

World 3-1 Translating Words into an Algebra Expressions

Example: the sum of five times a number and two means $5x + 2$

Write an *algebraic expression* for **each statement**.

1. The sum of a number and three _____
2. The difference of ten and a number _____
3. The quotient of twelve and a number _____
4. The **product** of six and a number _____
5. The square root of a number _____
6. The sum of double a and triple b _____
7. A third of a number _____
8. Three times a number decreased by nine _____
9. The produced of a number and fives less than that number _____
10. The sum of triple a number and five _____
11. The difference between a number and one-fifth _____
12. The square of the difference between a number and three _____
13. The product of ten and a number _____
14. The sum of a number and three times that same number _____
15. The product of a number and that same number plus two _____
16. The sum of an even number & the next even number _____
17. The sum of a number & the next two consecutive numbers _____

Write an algebraic equation for each statement, & then **SOLVE** for x

- 1) The **sum** of a number and six is fourteen. 2) The **quotient** of fifteen and a number equals three.

$$\begin{array}{r} x + 6 = 14 \\ - 6 \quad -6 \\ \hline x = 8 \end{array}$$

- 3) The **difference** between a number and twenty is seventeen. 4) The **product** of seven and a number equals fifty-six.

- 5) The **difference** between the **square** of a number four is twelve. 6) The **sum** of triple z and double n equals forty-four.

- 7) When a certain number is multiplied by seven the product is seventy-two. Find the number. 8) When a number is decreased by forty-five result is seventy-five. Find the number.

- 9) In five years Karen will be twenty-three. How old is she now? 10) When a number is multiplied by eight the product is ninety-six. Find the number.

- 11) Decrease triple a number by seven and you get twenty-eight. Find the number. 12) Add twelve to eight times a number and the result is eighty-four. Find the number.

World 3-2 Solving Equations Levels 1 to 3



Level I (1 Step Solutions)

$$x + 6 = 12$$

$$x - 4 = 0$$

$$b + 4 = 7$$

$$-3 + y = 5$$

$$\frac{x}{3} = 4$$

$$x - 7 = 4$$

$$m - 3 = -4$$

$$q - 5 = -13$$

$$-x = 4$$

$$3x = 15$$

$$\frac{1}{3}x = 5$$

$$2n = 1$$

Level II (2 Step Solutions)

$$2x + 4 = 16$$

$$4b - 14 = 30$$

$$-3x + 2 = 2$$

$$7a + 1 = 22$$

$$-5 + 9q = 22$$

$$-12 + 2y = 10$$

$$\frac{x}{2} + 8 = 9$$

$$6w - 14 = 22$$

Level III (Three Step Solutions)

$$5x + 2 = 3x + 12$$

$$7x + 8 = 3x + 44$$

$$11x + 4 = 4x + 53$$

$$x + 8 = -7x + 88$$

$$8 + 5x = -6x + 30$$

$$25x + 60 = -5x + 90$$

$$5x - 8 = 7x + 16$$

$$5 - 4x = -9x - 30$$

$$-6x - 4 = -3x + 5$$

World 3-3 Solving Equations Levels 4 and 5



Level IV (Four Step Solutions)

$$6(3x - 4) = 12 + 6x \quad -3(3x + 2) = 12x + 15 \quad 9(3x) = 7(x + 20)$$

$$(2x - 1) - (3x + 2) = 14 \quad 6(x - 1) + 4(3x - 2) = 32 \quad 3x = -2(x + 7) - 3(2x + 6)$$

$$7(3x - 5) = 120 - 10x \quad 4(3x + 8) = -6x + 99 \quad 4(3x - 5) + 2(x + 3) = 1$$

$$7y + 24 = 3(y + 5) + 5 \quad 3 - 6(x - 1) + 4(3x - 2) = 2x + 3 \quad 4(x + 3) = 12(x + 5)$$

