2	Using graphs (& Representing data) (Ch. 3(+4))
3	Averaging & Measures of Difference (Ch. 5,6)
4	Making comparisons using index numbers & Working with possible relationships (Ch. 7,8)
5	Projecting the future (Ch. 9)
6	Comparing monetary returns over time (Ch. 10)
7	Review of all the exam topics

Lecture 1: Basic Sums

BEDMAS | Algebra | Powers | Graphs & Functions | Roots of a Quadratic | Simultaneous Equations | Inequalities | Frequency Counts | Percentage Changes

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Have a great start!

- **B**rackets ()
- **E**xponentiation n^x
- **D**ivision ÷
- **M**ultiplications x
- **A**ddition +
- **S**ubtraction -

In the order they appear

In the order they appear

BEDMAS - Exercises

- 12 x 5 + 6 – (3 x 5)
- (5 + 4) x (4 – 1)
- 10 x 2 – 3 + (3 x 6) – (12 + 7)

Algebra

"Algebra uses letters to represent amounts or quantities which could be money, weight, people or whatever"

Curwin & Slater (2004)

Algebra - Exercises

"You are a salesman and you get 10% commission (C) on the total revenue of every deal you close (D)"

We could write this as: 0.10 * D = C

What would be your commission (C) if you have closed 10 deals, which generates a revenue of 120.000 €?

Algebra - Exercises

Simplify

- $3a + 6a - (2a \times 5b) + 2a\,(2 + 4)$
- $3\,(2a + 6a) - 4\,(2a - a)$
- $4xy - 2x + 3y - 2x\,(2y - 3 + y)$

Powers - rules

- **Product rule**: $a^m \cdot a^n = a^{(m+n)}$
- **Product rule – 2 bases**: $a^m \cdot b^n = a^m \cdot b^n$
- **Power rule**: $(a^m)^n = a^{(m.n)}$
- **Power rule**: $a^m \cdot b^m = (a.b)^m$
- **Power rule – 2 bases:** $(a^m \cdot b^n)^z = a^{(m.z)} \cdot b^{(n.z)}$
- **Power rule – 2 bases:** $(a^m : b^n)^z = a^{(m.z)} : b^{(n.z)}$
- **Quotient rule**: $a^m : a^n = a^{m-n}$
- **Quotient rule**: $a^m : b^m = (a:b)^m$

Powers – rules cont'd

- **Distributive rule** for exponents: exponents do distribute across multiplication and division, but don't distribute across addition and subtraction!

  $(2^3.3^2)^2 = (a^m \,.\, b^n)^z = 2^{(3.2)} \,.\, 3^{(2.2)} = 2^{(6)} \,.\, 3^{(4)} = 64 \,.\, 81 = 5184$

  But: $(2^3 + 3^2)^2 = (8 + 9)^2 = (17)^2 = 289$!!!

