

# The cultural approach to secondary school mathematics



**March 2021**

Direction de la formation générale des jeunes  
Ministère de l'Éducation

Québec 



# Welcome!

- **Geneviève Côté**, Coordinator, Arts Education program and Culture-Éducation files
- **Éric Yelle**, Arts teacher (loan of service), Arts Education program and Culture-Éducation files
- **Geneviève Dupré**, Coordinator, Mathematics program
- **Raymond Nolin**, Elementary school teacher (loan of service), Mathematics program
- **Esther Veilleux**, Secondary school mathematics teacher (loan of service), Mathematics program



# Objectives of the meeting

- Show the importance of the teacher's role in integrating culture into school subjects
- Define the idea of a cultural reference
- Identify selected cultural references that are an integral part of mathematics



## **Presentation outline**

1. Professional competencies
2. Definition and characteristics of a cultural reference
3. Selecting cultural references
4. Cultural references in mathematics
5. Cultural activities
6. Reflection questions



## Culture

**All of the social phenomena specific to a community or society of people.**  
[translation]

R. Legendre, *Dictionnaire actuel de l'éducation*. 2005

# 1 Professional competencies

## Statement of competency 1

“Act as a cultured professional who is at once an interpreter, facilitator and critic of culture when carrying out duties.”

“Competency 1” from MINISTÈRE DE L'ÉDUCATION DU QUÉBEC, *Reference Framework for Professional Competencies, For Teachers*, Québec, Gouvernement du Québec, 2020. p 48- 49.





## **Fundamental competencies**

- ◉ Cultural competency
- ◉ Mastery of the language of instruction
- ◉ These competencies are described as fundamental because neither school nor teaching would exist without them.



# Culture: the basis of education and teaching

- ◉ Students take ownership of their cultural heritage through the agency of the teacher as facilitator.
- ◉ This cultural heritage is composed of symbolic languages developed by humans.
- ◉ These languages are essential to the construction of human identity.
- ◉ Culture varies based on the era and place as well as national and cultural traditions or political and pedagogical ideologies.



## **Teachers' work as cultured professionals, interpreters, facilitators and critics of culture consists in:**

- ◉ introducing students to a variety of cultural references that are part of the world heritage of humanity
- ◉ making the meaning of cultural objects explicit and pertinent
- ◉ making connections between these objects, the educational content and youth culture
- ◉ encouraging students to take a critical and reflective stance toward culture



## To integrate culture

- ◉ Demonstrates an in-depth understanding of the content of the Québec Education Program
- ◉ Makes connections between everything they learn in the classroom, between the subject taught and cultural heritage
- ◉ Encourages students to develop critical thinking skills
- ◉ Turns the classroom into an inclusive cultural space



## To integrate culture

- ◉ Encourage students to share their culture
- ◉ Encourages open and critical dialogue between the culture of the students and that conveyed by the school
- ◉ Casts a critical look at own origins and cultural practices
- ◉ Collaborates with the community and local cultural organizations



## **Other competencies from the reference framework that pertain to culture**

- ◉ Competency 6  
Manage how the class operates
- ◉ Competency 7  
Take into account student diversity
- ◉ Competency 8  
Support students' love of learning

## Primary culture

### Immediate culture

Teachers help students become aware of their culture:

Their original community

The preconceptions and prejudices they have about cultural objects

The influence of social agents: family, media, advertising, hobbies, etc.