Level V (Five Step Solutions)

$$\frac{x+1}{3} = \frac{2(x-2)}{5}$$

$$\frac{2(x+10)}{4} = \frac{9(x-5)}{3}$$



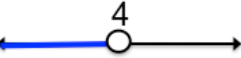

$$\frac{9x-3}{5} = \frac{-3(x-4)}{2}$$

$$\frac{2(c-3)}{4} = \frac{3(c+1)}{18}$$

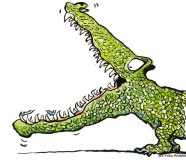
$$\frac{2x-3}{4} = \frac{9x}{3}$$

$$\frac{2x-1}{3} - \frac{3x+1}{2} = \frac{5}{6}$$

World 3-3 Representing Inequalities Using 3 Notations

	Inequality	Number Line	Bracket Notation	Set Builder
1.	$x \leq 5$			
2.			$[2, \infty [$	
3.	$-1 < x < 4$			
4.				
5.			$[-\infty, 7]$	
6.				
7.	$-6 \leq x$			
8.			$] 4, \infty [$	
9.	x is a # greater than 2			
10.	X is les than or equal to 9			
11.				
12.	$x > -2$			
13.			$] 0, 2 [$	
14.	$x \leq -14$			
15.				

World 3-4 Solving Inequalities



Level 1 – 1 Step Solutions

a) $\frac{3x}{3} > \frac{9}{3}$
 $x > 3$

b) $7y < -14$

c) $14 > 7x$

d) $4x > 16$

e) $12x \geq 36$

f) $21 > 3d$

g) $6a > 36$

h) $5h \leq 25$

i) $14 > 28f$

j) $2s \leq 24$

k) $15x < 45$

l) $5 < 3c$

Level 2 – 2 Step Solutions

a) $5x + 4 > 14$

b) $3x + 3 < 12$

c) $5b - 3 > 7$

d) $12g + 2 > 26$

e) $10k - 8 \geq 32$

f) $4h + 5 > 21$

g) $7x - 3 \leq 18$

h) $8y + 2 < 18$

i) $9p - 6 \geq 21$

Level 3 – 3 Step Solutions

a) $2(x+3) \leq 14$

b) $6(m+2) \geq 32$

c) $7x+9 \leq 3x+5$

d) $5(g-2) < 30$

e) $-2(6w+3) \geq 54$

f) $8x-3 > 7x-11$

g) $7(2x+5) \leq 63$

h) $2y+6y-3 > 61$

i) $9p-6 \geq 21$

Level 4 – 4 Step Solutions

a) $6(w+5)+3(w-2) < 6$

b) $\frac{6(x-6)}{4} \geq \frac{x+6}{2}$

c) $4(p-3) - 3(p+2) < 2$

d) $\frac{3m+10}{2} \leq \frac{5(m+6)}{4}$



Level NEGATIVE (Flip the inequality sign when dividing by a negative)

a) $-4x > 20$

c) $-4x + 6 < -2x + 14$

e) $-2(x+9) \leq 6x + 14$

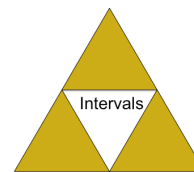
b) $5(r-2) < 6r + 7$

d) $5x + 9 > 12x - 16$

f) $9(x-3) \leq 10x - 8$

1) Use bracket notation to represent the following intervals.

- a) $\{-3 \leq x \leq 2\}$ _____ b) $\{-1 \leq x < \infty\}$ _____
 c) $\{-\infty < x \leq 8\}$ _____ d) $\{-8 < x \leq -1\}$ _____



2) **Solve** the following in-equalities and express the solution set on a **number line**.

a) $-3x + 2 > x - 8$

b) $2(x - 5) - 5(x + 2) \geq 1 - 4x$

3) D'arcy Math students are great people and score well every year. The average grade is always greater than 68 and less than or equal to 80. Express this in-equality using three other representations.

Bracket /Interval Notation	Set Builder Notation	Number Line

Memory Aid Space

Use Example(s) to Show how to Solve Inequalities and Represent them using the 3 Notations

World 3-5 Equality and Inequality Word Problems

Define your variables and set equations before solving.