- **Negative rule**: $a^{-m} = 1/a^m$

Powers – nice to know

$$\sqrt{4} = 4^{\frac{1}{2}} = 2$$

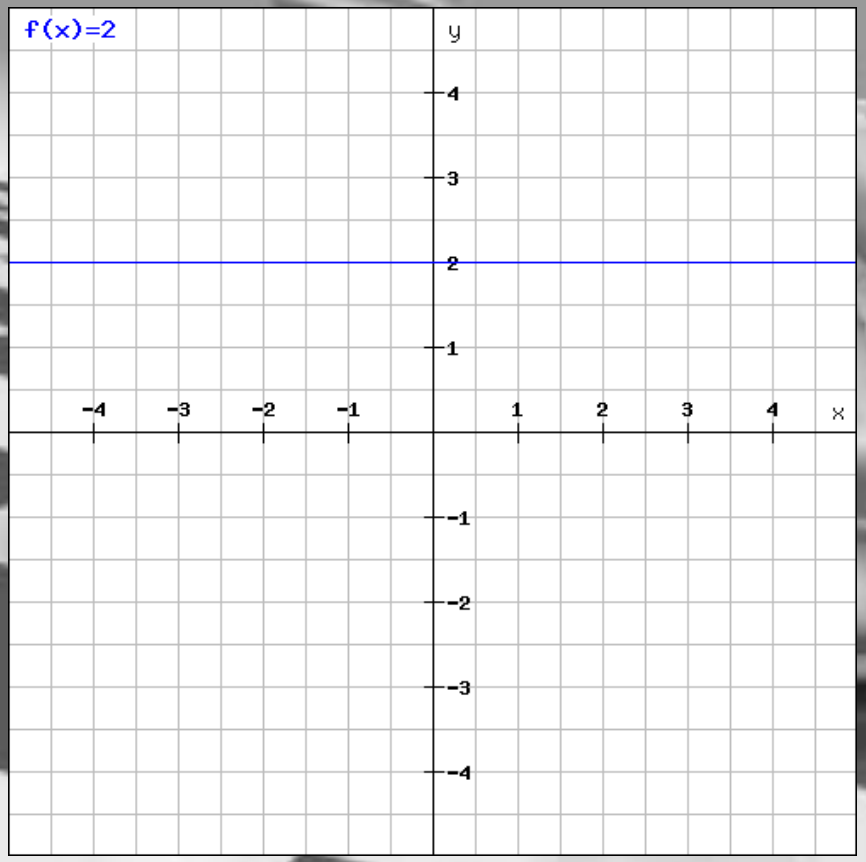
$$\sqrt[3]{27} = 27^{1/3} = 3$$

Powers - Exercises

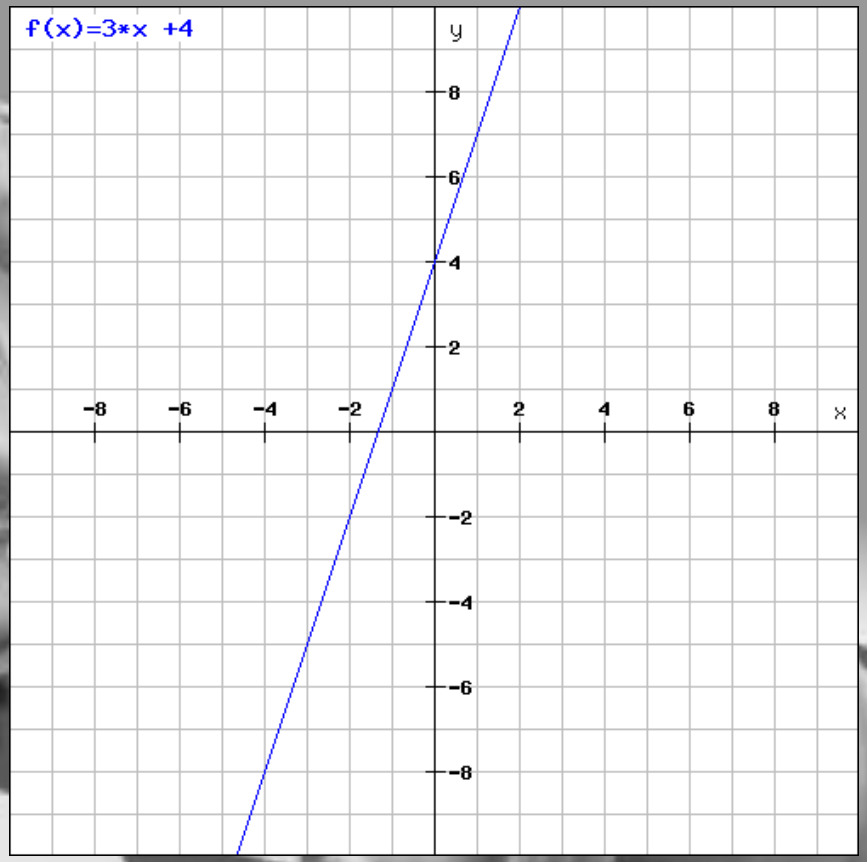
- $2^7 . 5^7$
- $2^4 . 2^6$
- $3^5 : 3^3$
- $2^6 . 4^2$
- $(3^3)^3$
- $(3^2 . 2^3)^2$
- 2^{-4}
- $(4^3 : 2^2)^3$
- $10^2 : 5^2$
- $(4^3 + 2^2)^2$

