Hes·so
Haute Ecole Spécialisée
de Suisse occidentale
Fachhochschule Westschweiz
University of Applied Sciences and Arts
Western Switzerland

Admission Exam		
	Subject:	**Mathematics**
	Date:	Monday 12th of June 2017
	Place:	HES-SO Provence, Lausanne
	Number of pages:	5
	Authorized material:	Non-programmable calculator

Candidate Information		
	Name:	.....
	First name:	.....
	Birthday:	.....
	Selected Bachelor's degree:	.....
	Selected location:	.....

Reservé Correcteur		
	Note obtenue :	❑
	Remarques :	.....
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	Nom du correcteur :	.....
	Date :	.....
	Signature :	.....

All answers must be mathematically justified!

Formula sheet

$$(a+b)^2 = a^2 + 2ab + b^2$$
$$(a-b)^2 = a^2 - 2ab + b^2$$
$$(a+b)(a-b) = a^2 - b^2$$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$
$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$
$$(a+b)(a^2 - ab + b^2) = a^3 + b^3$$
$$(a-b)(a^2 + ab + b^2) = a^3 - b^3$$

Solution of the equation $ax^2 + bx + c = 0$: $x_{1,2} = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Vertex of the parabola with equation $y = ax^2 + bx + c$: $S\left(-\frac{b}{2a}; -\frac{b^2-4ac}{4a}\right)$

Exercise 1 **[6 points]** Write the following expressions as a single fraction.

a) $\left(5 + \dfrac{1}{5}\right)\left(3 - \dfrac{1}{4}\right) =$

b) $\dfrac{\left(1 + \frac{1}{a}\right)}{\left(\frac{1}{b} - \frac{1}{c}\right)} =$

Exercise 2 **[4 points]** Expand and simplify the following expressions:

a) $(2y + 3)(-3y - 4) =$

b) $(9xy - 3z^2)^3 =$

Exercise 3 **[9 points]** Factor and simplify the following expressions:

a) $x^4 - x^2 =$

b) $4t^2 + 12ts + 9s^2 =$

c) $\dfrac{8x^3 - 27y^3}{2x - 3y} =$

Exercise 4 **[6 points]** Solve the following equations:

a) $3x^2 = 8 - 10x$

b) $\dfrac{x}{3} + 2 \cdot \dfrac{x^2 - 1}{3x - 3} = 2$

Exercise 5 **[5 points]** Solve the following inequalities:

a) $\dfrac{4x+1}{3} \geq 7 - x$

b) $x^2 - 1 > 3$

Exercise 6 **[8 points]** A company fabricates garden chairs. Let x be the number of chairs manufactured per day, x belonging to the interval $[0; 20]$.

Its profit is given by: $P(x) = -x^2 + 10x + 96$.

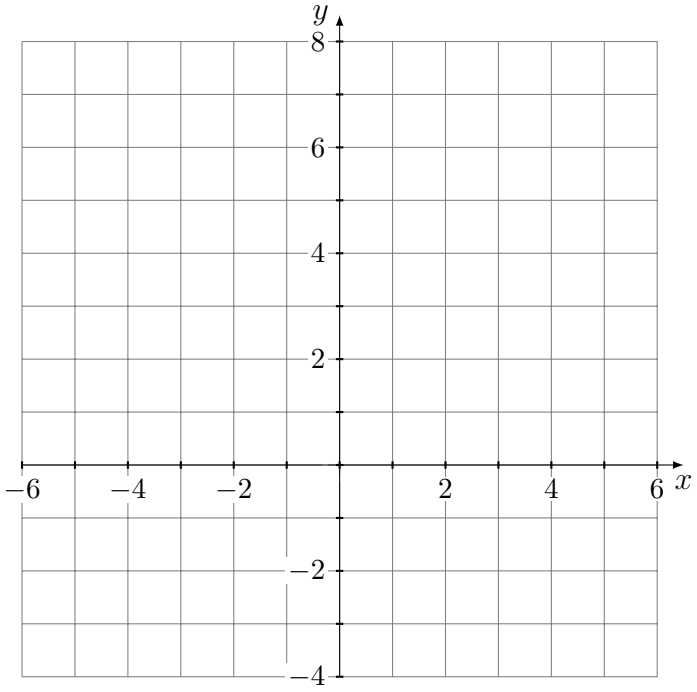
a) If the company makes 3 chairs, how much is its profit?

b) How many chairs must the company make in order to make a profit of 112 CHF?

c) What is the number of chairs to fabricate to maximize the profit?

d) What is the maximum profit?

Exercise 7 **[12 points]**



a) Graph the two parabolas $p_1 : y = x^2 + x - 2$ and $p_2 : y = -x^2 + 4x + 3$.

b) Give the coordinates of their vertex V_1 and V_2.

c) Draw the line through these two vertices and give its equation.

d) Determine algebraically the coordinates of the intersections I_1 and I_2 of the two parabolas.