Making

connections

### General culture

Teachers use the QEP and go deeper by:

Suggesting different viewpoints

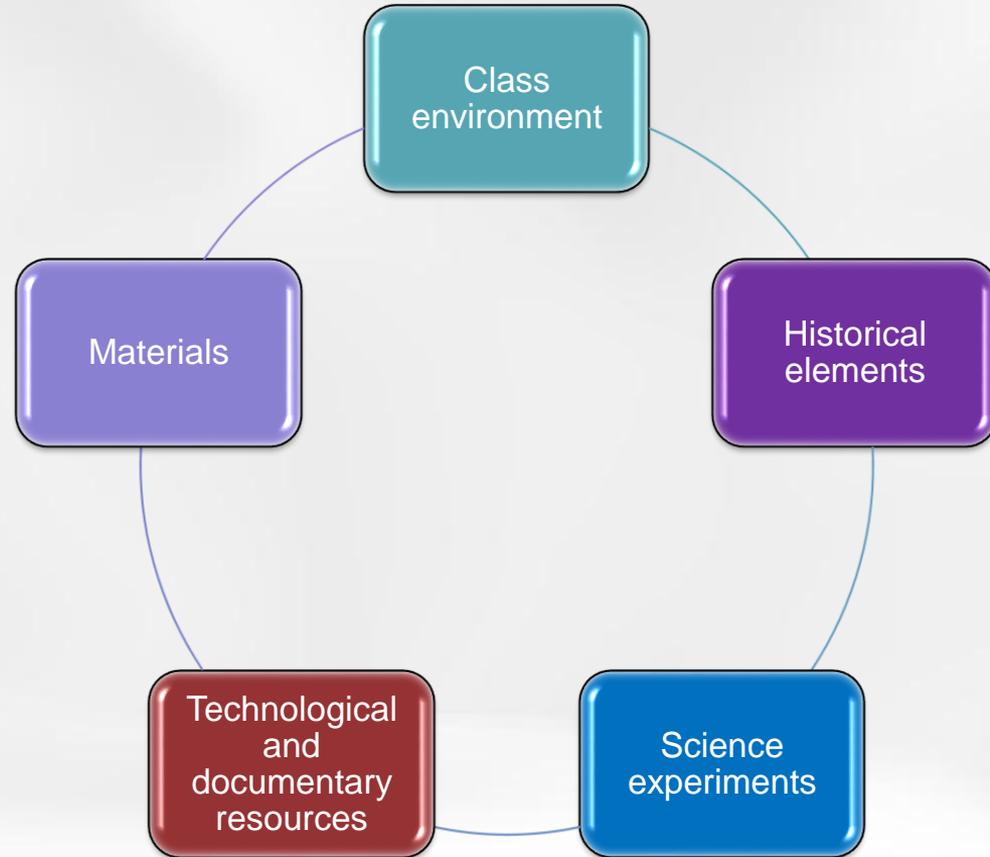
Increasing the number of reference points

Allowing students to understand diverse facets of the world and distance themselves from their primary culture

