

News from the Canada Region
Carol Matsumoto, Canada Regional Director
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Spotlight on the Québec Mathematics Education Program

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At the NCSM conference in April the Canadian Caucus decided it would be interesting to highlight a best practice that is integrated in our Provincial Curriculum.

Problem solving is integral to Mathematics. In fact, the first Mathematical Practice of the Common Core is *Makes sense of problems and perseveres in solving them*. The mathematics education in Québec is focused on getting students to solve problems, reason, establish connections and communicate. The program is centered on the development of three closely related competencies from Grade 1 to Grade 11:

- Competency 1: Solves a situational problem
- Competency 2: Uses mathematical reasoning
- Competency 3: Communicates by using mathematical language

Both competency 1 and competency 2 focus on problem solving. Competency 1 requires the students to carry out a series of actions such as decoding the elements that can be processed mathematically, representing the situational problem by using one or more mathematical models, working out a mathematical solution, validating this solution and sharing information related to the situational problem and the proposed solution. This is a dynamic process that calls for the capacity to anticipate, backtrack and exercise critical judgment.

Competency 2 Using mathematical reasoning involves making conjectures and criticizing, justifying or refuting a proposition by applying an organized body of mathematical knowledge and applying the rules of inference and deduction. When we evaluate students' capacity for mathematical reasoning there are three types of evaluative tasks: Formation of a conjecture, Action problems (focuses on applying an organized body of knowledge) and Validation problems (focuses on refuting or justifying a proposition).

Below are examples to illustrate the kind of problem solving each competency requires.

Let's Go Camping

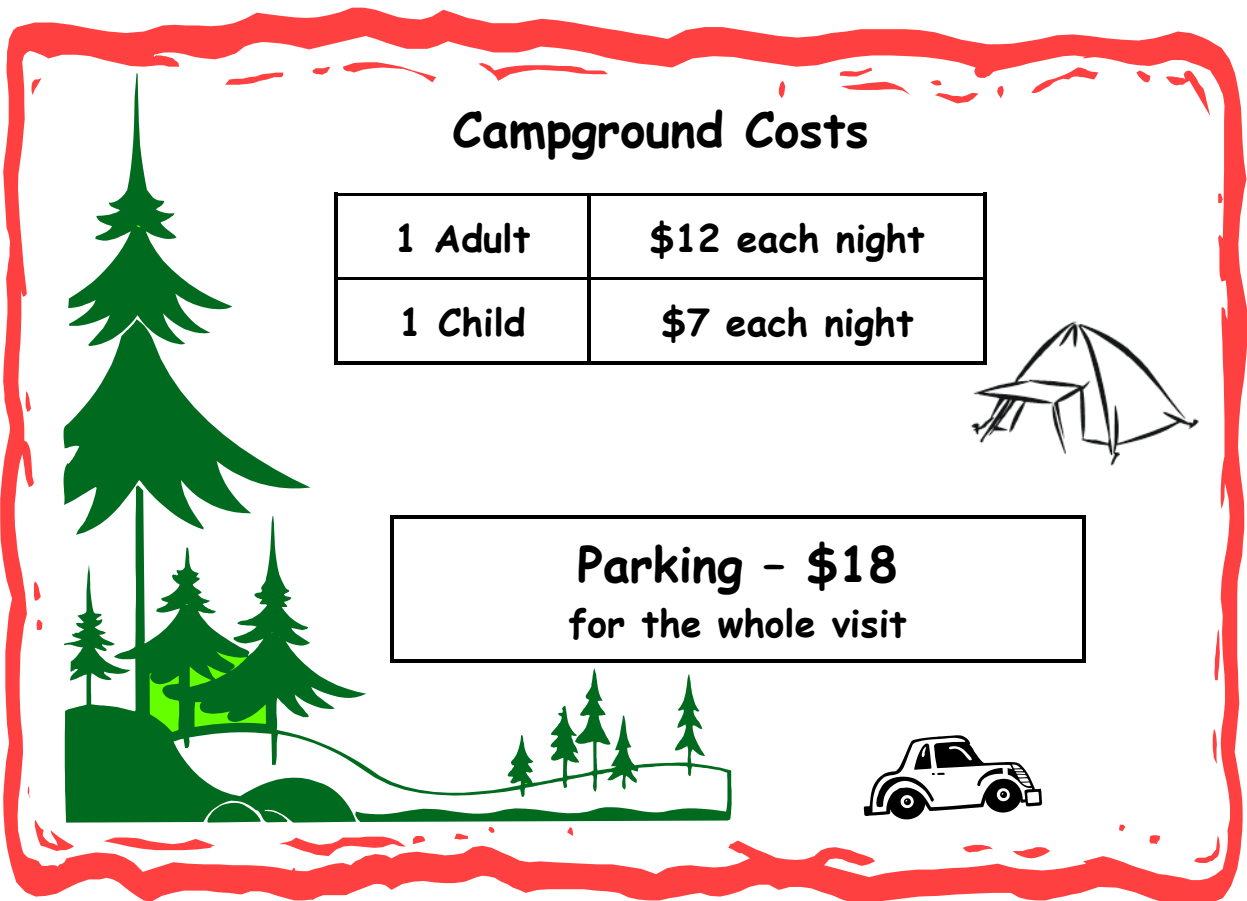
A family of 5 is going on a camping trip. There are 2 adults and 3 children.

