

## 2.1

## Using Models to Multiply Integers



## Quick Review

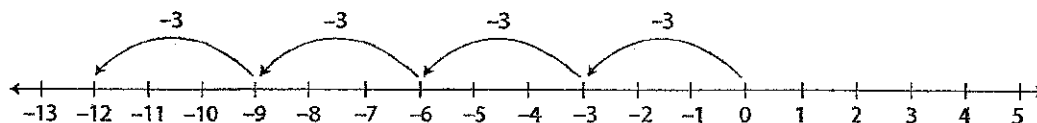
- You can think of multiplication as repeated addition.

$4 \times (-3)$  is the same as adding  $-3$  four times.

As a sum:  $(-3) + (-3) + (-3) + (-3) = -12$

As a product:  $4 \times (-3) = -12$

On a number line:



- You can use tiles to multiply integers.

Let a circle represent the bank. The bank has zero value at the start.

Multiply:  $(+2) \times (-3)$

$+2$  is a positive integer.

$-3$  is modelled with 3 black tiles.

So, put 2 sets of 3 black tiles into the circle.



The 6 black tiles in the circle represent  $-6$ .

So,  $(+2) \times (-3) = -6$

- Multiply:  $(-2) \times (-3)$

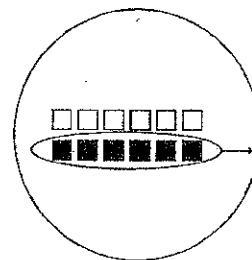
$-2$  is a negative integer.

$-3$  is modelled with 3 black tiles.

So, we need to take 2 sets of 3 black tiles from the circle.

Add zero pairs until there are enough black tiles to remove.

Take out 2 sets of 3 black tiles.



There now are 6 white tiles left in the circle.

So,  $(-2) \times (-3) = 6$

## Practice

1. Write a multiplication expression for each repeated addition.

a)  $(-2) + (-2) + (-2) + (-2) + (-2) = 5 \times \underline{\hspace{2cm}}$

c)  $(+2) \times (-3) =$  \_\_\_\_\_

d)  $(-4) \times (+5) =$  \_\_\_\_\_

**H I N T**

Add enough zero pairs to take away the appropriate number of white tiles.



5. Use a model to represent each product. Draw the model you used each time.

a)  $(-3) \times (-4) =$  \_\_\_\_\_

b)  $(+2) \times (-5) =$  \_\_\_\_\_

c)  $(+7) \times (+2) =$  \_\_\_\_\_

d)  $(-3) \times (+6) =$  \_\_\_\_\_

6. The temperature dropped  $2^{\circ}\text{C}$  each hour for 4 h. Use integers to find the total change in temperature.

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### Quick Review

► Integers have these properties of whole numbers.

- **Multiplying by 0:**  $4 \times 0 = 0$  and  $0 \times 4 = 0$

So,  $(-4) \times 0 = 0$  and  $0 \times (-4) = 0$

- **Multiplying by 1:**  $4 \times 1 = 4$  and  $1 \times 4 = 4$

So,  $(-4) \times (+1) = -4$  and  $(+1) \times (-4) = -4$

- **Commutative Property:**  $4 \times 2 = 8$  and  $2 \times 4 = 8$

So,  $(-4) \times (+2) = -8$  and  $(+2) \times (-4) = -8$

- **Distributive Property:**  $4 \times (2 + 3) = 4 \times 2 + 4 \times 3 = 20$

So,  $(-4) \times [(+2) + (+3)] = (-4) \times (+2) + (-4) \times (+3) = -20$

► You can write the product of integers without the use of the  $\times$  sign.

$(-4) \times (+2)$  can simply be written as:  $(-4)(+2)$

► When 2 integers with the same sign are multiplied, their product is positive.

$(+2)(+3) = +6$                        $(-2)(-3) = +6$

When 2 integers with different signs are multiplied, their product is negative.

$(+2)(-3) = -6$                        $(-2)(+3) = -6$

### Practice

1. Find a pattern rule for each multiplication pattern.

Extend the pattern for 3 more rows.

a)  $(+3)(+3) = +9$

$(+2)(+3) = +6$

$(+1)(+3) = +3$

$(0)(+3) = \underline{\hspace{2cm}}$

$(\underline{\hspace{1cm}})(+3) = \underline{\hspace{2cm}}$

$\underline{\hspace{2cm}}$

$\underline{\hspace{2cm}}$

b)  $(-3)(+3) = -9$

$(-3)(+2) = -6$

$(-3)(+1) = -3$

$(-3)(0) = \underline{\hspace{2cm}}$

$\underline{\hspace{2cm}}$

$\underline{\hspace{2cm}}$

$\underline{\hspace{2cm}}$

### HINT

To find a pattern rule, look for a pattern in the integer factors and in the products.



2. In this chart, write the sign of each product of multiplying 2 integers.

$\times$	positive integer	negative integer
positive integer		
negative integer		

- When 2 integer factors have the same sign, their product is \_\_\_\_\_.
- When 2 integer factors have different signs, their product is \_\_\_\_\_.

3. Find each product.

- a)  $(+7)(-2) =$  \_\_\_\_\_      b)  $(-4)(-3) =$  \_\_\_\_\_      c)  $(-8)(+9) =$  \_\_\_\_\_  
 d)  $(+10)(-5) =$  \_\_\_\_\_      e)  $(+5)(-7) =$  \_\_\_\_\_      f)  $(-9)(-4) =$  \_\_\_\_\_  
 i)  $(-7)(-1) =$  \_\_\_\_\_      j)  $(+5)(0) =$  \_\_\_\_\_      k)  $(+20)(-20) =$  \_\_\_\_\_

4. Fill in the blank to make each equation true.

- a)  $(+7) \times$  \_\_\_\_\_  $= -35$       b) \_\_\_\_\_  $\times (-9) = +99$       c)  $(-10) \times$  \_\_\_\_\_  $= -320$   
 d) \_\_\_\_\_  $\times (-5) = +20$       e)  $(+7) \times$  \_\_\_\_\_  $= -49$       f) \_\_\_\_\_  $\times (+13) = -65$   
 g) \_\_\_\_\_  $\times (-15) = -180$       h)  $(+14) \times$  \_\_\_\_\_  $= -140$       i) \_\_\_\_\_  $\times (-7) = 56$

5. Match each pattern rule with the corresponding pattern.

Complete each pattern and pattern rule.

**Number Pattern**

$-3, +9, -27, +81, \dots$

$+2, -10, +50, -250, \dots$

$+3, -3, \dots, \dots, \dots$

$+1, -10, \dots, \dots, \dots$

$-1, -2, -4, -8, -16, \dots$

**Pattern Rule**

Start at 2. Multiply by \_\_\_\_\_ each time.

Start at 1. Multiply by  $-10$  each time.

Start at \_\_\_\_\_. Multiply by  $-3$  each time.

Start at 3. Multiply by  $-1$  each time.

Start at  $-1$ . Multiply by \_\_\_\_\_ each time.