UNIT 1

Patterns and Relations

Just for Fun

Word Find

Find the following words in the puzzle below. You can move in any direction.

term
divisibility rule
unit
tile

d	i	v	i	s
e	t	e	l	i
l	m	r	i	b
u	n	i	t	i
r	y	t	i	l

Pattern Search

Choose a grid of any 4 squares in the calendar. What patterns do you see in the numbers?

May						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Variation: Choose a grid of any 9 squares or pick a different month and try again.

Express Yourself!

A Game for 2 or more

Make as many words as you can from the letters of the words "algebraic expression." The person with the most words after 3 minutes wins!

____

____

Activating Prior Knowledge

Order of Operations

Perform operations inside the brackets first.
Next, divide and multiply in order from left to right.
Then add and subtract in order from left to right.

The letters B, D, M, A, and S can help you remember the order of operations.
B—Brackets
D, M—Divide, Multiply
A, S—Add, Subtract

Example 1

Simplify.

a) $10 - 3 \times 2$ **b)** $12 \div (5 + 1)$ **c)** $6 \times 2 \div 3 + 1$

Solution

a) $10 - 3 \times 2 = 10 - 6$ Multiply first.
$= 4$ Then subtract.

b) $12 \div (5 + 1) = 12 \div 6$ Add inside the brackets first.
$= 2$ Then divide.

c) $6 \times 2 \div 3 + 1 = 12 \div 3 + 1$ Multiply first.
$= 4 + 1$ Then divide.
$= 5$ Then add.

Check

1. Simplify.

a) $12 - 2 \times 4$
$=12 -$ ______
$=$ ______

b) $20 \div (2 + 3)$
$= 20 \div$ ______
$=$ ______

c) $12 \div 6 \times 5 + 4$
$=$ ______ $\times 5 + 4$
$=$ ______

d) $10 + 4 \div 2$
$= 10 +$ ______
$=$ ______

e) $(9 - 5) \times 6$
$=$ ____ $\times 6$
$=$ ______

f) $5 + 2 \times 3 - 4$
$= 5 +$ ______
$=$ ______

Graphing on a Coordinate Grid

An ordered pair, such as (5, 3), tells you the position of a point on a grid.
The first number is the horizontal distance from the origin.
The second number is the vertical distance from the origin.
The numbers of an ordered pair are also called the **coordinates** of a point.

Example 2

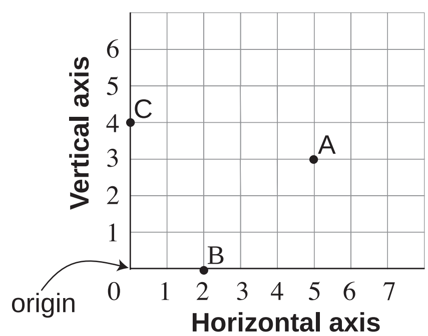
Graph the points A(5, 3), B(2, 0), and C(0, 4) on a grid.

Solution

To plot point A, start at 5 on the horizontal axis, then move up 3.

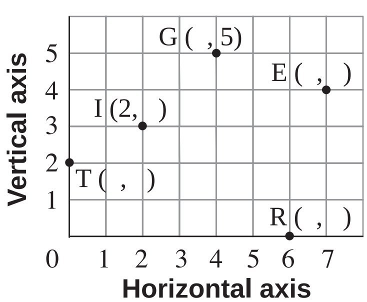
To plot point B, start at 2 on the horizontal axis, then move up 0. Point B is on the horizontal axis.

To plot point C, start at 0 on the horizontal axis, then move up 4. Point C is on the vertical axis.

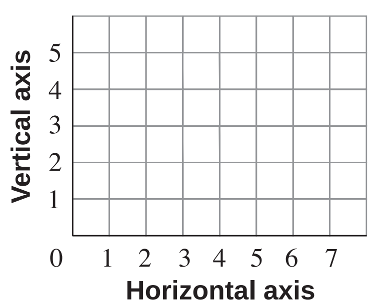


Check

2. Write the ordered pair for each point on the grid.



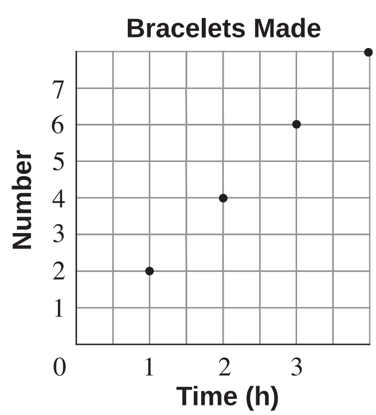
3. Plot and label these points:
A(0, 5), B(2, 4), E(4, 3), R(5, 0)



4. The graph shows the number of bracelets Jan can make over time.

a) How many bracelets can Jan make in 3 h? ______________

b) How long will it take to make 10 bracelets? ______________



1.1 Patterns in Division

Quick Review

➤ Multiples of 2 are even numbers.
They have these ones digits: 0, 2, 4, 6, 8
For example, these are even numbers and multiples of 2: 32, 74, 88, 96, 100
All even numbers are divisible by 2.

