Released Questions with Provincial Data

Mathematics

In This Resource:

- **Details of the Assessment**

- **Results Reported**

- **Definitions of the Categories of Knowledge and Skills**

- **Suggested Uses for This Resource**

- **Questions**

- **Questions with Answers and Provincial Data**

This resource is provided to support educators with the EQAO Grade 9 Assessment of Mathematics. Each question on the assessment is mapped to a category of knowledge and skills and an overall and a specific expectation in *The Ontario Curriculum, Grade 9: Mathematics* (2021). This resource includes the definitions of the categories of knowledge and skills as well as examples of assessment questions. Detailed information about each question, including the overall expectation and category of knowledge and skills to which the question is mapped, the correct answer and provincial data, are provided. For more information about the assessment design, refer to the *Framework* at www.eqao.com.

DETAILS OF THE ASSESSMENT

The EQAO Grade 9 Assessment of Mathematics is an online assessment completed by students at the end of the Grade 9 mathematics course. The assessment uses a multi-stage computer adaptive testing model that adapts to the individual student's performance as the student progresses through the stages of the assessment (e.g., based on a student's performance in Stage 1, the student will be routed to a set of questions that is overall easier or more difficult in Stage 2). Though students are routed to different question sets, outcomes are put on the same scale, and overall levels of achievement are comparable.

The EQAO Grade 9 Assessment of Mathematics assesses the knowledge and skills that are defined in the expectations found in *The Ontario Curriculum, Grade 9: Mathematics* (2021). The questions assess students' knowledge and skills in the strands:

- Number
- Algebra
- Data
- Geometry and Measurement
- Financial Literacy

Although the assessment does not measure the content in the Mathematical Thinking and Making Connections strand, students will be required to apply mathematical processes while completing the assessment. The assessment does not measure the content in the Social-Emotional Learning (SEL) Skills in Mathematics strand.

Each question on the assessment is mapped to an overall and a specific curriculum expectation. Each question is also mapped to one of these categories of knowledge and skills:

- Knowledge and Understanding (**KU**)
- Application (**AP**)
- Thinking (**TH**)

Questions in the mathematics assessment do not assess the Communication category of knowledge and skills.

During each stage of the assessment, students complete questions mapped to each category of knowledge and skills assessed. The category assigned to each question assumes that students have been taught the knowledge and skills outlined in the Grade 9 mathematics curriculum, as the EQAO assessment is completed near the end of the Grade 9 mathematics course.

Regardless of how students are routed as they progress through the stages of the assessment, students complete the same number of questions from each of the various strands assessed, as the assessment follows a blueprint. The blueprint, which can be found in the *Framework,* defines how many questions a student will complete from each strand. This makes the assessment comparable from year to year. (For more information, see www.eqao.com.)

RESULTS REPORTED

The EQAO Grade 9 Assessment of Mathematics is a standards-referenced large-scale assessment based on the expectations and standards (levels of achievement) for student proficiency in *The Ontario Curriculum.* EQAO reports an overall level of achievement in mathematics for each student. EQAO does not provide scores by strand or by category of knowledge and skills at the student level, as each student does not complete enough questions mapped to each strand or skill to report on each accurately. However, through the EQAO secure reporting tool, the agency provides reports by strand and skill at the school, board and provincial levels for schools and boards to use for improvement planning.

DEFINITIONS OF THE CATEGORIES OF KNOWLEDGE AND SKILLS

EQAO has adapted the definitions of the three categories below from the achievement chart for mathematics found in the Ontario mathematics curriculum. This section outlines the definitions EQAO uses to determine the category for each question on the assessment.

For previous examples of questions mapped to the categories of knowledge and skills, please refer to the 2023 edition of this resource.

Knowledge and Understanding

A question is mapped to Knowledge and Understanding if in order to answer the question students must demonstrate only

- subject-specific content (knowledge) and/or
- comprehension of its meaning and significance (understanding).

These questions assess basic knowledge and/or understanding of concepts.

Application

A question is mapped to Application if in order to answer the question students must either

- select the appropriate tool or
- get the necessary information and "fit" it to the problem.

The category that a question is mapped to may change from Knowledge and Understanding to Application if a context is added or if a tool required to answer the question is not provided.

Thinking

A question is mapped to Thinking if in order to answer the question students must either

- select and sequence a variety of tools or
- demonstrate a critical thinking process (e.g., reasoning).

Students may need to make a plan to answer these questions.

SUGGESTED USES FOR THIS RESOURCE

Here is a suggested list of how the example questions can be used in the classroom:

Use questions without including the answer options. Students can answer the question and then discuss the steps required and other possible answers, including those arrived at through common errors or misconceptions. Discuss whether there are multiple methods that can be used to answer the question. Students can then compare their answer to the given options.

Use technology in the classroom to have students record answers instantly, which will allow for discussion of correct answers and the common errors or misconceptions associated with the incorrect options. The discussion can lead to a deeper understanding of concepts and assist students in correcting their own misconceptions.

Use questions as part of a pre- and post-assessment on a topic to show students their improved understanding within a unit.

Use questions when spiralling as a method to revisit topics.

Encourage students to use manipulatives, and model how to use them effectively. For example, graphing applications can be used with questions mapped to expectations in the Algebra strand as well as those mapped to other strands, such as Data, or Geometry and Measurement.

Analyze the provincial data for each question and consider how students at each level responded. Consider how the provincial data relates to how your students responded to the question. Review each answer option and how different responses can demonstrate potential strengths and areas for improvement.

QUESTIONS

These released questions are from the EQAO Grade 9 Assessment of Mathematics. This section provides the overall expectation and the category of knowledge and skills for each question.

B. NUMBER

B1. Development of Numbers and Number Sets

Demonstrate an understanding of the development and use of numbers, and make connections between sets of numbers

1 Which number is an irrational number?

KU

A | -4

B | $0.\overline{35}$

C | $-\dfrac{3}{7}$

D | $\sqrt{5}$

2 Set F and Set G are given.

TH

Set F = {2, 4, 6, 8, 10, 12,…}

Set G is the set of whole numbers that are multiples of 3.

Select the statement that correctly describes the numbers that are common to **both** Set F and Set G.

A | The common numbers are always divisible by 4.

B | The common numbers are always multiples of 6.

C | The common numbers are always odd numbers.

D | There are no common numbers between Set F and Set G.

B2. Powers

Represent numbers in various ways, evaluate powers, and simplify expressions by using the relationships between powers and their exponents

3 Which value is equivalent to 1.2×10^4?
KU

A | 120
B | 1200
C | 12 000
D | 120 000

4 Select the **TWO** expressions that are equivalent
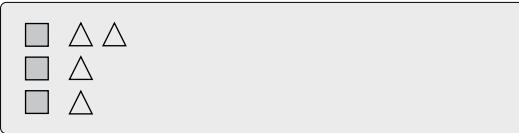**AP** to y^9.

A | $y^4 \times y^5$

B | $y^5 + y^4$

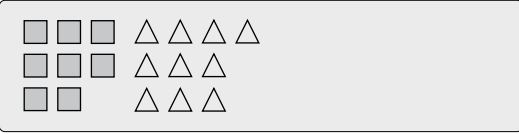C | $y^9 \times y^1$

D | $\dfrac{y^{10}}{y^1}$

B3. Number Sense and Operations

Apply an understanding of rational numbers, ratios, rates, percentages, and proportions, in various mathematical contexts, and to solve problems

5
KU Which option has a ratio of squares to triangles equivalent to 4:5?

A

B

C

D

6
TH A recipe uses $\frac{1}{3}$ cup of butter, $\frac{1}{4}$ cup of milk and $\frac{1}{2}$ cup of flour.

A baker has 4 cups of butter, 6 cups of milk and 7 cups of flour.

