

**EBA1180 Mathematics for Data Science**  
**autumn 2022**  
**Exercises**

*... if I couldn't formulate a problem in economic theory mathematically, I didn't know what I was doing.*

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**Lecture 1 – Basic algebra (Sec. 2.1-6, 2.8)**

Here are recommended exercises from the textbook [SHSC].

- Section 2.1 exercise 1
- Section 2.2 exercise 1-9
- Section 2.3 exercise 1-7, 9-11
- Section 2.4 exercise 1-8
- Section 2.5 exercise 1, 3, 3-7, 9-11
- Section 2.7 exercise 1-4

**Problems for the exercise session**  
**Wednesday 24 Aug. at 12-15+ in B2-065**

**Problem 1** Simplify the fractions as much as possible.

- a)  $\frac{36}{120}$       b)  $\frac{60}{48}$       c)  $\frac{96}{69}$       d)  $\frac{112}{12}$       e)  $\frac{64}{1024}$       f)  $\frac{91}{26}$
- g)  $\frac{4}{5} \cdot \frac{2}{3}$       h)  $\frac{4}{15} \cdot \frac{3}{7}$       i)  $\frac{18}{4} \cdot \frac{2}{3}$       j)  $\frac{2}{3}$       k)  $\frac{2}{3}$       l)  $\frac{2}{3}$

**Problem 2** Simplify the fractions as much as possible.

- a)  $\frac{x^2y^2}{xy^3z}$       b)  $\frac{15a(b+6)}{9(b+6)c}$       c)  $\frac{x(x+1)}{(x+1)(x+2)}$       d)  $\frac{x(x^2+1)}{x^2(x+1)}$
- e)  $\frac{(x+y)^2}{3x+3y}$       f)  $\frac{(x+y)^3}{x^2+2xy+y^2}$       g)  $\frac{x(x+5)}{2x^2+10x}$       h)  $\frac{x^2-5}{(x-\sqrt{5})(x+\sqrt{5})}$
- i)  $\frac{x^2-3x}{x(y-3)} \cdot \frac{xy^2-9x}{x-3}$       j)  $\frac{(3x-y)^2+6xy}{9x^2+y^2}$

**Problem 3** Write as one fraction in the simplest way possible.

- a)  $\frac{2}{x} + \frac{3}{x}$       b)  $\frac{2}{x} + \frac{3}{y}$       c)  $\frac{x-4}{x} - \frac{x}{x-4}$       d)  $x+3 + \frac{2}{x-1}$
- e)  $\frac{1}{\sqrt{7}-1} - \frac{1}{\sqrt{7}+1}$       f)  $\frac{1}{x-1} - \frac{1}{x+1}$       g)  $\frac{x+3}{x^2+1} - \frac{1}{x-3}$       h)  $\frac{x(x+3)}{(x+1)(x+2)} - 1$

**Problem 4** If you replace  $y$  with  $x$  in the answer to problem 3b you should get the answer in problem 3a. Why? Is it true?

What do you get if  $x$  is replaced by  $\sqrt{7}$  in the answer to problem 3f? Compare with problem 3e.

**Problem 5** Compute without using digital assistance.

a)  $2^3$       b)  $3^2$       c)  $-3^2$       d)  $(-3)^2$       e)  $-2^3$       f)  $(-2)^3$

**Problem 6** Compute/simplify without using digital assistance.

a)  $\frac{4^2}{2^6}$       b)  $\frac{2^5 \cdot 10^3}{5^3}$       c)  $\frac{3^{10}}{3^9}$       d)  $\frac{3^9}{3^{10}}$       e)  $\frac{35^8}{5^7 \cdot 7^8}$

f)  $\left(\frac{1}{2}\right)^3$       g)  $\left(\frac{2}{5}\right)^3$       h)  $(\sqrt{7})^2$       i)  $(\sqrt{7})^3$       j)  $\frac{7^2}{\sqrt{7} \cdot 7}$

