



1. Calculation Using an Expression

E.5655 Evaluate the following literal expressions for $x=2$:

- (a) $3x + 2$ (b) $2 \times (3x - 1)$ (c) $\frac{2x + 8}{x + 1}$

E.5656 Evaluate the following literal expressions for $x=-1$:

- (a) $4x + 1$ (b) $3 \times (3x + 1)$ (c) $\frac{9 - 3x}{9 + x}$

E.8792 Evaluate the following literal expressions for $x=2$:

- (a) $x^2 + 1$ (b) $x - x^2$ (c) $(x + 2)^2$

E.8793 Evaluate the following literal expressions for $x=-1$:

- (a) $x^2 + 1$ (b) $2x^2 + 2x$ (c) $(x + 2)^2$

E.4491 Using mental math, complete the table below, où for each row an expression is evaluated for

different values of x :

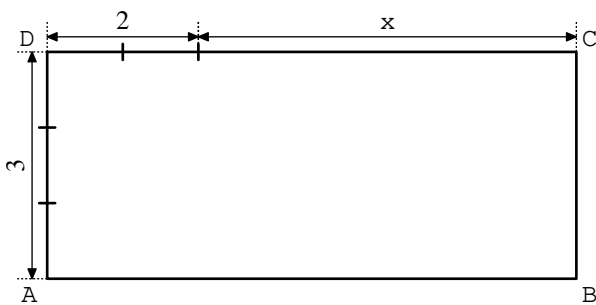
x	0	1	3	-2
$2x-3$				
x^2-2x+3				
$2x^2-4$				
$2(x+4)-3$				

E.4520 Consider the expression: $A = -2x^2 + 4x + 6$

- Evaluate the expression A for the values: $x = -1$; $x = 3$
- Tell whether the statement below is true or false. Justify your answer:
"The expression A is zero for any value of x ."

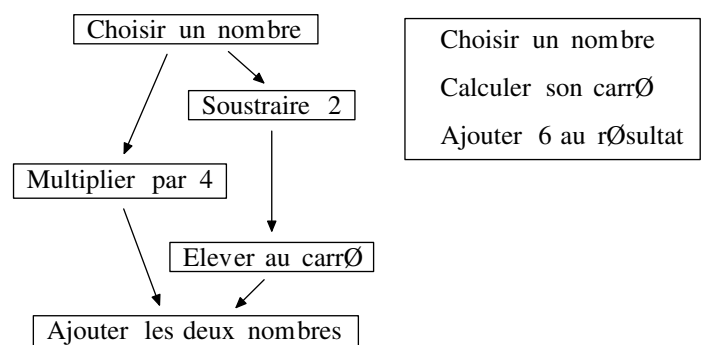
2. Modeling by an expression

E.8795 Consider the rectangle $ABCD$ shown below having length and width $(x+2)$ and 3 respectively:



- Determine the perimeter and area of the rectangle $ABCD$ when $x=1$? $x=4$?
- (a) Give an expression, in terms of x , for the perimeter of the rectangle $ABCD$.
(b) Give an expression, as a function of x , for the area of the rectangle $ABCD$.

E.8794 Here are two calculation programs:



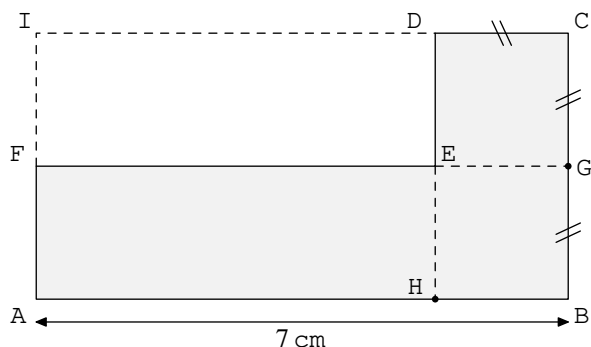
- For program A:**
 - Give the output value of program A when the input value is 3? is -1?
 - If the input number is denoted x , give an expression for the output value of program A.
- For program B:**
 - Give the output value of program B when the input value is 3? is -1?
 - If the input number is denoted x , give an expression for the output value of program B.

