

# Best Practices

## Assessment Guidelines

For the Secondary Classroom Teacher

With a Student Who Has a Visual Impairment and

## Reads Braille

# Mathematics

2010

A Resource Project by the Provincial Resource Centre for the Visually Impaired (PRCVI)

PRCVI is a Ministry of Education Provincial Resource Program

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# **Math for Secondary Students Who Use Braille**

## **Mission Statement**

Students with visual impairments have unique needs and challenges when demonstrating subject knowledge through tests. The responsibility for assessments lies with the classroom teacher. With appropriate accommodations, students with visual impairments are able to accurately demonstrate their knowledge and skills. Most test questions can be formulated or adapted to minimize the need to acquire and process visual information.

Many of the following suggested guidelines may be beneficial to all students.

The following guidelines have been developed to assist classroom teachers in making assessment accommodations to both informal and formal tests without compromising integrity, reliability or validity. A Teacher of Students with Visual Impairments should be consulted during the development of test items.

## **Math Exams – Braille Format**

Provide a copy of the exam to the transcribers as far in advance as possible. A minimum of one week is required for preparing, reviewing and proof reading a braille exam. Braille transcribers may need additional lead time to prepare exams depending on complexity and length. Graphs, charts and tactile diagrams are time consuming to prepare.

## **Test Administration:**

- Students with visual impairments should be expected to demonstrate competency in the same learning outcomes as their peers.
- Extra time may be required (often 3 or 4 times above what is required for a sighted student).
- Longer exams may need to be divided into sections to allow for them to be taken over a period of time or even days, with breaks during each sitting.
- A separate setting with qualified supervision must be available.
- Oral clarification of test questions should be provided to the student by a supervisor, if needed.
- Provision must be made for students to respond to test items using the equipment or materials best suited and/or familiar to them.
- Students with visual impairments should be active participants in lab tests and/or paired with a sighted partner when necessary.

## **Formulation of Test Questions**

- Questions that contain complex visual information should be reviewed. Adaptations may be made or questions may be replaced as long as mastery of learning outcomes is demonstrated.
- Tactile tables, diagrams and graphs are difficult and time consuming to interpret and process. Students must have previous experience and familiarity with the layout of tactile graphics and 3-D models presented on an exam.
- 3-D models or real objects may be necessary to substitute for some diagrams.

## Tables

**Redesign the question to include table information.**

### ***Instead of This***

Which factors determine the difference between gross pay and net pay?

I.	tax deductions
II.	CPP
III.	EI
IV.	commission

- A. II only
- B. IV only
- C. II and III only
- D. I, II, III only

### ***Try Doing It This Way***

Which factors (tax deductions, CPP, EI, commission) determine the difference between gross pay and net pay?

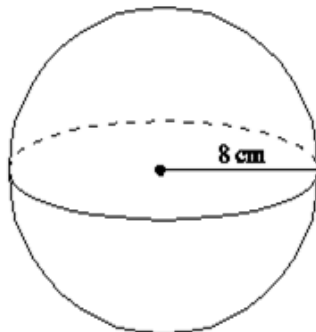
- A. CPP only
- B. commission only
- C. CPP and EI only
- D. tax deductions, CPP and EI only

## Redesign the question to include diagram information.

(perspective is very difficult for a student who is blind to interpret)

### *Instead of This*

Which of the following expressions represents the volume of the sphere below?



- A.  $4\pi(24) \text{ cm}^3$
- B.  $4\pi(8)^3 \text{ cm}^3$
- C.  $\frac{4}{3}\pi(24) \text{ cm}^3$
- D.  $\frac{4}{3}\pi(8)^3 \text{ cm}^3$

### *Try Doing It This Way*

Which of the following expressions represents the volume of the sphere with a radius of 8 cm?