Graphs & Functions

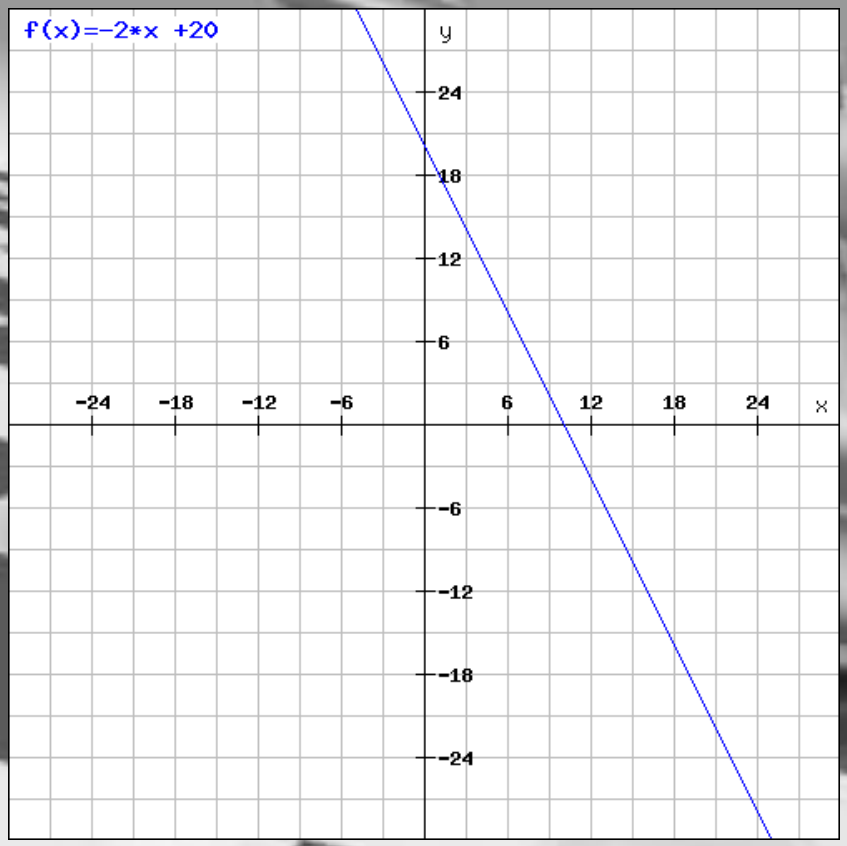
Constant: y = k



Linear function: y = a + bx



Graphs & Functions



Exercise 1:

Let's take the function

f(x) = -2x + 20

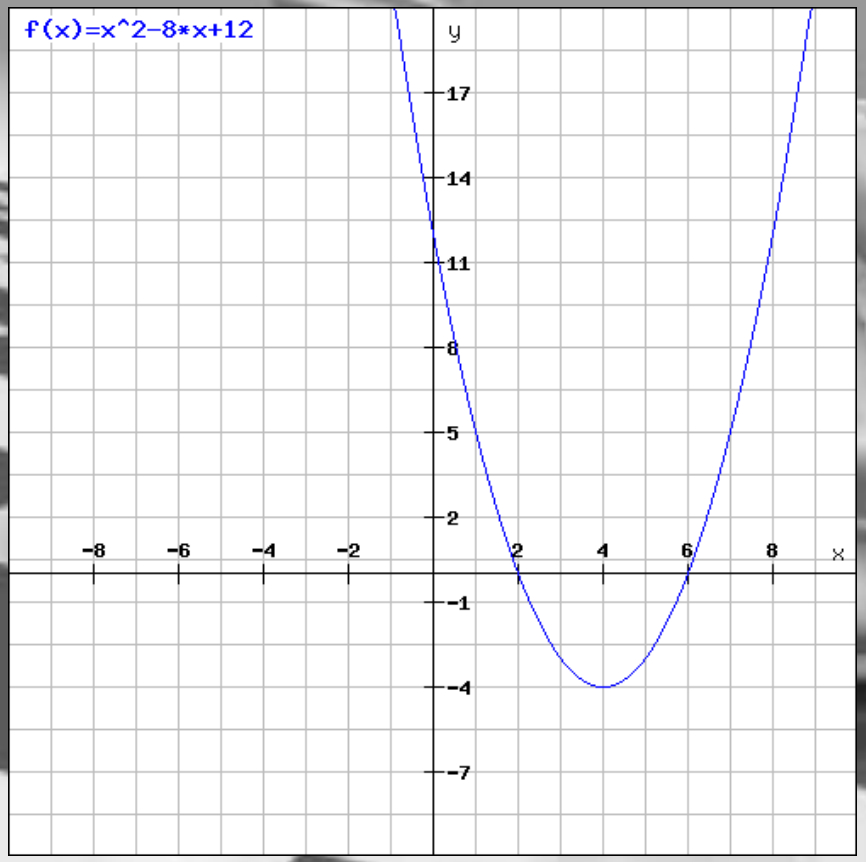
- What is the intercept?
- What is the slope?