1) In a gym of at least 30 people there are 4 more girls than boys. What is the minimum number of girls in the class?

2) In term 1 Julian receives a 70 and 80 on his first two tests. What must his mark be on the third test for the average of the three tests to be at least 78?

3) Jacky earns a weekly base salary of \$175. He also earns a commission of \$50 for each computer he sells. How many computers could he have sold in a week if he received a total salary of less than \$825?

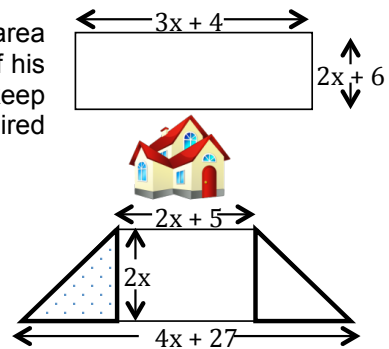
4) Hillary has a certain number of marbles. John has 4 less than twice the number of marbles that Hillary has. Bill has triple the number that John has. Mario has ten times the number that Hillary has. If the sum of all of the marbles is 98, how many marbles do they each have?

5) Carl is 9 years younger than quadruple Lenny's age. The sum of their ages is 56. How old is Carl. Define your variables and check your answer.

World 3-6 Equations involving Area and Perimeter

1) A rectangular field measures 10 m more than its width. The perimeter of the field is more than 80 m but less than 100 m. In what interval will the width of the field be?

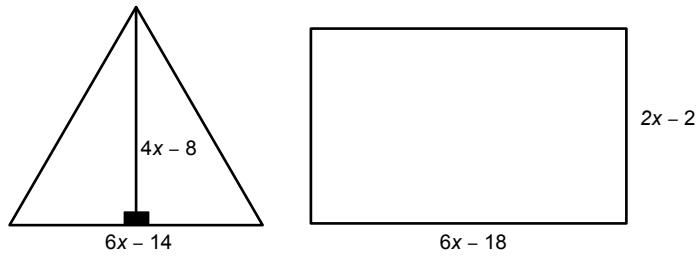
2) Matthew's rectangular front yard has the same area as his trapezoidal back yard. He wants to fence off his triangular vegetable gardens in the back yard to keep out pests. What length of fence, in metres, is required to enclose both gardens?



3) Buckingham Palace is known for its spectacular gardens. A couple on their honeymoon visits two beautiful flower gardens, one in the shape of a triangle and the other in the shape of a rectangle. The dimensions can be represented by algebraic expressions, as shown in the diagram below.

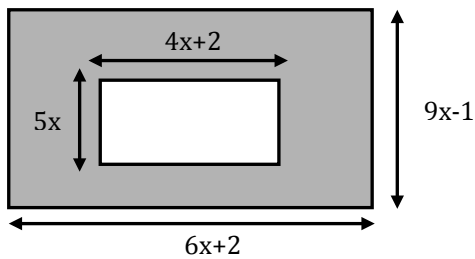
Garden A

Garden B

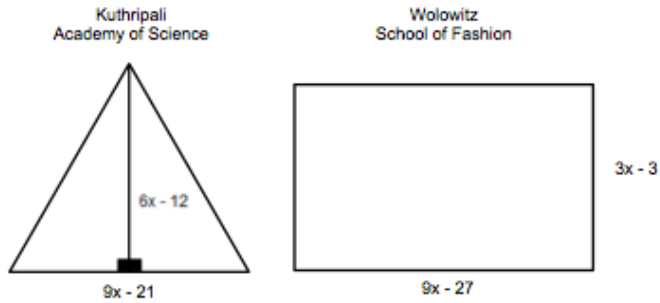


The travel brochure states that the gardens are equivalent in area.
What are the dimensions of each garden?

4) The perimeter around the pool is 60 m. What is the value for the area of the concrete.

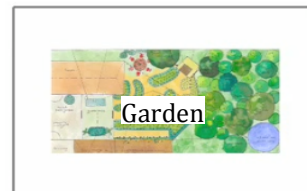


5) Big Bang: The Kuthripali Academy of Science and the Wolowitz School of Fashion are both building new facilities on neighbouring pieces of property. Although the properties are shaped differently, the properties have the same area.