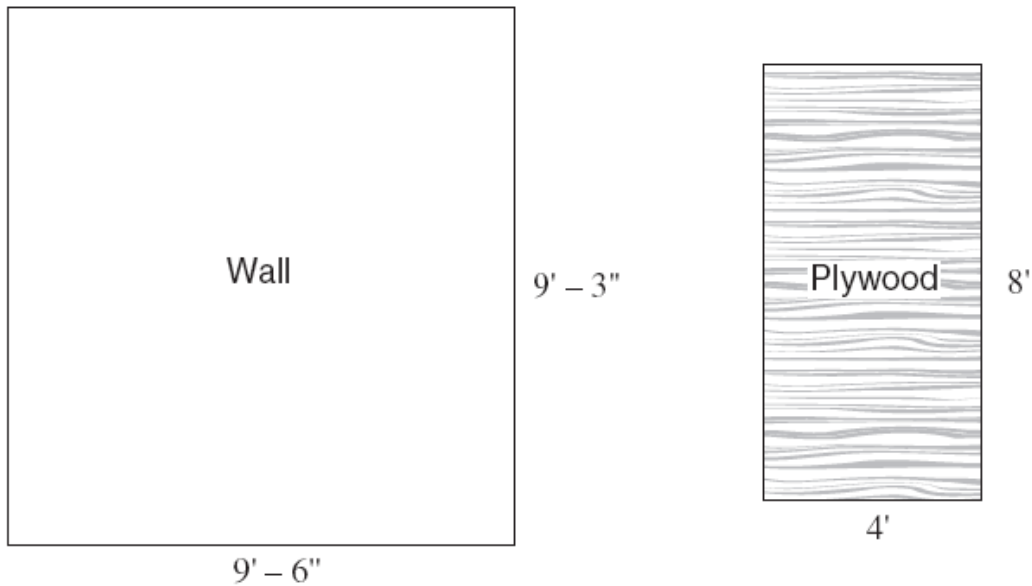
- A.  $4\pi(24) \text{ cm}^3$
- B.  $4\pi(8)^3 \text{ cm}^3$
- C.  $\frac{4}{3}\pi(24) \text{ cm}^3$
- D.  $\frac{4}{3}\pi(8)^3 \text{ cm}^3$

## Diagrams

**Redesign the question to include diagram information.**

### ***Instead of This***

Craig must completely cover the wall represented below with 4' X 8' sheets of plywood. A lumberyard charges him a fee per cut made to the plywood. What is the fewest number of cuts required?



- A. 2
- B. 3
- C. 4
- D. 5

### ***Try Doing It This Way***

Craig must completely cover the wall (9'-3" X 9'-6") with sheets of plywood.(4' X 8'). A lumberyard charges him a fee per cut made to the plywood. What is the fewest number of cuts required?

- A. 2
- B. 3
- C. 4
- D. 5



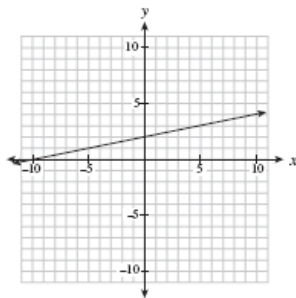
# Graphs

Redesign the question to reduce the amount of visual information represented by tactile graphics.

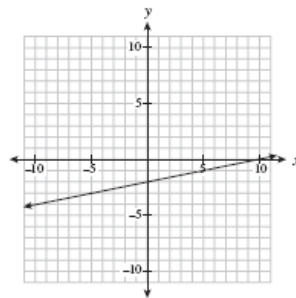
## *Instead of This*

1. Which graph represents the relation  $x - 5y + 10 = 0$ ?

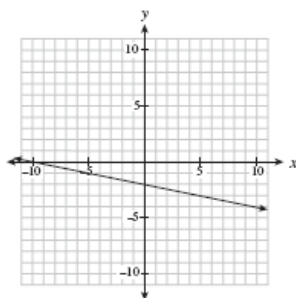
A.



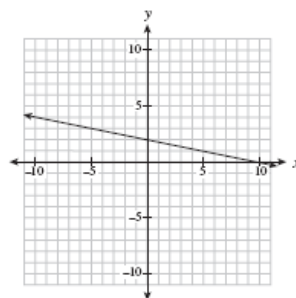
B.



C.

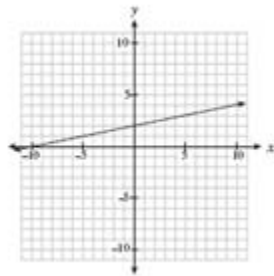


D.



