

PA5-11 Variables

1. Look at the sign at the right, then write a numerical expression for the cost of renting skates for ...



- a) 2 hours: 3×2 b) 5 hours: _____
 c) 6 hours: _____ d) 8 hours: _____

A **variable** is a letter or symbol (such as x , n , or H) that represents a number.
 To make an **algebraic expression**, replace some numbers in a numerical expression with variables.
 Examples of algebraic expressions: $x + 1$ $3 + 4 \times T$ $2 + t - 3 \times h$

2. Write an expression for the distance a car would travel at the given speed and time.

- | | | |
|--------------------------|--------------------------|--------------------------|
| a) Speed: 60 km per hour | b) Speed: 80 km per hour | c) Speed: 70 km per hour |
| Time: 2 hours | Time: 3 hours | Time: h hours |
| Distance: _____ km | Distance: _____ km | Distance: _____ km |

In the product of a number and a variable, the multiplication sign is usually dropped.
 Examples: $3 \times T$ can be written $3T$ and $5 \times z$ can be written $5z$.

3. Look at the sign at the right, then write an algebraic expression for the cost of renting skis for ...



- a) h hours: $5 \times h$ or $5h$ b) t hours: _____ or _____
 c) x hours: _____ or _____ d) n hours: _____ or _____

4. Write an equation that tells you the relationship between the numbers in Column A and Column B. Hint: First find the number that you need to add or multiply.

- | a) <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <thead> <tr><th>A</th><th>B</th></tr> </thead> <tbody> <tr><td>1</td><td>4</td></tr> <tr><td>2</td><td>5</td></tr> <tr><td>3</td><td>6</td></tr> </tbody> </table>

<u>$A + 3 = B$</u> | A | B | 1 | 4 | 2 | 5 | 3 | 6 | b) <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <thead> <tr><th>A</th><th>B</th></tr> </thead> <tbody> <tr><td>1</td><td>2</td></tr> <tr><td>2</td><td>4</td></tr> <tr><td>3</td><td>6</td></tr> </tbody> </table>

<u>$2 \times A = B$</u>
or <u>$2A = B$</u> | A | B | 1 | 2 | 2 | 4 | 3 | 6 | c) <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <thead> <tr><th>A</th><th>B</th></tr> </thead> <tbody> <tr><td>1</td><td>3</td></tr> <tr><td>2</td><td>4</td></tr> <tr><td>3</td><td>5</td></tr> </tbody> </table>

_____ | A | B | 1 | 3 | 2 | 4 | 3 | 5 | d) <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <thead> <tr><th>A</th><th>B</th></tr> </thead> <tbody> <tr><td>1</td><td>3</td></tr> <tr><td>2</td><td>6</td></tr> <tr><td>3</td><td>9</td></tr> </tbody> </table>

_____ | A | B | 1 | 3 | 2 | 6 | 3 | 9 | e) <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <thead> <tr><th>A</th><th>B</th></tr> </thead> <tbody> <tr><td>1</td><td>5</td></tr> <tr><td>2</td><td>10</td></tr> <tr><td>3</td><td>15</td></tr> </tbody> </table>

_____ | A | B | 1 | 5 | 2 | 10 | 3 | 15 |
|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|--|---|---|---|---|---|----|---|----|
| A | B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| A | B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A | B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A | B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A | B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

When replacing a variable with a number, we use brackets.

Example: Replacing n with 7 in the expression $3n$ gives $3(7)$, which is another way to write 3×7 .

5. Write the number 2 in the brackets and evaluate.

a) $5(2) = 5 \times 2 = 10$ b) $3(\quad) = \underline{\quad} = \underline{\quad}$ c) $4(\quad) = \underline{\quad} = \underline{\quad}$

d) $2(\quad) + 5$ e) $4(\quad) - 2$ f) $6(\quad) + 3$
 $= \underline{2 \times 2 + 5} = \underline{4 + 5}$ $= \underline{\quad} = \underline{\quad}$ $= \underline{\quad} = \underline{\quad}$
 $= \underline{9}$ $= \underline{\quad}$ $= \underline{\quad}$