Exercise 2: Draw the function

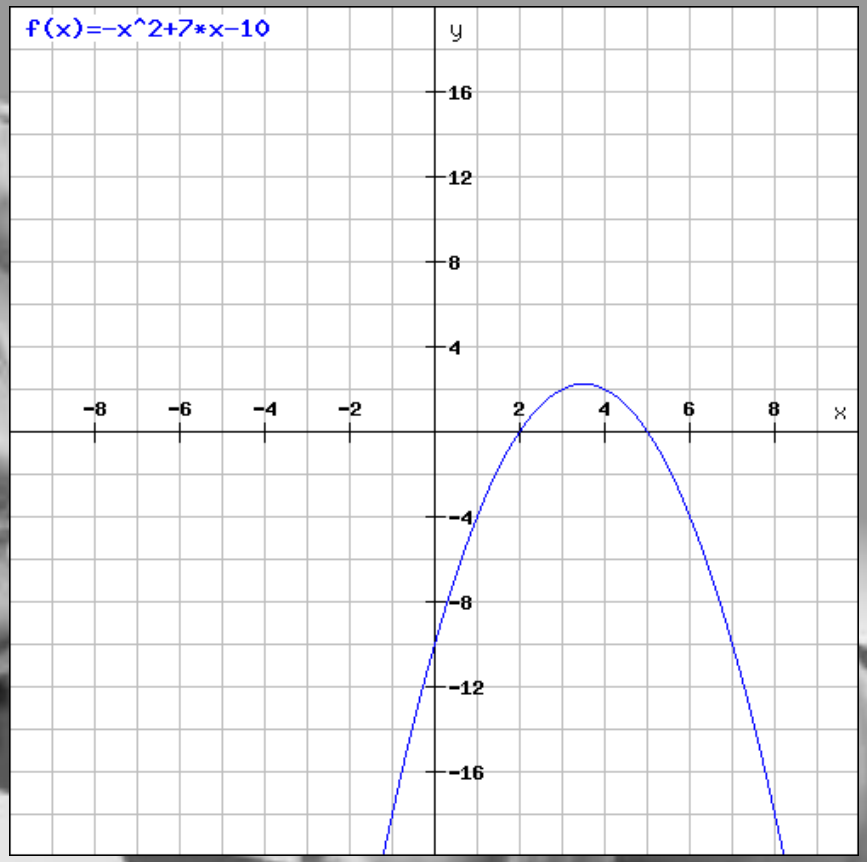
f(x) =3x + 10

Graphs & Functions

Quadratic function: $y = ax^2 + bx + c$

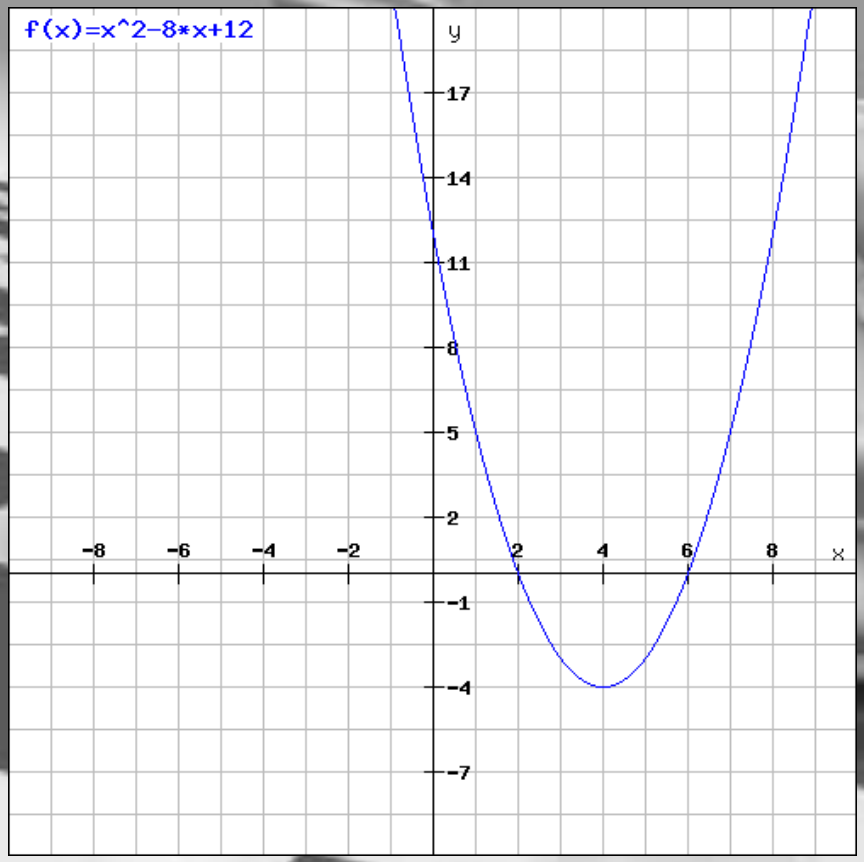


Quadratic function: $y = -ax^2 + bx + c$



Roots of a Quadratic

Quadratic function: $y = x^2 - 8x + 12$