What is the maximum number of times the baker can make this exact recipe using what he has?

A | 4 times

B | 12 times

C | 14 times

D | 20 times

C. ALGEBRA

C1. Algebraic Expressions and Equations

Demonstrate an understanding of the development and use of algebraic concepts and of their connection to numbers, using various tools and representations

7 What is a simplified form of this expression?

KU

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

A | $2x^2 - 6x + 4$

B | $2x^2 - 3x + 2$

C | $2x^3 - 3x + 2$

D | $2x^3 - 6x^2 + 4x$

8 In a game, a participant moves a game piece around a board. The participant will receive 100 points if the game piece stops on a blue box, b, and will lose 50 points if the game piece stops on a yellow box, y.

AP

Which expression represents the participant's total score after completing the game?
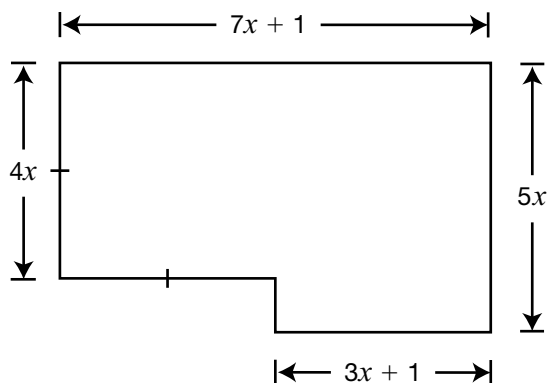
A | $100b + 50y$

B | $100b - 50y$

C | $100y + 50b$

D | $100y - 50b$

C1. Algebraic Expressions and Equations (continued)

9 Which algebraic expression represents the
TH **area** of this composite shape?

A	$31x^2 + 5x$
B	$23x + 2$
C	$35x^2 + 5x$
D	$36x^2$

C2. Coding

Apply coding skills to represent mathematical concepts and relationships dynamically, and to solve problems, in algebra and across the other strands

10 This pseudocode will be used to determine the hypotenuse of a right triangle
AP if the user inputs the lengths of the other two sides. A line is missing in the pseudocode.

> **sideA** = 0
> **sideB** = 0
> output "Enter the value of side a."
> store user input as **sideA**
> output "Enter the value of side b."
> store user input as **sideB**
>
> _____
>
> output "The length of the hypotenuse is", **hypotenuse**,"."

Hint: Remember the side-length relationship for right triangles is $a^2 + b^2 = c^2$.

Select the correct line of code to complete this pseudocode.

A | **hypotenuse** = $\sqrt{}$(**sideA** – **sideB**)

B | **hypotenuse** = $\sqrt{}$(**sideA** + **sideB**)

C | **hypotenuse** = $\sqrt{}$(**sideA** * **sideA** – **sideB** * **sideB**)

D | **hypotenuse** = $\sqrt{}$(**sideA** * **sideA** + **sideB** * **sideB**)

C2. Coding (continued)

11 Pseudocode is written to determine if the sum of two numbers is equal to 8.

TH

Two lines of pseudocode are missing.

Drag and drop the two missing lines of pseudocode to the correct positions.

numberA = 0
numberB = 0
output "Enter the first number."

[ ]

output "Enter the second number."
store user input as **numberB**

if [ ]

output "The sum of the two numbers is 8."
else
output "The sum of the two numbers is not 8."

A	store user input as **numberA**

B	store user input as **numberA** = 8

C	**numberA** − **numberB** = 8

D	**numberA** * **numberB** = 8

E	**numberA** + **numberB** = 8

C3. Application of Relations

Represent and compare linear and non-linear relations that model real-life situations, and use these representations to make predictions

12 This table shows the relationship between the
KU distance an object travels and time.

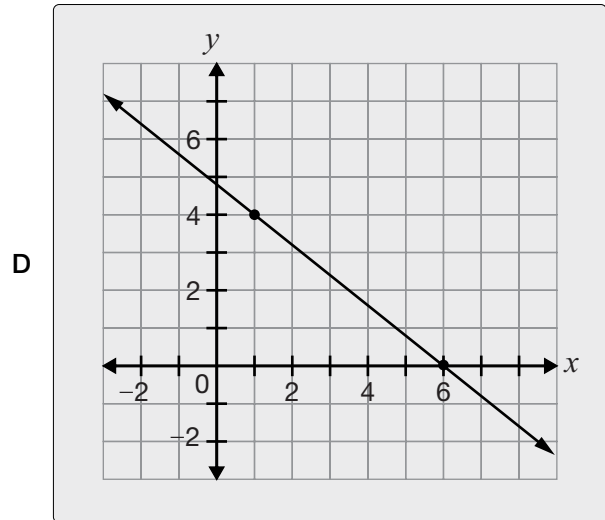| Time (s)	Distance (m)
0	0
1	1.5
2	3.0
3	4.5

If the object travels at a constant rate of change, what distance does it travel in 5 seconds?

A   6.0 m

B   6.5 m

C   7.5 m

D   9.0 m

C4. Characteristics of Relations

Demonstrate an understanding of the characteristics of various representations of linear and nonlinear relations, using tools, including coding when appropriate

13 Which line has a slope of $-\dfrac{4}{5}$ and a y-intercept of 6?

KU

A

B

C

D

C4. Characteristics of Relations (continued)

14
AP
This table shows information about the relationship between the amount of water in a pool, in litres, and time, in minutes.

The pool is being emptied at a constant rate.

Time (min)	Amount of water in the pool (L)
0	60 000
10	55 000
20	50 000
40	40 000

What is the total time required to empty the pool?