What are the dimensions of both properties?

6) A garden is surrounded by a walkway of uniform width. The dimensions of the garden are 25 m x 20 m. The outside perimeter of the walkway is at least 114 m. **What is the width of the walkway? Hint: What is x , and where does it go on the diagram?**

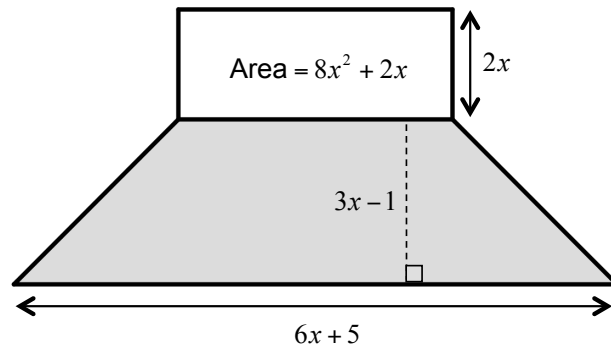


7) The perimeter of the rectangular room on the right is $(30x + 18)$ metres. The width is $(3x - 2)$ metres. Logan wants to install a carpet that covers the entire floor.



How many square metres of carpet are needed to cover the floor? The length of the room is 31 m?

8) The base of the rectangle which touches the trapezoid has a length of 9 m. What is the area of the trapezoid?



Student Name _____

	Total					
Criteria 1	0	8	16	24	32	40
Criteria 2	0	8	16	24	32	40
Criteria 3 & 4	0	4	8	12	16	20

MINI SITUATIONAL PROBLEM #2: A DINNER IN CAMELOT

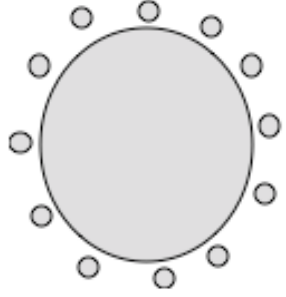
King Arthur and his knights are planning a large feast.

There are a total of twelve knights sitting at the table. 3 Blue, 3 Red, 4 Orange, Lancelot and King Arthur.

It was found that a Red knight eats one less dish than twice as many dishes as a Blue knight. An Orange knight eats three times as many dishes as a Red knight. Lancelot just ate, so he only had 3 dishes and King Arthur received five less dishes than all of the Blue knight's combined.

The court chef also realized that the total number of dishes could be found by $y - 15 = \frac{7y - 29}{8}$ solving the equation provided on the right.

How many dishes does each colour of knight, Lancelot and King Arthur eat?



Student Name _____

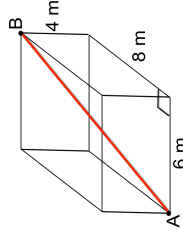
Can Jackie Chan safely complete these stunts?

	Total					
Criteria 1	0	8	16	24	32	40
Criteria 2	0	8	16	24	32	40
Criteria 3 & 4	0	4	8	12	16	20

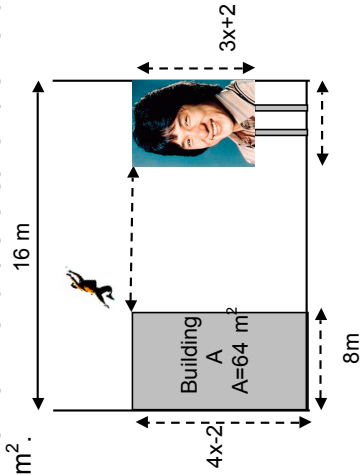
MINI SITUATIONAL PROBLEM #3: JACKIE'S STUNTS

Jackie Chan is considering 2 new stunts for his movie.

Stunt 1 – Rope Climb In this stunt, Jackie balances on a rope going from point A to point B. Jackie can only do this stunt if he makes it in under 5 seconds. He can run a maximum of 2.5 m/s on the rope.