How to find the roots

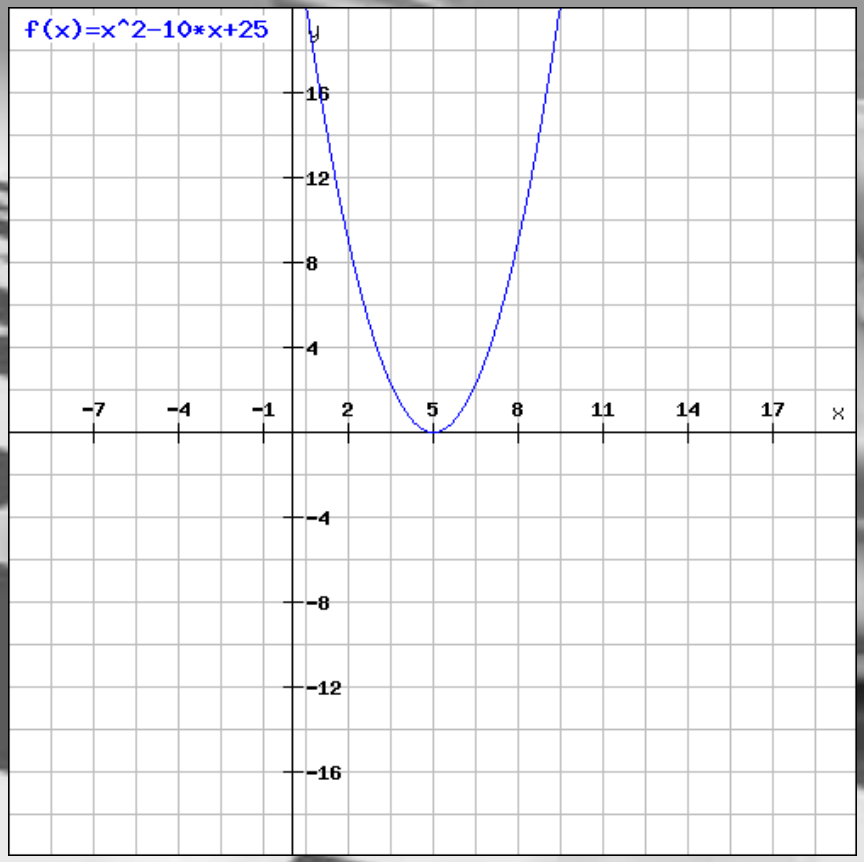
- Use factorization: (x+a)(x+b)=0
- Use ABC

  formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Roots of a Quadratic - Exercises

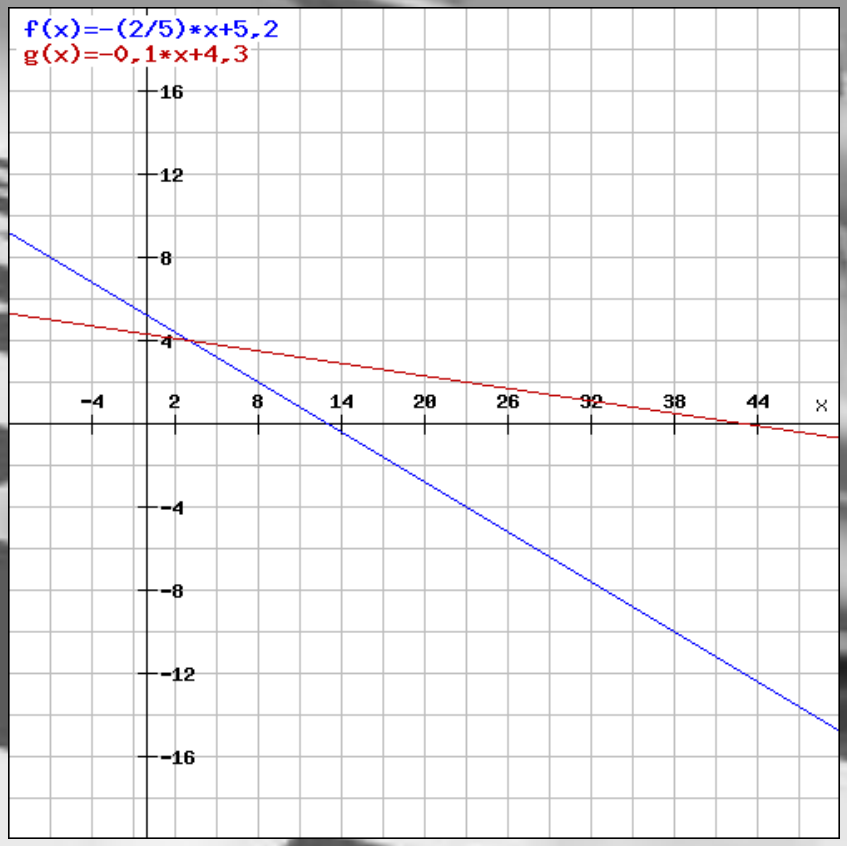
Quadratic function: $y = x^2 - 10x + 25$