A | 60 min
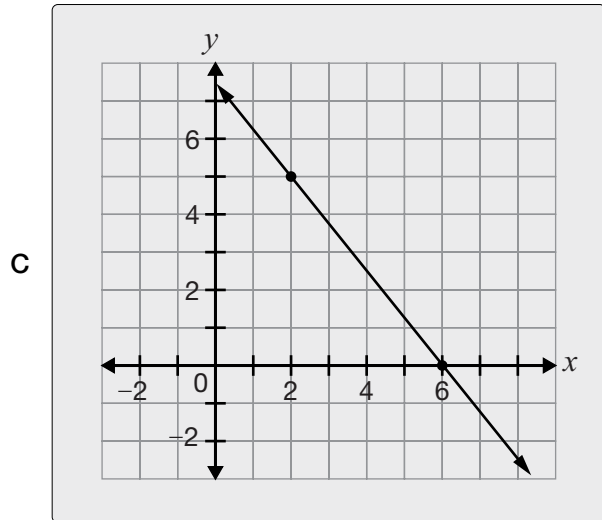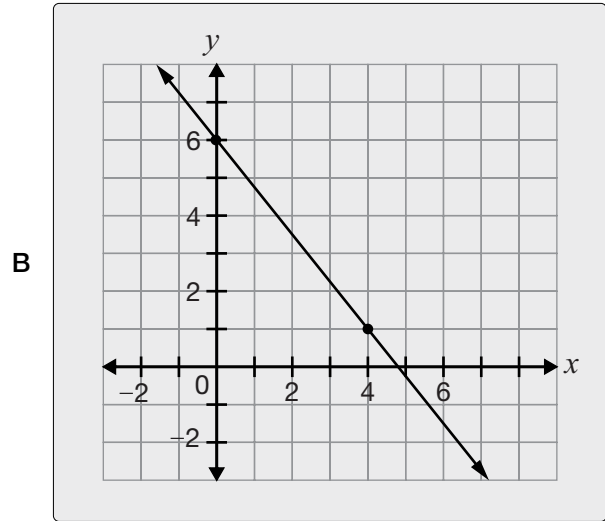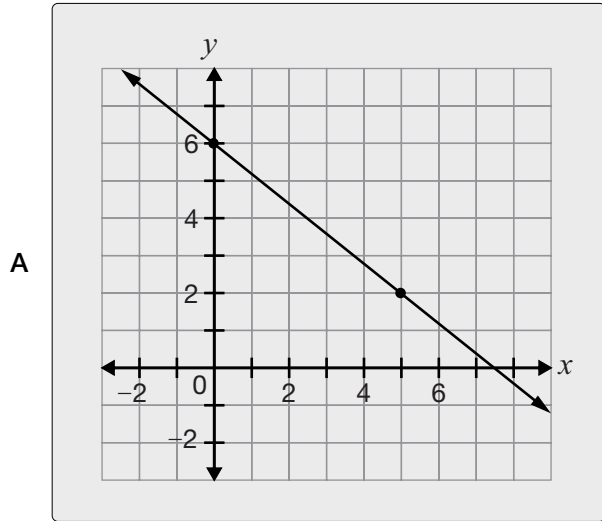
B | 80 min

C | 120 min

D | 200 min

D. DATA

D1. Collection, Representation, and Analysis of Data

Describe the collection and use of data, and represent and analyse data involving one and two variables

15 Drag and drop each graph into the box that correctly describes the relationship in the graph.
KU
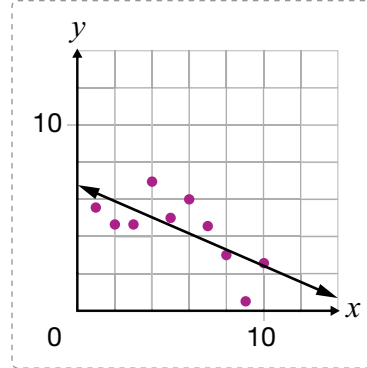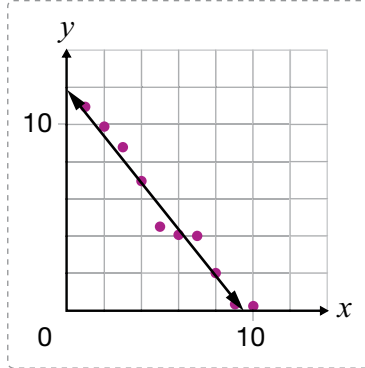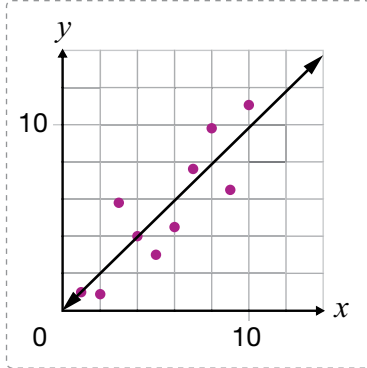
Strong negative correlation	Weak negative correlation	Strong positive correlation

D1. Collection, Representation, and Analysis of Data (continued)

16
AP These box plots represent the number of books students in Class A and Class B read throughout the year.
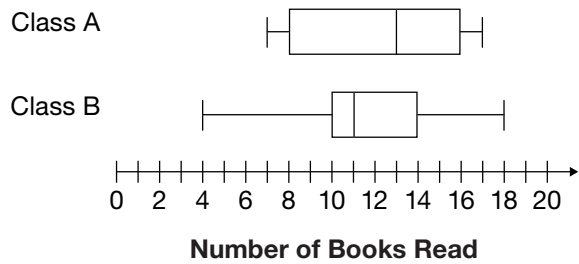
Class A

Class B

0 2 4 6 8 10 12 14 16 18 20

Number of Books Read

Select the **TWO** correct statements.

A | The student who read the most books is in Class A.

B | The range between quartile 1 and quartile 3 in Class A is 8.

C | The median of Class A is higher than the median of Class B.

D | The range of the number of books read is larger in Class A than in Class B.

D2. Mathematical Modelling

Apply the process of mathematical modelling, using data and mathematical concepts from other strands, to represent, analyse, make predictions, and provide insight into real-life situations

17 **AP** An ice cream company wants to be able to predict the number of ice cream treats that will be sold each day.

Which piece of information would be **least** helpful to collect for the company to make this prediction?

A | day of the week

B | average daily temperature

C | past daily sales of ice cream treats

D | cost of packaging of the ice cream treats

18 **TH** A radar counts the number of vehicles passing through an intersection every day from Monday to Friday. The data is recorded, and a model of the relationship between the number of vehicles passing through the intersection and the time of day is created.

Number of Vehicles vs. Time of Day

Based on the model created, which prediction is correct?

Between Monday and Friday,

A | the number of vehicles passing through the intersection will remain constant throughout the day.

B | the intersection will have twice as many vehicles passing through it at 1:00 p.m. than at 9:00 p.m.

C | the number of vehicles passing through the intersection is always increasing.

D | the busiest time of day will be between 5:00 p.m. and 6:00 p.m.

E. GEOMETRY AND MEASUREMENT

E1. Geometric and Measurement Relationships

Demonstrate an understanding of the development and use of geometric and measurement relationships, and apply these relationships to solve problems, including problems involving real-life situations

19
KU
A wire connects the top of a hydro pole to the ground 4 m away from the base of the hydro pole. The hydro pole measures 13 m.

Hint: You can use the side-length relationship for right triangles, $a^2 + b^2 = c^2$.

Which measurement is closest to the length of the wire from the top of the hydro pole to the ground?

A | 4.1 m

B | 12.4 m

C | 13.6 m

D | 17.0 m

20
AP
What is the value of x in this diagram?

A | 51°

B | 52°

C | 60°

D | 77°

E1. Geometric and Measurement Relationships (continued)

21
TH
These two cylinders and this cone all have the same circular base and the same height.

The first cylinder is completely filled with water. The cone and second cylinder are empty.

The water from the first cylinder is poured into the cone until it is completely full. The rest of the water is poured into the second cylinder.

How **full** will the second cylinder be?

A $\frac{1}{4}$ full

B $\frac{1}{3}$ full

C $\frac{1}{2}$ full

D $\frac{2}{3}$ full

F. FINANCIAL LITERACY

F1. Financial Decisions

Demonstrate the knowledge and skills needed to make informed financial decisions

22 Dustin wants to get a loan from a bank.

AP

Complete the statement so that he pays the least total amount of interest.

Dustin should go with the bank that offers a monthly

interest rate of [⌄], and he should pay the loan

back over [⌄].