3. Simple discounts

E.1908    Reduce, if possible, the writing of the following expressions :

- a) $3 \times x \times 2$ b) $5 + x$ c) $4x + x + x$
d) $3x + 2 + x$ e) $5 \times x + x$ f) $4x + 6 + 2 + x - 3x$

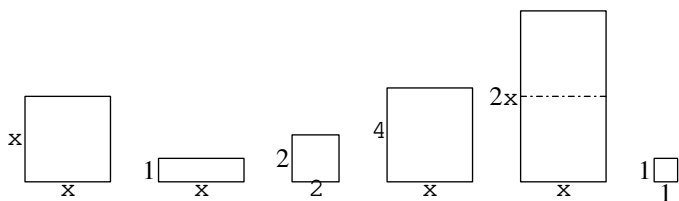
E.8791    Consider the polygon $ABCDEF$ shown shaded below où $ABGF$ is a rectangle and $CDEG$ is a square:



- Give, without justification, the perimeter of polygon $ABCDEF$ in the following cases:
 - $DC = 1$
 - $DC = 4$
- Consider the expression E defined by: $E = 14 + 4x$
 - Evaluate the expression E for each of the values of x below: $x = 1$; $x = 4$
 - Noting x the length of segment $[DC]$, justify that the expression E still yields the value of the perimeter of the polygon $ABCEF$.

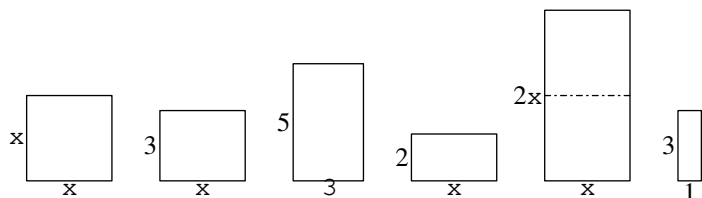
4. Discounts

E.6305    Below are shown 6 rectangles and squares where the letter x designates the same, undetermined measurement of some of the sides of these rectangles.



Justify that the total area of these rectangles can be expressed using the following literal expression: $3x^2 + 5x + 5$

E.6322    Below are shown 6 rectangles and squares où x is an undetermined length but expressing the side length of some of these triangles.



Give a simplified expression representing the total area of these six rectangles.

E.8797   

Definition:

The action of **reducing** a literal expression is to “count together” similar terms in order to avoid repetition. (S. Baruk)

Example: To reduce an expression, we group together terms of the same type:

$$\begin{aligned} 5 + 2a + 3b + 4b + 3 + 2a \\ = (2a + 2a) + (3b + 4b) + (5 + 3) \\ = 4a + 7b + 8 \end{aligned}$$

Often, we use “simplify” instead of reduce.

Reduce the following expressions :

- a) $-2x + 5 - 4x + 3$ b) $-5x + 4x + 3$

E.1922    Consider the two literal expressions below :

- a) $5 - 4x + 6x - 3$
b) $-x^2 + 5x - 4 + 3x - 5x^2 + 7 - 4x - 8$

- Copy each of these expressions and then :
 - underline in black the terms in x^2 ;
 - underline in red the terms in x ;
 - underline in blue the numeric terms.
- Reduce these two expressions.

E.8799    Reduce the following expressions :

- q) $x^2 + x + 3x + 5x^2 + 1$ b) $6x^2 - 3 + 5x - 7x^2 + 4 - 2x$

E.6321 🔑 🍷 📖 Reduce the following expressions :

(a) $3x+2-2x^2+5x+4x^2-5$ (b) $2x+x^2-5x^2+3x-2$

E.8923 🔑 🍷 📖 Simplify the following expressions :

(a) $5x \times 2x - 3x \times 2 - x \times 2x + 5 \times 2x$

(b) $3 \times 2 - x \times 3 + 2x \times x - 5x^2$

E.8798 🔑 🍷 📖 Reduce the following expressions :

(a) $2x \times 3x - 2 \times 4x + 5 \times 2 - 3 \times 3x^2 - 3^2$

(b) $5 \times 2x - 3 \times 4 + 3x \times 2 - 2x \times 3x$

E.1080 🔑 🍷 📖 Reduce the following expressions :

(a) $-2x \times 3x + 2x + 3x^2 - 4x$ (b) $2 \times (3x^2) - (4x) \times x + x^2$

5. Factoring and calculation

E.8954 🔑 🍷 📖 Use distributivity to calculate the following expressions :

(a) $13 \times 7 + 13 \times 3$ (b) $12 \times 5 + 8 \times 5$ (c) $3 \times 7 + 3 \times 3$

E.5657 🔑 🍷 📖 Using a mental calculation, give the value of the following calculations :

E.1928 🔑 🍷 📖 Reduce the following expressions :

