

Preparatory material SA1, SA2, SA3, SA4 / February 2020

SA1: Basic operations with algebraical expressions**Exercise A:**

Calculate the following mathematical expressions and simplify as much as possible:

1)

$$3x^2 + 3x - 2x^2 - 5x - x^2$$

2)

$$4x - 5y + x - 3x + 2y$$

3)

$$3(3x - 1) - 3(2x - 1)$$

4)

$$2x(2x + y) - y(5x + 3y)$$

5)

$$\frac{3x + 1}{3} - \frac{2x - 1}{2} - \frac{x + 1}{3}$$

6)

$$\frac{x - 3}{x^2 - 1} - \frac{1}{1 - x}$$

7)

$$\frac{x^2 - 6x + 9}{x^2 - 9}$$

8)

$$\frac{3x}{x + 4} \cdot \frac{x(-2x - 3)}{4 - x} \div \frac{2x + 3}{x^2 - 16}$$

9)

$$\frac{\frac{3x^2}{5}}{2x} + \frac{x}{5}$$

Exercise B:

Fully factorize (take out the common factor) the following mathematical expressions:

10)

$$25x^2 - 15xy + 20xz$$

11)

$$(2x + 3)(x - 1) + (2x + 3)^2$$

12)

$$(3x + 5)(2x - 3) + (3 - 2x)(3x + 1)$$

SA2: Powers and roots

Exercise C:

Calculate the followings and write the result as an irreducible fraction:

13)

$$10^6 + 10^{-6} - \sqrt{100^6}$$

14)

$$2\sqrt{5^2 - 4^2} \cdot 3^{-3}$$

15)

$$\sqrt[3]{-\frac{1}{125} \cdot \frac{15^2}{2} \cdot \left(\frac{3}{2}\right)^{-2}}$$

16)

$$\left(\frac{28}{9} - \frac{1}{3}\right)^{\frac{3}{-2}}$$

Exercise D:

Calculate the following mathematical expressions and simplify as much as possible:

17)

$$\sqrt{\frac{x^{-1}x^4 + x^2 \cdot 2x - x^3}{8x}}$$

18)

$$\frac{\sqrt{x^9}}{(\sqrt{x})^3} + \sqrt{\left(\frac{4}{x^2}\right)^{-3}}$$

19)

$$\sqrt[4]{\sqrt[3]{x^6}} + 2\sqrt{x} - \sqrt[6]{x^3}$$

20)

$$\frac{x^4}{9x} - \left(\frac{3}{2x}\right)^{-3}$$

21)

$$\frac{x^{\frac{2}{3}}}{\sqrt[3]{8x^2}} \cdot \left(\frac{1}{2x}\right)^{-3}$$

SA3: First degree equations and formula transformations**Exercise E:**

Find the solutions of the following equations:

22)

$$-x + 7 = 3x - 5$$

23)

$$3(6 - 3x) - 3x = 3(5 - 4x) + 3$$

24)

$$(x + 5)(x - 5) - (x - 5)^2 = 20$$

25)

$$x + \frac{x}{4} = \frac{2 - x}{2}$$

26)

$$\frac{1 - x}{4} - \frac{1}{2} = \frac{4 - x}{3}$$

27)

$$\frac{3}{x - 5} = \frac{5}{x - 3}$$

28)

$$\frac{2x + 1}{3x - 2} = \frac{4x + 3}{6x - 1}$$

29)

$$\frac{x + 2}{2x} - \frac{2}{x + 2} = \frac{1}{2}$$

Exercise F:

Make A and C the subject of the following formulae:

30)

$$K = \frac{A - B}{C}$$

31)

$$\frac{1}{A} = \frac{1}{B} + \frac{1}{C} + \frac{1}{D}$$

32)

$$K = 2 - A \cdot \sqrt{\frac{B}{C}}$$

Example of formula transformation:

The volume V of a sphere with radius r can be calculated using the formula:

$$V = \frac{4}{3}\pi r^3$$

Make r the subject of the formula.

$$\frac{4}{3}\pi r^3 = V \quad \rightarrow \quad 4\pi r^3 = 3V \quad \rightarrow \quad r^3 = \frac{3V}{4\pi} \quad \rightarrow \quad r = \sqrt[3]{\frac{3V}{4\pi}}$$

Formula transformation is the same as linear equation. In the “normal” equation your task is to find the x ; which is the same as making x the subject of the formula.

$$2x - 5 = \frac{3x + 1}{2}$$

$$Ax - B = \frac{Cx + D}{A}$$

$$A^2x - AB = Cx + D$$

$$x(A^2 - C) = D + AB$$

$$x = \frac{D + AB}{A^2 - C}$$

SA4: Word problems

(xx points)

Exercise G:

33) A transportation company charges the taxi fares as follows: the minimum fee is 175 Euro and includes the first fifty kilometers, then the charge is 0,5 Euro per km. If the cost of a trip is 191 Euro, how many kilometers were cruised in total? Write a mathematical expression of Price P as a function of kilometers k .

Exercise H:

34) You buy a book for 25,20 €, which is a 30% discount off the regular price. What is the regular price of the book?

Exercise I:

35) A 42 m long fence surrounds a rectangular terrain with the length 5 times the width. Calculate the length and the width of the terrain.

Exercise J:

36) A 52 m long fence surrounds a rectangular terrain with the length greater than the width with 11 m. Calculate the length and the width of the terrain.

Exercise K:

37) You are enlarging (zoom in) a picture on your computer screen. Initially, the picture is 1,25 cm wide. Each time you enlarge the photo, its width doubles. You enlarge the picture five times. What is the final width of the picture?

Exercise L:

38) Calculate the width and the length of a rectangle with an area of $28,35 \text{ m}^2$, knowing that its length is $7/5$ times the width.

Exercise M:

39) Luxembourg's area is around $2,5 \times 10^3 \text{ km}^2$, while Spain's area is about $5 \times 10^5 \text{ km}^2$. How many times is Spain's area greater than that of Luxembourg?

Success!