## *Try Doing It This Way*

Which equation describes the linear relation graphed below?



- A.  $x - 5y + 10 = 0$
- B.  $x - 5y - 10 = 0$
- C.  $x - y - 2 = 0$
- D.  $5x - y + 2 = 0$

## Matching Columns (no longer used for Provincial Exams)

Redesign matching column questions into multiple choice format.

### *Instead of This*

Match each Irrational Expression on the left with the correct Equivalent Form on the right. Each Equivalent Form may be used once, more than once or not at all.	
Irrational Expression	Equivalent Form
9. $2\sqrt{12} + \sqrt{48} - \sqrt{75}$	A. $3\sqrt{3}$ B. $3\sqrt{6}$ C. $3 - \sqrt{6}$ D. $5 - 2\sqrt{6}$ E. $5 - \sqrt{3}$ F. $\frac{\sqrt{2}}{2}$
10. $(\sqrt{2} - \sqrt{3})^2$	
11. $\frac{\sqrt{3}}{\sqrt{2} + \sqrt{3}}$	

### *Try Doing It This Way*

Simplify

9.  $2\sqrt{12} + \sqrt{48} - \sqrt{75}$

- A.  $3\sqrt{3}$    B.  $3\sqrt{6}$    C.  $3 - \sqrt{6}$    D.  $5 - 2\sqrt{6}$    E.  $5 - \sqrt{3}$    F.  $\frac{\sqrt{2}}{2}$

Simplify

10.  $(\sqrt{2} - \sqrt{3})^2$

- A.  $3\sqrt{3}$    B.  $3\sqrt{6}$    C.  $3 - \sqrt{6}$    D.  $5 - 2\sqrt{6}$    E.  $5 - \sqrt{3}$    F.  $\frac{\sqrt{2}}{2}$

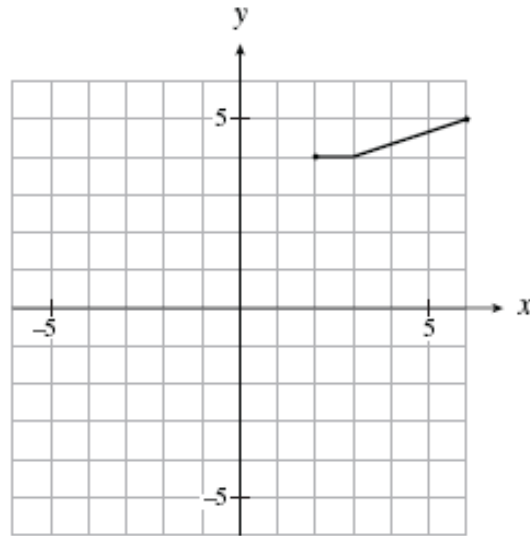
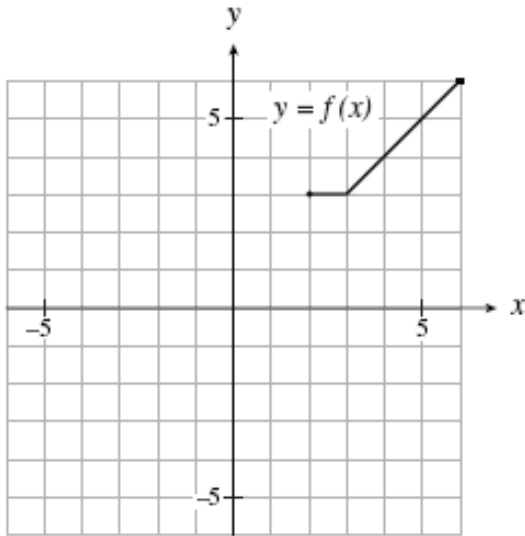
Simplify

11.  $\frac{\sqrt{3}}{\sqrt{2} + \sqrt{3}}$

- A.  $3\sqrt{3}$    B.  $3\sqrt{6}$    C.  $3 - \sqrt{6}$    D.  $5 - 2\sqrt{6}$    E.  $5 - \sqrt{3}$    F.  $\frac{\sqrt{2}}{2}$

## A question which is not feasible or practical to transcribe into braille. (Question deleted from exam)

The graph of  $y = f(x)$  is shown below on the left. Determine an equation of the function graphed on the right.