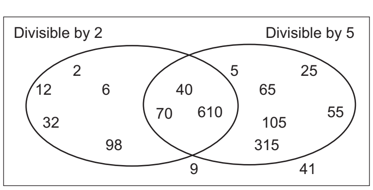
➤ A number is a multiple of 4 if the tens and ones digits of the number form a number that is a multiple of 4.
For example, 1**24** is a multiple of 4 because **24** is a multiple of 4.
And, 30**36** is a multiple of 4 because **36** is a multiple of 4.

➤ Multiples of 5 have these ones digits: 0, 5
For example, these numbers are multiples of 5: 5, 20, 45, 350
Multiples of 5 are divisible by 5.

➤ A number is a multiple of 8 if the hundreds, tens, and ones digits of the number form a number that is a multiple of 8.
For example, 1**888** is a multiple of 8 because **888** is a multiple of 8.
And, 1**040** is a multiple of 8 because **040**, or **40** is a multiple of 8.

➤ Multiples of 10 have a ones digit that is 0.
For example, these numbers are multiples of 10: 20, 40, 130, 770
Multiples of 10 are divisible by 10.

➤ You can use a Venn diagram to show numbers that are divisible by two or more numbers.
This Venn diagram shows divisibility by 2 and by 5.

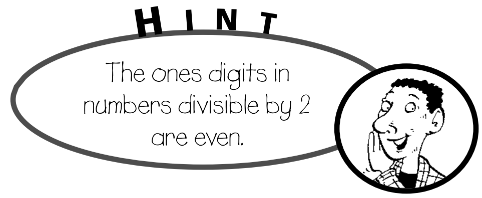


Multiples of 2 are in the left loop.
Multiples of both 2 and 5 are in the middle loop.
Multiples of 5 are in the right loop.
Numbers that are *not* multiples of 2 or of 5 are outside the loops.

Practice

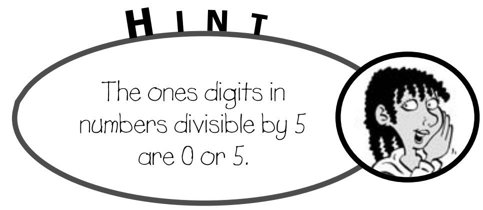
1. Circle the numbers that are divisible by 2.

23 98 21 44 11 77 34



2. Circle the numbers that are divisible by 5.

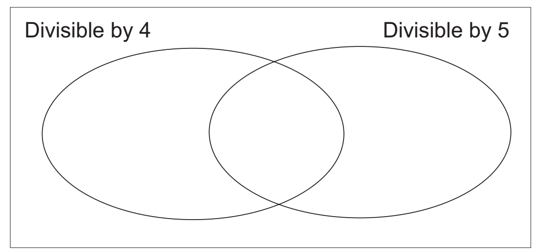
55 10 7 59 105 775 1025



3. Circle the numbers that are divisible by 2 and by 5.

10 30 25 55 1000 52

4. Write each number in the correct place in the Venn diagram.
16, 20, 33, 64, 80, 95, 97, 105, 214, 216, 324, 405



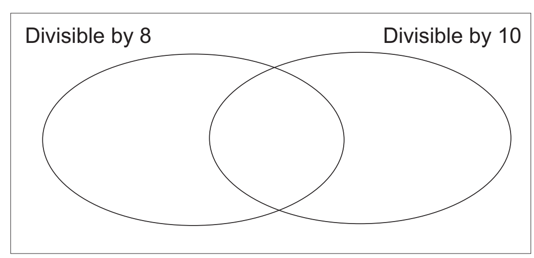
5. Write four 3-digit numbers that are divisible by 10.

____

6. Write three 4-digit numbers that are divisible by 8.

____

7. **a)** Write each number in the correct place in the Venn diagram.
115, 116, 120, 168, 450, 753, 800, 928, 1008, 1110



b) Write 4 more numbers in the Venn diagram – one in each loop and one outside the loops. How do you know you placed each number correctly?

____

____

1.2 More Patterns in Division

At Home At School

Quick Review

➤ A number is divisible by 3 if the sum of its digits is divisible by 3. For example,
1035 is divisible by 3 because 1 + 0 + 3 + 5 = 9, and 9 is divisible by 3.
1036 is *not* divisible by 3 because 1 + 0 + 3 + 6 = 10, and 10 is *not* divisible by 3.