(a) $3x + 5x \times (-2x) + x \times 2$ (b) $2 + 3 \times 4 - x - x$

(c) $-3 \times 2 + (x \times 5) \times 3 + x \times 2x$ (d) $(-x) \times (-x) + (-x) \times x$

E.4519 🔑 🍷 📖 Reduce the following expressions :

(a) $2 \times 5 - x \times x + 4 \times (-3) + 3 \times (-2x)$

(b) $x \times (-3x) + 7 \times 3 - 2x \times (-2) - 3 \times (-2x^2)$

E.62 🔑 🍷 📖 Expand and simplify the following expressions :

(a) $5 \times x + (-3) \times 2x + x \times 2x$

(b) $2x \times (-2x) + (-x^2) \times (-2)$

(c) $(-3) \times x + (-2x) \times (+2x) + x^2 \times 3$

(a) $12 \times 17 + 12 \times 3$ (b) $15 \times 19 - 5 \times 19$ (c) $23 \times 81 - 3 \times 81$

E.8813 🔑 🍷 📖 Use distributivity to calculate the following expressions :

(A) $18.87 \times 32.7 + 18.87 \times 56.5 + 18.87 \times 10.8$

(b) $19.67 \times 19.67 - 19.67 \times 9.67$

6. Development and calculation

E.4492 🔑 🍷 📖 Using a mental calculation, give the value of the following calculations :

(a) 11×15 (b) 21×33 (c) 31×16

E.1253 🔑 🍷 📖 Perform the following calculations, leaving the steps of your calculations :

(A) 101×347 (b) 98×240

E.8955 🔑 🍷 📖 Using a mental calculation, give the value of the following calculations :

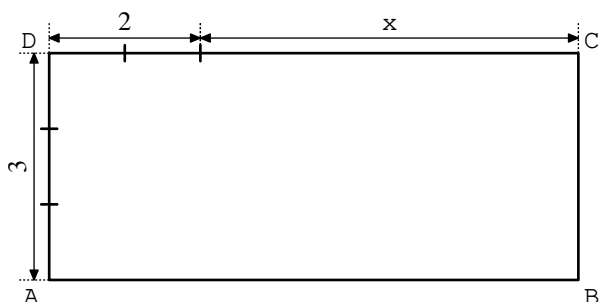
(a) 9×37 (b) 9×32 (c) 19×64

E.1226 🔑 🍷 📖 Clever calculation :

(A) 101×347 (b) 98×240

7. Distributivity: development

E.4512 🔑 🍷 📖 Consider the rectangle $ABCD$ shown below having length and width $(x+2)$ and 3 respectively :



1 Determine the area of the rectangle $ABCD$.

2 By hatching the representation of $ABCD$, highlight the following equality :

$$A = 3x + 6$$

E.1910 🔑 🍷 📖 Expand and reduce the following expressions :

(a) $3 \times (2x + 4)$ (b) $x \times (2x - 1)$

(c) $(3 - 2x)x$ (d) $x \times (3 + x)$

E.8810    Expand and reduce the following expressions :

(a) $3 \times (2x + 1)$ (b) $x + (2x - 1) \times 2$

E.1251    Consider the following two expressions :

- The product of 3 by the sum of x and 2.
- The sum of the product of 3 by x and 6.

Justify that these two expressions are equal.

E.1249    In the following two calculations, use distributivity to give the following expressions in their **developed** and **reduced** forms :

(a) $7 \times (2x + 5) + 4$ (b) $3 \times (3 + x) + 2x + 12$

E.8925    Expand and reduce the following expressions :

(a) $x + 2(2x - 1)$ (b) $3 - 3x + x \times (3x + 1)$

E.8812    Reduce the following expressions :

(a) $2(3 + x) + (2 + x) \times 4$ (b) $2(3 + x) + [5 + 2(x - 1)]$

E.8814    Write the literal expressions below in their expanded and reduced forms :

(a) $2[1 + x(x - 2)]$ (b) $x[-1 + 2(x + 1)]$

8. Distributivity: factoring

E.8816    Using distributivity, transform the writing of the following expressions to show their **factorized** forms :

(a) $5x - 5 \times 3$ (b) $3x + 12$

E.4548    Factor the following expressions :

(a) $4x + 2$ (b) $5 - 15x$ (c) $4x - 6$

E.6344    Factor the following expressions :

(a) $12x + 15$ (b) $12x + 20$ (c) $3x + 6$

E.8815    Give the factorized form of the following expressions :

(a) $2 \times x + 2 \times 4$ (b) $25x + 15$

E.1909    If possible, factor the following expressions :

(a) $3 \times x + 9$ (b) $5x + 5$ (c) $5x + 25$

E.8811    Factor the following expressions :