Find the roots!



- Can you use factorization? (x+a)(x+b)=0
- Is not, use ABC formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Simultaneous Equations



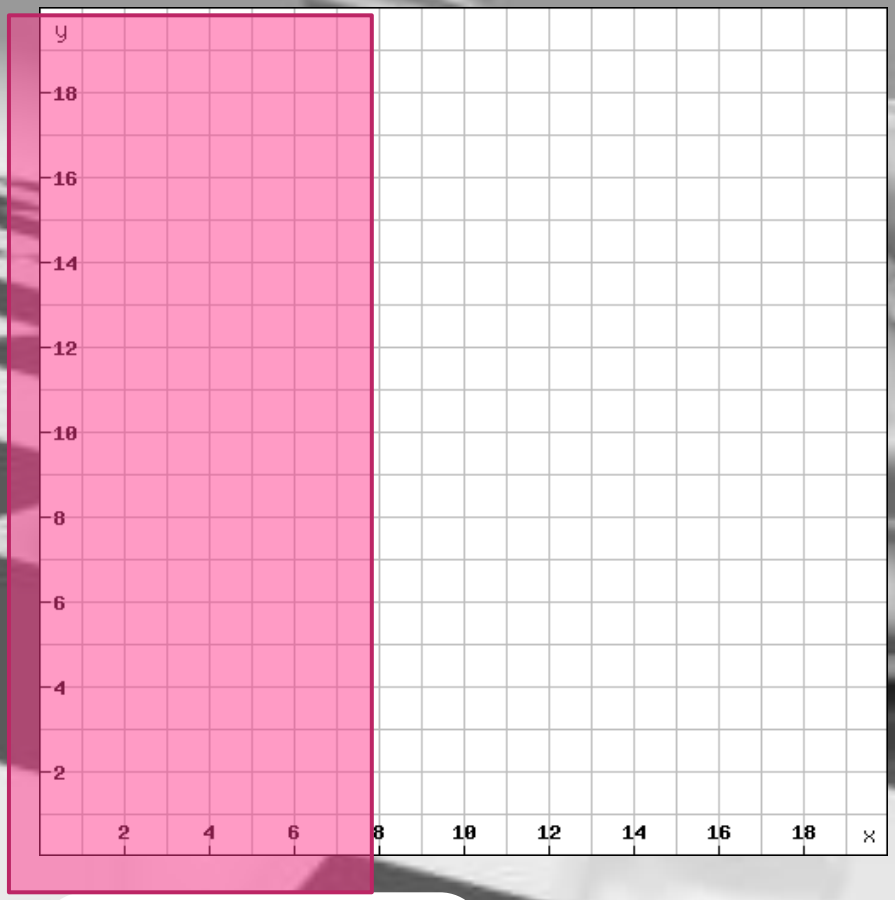
- Equation 1: 2x + 5y = 26
- Equation 2: x + 10y = 43

For which x are both equations true?