➤ A number is divisible by 6 if the number is divisible by 2 and by 3. For example,
1038 is divisible by 2 because the number is even.
1038 is divisible by 3 because 1 + 0 + 3 + 8 = 12, which is divisible by 3.
So, 1038 is divisible by 6.

➤ A number is divisible by 9 if the sum of its digits is divisible by 9. For example,
5418 is divisible by 9 because 5 + 4 + 1 + 8 = 18, and 18 is divisible by 9.
5428 is *not* divisible by 9 because 5 + 4 + 2 + 8 = 19, and 19 is *not* divisible by 9.

➤ No number is divisible by 0.

➤ You can use a Carroll diagram to show numbers that are divisible by two numbers.
This Carroll diagram shows divisibility by 6 and by 9.

	Divisible by 6	**Not divisible by 6**
Divisible by 9	18, 36, 126, 162	27, 45, 963, 711
Not divisible by 9	6, 12, 204, 402	10, 29, 325, 802

➤ You can use divisibility rules to help list the factors of a number.
To list the factors of 156:
Try each rule in turn.
Divide by 2: 156 ÷ 2 = 78
Divide by 3: 156 ÷ 3 = 52
Divide by 4: 156 ÷ 4 = 39
156 is not divisible by 5.
Divide by 6: 156 ÷ 6 = 26
156 is not divisible by 7, by 8, by 9, or by 10.
Use a calculator to check for divisibility by 11 and 12.
156 is not divisible by 11.
Divide by 12: 156 ÷ 12 = 13
Since the factors 12 and 13 are close in value, you have found all the factors.
In order, the factors of 156 are: 1, 2, 3, 4, 6, 12, 13, 26, 39, 52, 78, 156

Practice

1. Match the number with the correct divisibility statement.
Draw more than one line if it is needed.

54	Divisible by 10.
56	Divisible by 3.
50	Divisible by 9.
92	Divisible by 8.
75	Divisible by 5.
93	Divisible by 2.
30	Divisible by 6.

2. Cross out the numbers that are *not* divisible by 2.

12 79 98 134 227 2469

How do you know the numbers are not divisible by 2?

____

3. Circle the numbers that are divisible by 9.

91 331 333 153 99 12 321

How do you know you are correct?

____

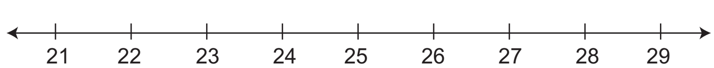
____

4. Write four numbers that are divisible by 6: ______________________________
How did you choose those numbers?

____

5. Solve each riddle.

a) I am divisible by 2 and by 3.
I am between 21 and 29.
Which number am I? ________



b) I am divisible by 5 and by 10.
I am between 56 and 64.
Which number am I? ________

c) I am divisible by 2 and by 9.
I am between 424 and 449.
Which number am I? ________

6. Which numbers below are divisible by 3? By 6? By 9?
How do you know?

a) 124 ______________________________

b) 215 ______________________________

c) 330 ______________________________

____

d) 450 ______________________________

____

e) 150 ______________________________

____

7. Use your answers to question 6 to help you list the factors of each number.

a) 124: ______________________________

b) 215: ______________________________

c) 150: ______________________________

8. **a)** Sort these numbers in the Carroll diagram below.
16, 18, 27, 37, 120, 180, 281, 288, 352, 411, 432, 540

	Divisible by 9	**Not divisible by 9**
Divisible by 4		
Not divisible by 4		

b) Write one more number in each part of the Carroll diagram.
Explain how you knew where to place each number.

____

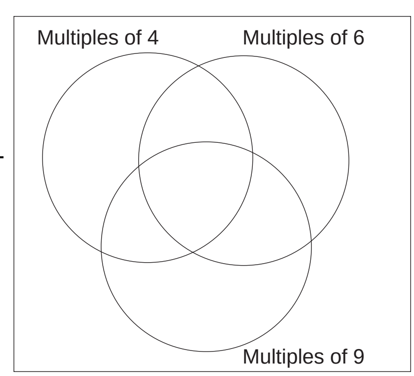
____

9. **a)** Sort these numbers in the Venn diagram.
12, 28, 36, 54, 72, 79, 135, 256, 270, 318, 371, 432

b) Which loop is empty? ______________________________
Explain why there is no number that belongs in that loop.

____

____



Quick Review

➤ **Algebraic expressions** contain **variables** such as x and n.
x and ***n*** can represent any numbers you choose.

Here are some examples of algebraic expressions and what they mean.

$x + 5$:	Five more than a number
$n - 3$:	Three less than a number
$3 - n$:	Three subtract a number
$5x$:	Five times a number
$5n + 3$:	Five times a number, then add 3; or three more than five times a number
$\frac{100}{n}$:	One hundred divided by a number
$\frac{n}{100}$:	A number divided by one hundred

➤ In the algebraic expression $7t + 2$

7 is the **numerical coefficient** of the variable.
2 is the **constant term**.
t is the variable.