They will be going camping for 5 days and 4 nights.

The family will participate in 2 campground activities.

You must determine:


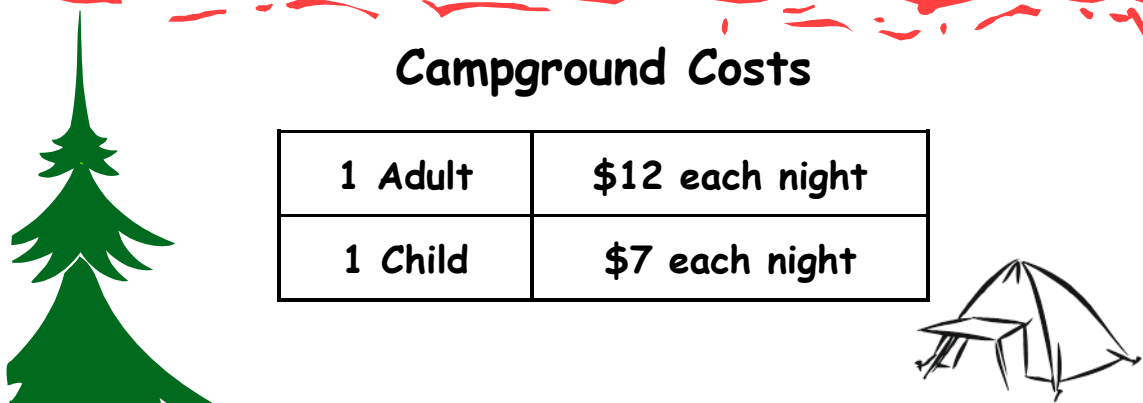
- the total cost of the camping trip, including the campground costs and the chosen activities
- how to set up the campsite



Campground Costs

1 Adult	\$12 each night
1 Child	\$7 each night

Parking - \$18
for the whole visit



You must choose 2 campground activities:

Activity	Cost for the whole family
 <p data-bbox="646 285 802 327">Canoeing</p>	<p data-bbox="1154 285 1227 327">\$33</p>
 <p data-bbox="623 422 824 464">Movie night</p>	<p data-bbox="1154 422 1227 464">\$25</p>
 <p data-bbox="570 552 878 594">Rock wall climbing</p>	<p data-bbox="1154 552 1227 594">\$36</p>
 <p data-bbox="574 684 873 726">Horseback riding</p>	<p data-bbox="1154 684 1227 726">\$48</p>
 <p data-bbox="613 821 834 863">Water slides</p>	<p data-bbox="1154 821 1227 863">\$42</p>
 <p data-bbox="623 951 824 993">Magic show</p>	<p data-bbox="1154 951 1227 993">\$27</p>

Use this information to set up your campsite:

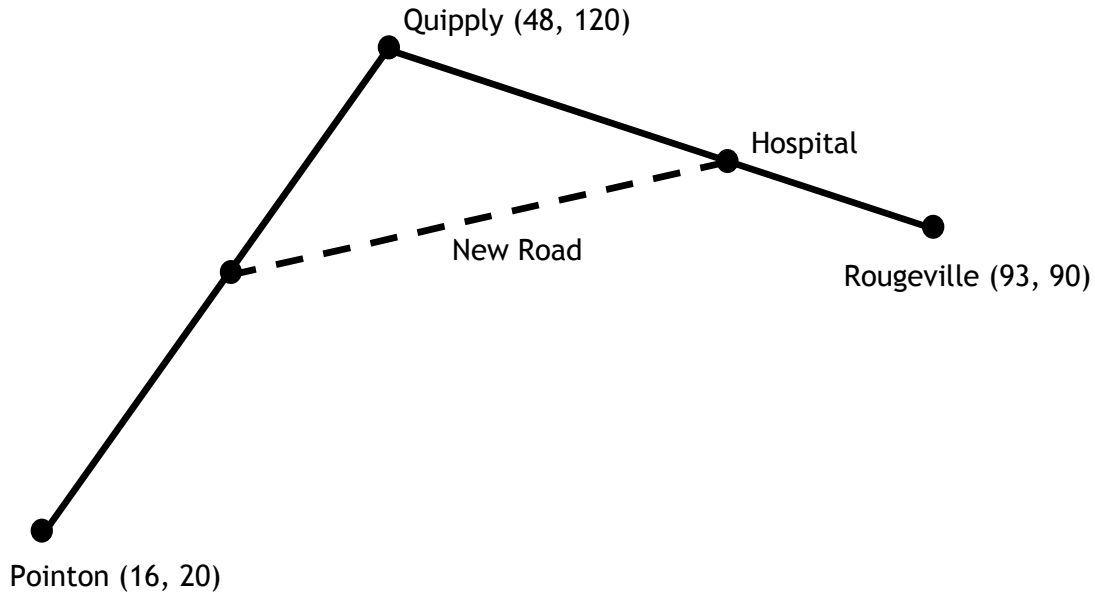
- the tent is in the shape of a triangle
- the firepit is in the shape of a circle
- the kitchenette is in the shape of a square
- the picnic table is in the shape of a rhombus
- the firepit is above the parking space
- the tent is to the right of the firepit
- the kitchenette is to the left of the firepit
- the picnic table is below the kitchenette



Example 3: Competency 2 Conjecture Problem End-of-year evaluation for Grade 7 Mathematics (15 minutes)

Hospital Road

Three small towns are located in the Quebec countryside. A map of the region, scaled in kilometres, shows the location of these towns and the roads connecting them. On the map, ordered pairs indicate the coordinates of each town. The location of the hospital is also shown to be two thirds of the way from Quipply to Rougeville.



In order to make it easier for Pointon residents to reach the hospital quickly, the government has decided to build a new road. The road will start at the midpoint between Pointon and Quipply and go directly to the hospital.

Rounded to the nearest kilometre, what is the length of the new road?

THE PARKING STRUCTURE

A large city in the province of Quebec would like to build a parking structure with at least 580 available parking spaces. Given that the structure is to be built in the downtown core of the city, there is limited space available. Because of the limited space the structure will need to have several levels. City regulations limit the height of the structure to 16 metres. The city would like cover the entire rooftop of the parking structure with a garden to help contribute to urban ecology.

Specifications for the garage:

- Each level of the structure must be identical.
- Each level of the structure must have four cylindrical supporting columns.
- Each level of the structure must have a hexagonal area reserved for the elevator shaft located at its centre.
- Two waiting zones must be marked off on either side of the elevator shaft to ease the flow of people getting in and out of the elevator. These waiting zones will be designated by a circular sector.
- There must be two rectangular walkways leading away from the elevator shaft.