(a) $x^2 + 2x$ (b) $3x^2 - 2x$ (c) $4x^2 + x$

E.8821    Factor the following expressions :

(a) $5x^2 - x$ (b) $6x^2 + 3x$ (c) $8x + 16x^2$

E.8927    Factor each of the following expressions :

(a) $5x + 15$ (b) $7x + 2x^2$

E.8822    Factor, if possible, the following expressions :

(a) $3 \times x + 9$ (b) $x \times x + 3x$ (c) $5x + x$
(d) $5x + 25$ (e) $3x^2 + 9x$ (f) $6xy + 12x$

E.4522    Factor the following expressions :

(a) $3 \times x + 6$ (b) $4x^2 - 3x$ (c) $15x^2 + 5$
(d) $5x^2 + 4x$ (e) $6x^2 + 9x$ (f) $12x^2 - 4x$

9. Modeling, development, reduction

E.5659    The following calculation program is considered :

- Choose a number ;
- Multiply it by 2 ;
- Add 3 ;
- Multiply by 2 ;
- Subtract 6

1 Noting x as the starting number, give the expression constructed by this calculation program.

2 (a) Without justification, complete the table below :

Nombre d'entrée	1	0	4	-2
Number returned				

(b) Can we conjecture a new expression that would represent this calculation program?

(c) Justify your previous remark.

For this last question, any trace of research will be considered.

E.1241 📏 📐 📚 A notebook costs x pesos and a binder costs 5 pesos more than a notebook.

① Given x the price of a notebook, establish a literal expression as a function of x representing the following purchase:

5 binders and 4 notebooks

② Reduce the expression obtained in question ①.

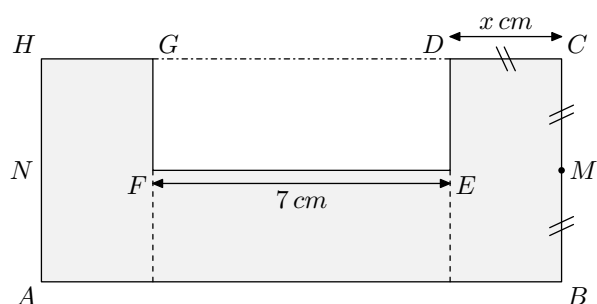
E.5700 📏 📐 📚 ⚠️ All calculations and any record of research, no matter how incomplete, will be considered in the evaluation.

Marc and Sophie are challenging each other with math. It's Marc's turn; he proposes a calculation program to his classmate:

- Choose a positive integer
- Square this number
- Add 3 to the result
- Then multiply by 2 the result obtained
- Subtract 6 from the previous result
- Finally, take half of the last result
- Write the final result

10. Areas, development, reduction

E.1863 📏 📐 📚 We want to study the area of the polygon $ABCDEFGH$ shown below, where $ABMN$ is a rectangle and $FGHN$ and $CDEM$ are squares:



The measurement $FE = 7 \text{ cm}$ is given, and we denote the measurement of segment $[CD]$ by x .

① Complete the table below without justification:

Value of x	2	4
Area $\mathcal{A}$ of polygon $ABCDEFGH$		

② a) Using the polygon division proposed in the statement, show that the area $\mathcal{A}$ can be expressed as:

$$\mathcal{A} = (7 + 2x) \times x + 2x^2$$

b) Propose another division that allows you to justify that the area $\mathcal{A}$ can also be expressed by the expression:

$$\mathcal{A} = 4x^2 + 7x$$

Hint: you can justify this last question either by reduction or by a different area calculation

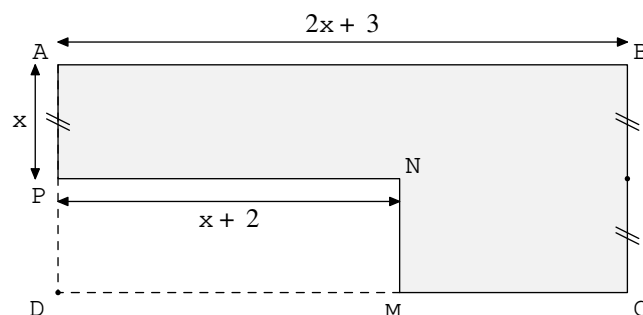
Sophie announces that we can go from the originally chosen number to the final number in one step. Is she right?

E.6315 📏 📐 📚 ⚠️ "I take a whole number, add 3 to it, and multiply the result by 7. I add three times the starting number to the result and remove 21. I still get a multiple of 10."

