Sample Questions

Students who achieve the *acceptable standard* should be able to answer all the following questions, except for any part of a question labelled **SE**. Parts labelled **SE** are appropriate examples for students who achieve the *standard of excellence*.

Note: In the multiple-choice questions that follow, * indicates the correct answer. Please be aware that the worked solutions shown are possible strategies; there may be other strategies that could be used.

Use the following information to answer the next two questions.

Three rows of a pattern are shown below.

Row 1	$1 \times 8 + 1 = 9$
Row 2	$12 \times 8 + 2 = 98$
Row 3	$123 \times 8 + 3 = 987$

1. The fifth row of the pattern will be

    A. $1\ 234 \times 8 + 4 = 9876$
    B. $1\ 234 \times 8 + 5 = 9876$
    C. $12\ 345 \times 8 + 4 = 9876$
    *D. $12\ 345 \times 8 + 5 = 98765$

2. If the number 8 in the pattern above is replaced by the number 9 as shown below, describe a pattern that could be used to calculate the value of row 7.

    Row 1 $1 \times 9 + 1 =$ _____
    Row 2 $12 \times 9 + 2 =$ _____
   **Row 3** $123 \times 9 + 3 =$ _____

    Possible Solution:
    The row number tells you the number of ones that occur in the answer followed by a single 0. Therefore, the value of row 7 would be seven ones followed by a single 0; i.e., 11 111 110.

The goal of a particular puzzle is to fill the circles in a grid with the letters A, B, C, and D so that no letters are repeated in any row, column, or set of connected circles.

The three entries in the grey circles were given to start the puzzle. Jerome has already completed three entries shown in the white circles, but he has made an error.
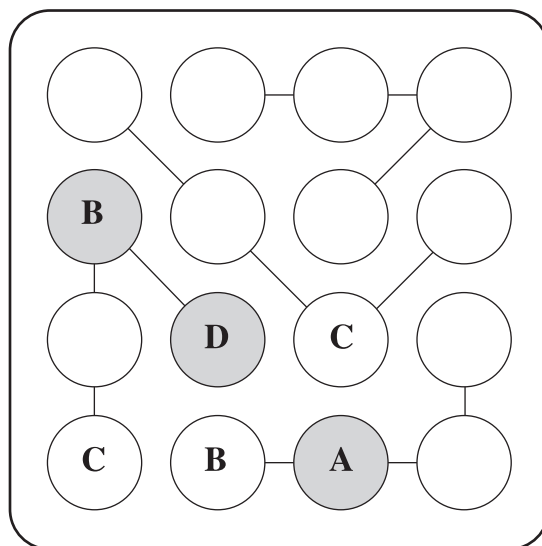
3. a. Identify the error that Jerome made in his solution to the puzzle.

Possible Solution:
a. The error that Jerome made is in row 3, column 3.

SE

**b.** Explain why this entry is incorrect.

Possible Solution:
b. The entry in row 3, column 1 must be an A, and the entry in row 4, column 4 must be a D. If the entry in row 3, column 3 is a C, then the entry in row 3, column 4 should be a B. However, since the last three circles in the last row are connected to the circle in row 3, column 4, this will mean that one of the rules of the game is violated because a set of connected circles has repeated letters.

c. Correct the error that Jerome made and complete the puzzle.

Possible Solution:

D	A	C	B
B	C	D	A
A	D	B	C
C	B	A	D
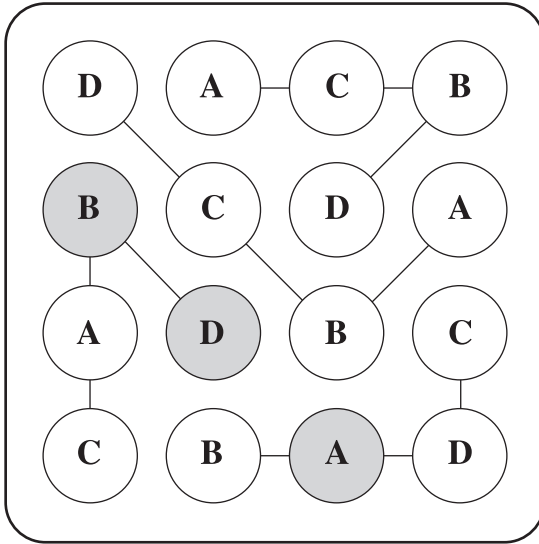
The intention of a particular two-player game is to create a line of four adjacent squares using the same letter. To play, each player takes turns placing their first initial somewhere on a six-by-six grid. Margaret and Gerda have started playing this game, as shown on the grid below.