Encouraging students to develop a new relationship with culture

## Secondary culture

# The cultural approach to mathematics



## 2

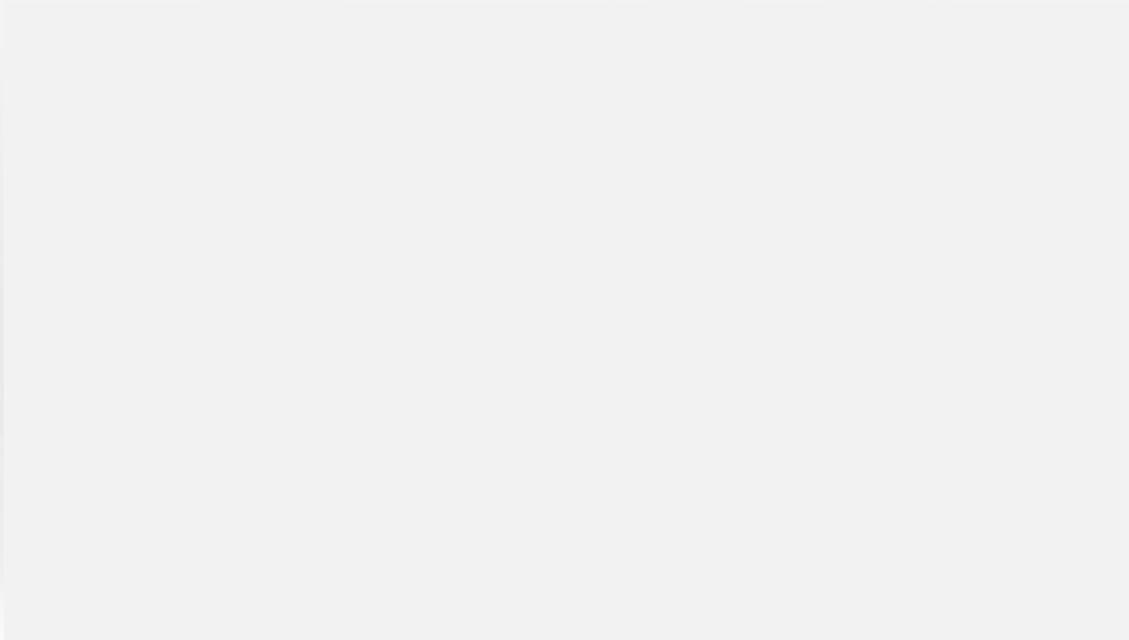
## Definition of a cultural reference

“Cultural references are focuses of learning that are culturally significant and whose use in the classroom enables students to enrich their relationships with themselves and others and the world.”



## **Short video on cultural references**

[www.youtube.com/watch?v=SUqD93dRT1s&list=RDCMUCgcPCv5VQhsAY3vNNoH6Zrw&index=1](https://www.youtube.com/watch?v=SUqD93dRT1s&list=RDCMUCgcPCv5VQhsAY3vNNoH6Zrw&index=1)





## Different types of references

- ◉ An event
- ◉ A piece of media
- ◉ An object used in daily life
- ◉ A heritage object
- ◉ A personality
- ◉ A territorial reference
- ◉ A work of art
- ◉ A scientific discovery
- ◉ A school of thought
- ◉ Values, etc.



## **References originate in different fields**

- ◉ Art
- ◉ Sociology
- ◉ Science
- ◉ History
- ◉ Anthropology



## References represent

- ◉ A period
- ◉ A school of thought
- ◉ Societal values
- ◉ Responses to various historical issues
- ◉ The imaginativeness and creativity of human beings



## References enable students to:

- ◉ become open to other realities
- ◉ become open-minded when faced with elements that they do not have access to in their environments
- ◉ discover diversity and better understand differences
- ◉ make connections between the present and the past
- ◉ recognize the similarities and differences between here and elsewhere as well as the self and others



## References develop

- ◉ sensitivity
- ◉ awakened senses
- ◉ imagination
- ◉ critical thought
- ◉ interest in visiting cultural venues

### 3

## Selecting cultural references

- ◉ Level 1: identify the origin
- ◉ Level 2: identify the nature
- ◉ Level 3: identify the knowledge
- ◉ Level 4: identify links with the QEP

# Selecting cultural references

## Mathematics

A cultural reference meets one of the criteria for levels 1, 2 and 3 as well as one of the criteria of each element for level 4

Level 1  
Identify the origin

- Immediate culture: the world of the student
- General culture: local cultural heritage, cultural heritage elsewhere and manifestations of culture around the world.

Level 2  
Identify the nature

- Represents a period, a school of thought, societal values, etc.
- Responds to problems faced over time
- Demonstrates the power of imagination and the scope of human creativity

Level 3  
Identify the knowledge

- Openness to the immediate environment
- Openness to external realities
- Personal development of the student

Level 4  
Identify links with the Québec Education Program

### SUBJECT-SPECIFIC COMPETENCIES

Solves a situational problem  
Uses mathematical reasoning  
Communicates by using mathematical language

### USE IN CLASS

Interdisciplinary project  
Learning and evaluation situations

### BROAD AREAS OF LEARNING

Health and well-being  
Personal and career planning  
Environmental awareness and  
consumer rights and responsibilities  
Media literacy  
Citizenship and community life