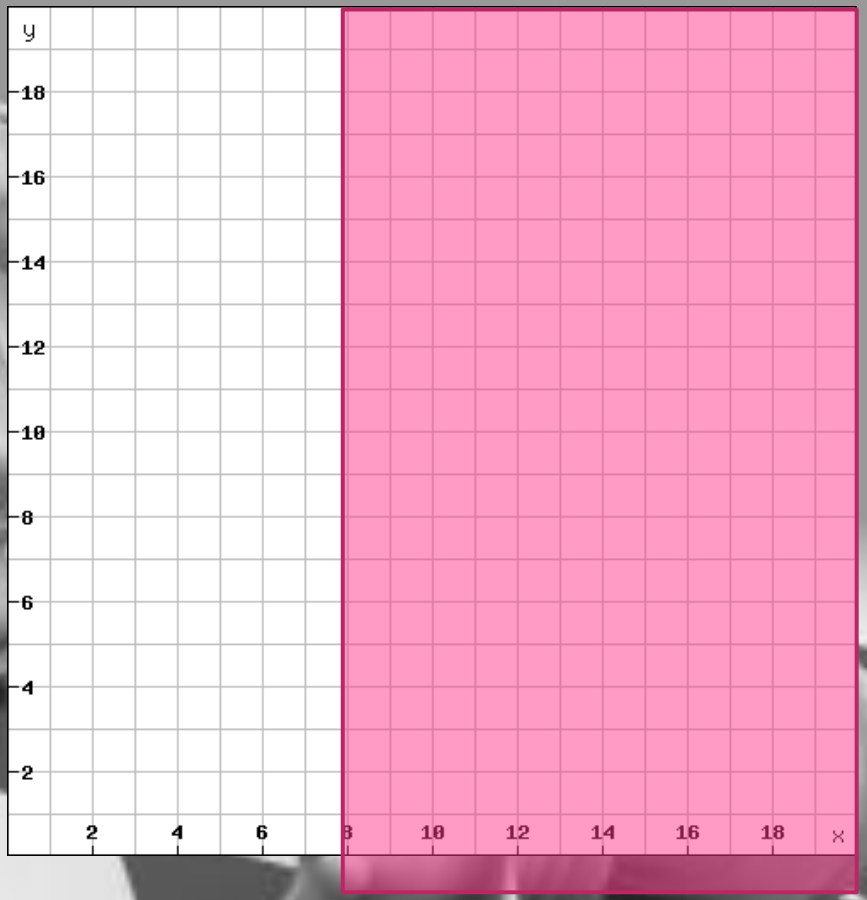
How you use this in the real world (apple pie example)