➤ An algebraic expression can help you solve similar problems more efficiently. Once you know the algebraic expression, you can use it again, even if the numbers change.

Suppose you earn $8 per hour.

For 3 hours, you earn: $3 \times \$8 = \$24$

For t hours, you earn: $t \times \$8 = 8t$ dollars

HINT

If you see how to solve a problem using numbers, then you can write an algebraic expression for the problem. Replace the number that changes with a variable.

➤ To evaluate an expression means to substitute a number for the variable, then calculate the answer.

To evaluate $2a - 5$ for $a = 7$:
Replace a with 7 in the expression $2a - 5$.

$$\begin{aligned} 2a - 5 &= 2(7) - 5 \\ &= 14 - 5 \\ &= 9 \end{aligned}$$

HINT

Recall that $2a$ means $2 \times a$. Use the order of operations. Multiply before subtracting.

Practice

1. Match each algebraic expression with its meaning.

$6 + x$	Five less than a number
$4n$	One more than double a number
$1 + 2t$	Five subtract a number
$5 - p$	Four times a number
$s - 5$	Three times a number subtract four
$3g - 4$	Six more than a number

2. Identify the numerical coefficient, the variable, and the constant term in each expression.

a) $4 + 5s$
Numerical coefficient: ________ Variable: ________ Constant term: ________

b) $x + 7$
Numerical coefficient: ________ Variable: ________ Constant term: ________

c) $9m$
Numerical coefficient: ________ Variable: ________ Constant term: ________

3. An algebraic expression has constant term 12, variable t, and numerical coefficient 8.
What might the expression be? ______________________________

4. Write an algebraic expression for each phrase.
Use the variable n.

a) Ten times a number __________________ **b)** Double a number __________________

c) A number divided by four ____________ **d)** Six less than a number ____________

e) Three more than ten times a number ____

f) Six less than ten times a number ____

5. A clerk earns $12 an hour.
Find how much the clerk earns for each time.

a) 5 h work **b)** 8 h work **c)** p hours work

$5 \times$ _____ = _____ ________ = _____ ________ = ____________

6. A car travels at an average speed of 60 km/h.
Find how far it travels in each time.

a) 3 h **b)** 5 h **c)** x hours

$3 \times$ _______ = ________ __________ = _______ __________ = ________

7. Evaluate each expression by replacing z with 10.

a) $z + 5 = 10 + 5$

$= \_\_\_\_\_\_\_\_$

b) $8 + z = \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

c) $z - 6 = \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

d) $15 - z = \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

e) $3z = \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

f) $5z = \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

8. Evaluate each expression by replacing n with 2.

a) $2n + 3$

$= 2 \times \_\_\_\_\_\_\_\_ + 3$

$= \_\_\_\_\_\_\_\_ + 3$

$= \_\_\_\_\_\_\_\_$

b) $20 - 5n$

$= \_\_\_\_\_\_\_\_ - 5 \times 2$

$= \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

Tip

Use the order of operations:
B — Brackets
D, M — Divide, Multiply
A, S — Add, Subtract

c) $\frac{n}{2} + 8$

$= \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

d) $14 - \frac{n}{2}$

$= \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

$= \_\_\_\_\_\_\_\_$

9. Sofia works part-time in a convenience store.
She earns \$6/h during the day, and \$8/h during the evening.

a) In one week, Sofia worked 10 h in the day and 9 h in the evening.
Write an expression for her earnings in dollars.

____

b) Suppose Sofia works n hours in the day and 7 h in the evening.

i) Write an expression for her earnings in dollars.

____

ii) How much does Sofia earn when $n = 5$?

____

c) Suppose Sofia works 9 h in the day and
m hours in the evening.

i) Write an expression for her earnings in dollars.

____

ii) How much does Sofia earn when $m = 11$?

____

KEY TO SUCCESS

Evaluating algebraic expressions is an important skill. Carpenters, computer scientists, designers, electricians, and auto mechanics all use this skill to solve problems on the job.

1.4 Relationships in Patterns

Quick Review

At Home At School

➤ You can describe a number pattern using the term number.

Term number	1	2	3	4	5	6
Term	8	16	24	32	40	48

We can write an algebraic expression for the term when we know the term number.
Each term is 8 times the term number.
Let n represent any term number.
Then the term is represented by $8 \times n$, or $8n$.

When you compare or *relate* a variable to an expression that contains the variable, you have a *relation*.
The variable is n.
The expression is $8n$.
The relation is: $8n$ is related to n

➤ The table and relation above can represent the total number of beats in a music score when there are 8 beats in each bar.