⌄
1%
5%
10%

⌄
6 months
1 year
5 years

F1. Financial Decisions (continued)

23 A person purchases two different items. This graph represents
AP the value of each item over time, in years.

**Value of Item vs.
Number of Years Since Purchase**
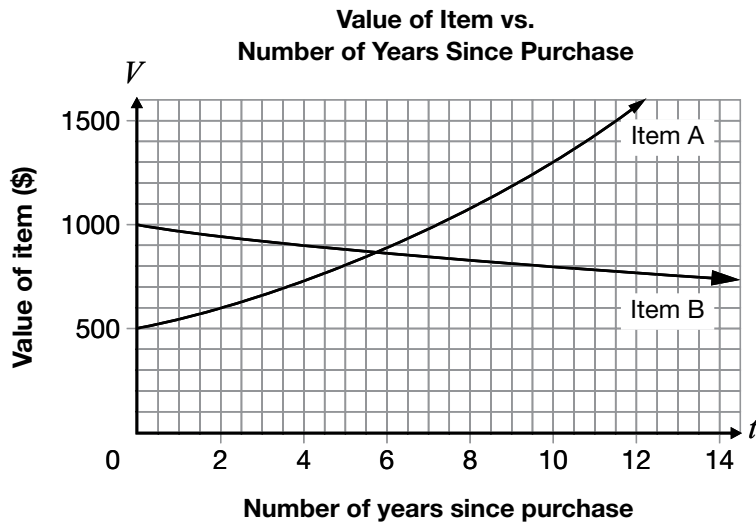
Complete the following statements.

Item [⌄] is an example of appreciation.

From the date of purchase, the value of the item

appreciates by 20% after approximately [⌄] years.

[⌄]
A
B

[⌄]
2
4
9
12

QUESTIONS WITH ANSWERS AND PROVINCIAL DATA

Sample Data with Observations

In this section, each question is presented with the correct response and its data in a table. This data shows the percentage of students who selected each answer choice by level. The observations that follow each table are provided for consideration as the data in the table is analyzed.

There are no questions in this EQAO resource where more than 100 fully participating students achieved Below Level 1 and responded to the question. Therefore, data is not provided for students who achieved Below Level 1.

	No Response	A	B	C	D
Level 1	1	13	37	29	20
Level 2	0	10	55	22	12
Level 3	0	5	75	14	7
Level 4	0	1	92	4	2

LEGEND			
0-24	25-49	50-79	80-100

The correct answer, option B, was selected by
- 37% of all students who received Level 1;
- 55% of all students who received Level 2;
- 75% of all students who received Level 3 and
- 92% of all students who received Level 4.

Among all the students who received a Level 3 on the assessment,
- 75% selected the correct answer, option B;
- 5% selected option A;
- 14% selected option C and
- 7% selected option D.

One of the incorrect answers, option C, was selected by 29% of students who received a Level 1 and 22% of students who received Level 2.

Reminders:

- The percentages in a row for a particular question and a particular level are not provided when the row's sample size is fewer than 100 students. In these cases, ND (not enough data) is shown.
- The percentages in each row may not add up to 100%, due to rounding.
- The legend provided applies to each table with the data.
- For some of the questions in this resource, the data provided shows the percentage of students whose responses were fully correct, partially correct or incorrect at each achievement level.

Using the Data

There are many things to consider when reviewing the data. It is not possible to know why the students selected the response they did. In a single-selection question with four options, if the percentages in one row (at a specific level) are approximately 25% each, this may demonstrate that many of the students who received the particular level guessed.

B. NUMBER

B1. Development of Numbers and Number Sets

Demonstrate an understanding of the development and use of numbers, and make connections between sets of numbers

1 Which number is an irrational number?
KU

A	-4
B	$0.\overline{35}$
C	$-\dfrac{3}{7}$
D	$\sqrt{5}$

English-Language Schools

	No Response	A	B	C	D
Level 1	0	12	46	15	27
Level 2	0	8	42	15	36
Level 3	0	6	32	14	48
Level 4	ND	ND	ND	ND	ND

Among students who received this question, 48% who achieved a Level 3 on the assessment, 36% who achieved a Level 2 and 27% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	10	47	9	34
Level 2	0	12	32	13	43
Level 3	0	6	27	16	50
Level 4	ND	ND	ND	ND	ND

Among students who received this question, 50% who achieved a Level 3 on the assessment, 43% who achieved a Level 2 and 34% who achieved a Level 1 selected the correct response.

B1. Development of Numbers and Number Sets (continued)

2 Set F and Set G are given.

TH

Set F = {2, 4, 6, 8, 10, 12,…}

Set G is the set of whole numbers that are multiples of 3.

Select the statement that correctly describes the numbers that are common to **both** Set F and Set G.

A	The common numbers are always divisible by 4.
B	The common numbers are always multiples of 6.
C	The common numbers are always odd numbers.
D	There are no common numbers between Set F and Set G.

English-Language Schools

	No Response	A	B	C	D
Level 1	1	24	34	22	19
Level 2	0	16	54	10	20
Level 3	0	6	81	3	11
Level 4	0	0	97	0	2

Among students who received this question, 81% who achieved a Level 3 on the assessment, 54% who achieved a Level 2 and 34% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	25	22	24	28
Level 2	0	16	41	14	28
Level 3	0	7	70	5	18
Level 4	0	1	95	1	3

Among students who received this question, 70% who achieved a Level 3 on the assessment, 41% who achieved a Level 2 and 22% who achieved a Level 1 selected the correct response.

B2. Powers

Represent numbers in various ways, evaluate powers, and simplify expressions by using the relationships between powers and their exponents

3 Which value is equivalent to 1.2×10^4?
KU

A	120
B	1200
C	**12 000**
D	120 000

English-Language Schools

	No Response	A	B	C	D
Level 1	0	10	14	50	25
Level 2	0	2	4	79	15
Level 3	0	0	1	94	5
Level 4	ND	ND	ND	ND	ND

Among students who received this question, 94% who achieved a Level 3 on the assessment, 79% who achieved a Level 2 and 50% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	4	10	62	24
Level 2	0	1	4	83	12
Level 3	0	0	1	92	7
Level 4	ND	ND	ND	ND	ND

Among students who received this question, 92% who achieved a Level 3 on the assessment, 83% who achieved a Level 2 and 62% who achieved a Level 1 selected the correct response.

B2. Powers (continued)

4 Select the **TWO** expressions that are equivalent to y^9.
AP

A $\quad y^4 \times y^5$

B $\quad y^5 + y^4$

C $\quad y^9 \times y^1$

D $\quad \dfrac{y^{10}}{y^1}$

English-Language Schools

	No Response	Fully Correct (A&D)	Partially Correct (A)	Partially Correct (D)	Fully Incorrect
Level 1	0	8	30	18	43
Level 2	0	21	24	18	37
Level 3	0	65	10	15	11
Level 4	0	96	1	3	0

Among students who received this question, 65% who achieved a Level 3 on the assessment, 21% who achieved a Level 2 and 8% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	Fully Correct (A&D)	Partially Correct (A)	Partially Correct (D)	Fully Incorrect
Level 1	0	8	27	13	52
Level 2	0	34	23	16	27
Level 3	0	75	8	10	6
Level 4	0	97	0	3	1

Among students who received this question, 75% who achieved a Level 3 on the assessment, 34% who achieved a Level 2 and 8% who achieved a Level 1 selected the correct response.