- A.  $y = \frac{1}{3}f(x) + 1$
- B.  $y = 3f(x) + 1$
- C.  $y = \frac{1}{3}f(x) + 3$
- D.  $y = 3f(x) + 3$

### If the question is not deleted Try Doing It This Way

A graph with the equation  $y = f(x)$  is transformed. The resulting graph has the equation  $y = f(x) + 3$ . What transformation was applied to the initial graph?

- A. Moved up by 3
- B. Moved down by 3
- C. Translated to the right by 3
- D. Translated to the left by 3

## Extraneous Information

Redesign the question to remove extraneous information.

### *Instead of This*

Refer To Data  
Booklet

Refer to the Sales Taxes in Canada in the Data Booklet  
to answer question 21.

	A	B	C	D	E	F	G	H	I	J
1	Item	Price (\$)	Quantity		Total (\$)					
2	T-shirt	15.99	20		319.80					
3	Shorts	23.99	12		287.88					
4	Socks	6.99	30							
5				Subtotal						
6				GST						
7				PST						
8				Total	874.60					

These items were purchased in Alberta.

- A. Statement is always true.
- B. Statement is sometimes true.
- C. Statement is never true.

### *Try Doing It This Way*

Canadian Sales Tax (GST) is 5%

Alberta Sales Tax (PST) is 0%

	A	B	C	D
1	Item	Quantity Price		Total (\$)
2	T-shirt	20 at \$15.99 ea.		319.80
3	Shorts	12 at \$23.99 ea		287.88
4	Socks	30 at \$5.99 ea		
5			Subtotal	
6			GST	
7			PST	
8			Total	874.60

These items were purchased in Alberta.

- A. Statement is always true.
- B. Statement is sometimes true.
- C. Statement is never true.

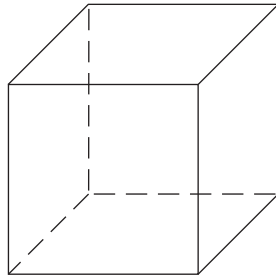
## **3-D Models** Example 1

### **3-D models may need to be substituted for diagrams**

(perspective is very difficult for a student who is blind to interpret)

### ***Instead of This***

How many edges are on the diagram?



- A. 6
- B. 8
- C. 9
- D. 12

### ***Try Doing It This Way***

### **Use a real 3-D Model (in this case a cube)**

How many edges are on a cube?

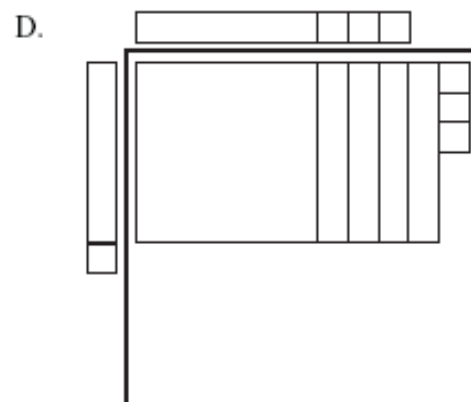
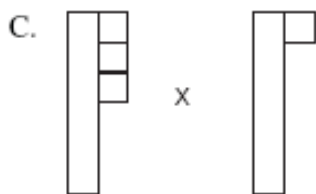
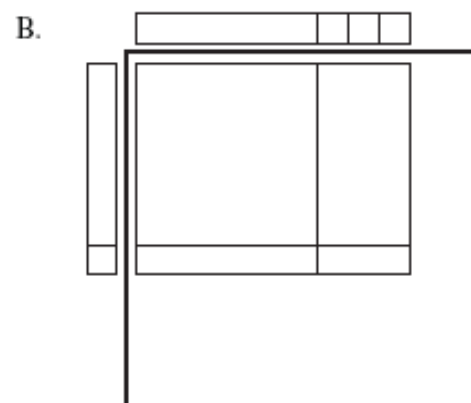
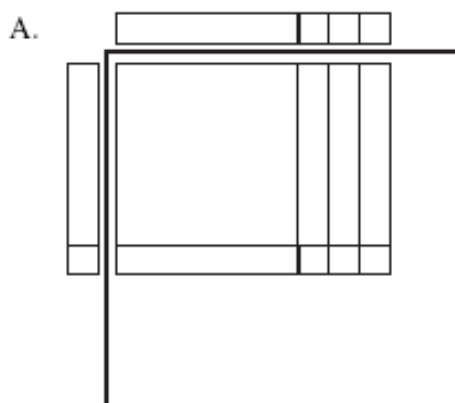
- A. 6
- B. 8
- C. 9
- D. 12