6. Replace n with 2 in each expression and evaluate.

a) $4n + 3$ b) $5n + 1$ c) $3n - 2$
 $4(2) + 3$
 $= 8 + 3 = 11$

d) $2n + 3$

e) $4n - 3$

f) $2n - 4$

7. Replace the variable with the given number and evaluate.

a) $5h + 2, \quad h = 3$ b) $2n + 3, \quad n = 6$ c) $5t - 2, \quad t = 4$
 $5(3) + 2$
 $= 15 + 2 = 17$

d) $3m + 9, \quad m = 8$ e) $9 - z, \quad z = 4$ f) $3n + 2, \quad n = 5$

8. Evaluate each expression.

a) $2n + 3, \quad n = 5$ b) $2t + 3, \quad t = 5$ c) $2w + 3, \quad w = 5$
 $2(5) + 3$
 $= 10 + 3 = 13$

9. What do you notice about your answers to Question 8? _____

Why is that so? _____

PA5-12 Totals, Differences, and Equations

1. Fill in the table. Write x for the number you are not given.

	Blue Balloons	Red Balloons	Total Balloons	Another Way to Write the Total
a) 9 blue balloons 17 balloons in total	9	x	17	$9 + x$
b) 15 blue balloons 13 red balloons				
c) 31 balloons in total 18 blue balloons				
d) 17 red balloons 23 balloons altogether				
e) 34 red balloons 21 blue balloons				

When you can write the same number two ways, you can write an equation.
 Example: 9 blue balloons, x red balloons, 17 balloons in total
 Write the total two ways to get an equation: $9 + x = 17$

2. Circle the total in the story. Then write an equation.

a) 15 blue balloons
28 balloons altogether
 x red balloons

 $15 + x = 28$

b) 12 blue balloons
 14 red balloons
 x balloons altogether

c) 27 balloons altogether
 19 red balloons
 x blue balloons

d) There are 13 red apples.
 There are x green apples.
 There are 27 apples in total.

e) There are x red apples.
 There are 14 green apples.
 There are 39 apples in total.

f) There are 55 red apples.
 There are 16 green apples.
 There are x apples in total.

3. Circle the total in the story. Then write an equation and solve it.

a) There are 9 cats.
 There are 12 dogs.
 There are x pets altogether.

b) There are 19 stickers.
 x of them are black.
 11 of them are not black.

c) Kim has 9 friends.
 x of them are in Grade 6.
 6 friends are in Grade 5.

larger part – smaller part = difference

$$9 - x = 4$$

9 is 4 more than x. x is 4 fewer than 9. So $x = 9 - 4$ and now the variable x is by itself.

4. Fill in the table. Write x for the number you are not given. Circle the larger part and then write the difference another way.

		Parts		Difference	Another Way to Write the Difference
		Apples	Oranges		
a)	13 apples, 5 more oranges than apples	13	x	5	$x - 13$
b)	9 more oranges than apples, 12 apples				
c)	6 apples, 7 oranges				
d)	19 oranges, 8 fewer apples than oranges				
e)	27 oranges, 13 fewer oranges than apples				

5. Circle the part that is larger. Write the difference two ways to make an equation.

- | | | |
|--|--|--|
| a) 8 apples
3 fewer oranges than apples
x oranges
<u>$8 - x = 3$</u> | b) 5 apples
13 oranges
x more oranges than apples
_____ | c) 12 more apples than oranges
5 oranges
x apples
_____ |
|--|--|--|

6. Circle the part that is larger. Write the difference two ways to make an equation. Then solve the equation.

- | | | |
|---|---|--|
| a) There are 7 games.
There are x books.
There are 5 more games than books. | b) There are x games.
There are 12 books.
There are 6 fewer games than books. | c) There are 12 games.
There are 29 books.
There are x fewer games than books. |
|---|---|--|

- d) There are 17 pens.
There are x pencils.
There are 8 more pens than pencils.

- e) Tom has 19 stickers.
Avril has x stickers.
Tom has 13 fewer stickers than Avril.

- f) Eric's class has x students.
Amy's class has 34 students.
Eric's class has 6 fewer students than Amy's class.