B3. Number Sense and Operations
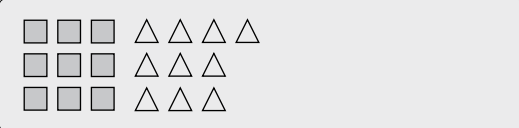
Apply an understanding of rational numbers, ratios, rates, percentages, and proportions, in various mathematical contexts, and to solve problems

5 **KU** Which option has a ratio of squares to triangles equivalent to 4:5?

A

B

C

D

English-Language Schools

	No Response	A	B	C	D
Level 1	1	31	39	21	9
Level 2	0	17	24	49	9
Level 3	0	3	5	90	3
Level 4	0	0	0	100	0

Among students who received this question, 90% who achieved a Level 3 on the assessment, 49% who achieved a Level 2 and 21% who achieved a Level 1 selected the correct response.

French-Language Schools

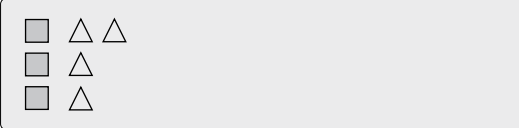|	No Response	A	B	C	D
Level 1	0	32	37	23	8
Level 2	0	1C	26	52	9
Level 3	0	3	7	86	4
Level 4	0	0	1	99	0

Among students who received this question, 86% who achieved a Level 3 on the assessment, 52% who achieved a Level 2 and 23% who achieved a Level 1 selected the correct response.
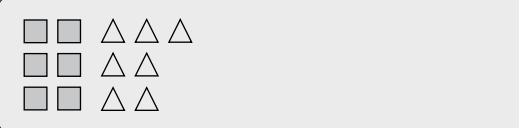
B3. Number Sense and Operations (continued)

6 A recipe uses $\frac{1}{3}$ cup of butter, $\frac{1}{4}$ cup of milk

TH and $\frac{1}{2}$ cup of flour.

A baker has 4 cups of butter, 6 cups of milk and 7 cups of flour.

What is the maximum number of times the baker can make this exact recipe using what he has?

A	4 times

B	12 times

C	14 times

D	20 times

English-Language Schools

	No Response	A	B	C	D
Level 1	0	28	37	25	11
Level 2	0	26	48	22	4
Level 3	0	11	78	11	1
Level 4	0	1	97	2	0

Among students who received this question, 78% who achieved a Level 3 on the assessment, 48% who achieved a Level 2 and 37% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	1	25	38	28	9
Level 2	0	27	47	21	5
Level 3	0	12	77	10	2
Level 4	0	2	95	3	0

Among students who received this question, 77% who achieved a Level 3 on the assessment, 47% who achieved a Level 2 and 38% who achieved a Level 1 selected the correct response.

C. ALGEBRA

C1. Algebraic Expressions and Equations

Demonstrate an understanding of the development and use of algebraic concepts and of their connection to numbers, using various tools and representations

7 What is a simplified form of this expression?

KU

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

A $2x^2 - 6x + 4$

B $2x^2 - 3x + 2$

C $2x^3 - 3x + 2$

D $2x^3 - 6x^2 + 4x$

English-Language Schools

	No Response	A	B	C	D
Level 1	0	29	34	16	21
Level 2	0	24	21	19	36
Level 3	0	10	4	7	79
Level 4	0	1	0	0	99

Among students who received this question, 79% who achieved a Level 3 on the assessment, 36% who achieved a Level 2 and 21% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	29	27	20	24
Level 2	0	24	12	15	49
Level 3	0	9	2	3	87
Level 4	0	1	0	0	99

Among students who received this question, 87% who achieved a Level 3 on the assessment, 49% who achieved a Level 2 and 24% who achieved a Level 1 selected the correct response.

C1. Algebraic Expressions and Equations (continued)

8
AP In a game, a participant moves a game piece around a board. The participant will receive 100 points if the game piece stops on a blue box, b, and will lose 50 points if the game piece stops on a yellow box, y.

Which expression represents the participant's total score after completing the game?

A $100b + 50y$

B $100b - 50y$

C $100y + 50b$

D $100y - 50b$

English-Language Schools

	No Response	A	B	C	D
Level 1	1	20	50	12	16
Level 2	0	6	86	2	6
Level 3	0	2	96	0	2
Level 4	ND	ND	ND	ND	ND

Among students who received this question, 96% who achieved a Level 3 on the assessment, 86% who achieved a Level 2 and 50% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	18	68	6	8
Level 2	0	8	87	1	5
Level 3	0	1	97	1	1
Level 4	ND	ND	ND	ND	ND

Among students who received this question, 97% who achieved a Level 3 on the assessment, 87% who achieved a Level 2 and 68% who achieved a Level 1 selected the correct response.

C1. Algebraic Expressions and Equations (continued)

9 Which algebraic expression represents the
TH **area** of this composite shape?

A $31x^2 + 5x$

B $23x + 2$

C $35x^2 + 5x$

D $36x^2$

English-Language Schools

	No Response	A	B	C	D
Level 1	ND	ND	ND	ND	ND
Level 2	1	20	52	18	10
Level 3	0	40	43	9	7
Level 4	0	91	6	1	1

Among students who received this question, 40% who achieved a Level 3 on the assessment and 20% who achieved a Level 2 selected the correct response.
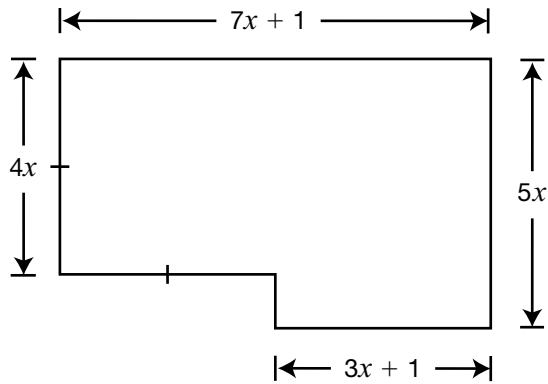
French-Language Schools

	No Response	A	B	C	D
Level 1	ND	ND	ND	ND	ND
Level 2	0	33	58	0	8
Level 3	0	54	33	6	6
Level 4	0	93	3	3	1

Among students who received this question, 54% who achieved a Level 3 on the assessment and 33% who achieved a Level 2 selected the correct response.

C2. Coding

Apply coding skills to represent mathematical concepts and relationships dynamically, and to solve problems, in algebra and across the other strands

10 This pseudocode will be used to determine the hypotenuse of a right triangle if the
AP user inputs the lengths of the other two sides. A line is missing in the pseudocode.

> **sideA** = 0
> **sideB** = 0
> output "Enter the value of side a."
> store user input as **sideA**
> output "Enter the value of side b."
> store user input as **sideB**
>
> **hypotenuse** = √(**sideA** * **sideA** + **sideB** * **sideB**)
>
> output "The length of the hypotenuse is", **hypotenuse**,"."

Hint: Remember the side-length relationship for right triangles is $a^2 + b^2 = c^2$.

Select the correct line of code to complete this pseudocode.

A | **hypotenuse** = √(**sideA** − **sideB**)

B | **hypotenuse** = √(**sideA** + **sideB**)

C | **hypotenuse** = √(**sideA** * **sideA** − **sideB** * **sideB**)

D | **hypotenuse** = √(**sideA** * **sideA** + **sideB** * **sideB**)

English-Language Schools

	No Response	A	B	C	D
Level 1	2	19	44	21	14
Level 2	1	9	45	13	32
Level 3	0	2	21	5	72
Level 4	0	0	2	1	98

Among students who received this question, 72% who achieved a Level 3 on the assessment, 32% who achieved a Level 2 and 14% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	2	17	44	20	17
Level 2	0	8	46	13	33
Level 3	0	2	25	5	68
Level 4	0	0	1	1	98

Among students who received this question, 68% who achieved a Level 3 on the assessment, 33% who achieved a Level 2 and 17% who achieved a Level 1 selected the correct response.