Number of bars of music	1	2	3	4	5	6
Total number of beats	8	16	24	32	40	48

You can use the relation to find the number of beats in 17 bars of music.
Substitute $n = 17$ in the expression $8n$.

$8n = 8(17)$
$= 136$

There are 136 beats in 17 bars of music.

Practice

1. Complete each chart.

a)

Term number	1	2	3	4	5	6
Term	5		15		25	

b)

Term number	1	2	3	4	5	6
Term	5		7		9	

c)

Term number	1	2	3	4	5	6
Term	3		9		15	

2. Every day, Ray rides his bike 12 km around Stanley Park.
Complete the chart to show the total distance Ray travelled.

Number of days	1	2	3	4	5	6
Distance (km)	12					72

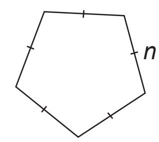
3. Write a relation for the pattern rule for each pattern.
Use the relation to find the 12th term.
Let n represent any term number.

a) 6, 12, 18, 24, ... ______

b) 10, 11, 12, 13, ... ______

4. a) Write a relation for the perimeter of a regular pentagon

with side length n centimetres. ______



b) What is the perimeter of a regular pentagon with side length 9 cm?

______

5. Ally is organizing an end-of-term party.
The cost to rent the hall is \$100. The cost of food is \$8 per person.

a) Write a relation for the total cost of the party, in dollars, for n people.

______

b) How much will the party cost if:

i) 20 people attend? ______

ii) 50 people attend? ______

c) How does the relation in part a change in each case?

i) The cost of food doubles.

______

ii) The cost of the food increases by \$2 per person.

______

d) For each scenario in part c, find the cost when 40 people attend.

i) ______

ii) ______

1.5 Patterns and Relationships in Tables

Quick Review

➤ You can make a table of values for a relation such as: $2n + 5$ is related to n
Choose values for n. These are Input numbers.
Substitute each value of n in $2n + 5$ to get the Output numbers.

When $n = 1$, $2n + 5 = 2(1) + 5$
$= 7$

When $n = 2$, $2n + 5 = 2(2) + 5$
$= 9$

When $n = 3$, $2n + 5 = 2(3) + 5$
$= 11$

When $n = 4$, $2n + 5 = 2(4) + 5$
$= 13$

Here is the table:

Input n	**Output** $2n + 5$
1	7
2	9
3	11
4	13

➤ You can find a relation given its table of values.

	Input	**Output**	
	1	2	
+1	2	6	+4
+1	3	10	+4
+1	4	14	+4
+1	5	18	+4

Let n represent any Input number.
When n increases by 1, the Output number increases by 4.
This means that the expression for the Output numbers contains $4n$.
So, compare the Output numbers to multiples of 4: 4, 8, 12, 16, 20, . . .
Each Output number is 2 less than a multiple of 4.
So, the output is $4n - 2$.
The table shows how $4n - 2$ relates to n.

Practice

1. **a)** Evaluate the expression $3n + 1$.

When $n = 1$, $3n + 1 = 3(1) + 1$
$= \_\_\_\_\_$

When $n = 2$, $3n + 1 = 3(2) + 1$
$= \_\_\_\_\_$

When $n = 3$, $3n + 1 = 3(3) + \_\_\_\_\_$
$= \_\_\_\_\_$

When $n = 4$, $3n + 1 = 3(\_\_\_\_\_) + \_\_\_\_\_$
$= \_\_\_\_\_$

When $n = 5$, $3n + 1 = 3(\_\_\_\_\_) + \_\_\_\_\_$
$= \_\_\_\_\_$

b) Complete the table. Use your results from part a.

Input n	Output $3n + 1$
1	
2	
3	
4	
5	

2. Complete each table.
Explain how the Output number is related to the Input number.

a)

Input n	Output $n + 5$
1	
2	
3	
4	
5	

____

____

b)

Input b	Output $8 - b$
1	
2	
3	
4	
5	

____

____

c)

Input a	Output $6 + a$
1	
2	
3	
4	
5	

____

____

3. Complete each table.

a)

Input d	Output $2d + 3$
1	
2	
3	
4	
5	

b)

Input f	Output $3f - 2$
1	
2	
3	
4	
5	

c)

Input h	Output $5h + 1$
1	
2	
3	
4	
5	

4. Use algebra. Write a relation for each table.

a)

Input n	Output
1	2
2	3
3	4
4	5
5	6

____

b)

Input p	Output
1	0
2	1
3	2
4	3
5	4

____

c)

Input m	Output
1	8
2	16
3	24
4	32
5	40

____

5. Use algebra. Write a relation for each table.
Then extend each table 3 more rows.

a)

Input r	Output
1	4
2	6
3	8
4	10
5	12

____

b)