### CROSS-CURRICULAR COMPETENCIES

Intellectual competencies  
Methodological competencies  
Personal and social competencies  
Communication-related competencies



# Principles for integrating the cultural dimension into school

- ◉ Know the history, methods, principles and evolution of the subject taught
- ◉ Master the competencies, principles and concepts that are intrinsic to the subject
- ◉ Possess a pedagogical knowledge of the subject taught
- ◉ Make sure the information given to students is valid



# Principles for integrating the cultural dimension into school

- ⦿ Diversify human, material and technical or institutional educational resources
- ⦿ Avoid both elitism and excessive populism
- ⦿ Do not be dogmatic or moralistic
- ⦿ Avoid drawing all cultural references from a single kind of culture (immediate or general)

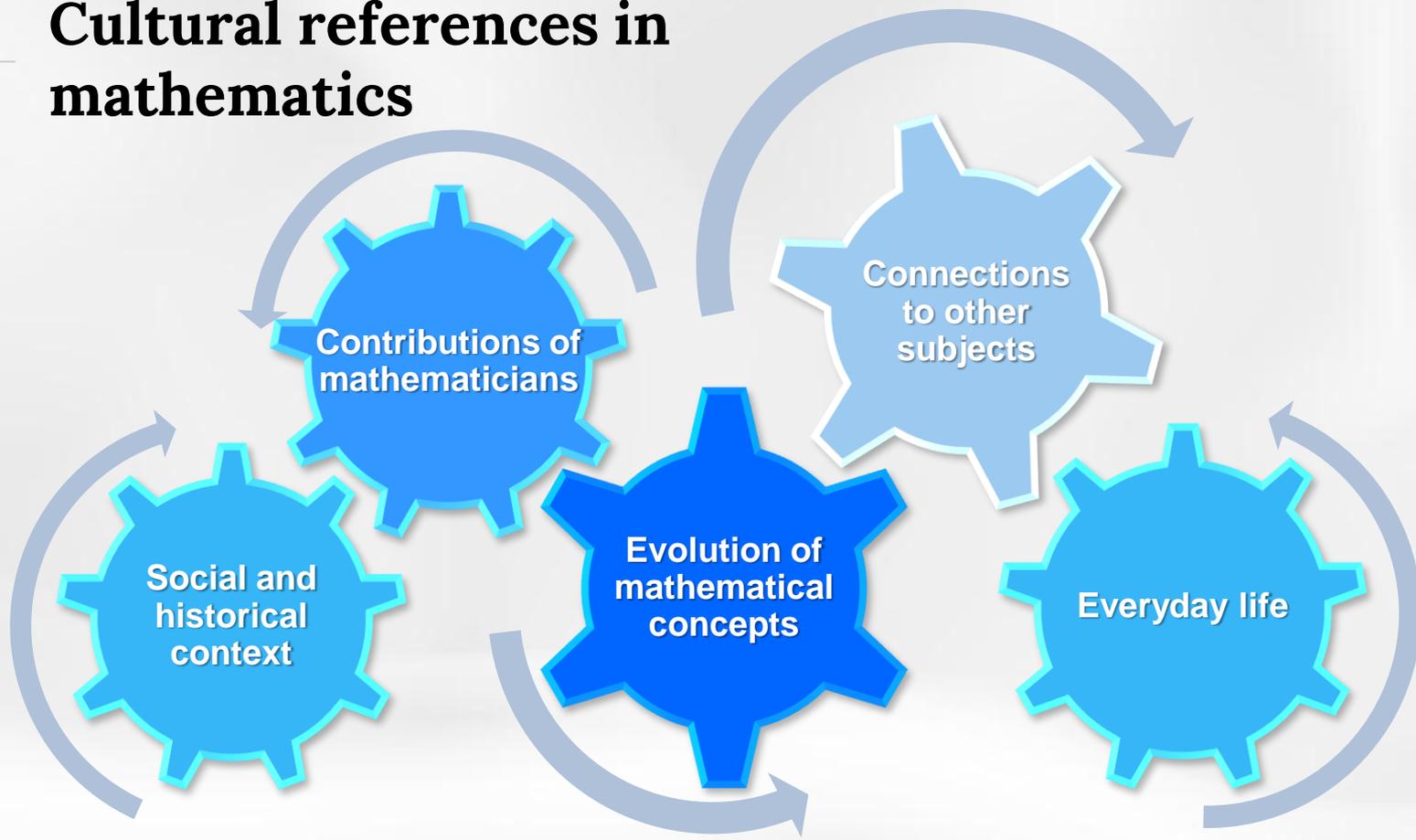
Mathematics has become a  
fundamental component of our  
culture. [It] is part of the  
heritage of humanity and (...)  
has evolved over time.