Column

Row	1	2	3	4	5	6
1	G					
2		G				
3			G	G		
4			M	M	G	
5		M				
6	M	M	G			

Numerical Response

4. It is Margaret's turn, and she determines that she can guarantee a win by placing the letter M in

row _____
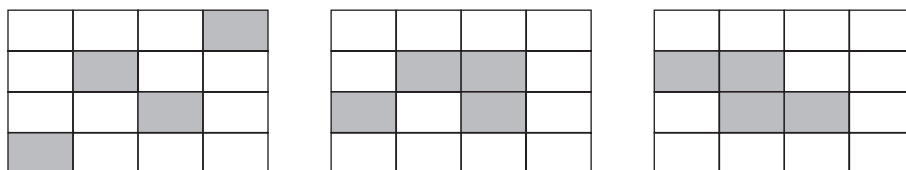
column _____

Possible Solution:
42
If Margaret places her next M in Row 4 Column 2, she will have two sets of three M's available that gives her two options for winning when placing her next M. Gerda can block only one of them and cannot create a line of four adjacent G's on her next turn, so Margaret is guaranteed to win.

**Note:** This question is intended to be an alternate digital-format item. Please consult the site https://questaplus.alberta.ca/ for more examples of this item type.

A pattern of pictures is shown below. The first picture is the original. In each subsequent picture, each shaded square has stayed in the same place **or** moved to a square horizontally, vertically, or diagonally adjacent to its previous location. The shaded square undergoes the same movement in each subsequent step.
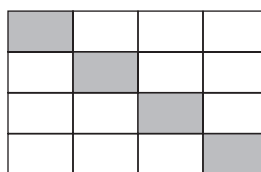
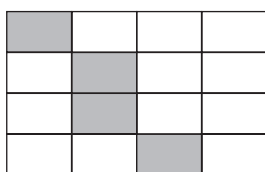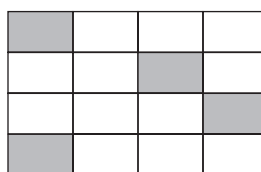**5.** Which of the following pictures is next in the pattern?

*A.

B.

C.

D.
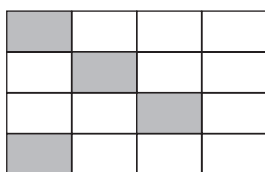
Possible Solution:
The shaded box in the first column is moving upwards in each step. The shaded boxes in the second and third columns are remaining stationary. The remaining shaded box, which started in Column 4, moves diagonally down and to the left.

A student makes the following statement.

"VOTE compares to VETO as the number 8570 compares to the number _____."
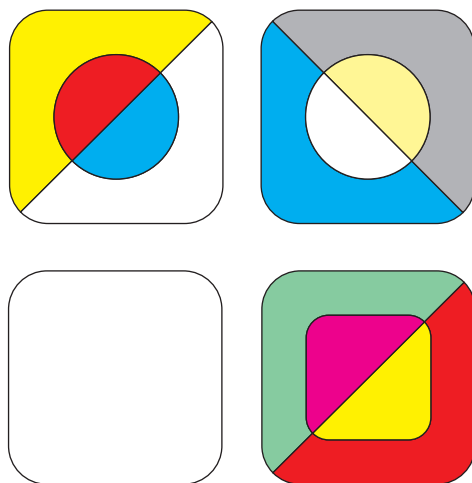
Numerical Response