Input s	Output
1	2
2	5
3	8
4	11
5	14

____

c)

Input n	Output
1	9
2	14
3	19
4	24
5	29

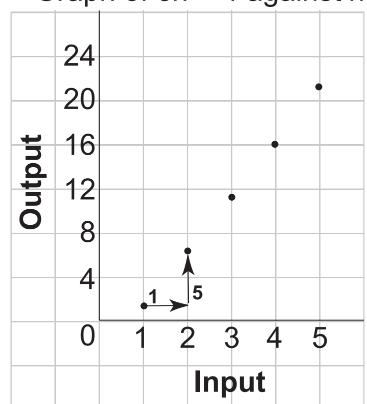
____

Quick Review

➤ You can use a graph to show a relation.
This table and graph show how $5n - 4$ relates to n.

	Input n	Output $5n - 4$	
	1	1	
+1			+5
	2	6	
+1			+5
	3	11	
+1			+5
	4	16	
+1			+5
	5	21	

Graph of $5n - 4$ against n



The scale on the *Output* axis is 1 square to 4 units.
The points lie on a straight line, so the relation is linear.
Both the table and the graph show that when the input increases by 1, the output increases by 5.

Practice

1. Complete each table.

a)

Input n	Output $2n + 8$
1	10
2	12
3	14
4	16
5	
6	
7	

b)

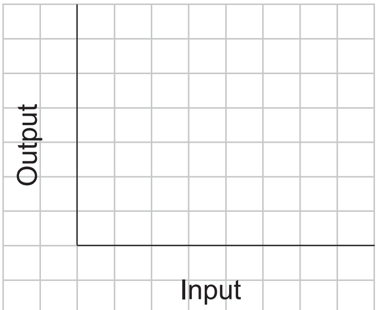
Input n	Output $5n + 1$
1	6
2	11
3	16
4	21
5	
6	
7	

c)

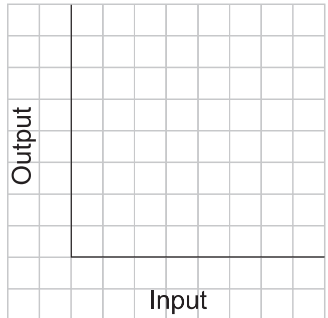
Input n	Output $9 - n$
1	8
2	7
3	6
4	5
5	
6	
7	

2. Choose a suitable scale.
Graph each relation in question 1.

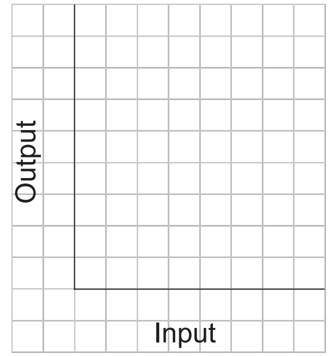
a)



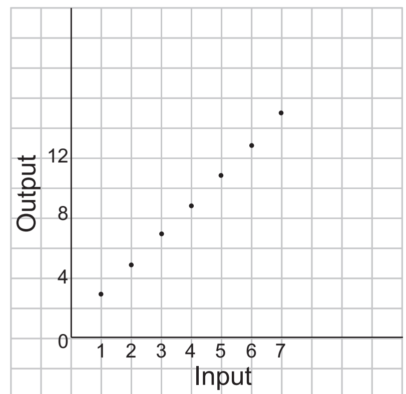
b)



c)



3. Look at the graph at the right.



a) What is the output when the input is 1? ________

b) Which input gives an output of 13? ________

c) Extend the graph.

i) What is the output when the input is 8? ________

ii) What is the input when the output is 21? ________

4. a) Complete this table.

Input a	Output $5a + 3$
2	
4	
6	
8	
10	

b) Graph the relation in part a.

c) How does the graph illustrate the relation?

____

____

5. The members of the student council wash cars to raise money for charity.
The students charge $3.00 per car.

a) Let *c* represent the number of cars washed.
Write a relation to show how the money collected, in dollars, is related to the number of cars washed. ____________________

b) Complete this table to show the relation.

Number of cars	Money collected ($)
10	
20	
30	
40	
50	

c) Graph the data.

d) Describe the graph.

____

____

e) Use the relation, the graph, or the table to answer these questions.
Explain your choice.

i) Suppose the students wash 33 cars.
How much money will they collect? ________

I used the: ____________________

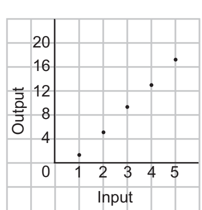
ii) Suppose the students wash 60 cars.
How much money will they collect? ________

I used the: ____________________

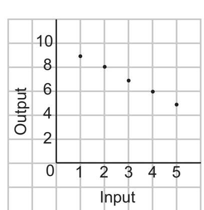
____

6. Match each graph to its relation.

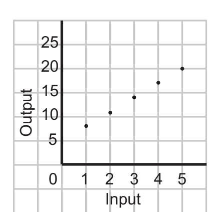
a)



b)



c)



A. $10 - n$ relates to n

B. $3n + 5$ relates to n

C. $4n - 3$ relates to n

________________ ________________ ________________

1.7 Reading and Writing Equations

Quick Review

➤ An equation is a statement that two expressions are equal.