7. Fill in the table. Write x for the number you are not given.

Problem	Parts	How Many?	Equation and Solution
a) Alex has 22 jazz songs in his collection. He has 8 more jazz songs than pop songs. How many pop songs does he have?	<i>jazz songs</i>	22	$22 - x = 8$
	<i>pop songs</i>	x	$22 - 8 = x$ $14 = x$
b) Dory has 21 red balloons. She has 9 green balloons. How many more red balloons than green balloons does she have?			
c) There are 7 apples in the fridge. There are 4 more oranges than apples in the fridge. How many oranges are there?			
d) Female European wolves weigh 4 kg less than male wolves. Males weigh 38 kg. How much do females weigh?			

8. Write the difference two ways to write an equation. Then solve the equation.

- a) Simon exercised for 25 minutes on Saturday. On Sunday he exercised for 17 minutes more than on Saturday. For how long did he exercise on Sunday?

$$\begin{aligned} x - 25 &= 17 \\ x &= 17 + 25 \\ &= 42 \end{aligned}$$

- b) There are 32 teachers in the school. There are 18 fewer volunteers than teachers. How many volunteers are there?

$$\begin{aligned} & \\ & \\ & \end{aligned}$$

- c) North American wolves weigh 36 kg. Indian–Arabian wolves weigh 11 kg less. How much do Indian–Arabian wolves weigh?

- d) Jasmin biked 13 km on Saturday. She biked 5 km more on Sunday than on Saturday. How many kilometres did she bike on Sunday?

- e) Raj counted 68 cars in a parking lot on Monday and 39 cars on Tuesday. How many fewer cars were parked there on Tuesday?

- BONUS** ▶ Grace's art exhibition had 658 visitors on the first night. The next night, there were 18 more visitors than on the first night. How many visitors came on the second night?

PA5-13 Problems and Equations—Addition and Subtraction

1. Fill in the table. Write x for the number you need to find. Cross out the cell you do not use.

	Problem	Parts	How Many?	Difference	Equation and Solution
				Total	
a)	Ethan has 2 dogs and 5 fish. How many pets does he have?	<i>dogs</i>	2	Difference: _____	$2 + 5 = x$ $x = 7$
		<i>fish</i>	5	Total: <u> x </u>	
b)	Sharon hiked 9 km on Saturday. She hiked 12 km on Sunday. How far did Sharon hike in two days?			Difference: _____	
				Total: _____	
c)	Luc saved \$36 in January. He saved \$17 less in February than in January. How much money did he save in February?			Difference: _____	
				Total: _____	
d)	The Leviathan roller coaster is 93 m tall. It is 25 m taller than the Yukon Striker roller coaster. How tall is the Yukon Striker?			Difference: _____	
				Total: _____	
e)	A supermarket sold 164 bags of white and yellow potatoes. If 76 of the bags were filled with white potatoes, how many bags of yellow potatoes were sold?			Difference: _____	
				Total: _____	

2. Write the parts and how many of each part. Then write and solve an equation.

- Cam has 12 blue marbles. He has 9 more red marbles than blue marbles. How many red marbles does he have?
- Cam also has 7 fewer green marbles than red marbles. How many green marbles does he have?
- How many red, blue, and green marbles does Cam have altogether? _____

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Write an equation to solve the problems on this page.

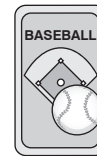
3. There are 32 children in a class. 13 of them wear eyeglasses.

- a) How many students don't wear eyeglasses?
- b) How many more students are there who don't wear eyeglasses than students who wear eyeglasses?



4. Rani bought 8 hockey cards and 10 baseball cards. She gave away 3 cards.

- a) How many cards did she buy altogether?
- b) How many cards does she have left?



5. Neka is three years older than Megan. Megan is 9 years old. How old is Neka?

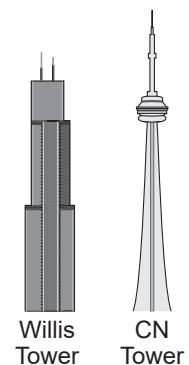
6. Anton bought a science-fiction novel for \$11 and a graphic novel for \$7.

- a) How much more expensive is the science-fiction novel than the graphic novel?
- b) How much did the books cost in total?

7. Nina watched TV for 60 minutes. She spent 20 minutes less on her homework than on watching TV. How much time did she spend on homework?