6. The 4-digit number that completes the statement above is _____.
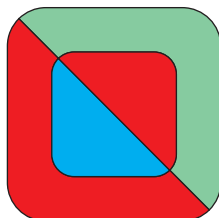
Possible Solution:
8075

A geometric pattern is presented below. In this pattern, the lower left square is unknown.
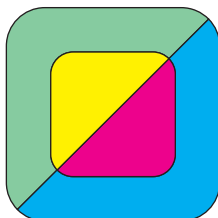

SE **7.** Which of the following could be in the lower left square to complete the geometric pattern shown above?
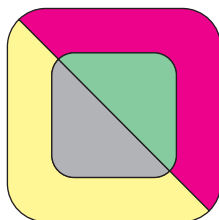
A.

B.

*C.

D.
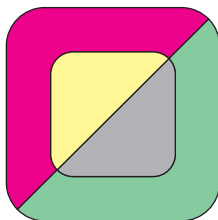
Possible Solution:
Comparing the squares in the top layer reveals that the direction of the slanted dividing line changes, but the same shapes are preserved. The blank square must therefore be a square shape within the square shape having a slanted dividing line that goes down and to the right. The colours on the right half of the diagram are the same as in the square on the right, but their positions are switched. This leads to a pink exterior and green interior on the right half. For the colours in the left half, light yellow has changed to grey and red has changed to dark yellow.

Use the following information to answer the next four questions.

Students in a particular high school were surveyed to determine the subjects in which they were currently enrolled. The table below represents the data that was collected.

Courses Enrolled In	Number of Students
Math only	28
Art only	33
Math and Art	17
Neither course	20

8. The number of students in the universal set is

    A. 61

    B. 64

    C. 78

  *D. 98

Numerical Response

9. The number of students taking Art is _____.

Possible Solution:
50
33 who take Art only and 17 who take both Math and Art.

10. The number of students **not** taking Math is _____.

Possible Solution:
53
33 who take Art only and 20 who take neither.

11. The number of students taking Math or Art is

    A.   17
    B.   61
   **C.*   78
    D.   98

Use the following information to answer the next four questions.

A group of 100 students was surveyed about movies that they have seen, as shown below.

  2 people saw all three movies

12 people saw "Metal Man" and "The Princely Groom"

53 people saw "Metal Man"

10 people saw "Metal Man" and "Quick and Angry 8"

18 people saw "The Princely Groom" only

23 people saw "The Princely Groom" and "Quick and Angry 8"

  6 people did not see any of the movies

Jason started to organize the results in the Venn diagram shown below.
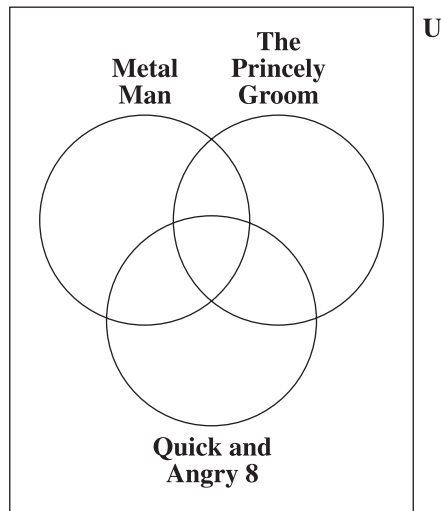
Possible Solution:
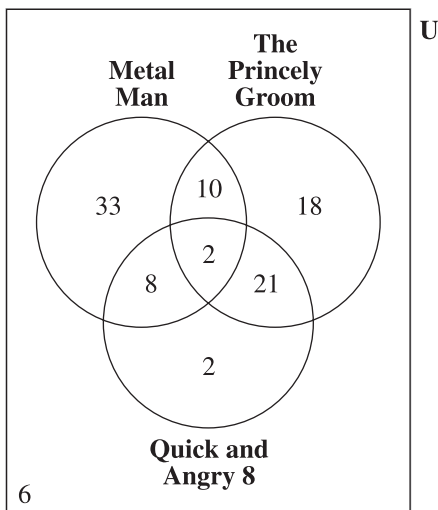
12. The number of people who saw "The Princely Groom" is