C2. Coding (continued)

11 Pseudocode is written to determine if the sum of two numbers is equal to 8.

TH Two lines of pseudocode are missing.

Drag and drop the two missing lines of pseudocode to the correct positions.

numberA = 0
numberB = 0
output "Enter the first number."

> store user input as **numberA**

output "Enter the second number."
store user input as **numberB**

if numberA + numberB = 8

output "The sum of the two numbers is 8."
else
output "The sum of the two numbers is not 8."

A	store user input as **numberA**
B	store user input as **numberA** = 8
C	**numberA** − **numberB** = 8
D	**numberA** * **numberB** = 8
E	**numberA** + **numberB** = 8

English-Language Schools

	No Response	Fully Correct (A&E)	Partially Correct (A)	Partially Correct (E)	Fully Incorrect
Level 1	4	11	31	12	42
Level 2	2	34	31	11	23
Level 3	0	73	15	6	6
Level 4	0	97	2	1	0

Among students who received this question, 73% who achieved a Level 3 on the assessment, 34% who achieved a Level 2 and 11% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	Fully Correct (A&E)	Partially Correct (A)	Partially Correct (E)	Fully Incorrect
Level 1	2	8	30	15	45
Level 2	1	34	31	11	23
Level 3	0	70	15	8	7
Level 4	0	98	1	0	0

Among students who received this question, 70% who achieved a Level 3 on the assessment, 34% who achieved a Level 2 and 8% who achieved a Level 1 selected the correct response.

C3. Application of Relations

Represent and compare linear and non-linear relations that model real-life situations, and use these representations to make predictions

12
KU This table shows the relationship between the distance an object travels and time.

Time (s)	Distance (m)
0	0
1	1.5
2	3.0
3	4.5

A   6.0 m

B   6.5 m

C   7.5 m

D   9.0 m

If the object travels at a constant rate of change, what distance does it travel in 5 seconds?

English-Language Schools

	No Response	A	B	C	D
Level 1	0	29	28	32	10
Level 2	0	9	8	80	2
Level 3	0	2	2	96	1
Level 4	ND	ND	ND	ND	ND

Among students who received this question, 96% who achieved a Level 3 on the assessment, 80% who achieved a Level 2 and 32% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	25	22	40	12
Level 2	0	4	8	86	2
Level 3	0	4	3	93	0
Level 4	ND	ND	ND	ND	ND

Among students who received this question, 93% who achieved a Level 3 on the assessment, 86% who achieved a Level 2 and 40% who achieved a Level 1 selected the correct response.

C4. Characteristics of Relations

Demonstrate an understanding of the characteristics of various representations of linear and nonlinear relations, using tools, including coding when appropriate

13 Which line has a slope of $-\frac{4}{5}$ and a y-intercept of 6?
KU

A

B

C

D

English-Language Schools

	No Response	A	B	C	D
Level 1	0	20	37	14	27
Level 2	0	43	35	7	16
Level 3	0	81	14	1	4
Level 4	0	98	2	0	1

Among students who received this question, 81% who achieved a Level 3 on the assessment, 43% who achieved a Level 2 and 20% who achieved a Level 1 selected the correct response.
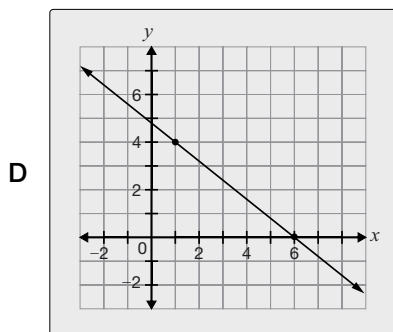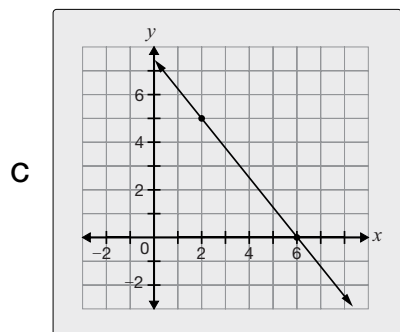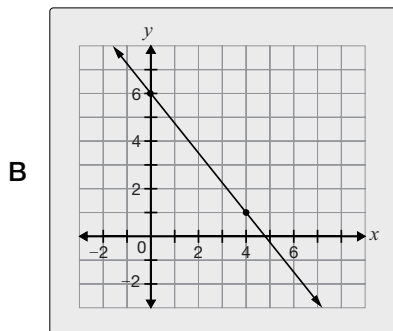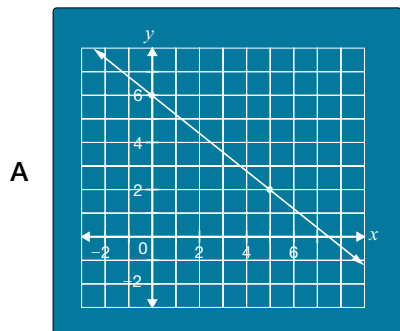
French-Language Schools

	No Response	A	B	C	D
Level 1	0	18	32	16	34
Level 2	0	32	29	12	26
Level 3	0	68	18	5	9
Level 4	0	97	2	0	1

Among students who received this question, 68% who achieved a Level 3 on the assessment, 32% who achieved a Level 2 and 18% who achieved a Level 1 selected the correct response.

C4. Characteristics of Relations (continued)

14
AP This table shows information about the relationship between the amount of water in a pool, in litres, and time, in minutes.

The pool is being emptied at a constant rate.

Time (min)	Amount of water in the pool (L)
0	60 000
10	55 000
20	50 000
40	40 000

What is the total time required to empty the pool?

A | 60 min
B | 80 min
C | 120 min
D | 200 min

English-Language Schools

	No Response	A	B	C	D
Level 1	0	24	36	27	13
Level 2	0	8	32	51	9
Level 3	0	2	14	80	4
Level 4	0	0	2	98	0

Among students who received this question, 80% who achieved a Level 3 on the assessment, 51% who achieved a Level 2 and 27% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	21	39	29	11
Level 2	0	7	32	53	8
Level 3	0	2	15	79	3
Level 4	0	0	2	98	0

Among students who received this question, 79% who achieved a Level 3 on the assessment, 53% who achieved a Level 2 and 29% who achieved a Level 1 selected the correct response.