Stunt 2 – Building to Sign Jump- In this stunt, Jackie jumps from the roof of a building onto a giant sign of himself. From experience, we know Jackie can only jump a maximum horizontal distance of 4 m. The perimeter around the sign is 28 m and the area of the front of building A is 64 m^2 .



3] How many more minis could fit in the box without any cupcakes being stacked?

Student Name _____

Criteria 1	0	8	16	24	32	40	Total
Criteria 2	0	8	16	24	32	40	
Criteria 3 & 4	0	4	8	12	16	20	

**MINI SITUATIONAL PROBLEM #4:
AYLMER CUPCAKES**

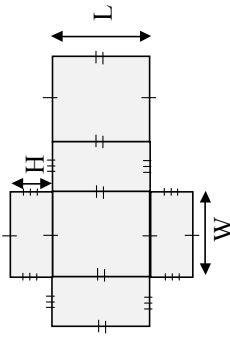
Robin is volunteering at the new cupcake store. An order comes in for 19 cupcakes; 12 mini chocolate, 4 regular vanilla and 3 jumbo cherry. Robin quickly looks at the cupcake information sheet.



Cupcake Information		
Size	Area (cm ²)	Cost Each (\$)
Mini	25	2.50
Regular	36	3.75
Jumbo	100	5.25

Box Dimensions

Robin has to place all of the cupcakes in a folded box. Unfortunately they have already run out of regular boxes and she's got to make one out of scrap cardboard. A co-worker remembers that the width of a regular box is about ten cm less than four times the height of the box and the length is twice the height plus 6 cm. She also mentions from the packaging specifications that the total surface area of the box is exactly 2680 cm².



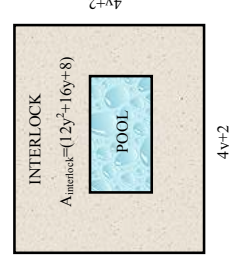
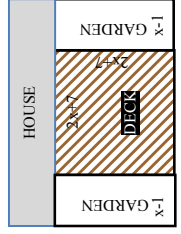
- 1] What is the length, width, & height of the box?
- 2] How much do the cupcakes cost?

Name: _____ Date: _____

	0	8	16	24	32	40	Total
Understanding	0	8	16	24	32	40	
Calculations	0	8	16	24	32	40	
Organization	0	4	8	12	16	20	
Validation	0	4	8	12	16	20	

Mr. Lee has a budget of \$40 000 to renovate his backyard. He would like a large lot with a patio. He wants a raised deck, a couple of gardens and an in-ground swimming pool. To improve the property value, he'd like interlock around the pool. Neighbourhood regulations state he will have to fence all around the interlock. Here is the design he came up with.

Design:



Notes:

- 1) The deck is square with side length $(2x + 7)$
- 2) The 2 gardens are identical with width $x-1$
- 3) The total width of the deck and flower beds must be the same as the width of the house which is 13 m.
- 4) The fenced section of interlock is a square, but the pool is a rectangle.
- 5) The section that will be covered with interlock has an area of $(12y^2 + 16y + 8)$
- 6) The surface area that will be dug out for the pool is Option A 32 m^2 and Option B 60 m^2 , for the flat price he was given.

After shopping around and researching prices, Mr. Lee organized his findings in the following table: (Prices **do not** include the 13% tax)

Item	Price
Deck – installed	\$100 / m^2
Dirt for flower beds	\$15 / m^2
Pool with S.A. between 32 and 60 m^2	\$10 000
Interlock	\$50 / m^2
Fence	\$75 / m

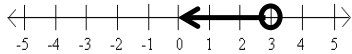
Can Mr. Lee afford to landscape this year?

What Will I Need to Do to Solve this Problem?