Is this true? Justify.

Any trace of research, even if incomplete, will be considered in the assessment.

E.1252 📏 📐 📚 Consider the shaded $ABCMNP$ polygon below:



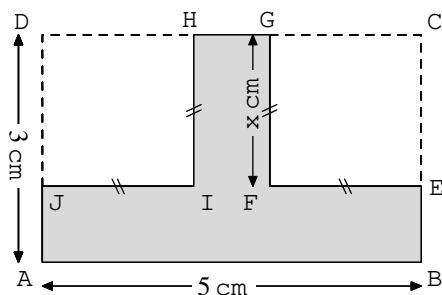
où the quadrilaterals $ABCD$ and $MNPD$ are rectangles and x is the length of the segment $[AP]$:

① Give the expression for the perimeter of the polygon $ABCMNP$ in terms of x .

Give this literal expression in its expanded and reduced form.

② Calculate the perimeter of the figure in the cases où $x = 5$

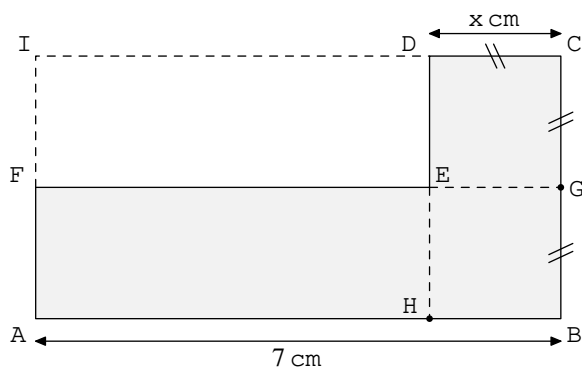
E.1880    Consider the polygon $ABEFGHIJ$ formed from the rectangle $ABCD$ from which the two squares $DHIJ$ and $CEFG$ of side x cm have been removed.



- 1 Reproduce this figure for $x = 1.5$ cm.
- 2
 - a Determine as a function of x the perimeter measure of this polygon. Give the reduced form of this expression.
 - b Deduce the measure of this perimeter for $x = 1.5$ cm.
- 3
 - a Give the measure of the area of the polygon $ABEFGHIJ$ for $x = 1.5$ cm.
 - b Write a literal expression representing the area of this polygon.

11. Equality of expression

E.1887    Consider the polygon $ABCDEF$ shown shaded below where $ABGF$ is a rectangle and $CDEG$ is a square:



- 1 Using two distinct geometric reasonings, show that the area $\mathcal{A}$ admits the following two expressions: $\mathcal{A} = 7x + x^2$; $\mathcal{A} = x^2 + x^2 + (7-x) \times x$
 - 2
 - a Complete the table of values below:
- | | | |
|-----------------------|---|---|
| Value of x | 1 | 3 |
| Polygon area $ABCDEF$ | | |
- b Check that the values obtained are valid whatever the expression used.

E.1240   

- 1 Consider the two expressions:
 $A = 5x + 3$; $B = 8x$

- a Complete the table of values below:

Value of x	1	-2
Value of A		
Value of B		

- b Can we say that the expressions A and B are equal?

- 2 Consider the two expressions:
 $C = 8x + 4$; $D = 4 \times (2x + 1)$

- a Complete the table of values below:

Value of x	2	-3
Value of C		
Value of D		

- b Can we say that the expressions C and D are equal?
What can we do to be sure?

Note:

- To show that **two expressions are different**, we look for a value of x for which these two expressions have a distinct evaluation.
- To show that **two expressions are equal**, we need to show that they have the same developed and reduced form.

E.1324    Say whether the following equalities are true or false. **Justify!**

- a $3x + 9 = 3 \times (x + 9)$
 - b $3 \times (2x + 3) = 6x + 5$

E.8820    Say whether the following equalities are true or false. **Justify!**

- a $5x + 3 = 8x$
 - c $8x + 4 = 4 \times (2x + 1)$

E.1225    Justify that these literal expressions are false:

- a $3 \times (2x + 1) + 3 = 5x + 6$
 - b $2x + 2 \times (x + 2) = 6x + 2$

E.1239 🌡️ 🍷 📖 Which of the following equalities are true or false? Justify:

- a false equality by a counterexample;
- a true equality by development and reduction of literal expressions.