D. DATA

D1. Collection, Representation, and Analysis of Data

Describe the collection and use of data, and represent and analyse data involving one and two variables

15 Drag and drop each graph into the box that correctly describes the relationship in the graph.
KU

Strong negative correlation	Weak negative correlation	Strong positive correlation
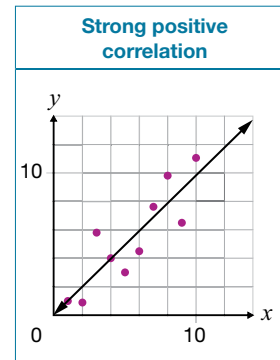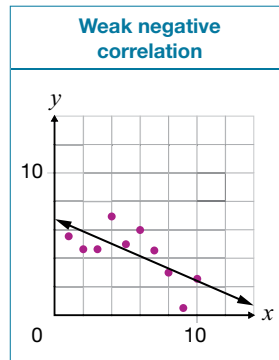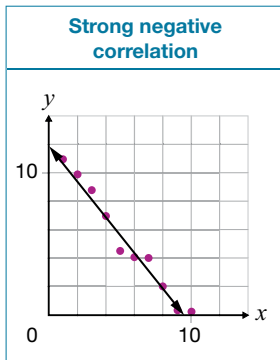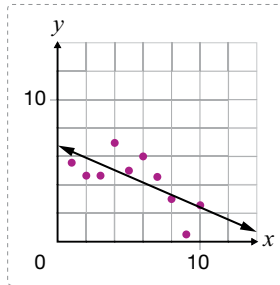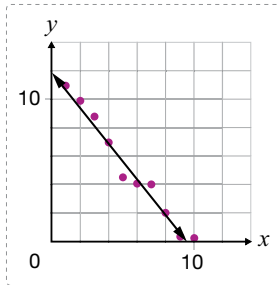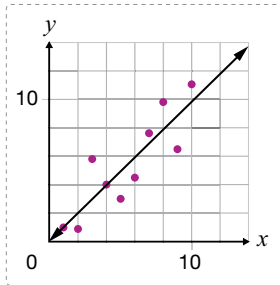
English-Language Schools

	No Response	All Three Correct	One or Two Correct	None Correct
Level 1	1	43	38	17
Level 2	0	81	15	5
Level 3	0	95	4	1
Level 4	0	99	1	0

Among students who received this question, 95% who achieved a Level 3 on the assessment, 81% who achieved a Level 2 and 43% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	All Three Correct	One or Two Correct	None Correct
Level 1	0	39	43	18
Level 2	0	75	21	4
Level 3	0	90	9	1
Level 4	0	98	2	0

Among students who received this question, 90% who achieved a Level 3 on the assessment, 75% who achieved a Level 2 and 39% who achieved a Level 1 selected the correct response.

**D1. Collection, Representation, and Analysis of Data (continued)**

16 These box plots represent the number of books students
AP in Class A and Class B read throughout the year.

Select the **TWO** correct statements.

A   The student who read the most books is in Class A.

B   The range between quartile 1 and quartile 3 in Class A is 8.

C   The median of Class A is higher than the median of Class B.

D   The range of the number of books read is larger in Class A than in Class B.

English-Language Schools

	No Response	Fully Correct (B&C)	Partially Correct (B)	Partially Correct (C)	Fully Incorrect
Level 1	0	13	19	46	23
Level 2	0	27	11	49	13
Level 3	0	66	5	26	3
Level 4	0	95	0	4	0

Among students who received this question, 66% who achieved a Level 3 on the assessment, 27% who achieved a Level 2 and 13% who achieved a Level 1 selected the correct response.
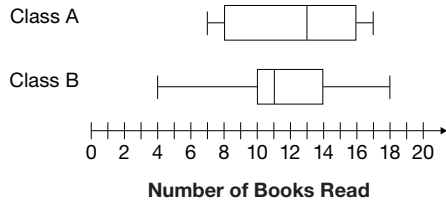
French-Language Schools

	No Response	Fully Correct (B&C)	Partially Correct (B)	Partially Correct (C)	Fully Incorrect
Level 1	0	10	20	43	27
Level 2	0	19	13	49	18
Level 3	0	50	7	36	6
Level 4	0	89	1	9	1

Among students who received this question, 50% who achieved a Level 3 on the assessment, 19% who achieved a Level 2 and 10% who achieved a Level 1 selected the correct response.

D2. Mathematical Modelling

Apply the process of mathematical modelling, using data and mathematical concepts from other strands, to represent, analyse, make predictions, and provide insight into real-life situations

17 **AP** An ice cream company wants to be able to predict the number of ice cream treats that will be sold each day.

Which piece of information would be **least** helpful to collect for the company to make this prediction?

A	day of the week

B	average daily temperature

C	past daily sales of ice cream treats

D	**cost of packaging of the ice cream treats**

English-Language Schools

	No Response	A	B	C	D
Level 1	0	23	28	20	28
Level 2	0	19	17	10	54
Level 3	0	13	7	4	76
Level 4	0	7	2	1	90

Among students who received this question, 76% who achieved a Level 3 on the assessment, 54% who achieved a Level 2 and 28% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	20	43	15	22
Level 2	0	20	26	19	36
Level 3	0	17	13	10	60
Level 4	0	7	3	3	87

Among students who received this question, 60% who achieved a Level 3 on the assessment, 36% who achieved a Level 2 and 22% who achieved a Level 1 selected the correct response.

D2. Mathematical Modelling

18 A radar counts the number of vehicles passing
TH through an intersection every day from Monday
to Friday. The data is recorded, and a model
of the relationship between the number of
vehicles passing through the intersection and
the time of day is created.

**Number of Vehicles
vs. Time of Day**

Based on the model created, which prediction
is correct?

Between Monday and Friday,

A | the number of vehicles passing through the intersection will remain constant throughout the day.

B | the intersection will have twice as many vehicles passing through it at 1:00 p.m. than at 9:00 p.m.

C | the number of vehicles passing through the intersection is always increasing.

D | the busiest time of day will be between 5:00 p.m. and 6:00 p.m.

English-Language Schools

	No Response	A	B	C	D
Level 1	1	20	34	13	32
Level 2	0	11	8	3	78
Level 3	0	3	1	0	95
Level 4	0	0	0	0	100

Among students who received
this question, 95% who achieved
a Level 3 on the assessment,
78% who achieved a Level 2
and 32% who achieved a Level 1
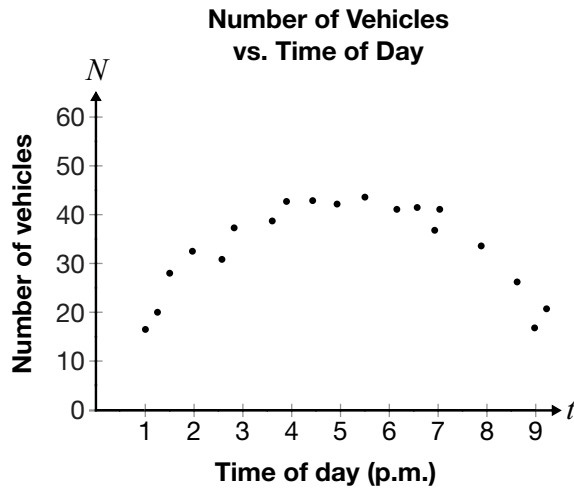selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	1	13	38	10	37
Level 2	0	8	8	3	80
Level 3	0	2	2	1	96
Level 4	0	0	0	0	100

Among students who received
this question, 96% who achieved
a Level 3 on the assessment,
80% who achieved a Level 2
and 37% who achieved a Level 1
selected the correct response.

E. GEOMETRY AND MEASUREMENT

E1. Geometric and Measurement Relationships

Demonstrate an understanding of the development and use of geometric and measurement relationships, and apply these relationships to solve problems, including problems involving real-life situations

19
KU A wire connects the top of a hydro pole to the ground 4 m away from the base of the hydro pole. The hydro pole measures 13 m.