$2x + 1$ is an algebraic expression.
7 is an expression.
$2x + 1 = 7$ is an equation.

This equation can be expressed in words as:
One more than double a number is seven.

➤ Here's how to write an equation from a statement.

1. Choose a letter for the variable.
2. Write an algebraic expression to represent the relationship described.
3. Write an equals sign between the expression and the constant term.

HINT

The words "is" and "equals" are written as an equals sign (=) in an equation.

Five more than a number is 20.
Let p represent the number.
Five more than p: $p + 5$
The equation is: $p + 5 = 20$

A number subtracted from ten is 4.
Let x represent the number.
x subtracted from ten: $10 - x$
The equation is: $10 - x = 4$

A number divided by two is 8.
Let n represent the number.
n divided by two: $\frac{n}{2}$

The equation is: $\frac{n}{2} = 8$

Practice

1. Match each sentence with an equation. The first one is done for you.

A number divided by three is 4.	$20 - n = 6$
Twenty subtract a number equals 6.	$2n + 3 = 11$
Nine subtract one-half a number is 6.	$\frac{n}{3} = 4$
Three added to double a number is 11.	$9 - \frac{n}{2} = 6$

2. Write an equation for each sentence.
Let n represent the number.

a) Eight less than a number is 2. $n -$ _____ $=$ _____

b) One-half a number equals 5. ________________________________

c) Four more than double a number is 20. ________________________________

d) Six plus three times a number is 9. ________________________________

3. Write a sentence for each equation.

a) $n - 6 = 12$

____

b) $\frac{x}{2} = 10$

____

c) $2p + 10 = 14$

____

4. Write an equation for each sentence.
Let x represent the number.

a) Three more than a number is 12. ________________________________

b) Three less than a number is 12. ________________________________

c) Three times a number equals 12. ________________________________

d) Three more than three times a number is 12. ________________________

e) Three subtracted from three times a number equals 12. __________________

5. Write an equation for each sentence.

a) The cost of 2 adult tickets at \$5 each and n child tickets at \$3 each is \$25.

____

b) William's age 4 years ago was 12. Let a years represent William's age now.

____

c) The perimeter of a square with side length s is 28.

____

1.8 Solving Equations Using Algebra Tiles

Quick Review

➤ You can use tiles to represent an expression.

This **unit tile** represents +1.

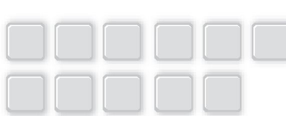
This **variable tile** or ***x*-tile** represents *x*.

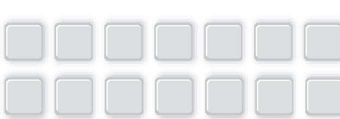
➤ You can use tiles to solve an equation. For example, to solve: $x + 3 = 14$:
Draw a vertical line in the centre of the page.
It represents the equals sign in the equation.
Arrange the tiles on each side of the line to represent the expression or number on each side of the equation.
On the left side, place tiles to represent $x + 3$.
On the right side, place tiles to represent 14.

To isolate the *x*-tile, remove 3 unit tiles from each side.

The tiles show the solution is $x = 11$.

To *verify* the solution, replace *x* with 11 tiles.

Left side:  + ⟶ 14 unit tiles

Right side:  ⟶ 14 unit tiles

Since both sides have equal numbers of tiles, the solution $x = 11$ is correct.

Practice

1. Complete each algebraic expression.

a) A number increased by 3: $x +$ ________

b) Two times a number: ________ x

c) Three more than 4 times a number: $4x +$ ________

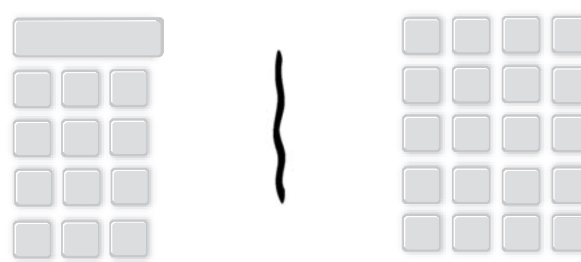
d) Twelve less than a number: ________ $- 12$