Practice Test #2 Equalities and Inequalities Test

Name: _____ Date: _____

PART A: Multiple Choice write the correct letter in the space provided (2 marks each)

_____ 1] Which interval represents this number line? 

- a) $]3, \infty[$ b) $[3, \infty]$ c) $] -\infty, 3[$ d) $] -\infty, 3]$

_____ 2] If p represents the number of people, which inequality represents the phrase: *a maximum of 12 people can be in the elevator at once*

- a) $p < 12$ b) $p \leq 12$ c) $p > 12$ d) $p \geq 12$

_____ 3] Choose the solution to the following inequality: $10x + 30 < 50$

- a) $x < 2$ b) $x > 2$ c) $x < 8$ d) $x > 8$

PART B: SHORT ANSWER only correct answers will be awarded points (4 marks each)

4] Mr. Burns is 48 years older than Smithers. The sum of their ages is 124. **How old is Mr. Burns?**

Answer: Mr. Burns is _____ years old.

5] On her first two tests Lisa scored 86 and 78. What does she have to receive on her third score to have an average of at least 85?



Answer: Lisa must score at least _____.

6] Solve the following equations:

a) $8x + 24 = 14x - 18$

b) $8(x - 2) = 5(x + 1)$

7] Solve the following inequalities. Write your answer using a number line, interval notation, and set notation.

$6x - 20 > 10x + 36$

Number line A horizontal number line with 11 equally spaced vertical tick marks. The line extends slightly beyond the first and last tick marks on both sides.

Interval notation:

Set notation:

LONG ANSWER Show all of your work. Include a final statement. (30 marks)

8] The Tokyo Tower measures 8.6 metres more than the Eiffel Tower. The CN Tower measures 111.87 metres less than double the Tokyo Tower. The sum of the heights of the three towers is less than 1.212 km.

Based on this data, determine the maximum height of each tower.



Tokyo Tower

Eiffel Tower

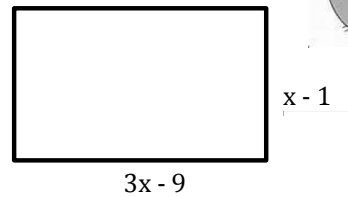
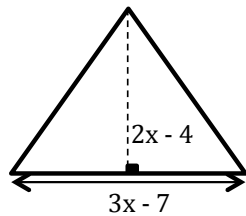
CN Tower

Uses mathematical reasoning							
		Observable indicators correspond to level					
Evaluation Criteria	LEVEL	A	B	C	D	E	
	Cr. 3	40	32	24	16	8	0
	Cr. 2	40	32	24	16	8	0
	Cr. 4	20	16	12	8	4	0
	Cr. 5						

9] Springfield Elementary was in rough shape after some Halloween pranks. Groundskeeper Willie had to replant some sections of the front lawn. Principal Skinner decided to be mean and he gave the lawn dimensions as algebraic expressions. He only knows that the areas are equal.



What are the dimensions of each section of lawn?



Triangular lawn:

Rectangular lawn:

Base: _____

Width:

Uses mathematical reasoning							
		Observable indicators correspond to level					
Evaluation Criteria	LEVEL	A	B	C	D	E	
	Cr. 3	40	32	24	16	8	0
	Cr. 2	40	32	24	16	8	0
	Cr. 4	20	16	12	8	4	0
	Cr. 5	20	16	12	8	4	0

Height: _____

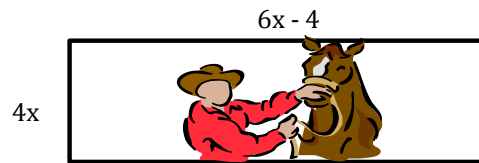
Length: _____

10] Chuck Norris' secret Texas ranch is rectangular in size. The length of the ranch is $(12x - 8)$ km, and the width is $8x$ km.



Chuck built an electrified fence to keep his horses in, and the bad guys out. It cost \$300 per kilometre to build the fence, and he spent a total of \$19 200 to fence the entire property.

What is the area of the ranch?



Uses mathematical reasoning							
		Observable indicators correspond to level					
Evaluation Criteria	LEVEL	A	B	C	D	E	
	Cr. 3	40	32	24	16	8	0
	Cr. 2	40	32	24	16	8	0
	Cr. 4 Cr. 5	20	16	12	8	4	0