k)  $\frac{6^2}{\sqrt{2} \cdot \sqrt{3}}$       l)  $\frac{(\sqrt{1,03})^{10}}{1.03^4}$       m)  $\sqrt{3^2 + 4^2}$       n)  $(\sqrt[3]{5})^3$       o)  $(\sqrt[4]{7})^8$

p)  $\sqrt[6]{27}$       q)  $|-3.2|$       r)  $|4.3 - 5.9|$

**Problem 7** Solve the equations.

a)  $x^2 = 9$       b)  $x^2 = -9$       c)  $\sqrt{x} = 9$       d)  $\sqrt{x} = -9$

e)  $(x - 4)^2 = 9$       f)  $(x + 7)^3 = 27$       g)  $|x| = 25$       h)  $|x| = -1$

i)  $\frac{1}{|x|} = 0.25$       j)  $x|x| = 9$       k)  $|x - 2| = 25$       l)  $|x - 3| = 3$

**Problem 8** Solve the equations ( $a$  is an arbitrary number).

a)  $x^2 = 3^2$       b)  $x^2 = (-3)^2$       c)  $x^2 = a^2$

d)  $x^3 = 2^3$       e)  $x^3 = (-2)^3$       f)  $x^3 = a^3$

g)  $x^2 = a^{-4}$       h)  $x^3 = 1.03^{-12}$       i)  $x^4 = a^{-4}$

## Answers

### Problem 1

- a)  $\frac{3}{10}$       b)  $\frac{5}{4}$       c)  $\frac{32}{23}$       d)  $\frac{28}{3}$       e)  $\frac{1}{16}$       f)  $\frac{7}{2}$   
 g)  $\frac{8}{15}$       h)  $\frac{4}{35}$       i)  $\frac{1}{4}$       j)  $\frac{2}{9}$       k) 1      l)  $\frac{4}{9}$

### Problem 2

- a)  $\frac{x}{yz}$       b)  $\frac{5a}{3c}$       c)  $\frac{x}{x+2}$       d)  $\frac{x^2+1}{x(x+1)}$       e)  $\frac{1}{3}(x+y)$   
 f)  $x+y$       g)  $\frac{1}{2}$       h) 1      i)  $x(y+3)$       j) 1

### Problem 3

- a)  $\frac{5}{x}$       b)  $\frac{3x+2y}{xy}$       c)  $\frac{8(2-x)}{x(x-4)}$       d)  $\frac{x^2+2x-1}{x-1}$   
 e)  $\frac{1}{3}$       f)  $\frac{2}{(x-1)(x+1)}$       g)  $\frac{-10}{(x^2+1)(x-3)}$       h)  $\frac{-2}{(x+1)(x+2)}$

### Problem 5

- a) 8      b) 9      c) -9      d) 9      e) -8      f) -8

### Problem 6

- a)  $\frac{1}{4}$       b)  $2^8$       c) 3      d)  $\frac{1}{3}$       e) 5      f)  $\frac{1}{8}$   
 g)  $\frac{2^3}{5^3}$       h) 7      i)  $7\sqrt{7}$       j)  $\sqrt{7}$       k)  $6\sqrt{6}$       l) 1,03  
 m) 5      n) 5      o) 49      p)  $\sqrt{3}$       q) 3,2      r) 1,6

### Problem 7

- a)  $x = 3, x = -3$       b) no solution      c)  $x = 81$       d) no solution  
 e)  $x = 1, x = 7$       f)  $x = -4$       g)  $x = 25, x = -25$       h) no solution  
 i)  $x = 4, x = -4$       j)  $x = 3$       k)  $x = -23, x = 27$       l)  $x = 0, x = 6$

### Problem 8

- a)  $x = 3, x = -3$       b)  $x = 3, x = -3$       c)  $x = |a|, x = -|a|$ , which is the same as  $x = \pm a$   
 d)  $x = 2$       e)  $x = -2$       f)  $x = a$   
 g)  $x = a^{-2}, x = -a^{-2}$       h)  $x = 0,888$       i)  $x = \frac{1}{a}, x = -\frac{1}{a}$