Québec Education Program. Mathematics, Secondary Cycle 2, p. 95 and 107



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## Cultural references in mathematics





**Cultural references specific to each  
branch of mathematics**



## **Arithmetic and algebra**

- Recognize the contributions of arithmetic and algebra to various subjects
- Observe the characteristics, advantages and inconveniences of different numbering systems
- Become aware of the existence of various types of numbers as well as some of their applications



## **Arithmetic and algebra**

- Introduce noteworthy sequences and their different applications
- Provide information on the historical evolution of the use of notation, symbols and calculation processes as well as methods for solving equations
- Spark discussion about the power and limits of calculation tools



## **Probability and statistics**

- Become aware of the origin and evolution of random experiments, of probability calculations and the development of statistics
- Appreciate mathematicians' contributions to the growth of this field
- Critically analyze games of chance
- Develop the ability to process and analyze statistical data



# Geometry

- Use geometric thinking skills and spatial sense in different subjects and social situations
- Appreciate mathematicians' contributions to geometry and measurement
- Study the evolution of the calculation of the value of  $\pi$
- Discover the evolution of measuring instruments and different units of measurement

## 5 Cultural activities

- ◉ On the Ministère's website, in the Culture-Education section of the School Network tab

[www.education.gouv.qc.ca/en/teachers/dossiers/culture-education](http://www.education.gouv.qc.ca/en/teachers/dossiers/culture-education)

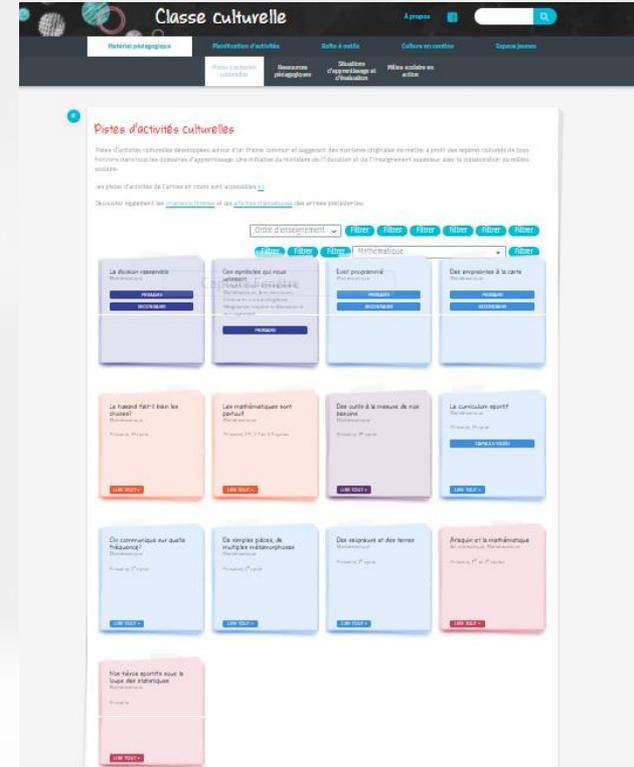
- ◉ On the *Classe culturelle* website, in the *Pistes d'activités culturelles* section of the *Matériel pédagogique* tab (available in French only)

