

## Grade 7 - Unit One

### Patterns and Relations

Name: \_\_\_\_\_

#### **Booklet 1 – 1.1: Patterns in Division**

In this section we will be looking at the Divisibility Rules for the numbers 2, 4, 5, 8 & 10.

*Divisible means that a number can be divided by a certain number.*

For example,  $30 \div 5 = 6$

So, 30 is divisible by 5.

#### **Divisibility by 10**

Which of the following numbers are divisible by 10?

80                      1                      20                      50  
105                      30                      4

How do you know?

So, the Divisibility Rule for 10 is:

If the ones digit is 0:

Ex. 10, 20, 30, 40 ... 100, 110 ...

#### **Divisibility by 2**

Which of the following numbers are divisible by 2?

80                      1                      27                      56  
105                      32                      4

How do you know?

So, the Divisibility Rule for 2 is:

If the number is EVEN!

Ex. 2, 4, 6, 8 ...

## Divisibility by 5

Which of the following numbers are divisible by 5?

80

1

27

56

105

32

4

How do you know?

So, the Divisibility Rule for 5 is:

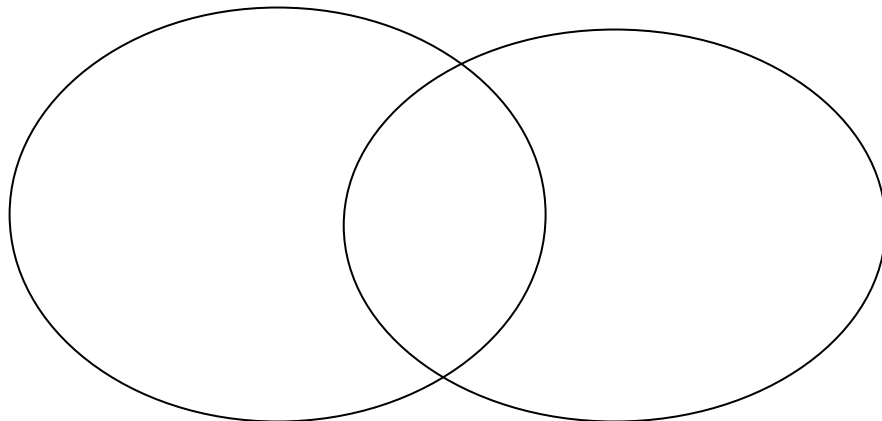
If the ones digit is 0 or 5.

Ex. 5, 10, 15, 20, 25 ... 100, 105 ...

Practice: 1) Which of the following numbers are divisible by 2 AND 5?

105, 211, 16, 210, 199, 36, 40

Use a Venn Diagram to help!



**Divisibility by 4** can be a little more tricky.

For numbers 0 to 100, you must check by seeing if the number divides by 4 - no trick.

Example:

Which numbers are divisible by 4?

16

24

30

100

Divide each number by 4 to find out.

So, we know that 100 is divisible by 4. Do you think that 116 is divisible by 4?

To decide, we can break the number into 2 parts:

$$116 = 100 + 16$$

Since both numbers are divisible by 4, 116 is divisible by 4.

What about 232? Break it apart!

$$232 = 100 + 100 + 32$$

Since both 100 and 32 are divisible by 4, 232 is divisible by 4.

So, the Divisibility Rule for 4 is:

If the number represented by the last 2 digits are divisible by 4.

Ex. 104 (04 or 4 is divisible by 4)

Practice:

2) Which of the following numbers is divisible by 4? Show your workings and explain how you know!

a) 44

b) 323

c) 532

d) 1024

3) Use the digits 0 to 9. Replace the  $\square$  in each number to make a number divisible by 4. Find as many answers as you can.

a) 822 $\square$

b) 211 4 $\square$ 8

c) 15  $\square$ 32

**Divisibility by 8** can be a little more tricky too.

For numbers between 0 and 1000, you must check by seeing if the number divides by 8 - no trick.

Example:

Which numbers are divisible by 8?

16                      24  
30                      1000

Divide each number by 8 to find out.

So, we know that 1000 is divisible by 8. Do you think that 1016 is divisible by 8?