8. A recreation pass costs \$23. It is \$8 more than a movie pass. How much does the movie pass cost?

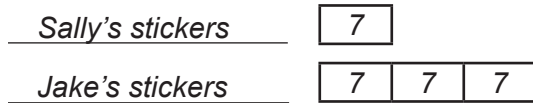
9. The Willis Tower in Chicago, USA, is 442 m tall. The CN Tower in Toronto is 553 m tall. How much taller is the CN Tower than the Willis Tower?



PA5-14 Models and “Times as Many”

1. Draw a diagram to model the story.

- a) Sally has 7 stickers. Jake has 3 times as many stickers as Sally does.



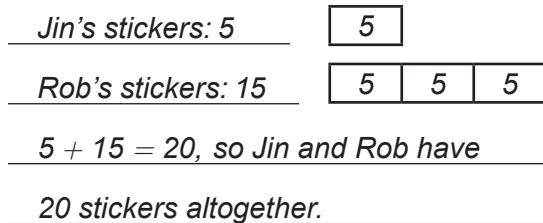
- b) There are 5 blue marbles. There are 4 times as many red marbles.

- c) There are 12 red apples. There are 4 times as many green apples as red apples.

- d) Yu has 4 stickers. Nora has 5 times as many stickers.

2. Solve the problem by drawing a model.

- a) Jin has 5 stickers. Rob has 3 times as many stickers as Jin. How many stickers do they have together?



- b) Randi studies rats and hamsters. She has 7 rats and twice as many hamsters. How many animals does she have altogether?

- c)** There are 12 chocolate chip cookies in a box. There are 6 times as many oatmeal cookies in the box. How many cookies are there altogether?

- d)** There are 17 math books in a school library. There are 4 times as many science books in the library. How many math books and science books are in the library altogether?

3. Draw a model for the story. Then write the given number beside the correct bar.

- a) There are 24 mangoes. There are 4 times as many mangoes as avocados.

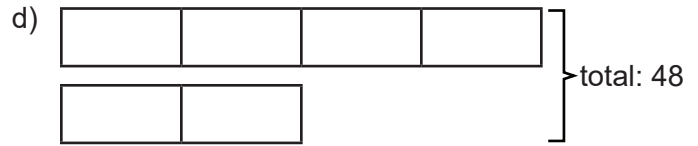
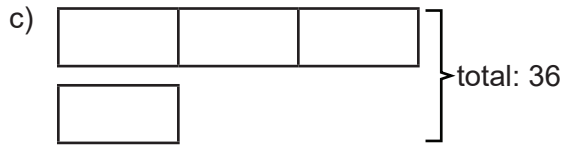
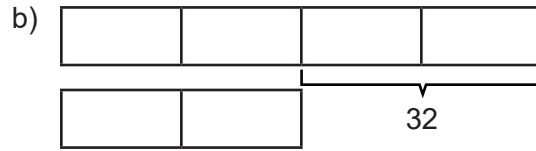
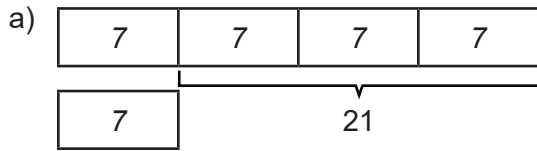


- b) There are 30 seniors in the audience. There are 6 times as many seniors as children.

- c) Matt spent \$24 on shoes and twice as much on pants.

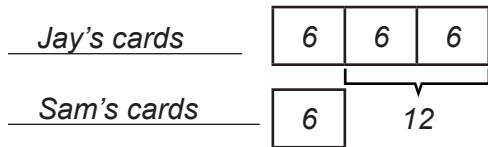
- d) Abella studied math for 30 minutes and science for 3 times as many minutes.

4. All the blocks are the same size. What is the size of each block?



5. Draw the model. Find the length of one block in the model. Then solve the problem.

a) Jay has 3 times as many cards as Sam. Jay has 12 more cards than Sam. How many cards does each person have?



Jay has 18 cards
and Sam has 6 cards.

b) Vicky is 4 times as old as Ella. Vicky is 15 years older than Ella. How old are Vicky and Ella?