Hint: You can use the side-length relationship for right triangles, $a^2 + b^2 = c^2$.

Which measurement is closest to the length of the wire from the top of the hydro pole to the ground?

A	4.1 m
B	12.4 m
C	13.6 m
D	17.0 m

English-Language Schools

	No Response	A	B	C	D
Level 1	1	11	26	28	34
Level 2	0	4	16	53	27
Level 3	0	1	5	87	7
Level 4	0	0	3	97	0

Among students who received this question, 87% who achieved a Level 3 on the assessment, 53% who achieved a Level 2 and 28% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	9	20	37	34
Level 2	0	5	15	59	21
Level 3	0	1	6	90	4
Level 4	0	0	2	97	1

Among students who received this question, 90% who achieved a Level 3 on the assessment, 59% who achieved a Level 2 and 37% who achieved a Level 1 selected the correct response.
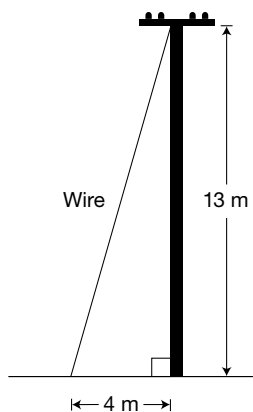
E1. Geometric and Measurement Relationships (continued)

20 What is the value of x in this diagram?
AP

A | 51°
B | 52°
C | 60°
D | 77°

English-Language Schools

	No Response	A	B	C	D
Level 1	0	23	31	24	22
Level 2	0	44	25	15	16
Level 3	0	87	7	3	4
Level 4	0	100	0	0	0

Among students who received this question, 87% who achieved a Level 3 on the assessment, 44% who achieved a Level 2 and 23% who achieved a Level 1 selected the correct response.

French-Language Schools

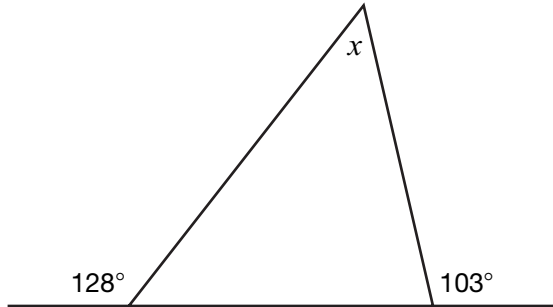|	No Response	A	B	C	D
Level 1	0	23	33	26	17
Level 2	0	53	19	12	15
Level 3	0	92	4	2	2
Level 4	0	100	0	0	0

Among students who received this question, 92% who achieved a Level 3 on the assessment, 53% who achieved a Level 2 and 23% who achieved a Level 1 selected the correct response.

E1. Geometric and Measurement Relationships (continued)

21 These two cylinders and this cone all have the same circular base and the same height.
TH

The first cylinder is completely filled with water. The cone and second cylinder are empty.

The water from the first cylinder is poured into the cone until it is completely full. The rest of the water is poured into the second cylinder.

How **full** will the second cylinder be?

A | $\frac{1}{4}$ full

B | $\frac{1}{3}$ full

C | $\frac{1}{2}$ full

D | $\frac{2}{3}$ full

English-Language Schools

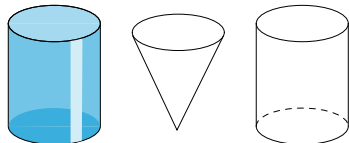|	No Response	A	B	C	D
Level 1	0	18	37	27	18
Level 2	0	15	40	25	20
Level 3	0	6	27	13	54
Level 4	0	0	7	0	93

Among students who received this question, 54% who achieved a Level 3 on the assessment, 20% who achieved a Level 2 and 18% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	A	B	C	D
Level 1	0	18	37	26	19
Level 2	0	11	41	26	22
Level 3	0	4	23	10	63
Level 4	0	0	3	0	97

Among students who received this question, 63% who achieved a Level 3 on the assessment, 22% who achieved a Level 2 and 19% who achieved a Level 1 selected the correct response.

F. FINANCIAL LITERACY

F1. Financial Decisions

Demonstrate the knowledge and skills needed to make informed financial decisions

22 Dustin wants to get a loan from a bank.

AP Complete the statement so that he pays the least total amount of interest.

Dustin should go with the bank that offers a monthly interest rate of ⌄ 1% , and he should pay the loan back over ⌄ 6 months .

⌄	
1%	
5%	
10%	

⌄	
6 months	
1 year	
5 years	

English-Language Schools

	No Response	Fully Correct (A&A)	Partially Correct (A)	Partially Correct (A)	Fully Incorrect
Level 1	1	10	9	31	50
Level 2	0	32	17	19	32
Level 3	0	70	13	8	9
Level 4	0	95	3	1	0

Among students who received this question, 70% who achieved a Level 3 on the assessment, 32% who achieved a Level 2 and 10% who achieved a Level 1 selected the correct response.

French-Language Schools

	No Response	Fully Correct (A&A)	Partially Correct (A)	Partially Correct (A)	Fully Incorrect
Level 1	0	11	12	31	45
Level 2	0	22	20	24	34
Level 3	0	55	20	13	12
Level 4	0	89	7	3	1

Among students who received this question, 55% who achieved a Level 3 on the assessment, 22% who achieved a Level 2 and 11% who achieved a Level 1 selected the correct response.

F1. Financial Decisions (continued)

23 **AP** A person purchases two different items. This graph represents the value of each item over time, in years.

Value of Item vs. Number of Years Since Purchase

Complete the following statements.

Item ⌄ A is an example of appreciation.

From the date of purchase, the value of the item appreciates by 20% after approximately ⌄ 2 years.

A ⌄
B

2 ⌄
4
9
12

English-Language Schools

	No Response	Fully Correct (A&A)	Partially Correct (A)	Partially Correct (A)	Fully Incorrect
Level 1	1	6	71	2	20
Level 2	0	18	77	1	5
Level 3	0	63	35	0	1
Level 4	0	95	5	0	0

Among students who received this question, 63% who achieved a Level 3 on the assessment, 18% who achieved a Level 2 and 6% who achieved a Level 1 selected the correct response.
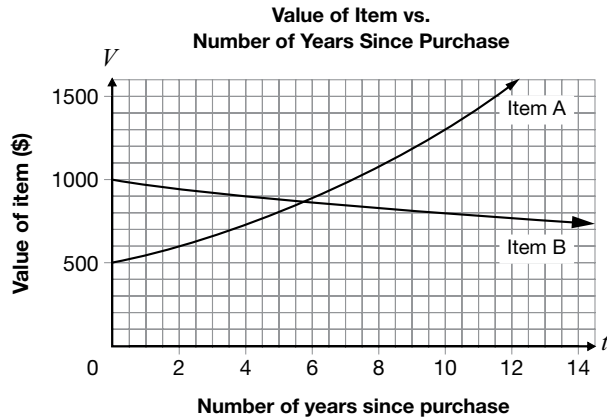
French-Language Schools

	No Response	Fully Correct (A&A)	Partially Correct (A)	Partially Correct (A)	Fully Incorrect
Level 1	0	6	67	3	24
Level 2	0	17	71	3	10
Level 3	0	61	34	2	3
Level 4	0	95	4	1	0

Among students who received this question, 61% who achieved a Level 3 on the assessment, 17% who achieved a Level 2 and 6% who achieved a Level 1 selected the correct response.

EQAO

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November 2024