To decide, we can break the number into 2 parts:

$$1016 = 1000 + 16$$

Since both numbers are divisible by 8, 1016 is divisible by 8.

What about 2040? Break it apart!

$$2040 = 1000 + 1000 + 40$$

Since both 1000 and 40 are divisible by 8, 2040 is divisible by 8

So, the Divisibility Rule for 8 is:

If the number represented by the last 3 digits are divisible by 8.

Ex. 1048 (048 or 48 is divisible by 8)

4056 (056 or 56 is divisible by 8)

4) Practice:

Which of the following numbers is divisible by 8? Show your workings and explain how you know!

a) 64

b) 4072

c) 10 088

d) 1024

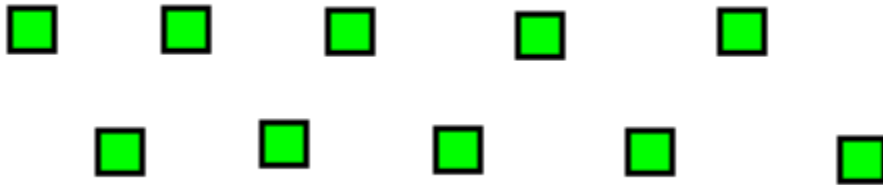
To complete on loose leaf: [Pages 8 and 9 # 1, 3, 5](#)

## 1. 2: More Patterns in Division

In this section we will be looking at the Divisibility Rules for the numbers 0, 3, 6 & 9.

### Divisibility by 0

Divide the following group of tiles into 0 groups:



Can this be done? What does this mean?

### Divisibility by 3

Which of the following numbers are divisible by 3?

6

1

27

56

15

32

36

How do you know? What do you notice about these numbers?

So, the Divisibility Rule for 3 is:

If the sum of the digits is divisible by 3.

Ex. 12:  $1 + 2 = 3$  which is divisible by 3

27:  $2 + 7 = 9$  which is divisible by 3.

5) Practice:

Which of the following numbers is divisible by 3? Show your workings and explain how you know!

a) 18

b) 111

c) 2006

d) 1024

**Divisibility by 6** can be a little more tricky too.

To find divisibility by 6, make sure the number is divisible by both 2 AND 3.

Example:

Is 246 divisible by 6?

**Divisibility by 2**

➤ It is even, so it is divisible by 2.

**Divisibility by 3**

➤  $2 + 4 + 6 = 12$ , 12 is divisible by 3, so 246 is divisible by 3.

*Since 246 is divisible by both 2 & 3, it is divisible by 6.*



What about 1008?

### Divisibility by 2

- It is even, so it is divisible by 2.

### Divisibility by 3

- $1+0+0+8 = 9$ , 9 is divisible by 3, so 1008 is divisible by 3.

*Since 1008 is divisible by both 2 & 3, it is divisible by 6.*

So, the Divisibility Rule for 6 is:

If the number is divisible by 2 and 3.

Ex. 204

204 is even (divisibility by 2)

$2+0+4 = 6$ , 6 is divisible by 3 (divisibility of 3)

Therefore, 204 is divisible by 6

6)Practice:

Which of the following numbers is divisible by 6? Show your workings and explain how you know!

a) 44

b) 324

c) 532

d) 1024

## Divisibility by 9

Divisibility by 9 is a lot like the divisibility of 3

Hint: Look at the sum of the digits in the following numbers that are divisible by 9:

18

27

36

What do you notice?

Is 2007 divisible by 9?

$$2 + 0 + 0 + 7 = 9$$

Since the digits add to 9, and 9 is divisible by 9 then 2007 is divisible by 9!

So, the Divisibility Rule for 9 is:

If the sum of the digits is divisible by 9.

Ex. 7047

$7 + 0 + 4 + 7 = 18$ , 18 is divisible by 9, so,  
7047 is divisible by 9.