- (a) $2 + 2x = 4x$ (b) $3 \times (x + 5) = 3 \times x + 15$
 (c) $2 \times (2 + 3) = 2x + 6$ (d) $5a + 35 = 5 \times (5a + 7)$
 (e) $3 \times (x + 2) + 2 \times (5x - 1) = 13x + 4$

E.8817 🌡️ 🍷 📖 Study the literal expressions below. Justify:

- (a) $3 \times (2x + 4) = 6x + 12$ (b) $5x + 13 = 5 \times (x + 2) + 3$

E.8818 🌡️ 🍷 📖 Tell us if the following equations are true. Justify your answer.

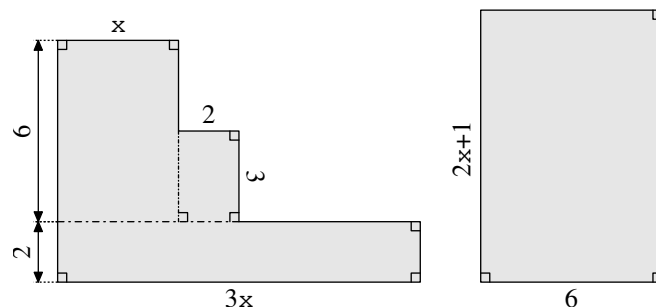
- (a) $(2x + 1) \times 3 + 2 \times (3x + 2) = 12x + 7$
 (b) $x + 15 + 3x + 7x + x + 23 - 1x - 8 = 11x + 30$

E.8819 🌡️ 🍷 📖 Tell if the following equalities are true or false. **Justify!**

- (a) $(2x + 1) \times 3 + 2 \times (3x + 2) = 12x + 7$
 (b) $x + 15 + 3x + 7x + x + 23 - 1x - 8 = 11x + 30$

12. Modeling: equality of expressions

E.6323 🌡️ 🍷 📖 We note x a length that is not yet determined. From this length, we construct the two figures below:



Justify that these two figures have the same area regardless of the value of x .

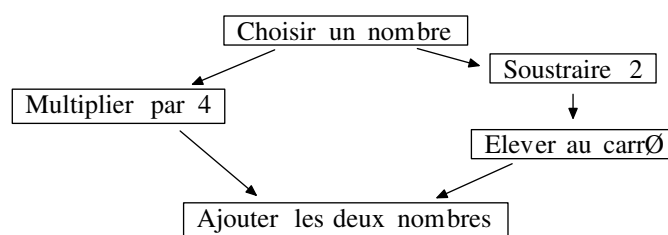
13. To the equations

E.8695 🌡️ 🍷 📖 ⚠️ We consider the calculation program:

Choisir un nombre
 Calculer son carré
 Ajouter 6 au résultat

- What is the result of the program B if we choose the number 5?
- If we note x the number chosen as the input to the algorithm, justify that the number returned by is expressed as $x^2 + 6$.
- Determine the input value so that this calculation program returns as an output value 31.

E.8796 🌡️ 🍷 📖 Consider the calculation program shown in the diagram below:



- Noting x as the number provided as input to this calculation program, give an expression giving the number returned by this calculation program.
 - We wish to evaluate the two expressions " $x^2 + 4$ " and " $4x + (x - 2)^2$ " for certain values of x :

x	-2	0	3
$4x + (x - 2)^2$			

x	-2	0	3
$x^2 + 4$			

- We look for the value of x such that the expression has the value 29
 - Check the answers to question (a).

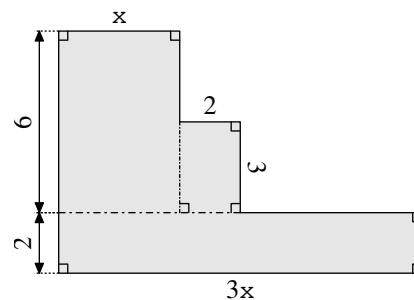
E.1881   Jacques has two children, Paul and Marie.

- Paul is two years older than Marie.
- James is four times Mary's age.

- 1 If Paul is 12 years old, give the ages of Mary and James.
- 2 We'll note x Paul's age. Give the expression for James' age as a function of x .
- 3 What is Paul's age, if James is 48?

E.8836   We consider the figure below com-

posed of three rectangles :



Determine the value of x so that the area of this figure is 21.