    A. 18

    B. 20

   *C. 51

    D. 53

Numerical Response

13. The number of people who saw "Metal Man" and "The Princely Groom" but **not** "Quick and Angry 8" is _____.

Possible Solution:
10

14. The number of people who saw "Metal Man" only is

    A. 20

   *B. 33

    C. 51

    D. 53

15. The number of people who saw "Metal Man" or "Quick and Angry 8" is

    A. 10

    B. 43

   *C. 76

    D. 98

Use the following information to answer the next two questions.

Two Sets

A = {prime numbers less than 20}
B = {factors of 20}

16. The union of sets A and B is

   A. {2, 5}
   B. {2, 4, 5, 10}
 *C.** {1, 2, 3, 4, 5, 7, 10, 11, 13, 17, 19, 20}
   D. {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}

17. The set $C = A \cap B$ is

 *A.** {2, 5}
   B. {2, 4, 5, 10}
   C. {1, 2, 3, 4, 5, 7, 10, 11, 13, 17, 19, 20}
   D. {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}

18. Which of the following rows includes two groups that would be an example of disjoint sets?

Row	Group 1	Group 2
A.	People who regularly drink coffee	People who regularly drink tea
B.	People who have a home phone line	People who have a cellular phone line
C.	The set of all prime numbers	The set of all even numbers
*D.	The set of all multiples of 5	The set of all factors of 24

Use the following information to answer the next question.

Vehicles with a sunroof are represented by {S} and vehicles with a hands-free phone system are represented by {P}.

19. Which of the following illustrates $(S \cap P)'$?

    A. A sunroof or a hands-free phone system

    B. A sunroof and not a hands-free phone system

   *C. Not a sunroof or not a hands-free phone system

    D. Not a sunroof and not a hands-free phone system

In a school of 120 students:

  5 students took English, Physics, and Chemistry

15 students took Physics and English

  8 students took Physics and Chemistry

10 students took English and Chemistry

99 students took English or Chemistry

45 students took Chemistry

30 students took Physics

Bobby summarized the data using the Venn diagram shown below.
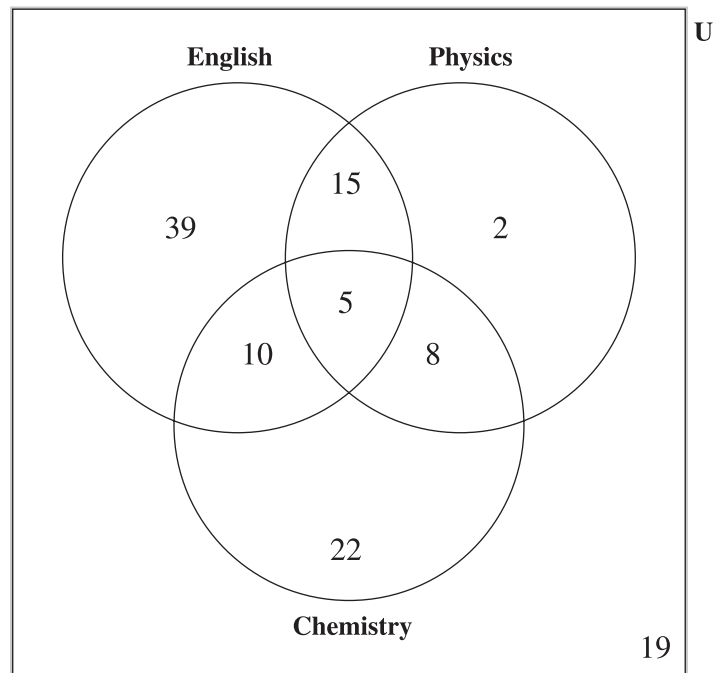
20. Identify the regions of Bobby's Venn diagram that have incorrect entries, and describe the errors that Bobby made. Make changes to the Venn diagram to show the correct entries.