Inequalities

Area for x < 8

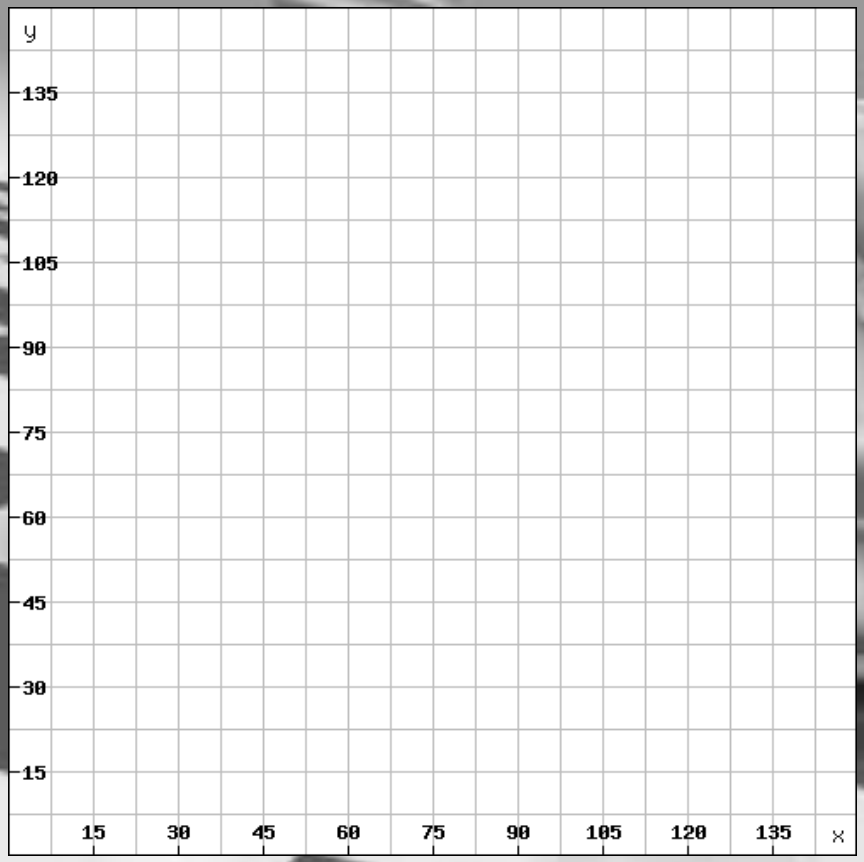


Area for x >= 8



Inequalities

Area for 2x + 5y <=200



Steps

- Find the value of x when y is zero
- Find the value of y when x is zero

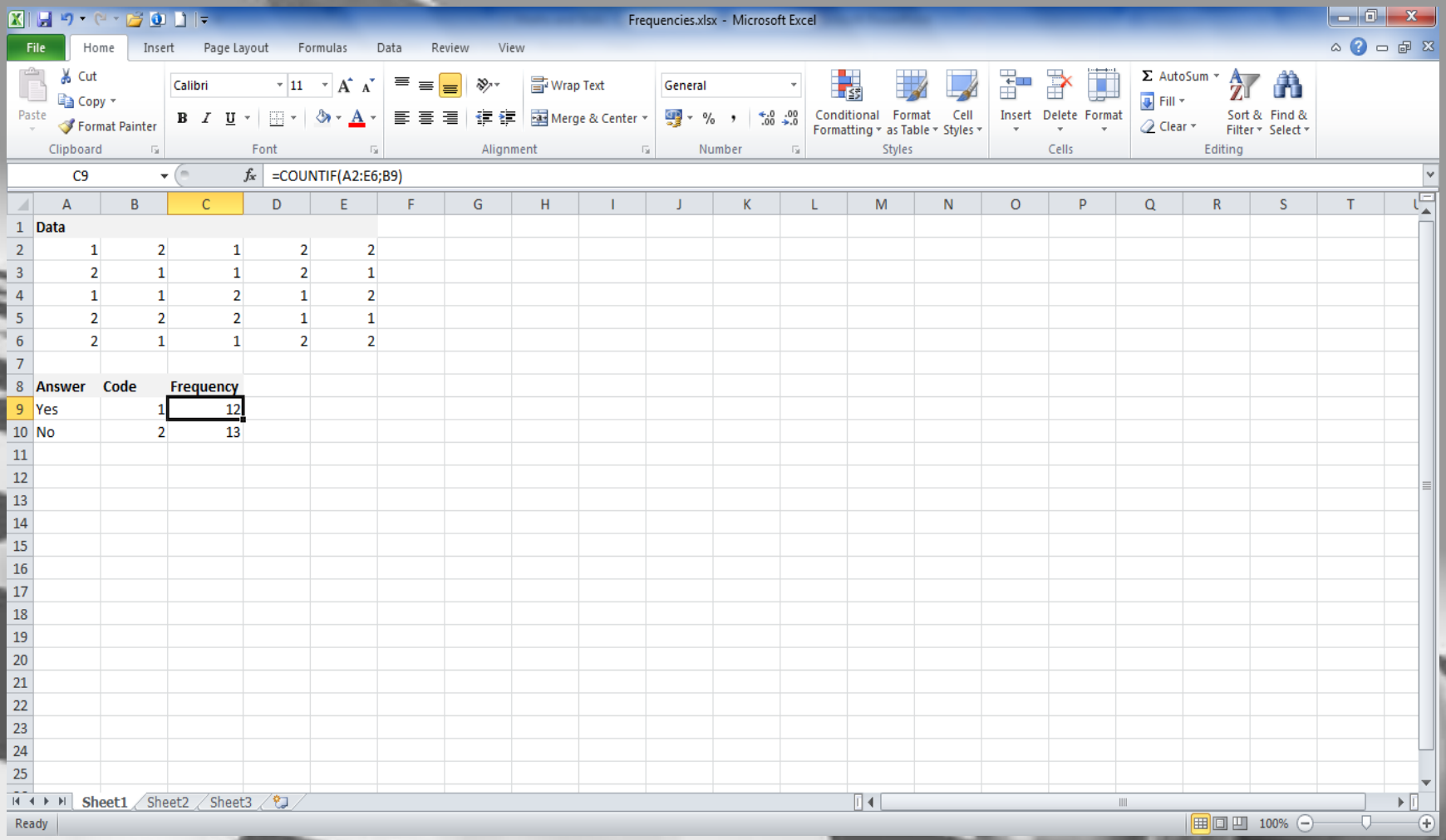
We'll come back to this with linear programming!

Frequency Counts

Data				
1	2	1	2	2
2	1	1	2	1
1	1	2	1	2
2	2	2	1	1
2	1	1	2	2

Answer	Code	Frequency		
Yes	1	12		
No	2	13		

Frequency Counts



Percentage changes

Year	Amount	Year to Year	% change from the start
1	100		
2	200	100%	100%
3	230	15%	130%
4	300	30%	200%
5	200	-33%	100%

$$\frac{Year\ (n)\ - Year\ (n-1)}{Year\ (n-1)}\ x\ 100\%$$

$$\frac{(Year\ n\ - Year\ 1)}{Year\ 1}\ x\ 100\%$$