14. Share

E.4534   

- 1 Reduce the following expressions :

a $3x^2 - 5 + 6x - 8x^2 + 4x + 4$

b $3 \times 2x - 5 \times 2 + x \times (-3x) - (-5x) \times (-2)$

- 2 Expand and reduce the following expressions :

a $3(x + 4)$ b $4(3 - 2x) + 2(5x - 4)$

- 3 Factor the following expressions :

a $6x + 15$ b $4x^2 + 6x$

E.1925   

- 1 Expand and reduce the following expressions :

a $3(x - 2)$

b $2(6x + 3) + x$

- 2 Factor the following expressions :

a $3x + 9$

b $x^2 + 2x$

E.1248    Using distributivity :

- 1 Give the **developed** and **reduced** form of the following literal expressions :

a $(3x + 2) \times 4$

b $2.2 \times (3 - 5x)$

- 2 Give the **factorized form** of the following literal expressions :

a $3.1 \times 5x - 2 \times 3.1$

b $3 \times x + 12$

15. Unclassified exercises

E.6359   

Intravenous infusions are used to administer fluids and medications to patients.

Nurses need to calculate the flow rate D of an infusion in drops per minute.

They use the formula $D = \frac{d \times v}{60 \times n}$ où :



- d : is the flow factor in drops per milliliter (ml) ;
- v : is the volume (*in ml*) of the infusion ;
- n : is the number of hours the infusion should last.

- 1 A nurse wants to double the duration of an infusion.

Describe precisely how D changes if n is doubled and d and v do not change

- 2 Nurses must also calculate the volume v of the infusion based on the infusion rate D .

An infusion with a flow rate of 50 drops per minute should be administered to a patient for 3 hours. For this infusion, the flow factor is 25 drops per milliliter.

What is the volume in ml of this infusion?

- 3 A nurse sets the flow factor to 10 drops per milliliter. She then uses the table adapted to this setting and giv-

ing the value of the parameter D of the number of drops per minutes.

Here's the table :

n \ v	100	150	200	250	300	350
0,1	167	250	333	417	500	583
0,2	83	125	167	208	250	292
0,3	56	83	111	139	167	194
0,4	42	63	83	104	125	146
0,5	33	50	67	83	100	117
0,6	28	42	56	69	83	97
0,7	24	36	48	60	71	83
0,8	21	31	42	52	63	73
0,9	19	28	37	46	56	65
1	17	25	33	42	50	58

Knowing that she has to infuse a patient for a maximum of $\frac{1}{2}h$ and that the rate D of drops per minute must not exceed 60 and given the values given in the table, what choice can she make for the volume (v) of the infusion and the number of hours (n) that the infusion will last? Justify your approach.

E.1362   Let $A = \frac{3}{2} \times \left(\frac{1}{4} + \frac{1}{4} \right)$:

- ① Calculate A by first calculating the parentheses.
- ② Calculate A by first using distributivity.

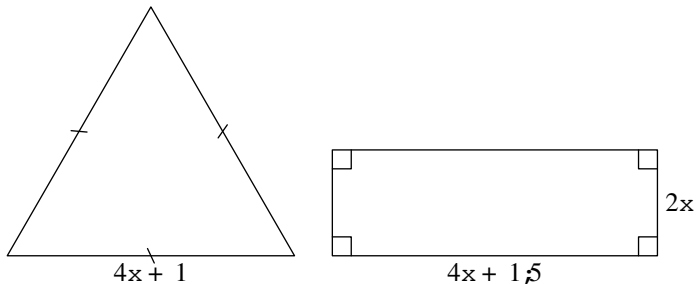
Give the results in simplified form.

E.8899   

Part 1

In this part, all lengths are expressed in centimeters.

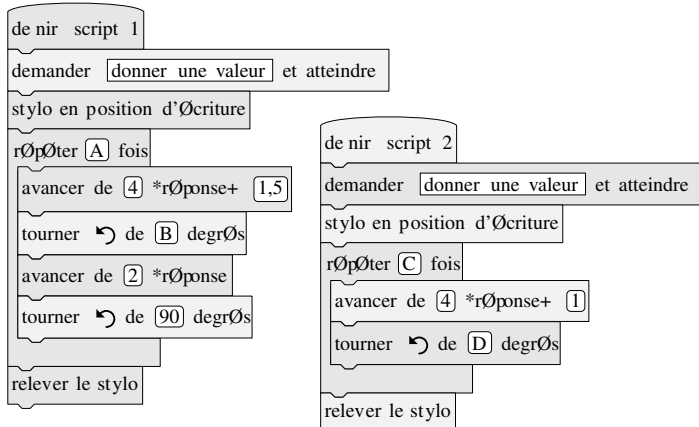
Consider the two figures below, an equilateral triangle and a rectangle, where x represents any positive number.