Vicky is years old
and Ella is years old.

BONUS ▶

c) There are 6 times as many party balloons as streamers to decorate a house. There are 42 decorations altogether. How many balloons and how many streamers are there?

A pancake recipe calls for 2 tablespoons of butter and 3 times as many tablespoons of sugar per batch. Anna wants to make 24 batches. How many tablespoons of sugar and butter does she need?

There are party balloons
and streamers.

Anna needs tablespoons of butter and
 tablespoons of sugar.

6. A pair of shoes costs twice as much as a wallet. Glen paid \$51 for a pair of shoes and a wallet. How much does each item cost?



BONUS ▶ How much would Glen pay for two pairs of shoes and three wallets?

PA5-15 Problems and Equations—Multiplication and Division

When the larger part is 3 times the size of the smaller part, we say the **scale factor** is 3.

Smaller Part

Larger Part

You can find one part from another part using the scale factor.

Larger Part = Smaller Part \times Scale Factor

Smaller Part = Larger Part \div Scale Factor

1. Circle the larger part and underline the smaller part in the problem. Then fill in the blanks for the equation where the unknown is by itself and cross out the other equation.

a) There are 21 cats and m dogs. There are three times as many dogs as cats.

$$\frac{m}{\text{Larger Part}} = \frac{21}{\text{Smaller Part}} \times \frac{3}{\text{Scale Factor}} \quad \text{or} \quad \frac{\text{Smaller Part}}{\text{Larger Part}} = \frac{3}{\text{Scale Factor}}$$

b) There are m cats and 6 dogs. There are 3 times as many dogs as cats.

$$\frac{\text{Larger Part}}{\text{Smaller Part}} = \frac{6}{\text{Scale Factor}} \times \frac{3}{\text{Scale Factor}} \quad \text{or} \quad \frac{\text{Smaller Part}}{\text{Larger Part}} = \frac{3}{\text{Scale Factor}}$$

c) There are 12 cars in a parking lot. There are twice as many vans as cars in the parking lot.

$$\frac{\text{Larger Part}}{\text{Smaller Part}} = \frac{12}{\text{Scale Factor}} \times \frac{2}{\text{Scale Factor}} \quad \text{or} \quad \frac{\text{Smaller Part}}{\text{Larger Part}} = \frac{2}{\text{Scale Factor}}$$

2. Fill in the table. Write n for the number you are not given.
Hint: Circle the larger part and underline the smaller part.

	Problem	Parts	How Many?	Equation
a)	There are 20 green apples in a box. There are 4 times as many <u>green apples</u> as <u>red apples</u> .	<i>green apples</i>	20	$20 \div 4 = n$
		<i>red apples</i>	n	
b)	There are 16 mangoes. There are twice as many mangoes as kiwis.			
c)	There are 6 cats in a shelter. There are three times as many dogs as cats in the shelter.			

3. Complete the table.

	Total Number of Things	Number of Sets	Number in Each Set	Multiplication or Division Equation
a)	p	5	2	$5 \times 2 = p$
b)	12	4	p	$12 \div 4 = p$
c)	14	p	7	
d)	p	2	11	

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4. Fill in the table. Write x to show what you don't know. Then write a multiplication or division equation in the last column and solve the equation.

	Total Number of Things	Number of Sets	Number in Each Set	Multiplication or Division Equation
a) 24 people 4 vans	24	4	x	$24 \div 4 = x$ 6 people in each van
b) 8 balloons in each bag 5 bags				_____ balloons
c) 35 students 7 teams				_____ students on each team
d) 9 books on each shelf 6 shelves				_____ books
e) 6 juice boxes in each pack 48 juice boxes				_____ packs of juice

5. A store sold 6 rats and twice as many hamsters.
- How many hamsters did the store sell?
 - How many rats and hamsters were sold altogether?
 - How many more hamsters than rats were sold?



6. Emma is 5 times as old as Eddy. Emma is 35.
- How old is Eddy?
 - How much older than Eddy is Emma?
7. A female angler fish is 5 times as large as a male angler fish. The female can be 100 cm long.
- How long is the male angler fish?
 - How much longer than the male is the female angler fish?