[classeculturelle.ca](http://classeculturelle.ca)

- ◉ Coming soon: the *Par ici la culture en mathématique* website (available in French only)

# Cultural activities

- Arithmetic:
  - Division brings us together
- Geometry:
  - Marks on a map
- Probability:
  - Je gage que je vais gagner! [available in French only]
- Statistics:
  - Mathematically augmented reality
- Programming:
  - Éveil programmé [available in French only]



## Mathematics

### MATHEMATICALLY AUGMENTED REALITY



#### Cultural references

- › Origin and evolution of surveys and sources of bias
- › Information manipulation

#### Introduction

Did you know that today, out of 100 people contacted by telephone pollsters, only about 30 answer? How can the data collected be interpreted when the answers of the other 70 potential respondents are not known?

#### Context

The Internet is revolutionizing the market research and polling industries. In the media, information is presented without much detail and is interpreted by many people, which results in multiple sources of bias. In the following activities, students gather and analyze information and then attempt to distort it.



#### Activity 1

##### Honing your critical skills

Students look into the evolution of opinion polls from the 1930s to the present. They learn about the methods used by polling firms and explore the limitations and sources of bias of various polling methods.



#### Activity 2

##### Manipulating the facts

Using a table or diagram showing data from a statistical study, students modify the presentation of results to deliberately mislead readers. They produce posters showing how results were transformed in order to raise awareness about disinformation.



#### Activity 3

##### You be the pollster

Based on the results of a survey on a given topic, students conduct a comprehensive statistical study on that topic, following a strict protocol regarding sample selection, methodology and data collection. After comparing results, they prepare an information exhibit for parents and other students.

## Additional resources

#### Targeted elements of the QEP

- › Conducting a survey or a census
- › Organizing and choosing certain tools to present data
- › Analyzing situations involving a one- or two-variable distribution
- › Measures of central tendency, dispersion, position and correlation

#### Questions that students could be asked during the activity

- › How do you validate information and statistics presented in the media?
- › How is it possible to distort reality based on the results of a survey?
- › What are the implications of survey results in everyday life?
- › How does the interpretation of statistical studies influence public opinion and political decisions?
- › What new methods might emerge as polling evolves?

#### Suggestions for activities with cultural partners

- › As part of the [#30sec to check it out](#) project, invite a journalist from the Fédération professionnelle des journalistes du Québec to speak to the class to raise awareness about disinformation
- › Invite a local polling firm employee to speak to the class to explain their work and the approach used in a statistical survey

#### References

- › Browse the [France Culture](#) website to find out more about the evolution of polling (in French)
- › Learn more about sample selection and probability sampling on the [Statistics Canada](#) website
- › Listen to the audiobook [Petit cours d'autodéfense intellectuelle](#) to develop critical thinking skills about beliefs and published information (in French)
- › Browse the [Institut de la statistique du Québec](#) and polling firm websites for statistical study results
- › Learn about [fake news](#) generators



## Reflexion and discussion activity

### Topic 1: The taste for discovery

Be it science, the arts, languages or physical education, everything is open to investigation.

### Topic 2: On the same frequency – in harmony with nature

Across continents, the rhythm of human life is determined by the seasons, the weather and variations in climate.

### Topic 3: Imagine what endures – Building bridges to the past

When you look closely, you can see that our environment is dotted with footprints from the past.