7)Practice:

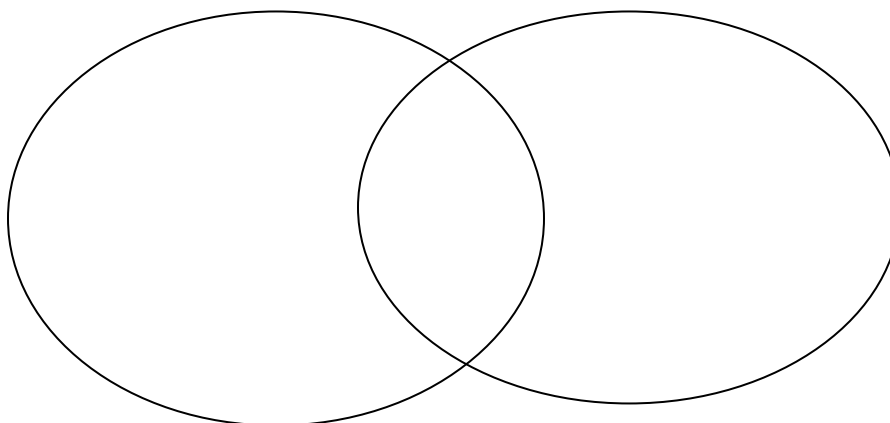
Which of the following numbers is divisible by 9? Show your workings and explain how you know!

a) 207

b) 181

Which of the following numbers are divisible by 3? By 9? Represent your answer in a Venn Diagram:

1002, 2007, 123, 18, 6, 1011, 27



Let's Use a Carroll diagram to sort the following numbers

10, 12, 24, 32, 120, 224, 139, 819, 2360, 9000

Which numbers are divisible by 3? By 8? By 3 and by 8? By neither 3 or 8?

	Divisible by 3	Not Divisible by 3
Divisible by 8		
Not Divisible by 8		

To complete on loose leaf: p.12,13 # 1 to 5, 8 & 9

Important terms to know:

#### 1) Variable:

**Variable:** a letter that represents a quantity that can vary or change.

#### 2) Constant Term:

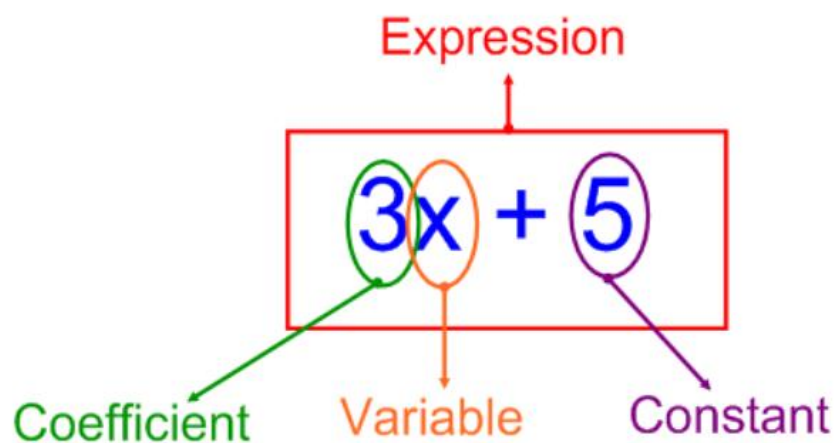
**Constant Term:** a number in an expression that is not multiplied by a variable. It is called constant because it does not change.

#### 3) Numerical Coefficient:

**Numerical coefficient:** the number that is multiplied by a variable.

#### 4) Algebraic Expression:

**Expression:** an expression consists of numbers and/or variables that are combined using  $+$ ,  $-$ ,  $\times$ , or  $\div$



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**Key words for writing algebraic expressions:****Addition****4 more than a number:****A number increased by 8:****Subtraction****A number decreased by 2:****2 decreased by a number:****6 less than a number:****Multiplication****6 times a number:****double a number:****triple a number:****Division****a number divided by 8:****6 divided by a number:****half a number:**

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**Writing algebraic expressions:**

Write an algebraic Expression for each of the following:

1) double a number increased by 3:

2) 4 times a number decreased by 2.

3) 9 more than half a number.