2. Match each picture to its equation.

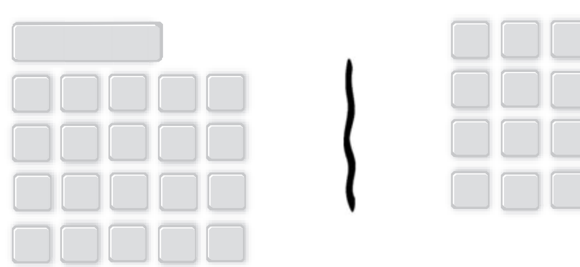
a) $x + 1 = 3$

b) $x + 2 = 4$

c) $x + 20 = 12$



d) $x + 12 = 20$



3. Zephyr had songs in his music player folder.
He bought 7 more. Zephyr then had 10 songs.
How many did he start with?
Complete the solution for the equation: $x + 7 = 10$

Step 1

Step 2

Step 3

The solution is: ______________________________

4. An online book costs \$15.00 to upload to a computer.
How many online books can be purchased for \$75.00?

a) Write an equation to represent this problem.

____

b) Solve the equation to find how many online books can be purchased.

____

5. Erica is thinking of a number. She multiplies it by 2, then adds 5.
The result is 19. Which number did Erica begin with?

a) Write an equation to represent this problem.

____

b) Solve the equation to find the number.

____

In Your Words

Here are some of the important mathematical words of this unit.
Build your own glossary by recording definitions and examples here. The first one is done for you.

divisibility rules rules I can use to find out multiples of numbers and factors of numbers. For example, to find out if a certain number is a multiple of 3, I add the digits of the number; if the sum is a multiple of 3, then the number is also a multiple of 3.

algebraic expression ______________________

variable ______________________

evaluate ______________________

equation ______________________

solve an equation ______________________

List other mathematical words you need to know.

____

Unit Review

LESSON

1.1 **1.** **a)** Circle the numbers that are divisible by 4.

312 1407 204 3441 640 763

b) How do you know if a number is divisible by 4?

____

2. **a)** Circle the numbers that are divisible by 2 and by 3.

606 330 501 2466 492 9342

b) What other number are the circled numbers in part a divisible by? ________

How do you know?

____

1.2 **3.** Which numbers below are divisible by 8? Divisible by 5?
How do you know?

a) 244: ____

____

b) 160: ____

____

c) 315: ____

____

d) 608: ____

____

4. Use your answers from question 3 to help you list all the factors of each number.

a) 244: ____

b) 160: ____

c) 315: ____

d) 608: ____

LESSON

1.3 **5.** Write an algebraic expression for each phrase. Use the variable n.

a) Three times a number: ______

b) Five less than a number: ______

c) Twenty divided by a number: ______

d) Seven more than four times a number: ______

6. Evaluate each expression for $n = 5$.

a) $n + 7 =$ ______ **b)** $10 - n =$ ______ **c)** $2n + 3 =$ ______

1.4 **7.** **a)** Zadie climbed four sets of stairs every minute for the Charity Stair Climb Fundraiser. Complete this table. The pattern continues.

Time (minutes)	1	2	3	4	5	6	7	8
Sets of stairs climbed								

b) How many sets of stairs will Zadie have climbed after 15 minutes? ______

8. Write a relation for the pattern rule for each number pattern.

a) 3, 6, 9, 12, 15, . . . ______

b) 8, 9, 10, 11, 12, . . . ______

1.5 **9.** Complete each table.
How is each Output number related to its Input number?

a)

Input n	**Output** $3n + 5$
1	
2	
3	
4	
5	

______
______
______

b)

Input n	**Output** $5n + 3$
1	
2	
3	
4	
5	

______
______
______

c)

Input n	**Output** $5n - 3$
1	
2	
3	
4	
5	

______
______
______

LESSON

10. Use algebra. Write a relation for each table.

a)

Input m	Output
1	9
2	11
3	13
4	15
5	17

____

b)

Input m	Output
1	9
2	16
3	23
4	30
5	37

____

c)

Input m	Output
1	5
2	12
3	19
4	26
5	33

____

1.6 **11.** Graph each relation in question 10.

a)

b)

c)

1.7 **12.** Write an equation for each sentence.
Let n represent the number.

a) Four times a number is sixteen. ____________________

b) Eight subtracted from four times a number is sixteen. ____________________

c) Twelve more than four times a number is sixteen. ____________________

d) Thirty-two minus four times a number is sixteen. ____________________

13. Write an equation for each sentence. Let n represent the number.

a) Four less than a number is sixteen. ______________

b) A number divided by five is ten. ____________

c) Five more than three times a number is eleven. ______________

1.8 **14.** Robin walked twice around a lake, plus an extra 3 km.
Her pedometer showed that she had walked a total of 19 km.
Write then solve an equation to find how far it is around the lake.

____