- ① Construct the equilateral triangle for $x = 2$
- ② a) Show that the perimeter of the rectangle as a function of x can be written $12x + 3$.
b) For what value of x is the perimeter of the rectangle equal to 18 cm ?
- ③ Is it true that the two figures have the same perimeter for all values of x ? Justify.

Part II

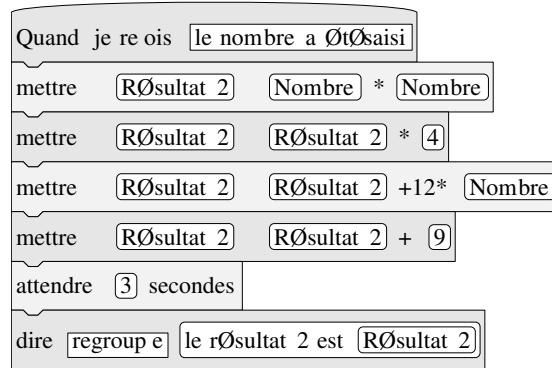
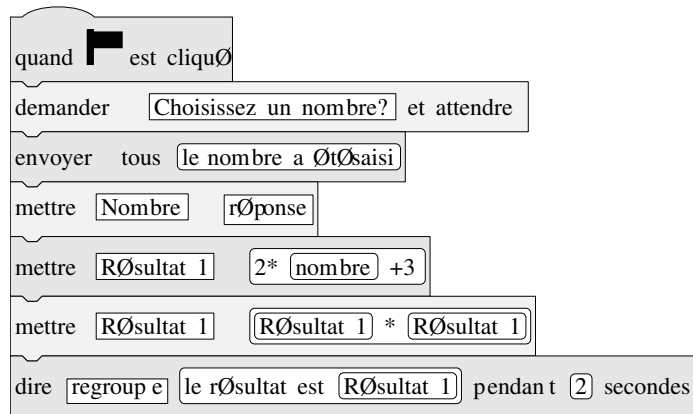
We created the scripts (*opposite*) on Scratch that, after asking the user for the value of x , construct the two figures in Part I.



In these two scripts, the letters A , B , C , and D replace numbers.

Give values to A , B , C , and D so that these two scripts construct the figures in part I and then specify the figure associated with each of the scripts.

E.8942    Here is a script entered by Alice in an algorithmic software.



- ① Alice chose 3 as her number, calculate the values of **Result 1** and **Result 2**?
Justify by showing the calculations performed.
- ② Generalization.
a) Calling x the number chosen in the algorithm, give a literal expression translating the first part of the algorithm corresponding to **Result 1**.
b) Calling x the number chosen in the algorithm, give a literal expression translating the second part of the algorithm corresponds to **Result 2**.

E.8944



Here are two calculation programs:

Calculation program 1:

- Subtract 5
- Multiply by 4

Calculation program 2:

- Multiply by 6
- Subtract 20
- Subtract double the starting number

- 1
 - a What result do we get when we apply the calculation program 1 to the number 3?
 - b What result do we get when we apply the computation program 2 to the number 3?
- 2 Demonstrate that by choosing the number -2 , both programs give the same result.
- 3 We decide to run more trials. To do this, a spreadsheet is used and the following screenshot is obtained:

	A	B	C	D
1	Nombre choisi	R�sultat avec le programme 1	R�sultat avec le programme 2	
2	0	-20	-20	
3	1	-16	-16	
4	2	-12	-12	
5	3	-8	-8	
6	4			
7	5			
8	6			

What formula could have been entered in cell B2 before copying it down to cell B5?

- 4 The results shown in the columns B and C are equal. Lucy then thinks that, for any number chosen at the beginning, both programs always give the same result.

Show that Lucie is correct.

E.5084



The following calculation program is proposed:

Choisir a number.

Subtract 6.

Calculate the square of the result.

- 1
 - a We choose the number -4 at the start, show that the result obtained is 100.
 - b We choose 15 as the starting number, what is the result obtained?
- 2 Noting x as a number, what expression gives the result obtained?

E.5085



We consider the following two calculation programs:

Choose a number.
Add 3 to that number.
Multiply the result by 2.
View product.

Choose a number.
Multiply by 3 this number.
Add 2 to the result.
Display the sum.

- 1
 - a Quel(s) r sultat(s) do you get with these two calculation programs when the chosen number is 4?
 - b Can we say that these two calculation programs are equivalent?
- 2
 - a What number must be chosen to obtain the number 18 by the first calculation program?
 - b What number should be chosen to get the number 8 by the second calculation program?

E.4612



Factor the following expressions:

a $3x + 6$

b $2x - 8$

c $27x + 18$