### 3-D Models Example 2

3-D models may need to be substituted for diagrams

#### ***Instead of This***

Which of the following diagrams best represents the expansion of  $(x + 3)(x + 1)$  pictorially?

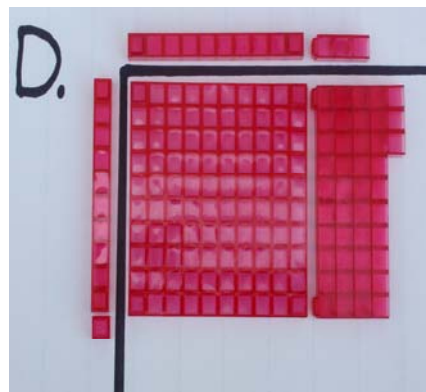
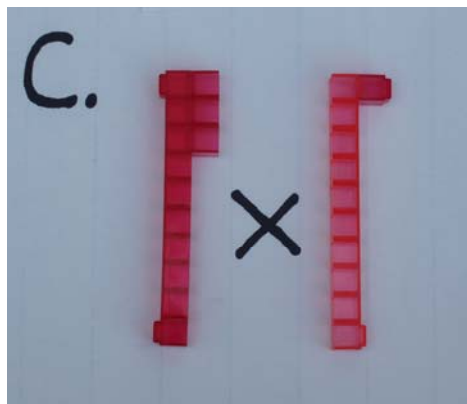
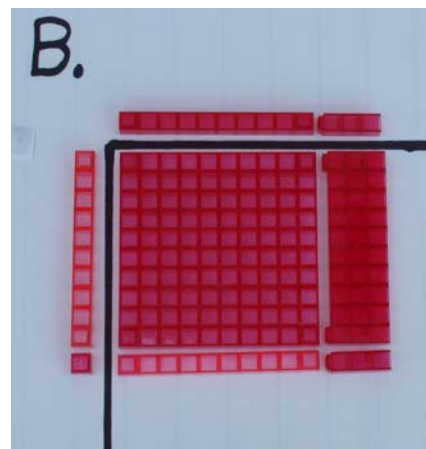
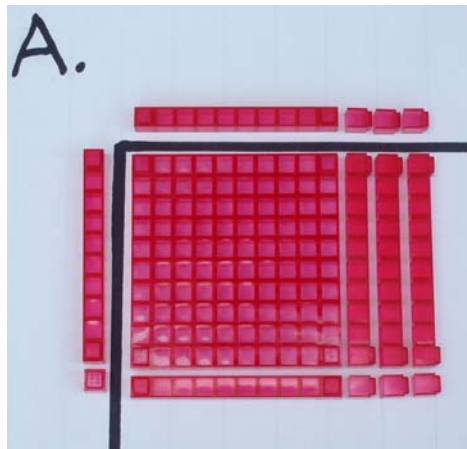


(See next page for redesigned question)

## Try Doing It This Way

Use a real 3-D Model (made with tactile materials eg: Math Tiles/Base Ten Blocks/teacher created etc.).

Which of the following models best represents the expansion of  $(x + 3)(x + 1)$ ?



## References:

- BC Ministry of Education Released Provincial Exams
- Classroom Teacher Created Exams and Assessments
- Allman, C. (2004). Making Tests Accessible for Students with Visual Impairments: A Guide for Test Publishers, Test Developers, and State Assessment Personnel. (2<sup>nd</sup> Edition). Louisville, KY: American Printing House for the Blind, Available from <http://www.aph.org>.