Write each algebraic expression in words:

1)  $3n$

2)  $6x - 1$

3)  $7 - 2t$

Evaluate each of the following when  $n = 3$

1)  $6n$

2)  $\underline{n} - 1$

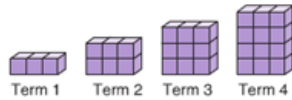
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3)  $3n + 1$

To complete on loose leaf: p.18-19 # 18-19 # 1 to 5, 7

## 1. 4: Relationships in Patterns

Here is a pattern made from linking cubes.



Describe the pattern using words:

Create a table to represent the pattern:

Term Number				
Term				

Write an algebraic expression to represent this pattern.

Let's look at page 23.

# 1a) & b)

1. i) For each number pattern, how is each term related to the term number?
- ii) Let  $n$  represent any term number. Write a relation for the term.

a)

Term Number	1	2	3	4	5	6
Term	2	4	6	8	10	12

b)

Term Number	1	2	3	4	5	6
Term	3	4	5	6	7	8

Let's look at page 23.

## # 2

- 2.** There are  $n$  students in a class. Write a relation for each statement.
- a) the total number of pencils, if each student has three pencils
  - b) the total number of desks, if there are two more desks than students
  - c) the total number of geoboards, if each pair of students shares one geoboard
  - d) the total number of stickers, if each student gets four stickers and there are ten stickers left over

Let's look at page 23.

## # 3

- 3.** A person earns \$10 for each hour worked.
- a) Write a relation for her earnings for  $n$  hours of work.
  - b) How much does she earn for 30 h of work?



Let's look at page 24.

## # 7

7. **Assessment Focus** A pizza with cheese and tomato toppings costs \$8.00.  
It costs \$1 for each extra topping.

- a) Write a relation for the cost of a pizza with  $e$  extra toppings.
- b) What is the cost of a pizza with 5 extra toppings?
- c) On Tuesdays, the cost of the same pizza with cheese and tomato toppings is \$5.00. Write a relation for the cost of a pizza with  $e$  extra toppings on Tuesdays.
- d) What is the cost of a pizza with 5 extra toppings on Tuesdays?
- e) How much is saved by buying the pizza on Tuesday?



To complete on loose leaf: [Pages 23 & 24 # 1\(c,d\), 4, 6](#)

Complete the Table using the expression:

$$2n - 2$$

Input	Output
1	
2	
3	
4	
5	
6	

Complete the following tables:

Input t	Output 3t

Input n	Output 10 - n

Input x	Output x + 3

Next, let's find the expression given the table:

**Example**

Write the relation represented by this table.

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

Find an expression for the following tables:

Input	Output
1	3
2	6
3	9
4	12
5	15
6	18

Input	Output
1	4
2	6
3	8
4	10
5	12
6	14

To complete on loose leaf [Page 27 - 28 # 1 to 3](#)

## Booklet 1 – 1. 6: Graphing Relations

You will need grid paper.

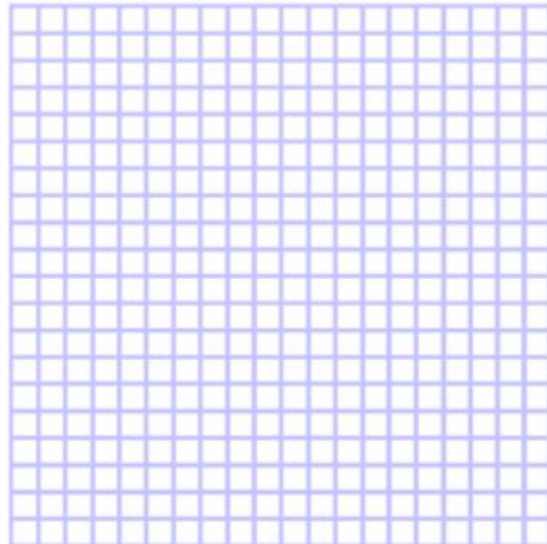
The cost of  $n$  CDs, in dollars, is  $12n$ .

- What is the cost of one CD?
- Copy and complete this table.
- Graph the data.

Use the graph to answer these questions:

- What is the cost of 5 CDs?
- How many CDs could you buy with \$72?

Number of CDs $n$	Cost (\$) $12n$
0	
2	
4	
6	
8	
10	



### Example

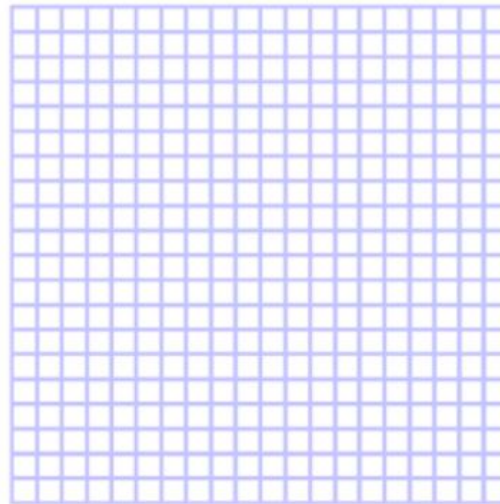
Mr. Beach has 25 granola bars.

He gives 3 granola bars to each student who stays after school to help prepare for the school concert.

- Write a relation to show how the number of granola bars that remain is related to the number of helpers.
- Make a table to show this relation.
- Graph the data. Describe the graph.
- Use the graph to answer these questions:
  - How many granola bars remain when 7 students help?
  - When will Mr. Beach not have enough granola bars?

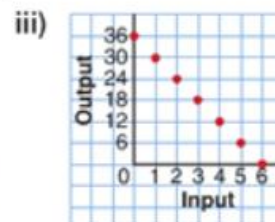
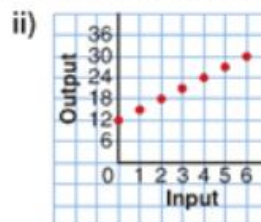
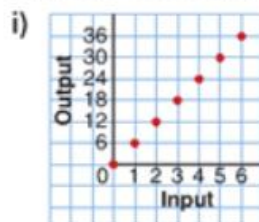


Number of Helpers $n$	Number of Granola Bars Left
0	
1	
2	
3	
4	
5	



Match each graph to its relation.

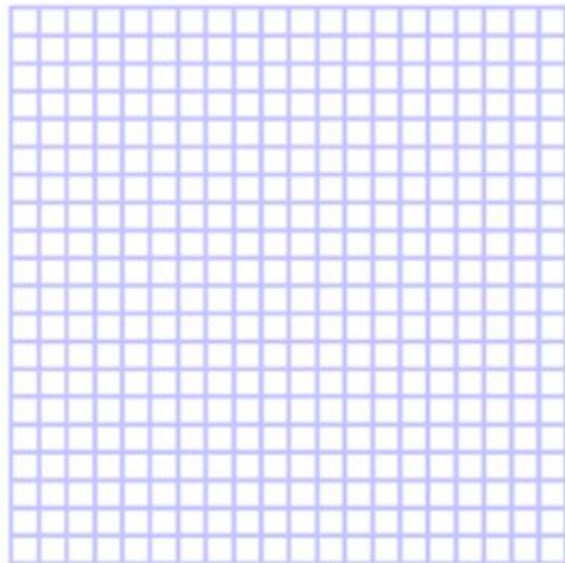
- The number of seashells collected is related to the number of students who collected. There are 12 seashells to start. Each student collects 3 seashells.
- The number of counters on the teacher's desk is related to the number of students who remove counters. There are 36 counters to start. Each student removes 6 counters.
- The money earned baby-sitting is related to the number of hours worked. The baby-sitter earns \$6/h.



Akuti borrows \$75 from her mother to buy a new lacrosse stick. She promises to pay her mother \$5 each week until her debt is paid off.

- Write a relation to show how the amount Akuti owes is related to the number of weeks.
- Make a table for the amount owing after 2, 4, 6, 8, and 10 weeks.
- Draw a graph to show the relation. Describe the graph.
- Use the graph to answer these questions:
  - How much does Akuti owe her mother after 13 weeks?
  - When will Akuti finish paying off her debt?

Week Number n	Amount Owing
0	
2	
4	
6	
8	
10	



To complete on loose leaf [Page 33 # 1 to 5](#)