# Cultural activities in mathematics

## Examples of references to Inuit culture

- ◉ Calculate the size of the Inuit territory of Nunavik by reading this activity and discovering this culture:  
[papyrus.bib.umontreal.ca/xmlui/bitstream/handle/1866/18266/Bortuzo\\_Jacqueline\\_2006\\_memoire.pdf?sequence=1&isAllowed=y](http://papyrus.bib.umontreal.ca/xmlui/bitstream/handle/1866/18266/Bortuzo_Jacqueline_2006_memoire.pdf?sequence=1&isAllowed=y) [available in French only]
- ◉ Calculate the number of people in the Nord-du-Québec region that speak Inuktituk



## Cultural activities in mathematics

### Examples of references to the cultures of Indigenous peoples

- ◉ The medicine wheel or the circle of life  
(Cosmic symbol representing the order of the universe)  
Students recreate the medicine wheel:  
[cspgno.ca/des-eleves-recreent-la-roue-de-medecine-autochtone](https://cspgno.ca/des-eleves-recreent-la-roue-de-medecine-autochtone)  
[available in French only]
- ◉ The importance of play in children's education:  
Shadow game to discover similar shapes [www.rcaanc-cirnac.gc.ca/eng/1316530132377/1535460393645#un5](http://www.rcaanc-cirnac.gc.ca/eng/1316530132377/1535460393645#un5) (Unit 5)



## Cultural activities in mathematics

### Examples of references to historic cultures

Sophie Genest,  
Secondary school math  
teacher:  
experimentation with  
students in Secondary I.

## Évolution des sondages

Des années 1930 à aujourd'hui, regard sur  
les méthodes et leurs limites



Sophie Genest



## Cultural activities

- ◉ La symétrie, un problème de grand-mère? [available in French only]
  - [www.pelf.ca/Initiative/ApprocheCulturelle](http://www.pelf.ca/Initiative/ApprocheCulturelle)
- ◉ La culture et la statistique [available in French only]
  - [www.youtube.com/watch?v=aG7Xopqmcak&feature=youtu.be](http://www.youtube.com/watch?v=aG7Xopqmcak&feature=youtu.be)
  - [www.youtube.com/watch?v=RTuOCRWHGXA](http://www.youtube.com/watch?v=RTuOCRWHGXA)
- ◉ Les arts plastiques et la géométrie (kaléidoscope) [available in French only]
  - [www.youtube.com/watch?v=CJc9dawC-d8&feature=youtu.be](http://www.youtube.com/watch?v=CJc9dawC-d8&feature=youtu.be)

## Other resources

- **Constellations:** [constellations.education.gouv.qc.ca](http://constellations.education.gouv.qc.ca)
  - Suggested readings for all subjects
- **Télé-Québec en classe:** [enclasse.telequebec.tv](http://enclasse.telequebec.tv)
  - Secondary School Mathematics
    - Short video:
      - [L'histoire du système métrique](#)
      - [L'histoire de Pi](#)
  - Elementary School Mathematics
    - Short video: [À quoi ça sert... les maths?](#)

## 6

# Reflection questions

- ◉ And you? Can you imagine integrating a cultural dimension into your teaching?
- ◉ Concerns?
- ◉ Challenges?
- ◉ Ideas?





# Thank you!

## Any questions?

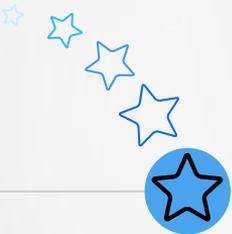
Contact us:

Mathematics program team:

[FGJ-math@education.gouv.qc.ca](mailto:FGJ-math@education.gouv.qc.ca)

Culture-Éducation team:

[politique-culturelle@education.gouv.qc.ca](mailto:politique-culturelle@education.gouv.qc.ca)



# Reflection and discussion activity

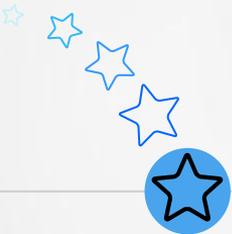
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WHAT?

WHY?

HOW?



## Reflection and discussion activity

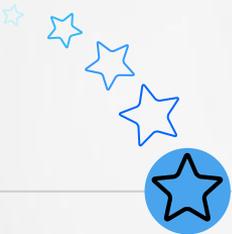
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# Reflection and discussion activity

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WHAT?

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