Possible Solution:
When completing the Venn diagram, Bobby made errors on the regions that represent the number of students taking two subjects. For example, the number of students taking Physics and English is 15. Out of those 15 students, 5 have already been accounted for in the region that represents the students who took English, Physics, and Chemistry. Therefore, there should be 10 additional students in the region for those taking Physics and English but not Chemistry, rather than 15 as Bobby has written. He repeated this same error for all combinations of two subjects. This error also then affects the regions of the diagram that represent students who took only a particular subject as well as the region that represents those who took none of the identified subjects. The correct Venn diagram is shown below.
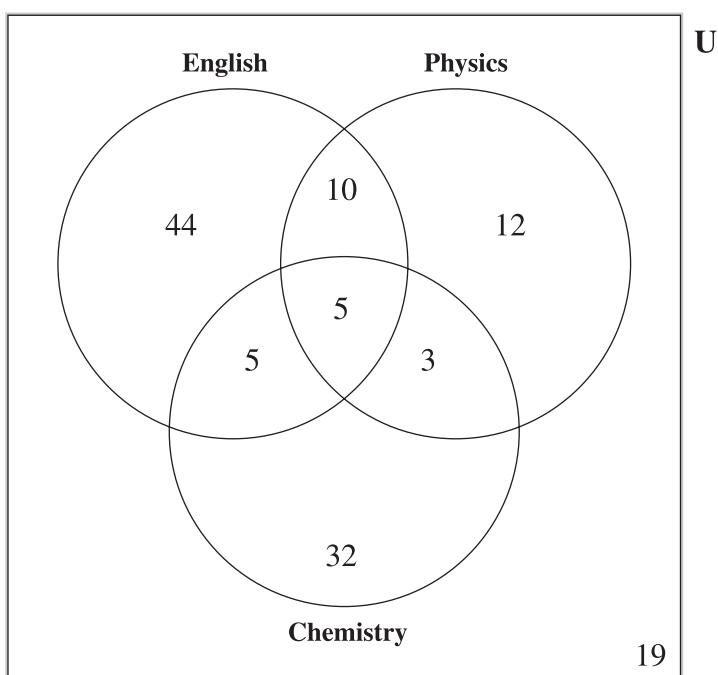
Use the following information to answer the next two questions.

Three Sets

$R = \{$natural numbers less than 50$\}$

$S = \{$even numbers$\}$

$T = \{10, 20, 30, 40\}$

SE   **21.**   Which of the following statements is true for sets R, S, and T?

    A. $R \subset S$

    B. $R \subset T$

    C. $S \subset R$

    *D. $T \subset R$

SE   **22.**   Which of the following statements is **not** true for sets R, S, and T?

    A. $T \subset (R \cap S)$

    B. $T \subset (R \cap T)$

    *C. $(R \cap S) \subset T$

    D. $(R \cap T) \subset T$

A student suggests that for any set A, $A \cup \varnothing = A$ and $A \cap \varnothing = A$.

SE

23. Is this student correct or incorrect? Use an example or a visual representation in your explanation.

Possible Solution:
Since the empty set is a subset of every set, the student is correct that $A \cup \varnothing = A$. No elements are added to A by combining it with the empty set so the initial set A remains after the union. For example, if $A = \{2, 3, 4\}$, when it is combined with a set that has no elements, the result will be $\{2, 3, 4\}$. The student is incorrect that $A \cap \varnothing = A$. Since the empty set has no elements, it cannot have any elements in common with A so $A \cap \varnothing = \varnothing$. For example, if $A = \{2, 3, 4\}$, none of these elements occur in $\varnothing$, so there are no common elements, or in other words, the set of common elements is $\varnothing$.

24. Which of the following phrases describes an empty set?

    A. Common factors of 3 and 7

    B. Prime numbers that are even

    C. Multiples of 5 that are less than 10

   *D. Perfect squares less than 20 that are divisible by 5