Figure 1: Lateral view of each level

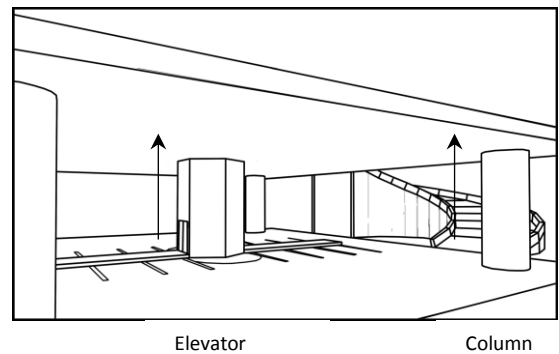
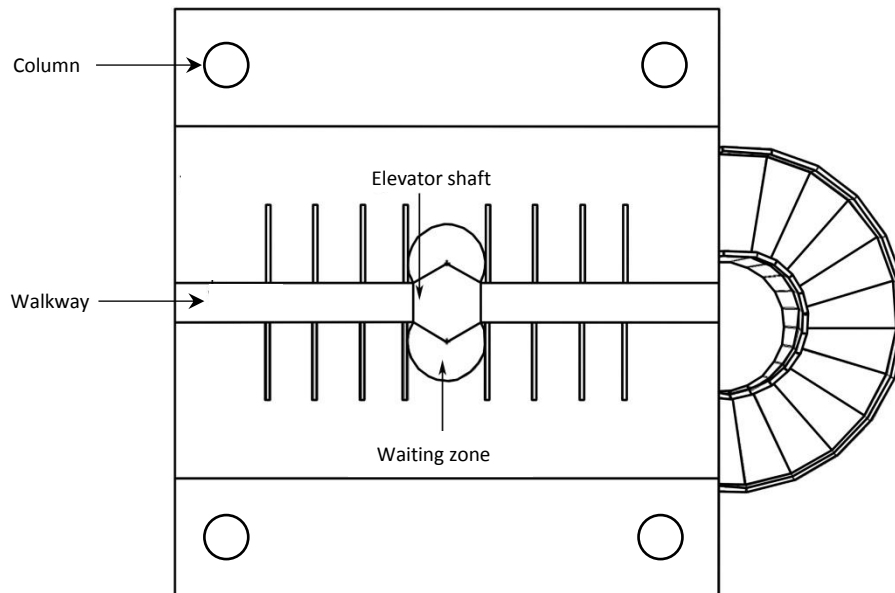
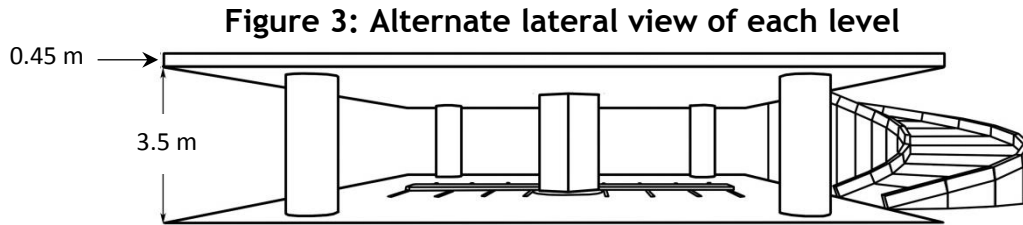


Figure 2: Overhead view of each level



Available Space for Each Level



- Each level of the structure is rectangular shaped with dimensions: 80 m × 60 m.
- Each level is 3.5 m high.
- The thickness of the concrete between each level is 0.45 m.

The Supporting Columns

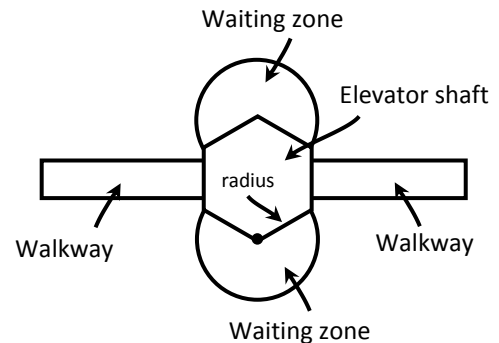
- The four supporting columns are right cylinders.
- The circumference of the base of each column is 5 655 mm.

The Elevator Shaft

- The elevator shaft is a regular prism, where the base is in the shape of a regular hexagon.
- The lateral area of the elevator shaft for one level is 9 450 dm².
- The apothem of the hexagonal base measures 3 900 mm.

The Walkways

- The two walkways are isometric.
- The two walkways are rectangular shaped.
- The perimeter of each walkway is 61 m.
- The length of the walkway is 13 metres more than four times the width.



The Waiting Zones

- The two waiting zones are isometric.
- Each zone is designated by a circular sector bordering the hexagonal elevator shaft.
- The radius of each waiting zone measures the same as one side of the hexagon.

The Number of parking spaces per level

In order to assure that there is sufficient room for vehicles to circulate safely, the engineers recommend that only 60% of the available space on each level be reserved for parking.

The table below represents the relationship between the number of parking spaces and the area reserved for parking found in other parking garages across the city.

Number of parking spaces	Available space reserved for parking (m ²)
75	1 350
214	3 852
726	13 068

Your Task

Using the information presented:

- **determine the number of levels required to contain at least 580 parking spaces.**
- **indicate whether or not the city height regulation is respected.**

You must choose 2 campground activities:

