

## 8.2: Multiplying and Dividing Integers

To represent a  $(-) \times (-)$ , we need to think in terms of "zero pairs":

Multiply:

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

Remove 4 groups of -3

A 3x4 grid of zero pairs (each pair is a '+' and a '-' sign). Four vertical blue lines are drawn through the first, second, third, and fourth columns, representing the removal of 4 groups of 3 zero pairs each. Below the grid, the text "+12" is written in red.

b)  $(-2) \times (-6) =$

Remove 2 groups of -6

A 6x2 grid of zero pairs (each pair is a '+' and a '-' sign). Two vertical blue lines are drawn through the first and second columns, representing the removal of 2 groups of 6 zero pairs each. To the right of the grid, the text "+12" is written in red.

c)  $(-5) \times (-2) =$

Remove 5 groups of -2

A 5x2 grid of zero pairs (each pair is a '+' and a '-' sign). Five vertical blue lines are drawn through each of the two columns, representing the removal of 5 groups of 2 zero pairs each. Below the grid, the text "+10" is written in red.

d)  $(-4) \times (-1) =$

Remove 4 groups of -1

A 4x1 grid of zero pairs (each pair is a '+' and a '-' sign). Four vertical blue lines are drawn through each of the four zero pairs, representing the removal of 4 groups of 1 zero pair each. Below the grid, the text "+4" is written in red.

What happens when you multiply two negative numbers together?

The result is always positive.

Multiply the following pairs of numbers:

$$(+4) \times (+2) = +8$$

++ ++ ++ ++

$$(-6) \times (+2) = -12$$

--- + --- + --- + --- +

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

++ --- + --- +

$$(+3) \times (-5) = -15$$

--- + --- + --- +

$$(+7) \times (+1) = +7$$

$$(+8) \times (-3) = -24$$

$$(-4) \times (-3) = +12$$

$$(+0) \times (+2) = 0$$

$$(-3) \times (-3) = +9$$

What do you notice about the products of each question? We can use your observations to make a *sign rule*.

Sign Rule:

$$(+ ) \times (+ ) = (+ )$$

$$(+ ) \times (- ) = (- )$$

$$(- ) \times (- ) = (+ )$$

$$(- ) \times (+ ) = (- )$$

What happens if there are more than 2 numbers being multiplied together?

$$(+12) \times (-2) = -24$$

$$(+6) \times (-24) = -144$$

$$(-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) = -1$$

$$(-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) = +1$$

Model each of the following situations with an integer multiplication:

- Jerry can climb stairs at a rate of 6 steps per second. If it takes him 9 seconds to climb a flight of stairs, how many steps did he go up?

Rate = +6 steps/second

$$(+6) \times (9)$$

Time = 9 sec.

$$= +54$$

Jerry climbed 54 steps.

- Every month, Joey spends \$70 on his cell phone plan. Represent this over the course of a year using integer multiplication.

Joey spend - \$70

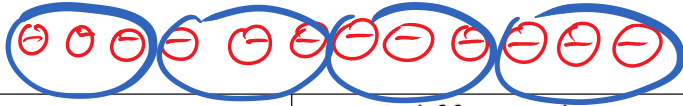
$$(-70) \times 12$$

one year = 12 months

$$= -840$$

Joey spends \$840 on his cell phone.

Complete the following table:



Multiplication Statement	Division Statement	A different division statement
$(+4) \times (-3) = -12$	$(-12) \div (-3) = +4$	$(-12) \div (+4) = -3$
$(-5) \times (-2) = +10$	$(+10) \div (-5) = (-2)$	$(+10) \div (-2) = (-5)$
$(-4) \times (+5) = \underline{-20}$	$(-20) \div (-4) = (+5)$	$(-20) \div (-5) = (+4)$
$(+2) \times (+7) = \underline{+14}$	$(+14) \div (+2) = (+7)$	$(+14) \div (+7) = (+2)$
$(+8) \times (-3) = \underline{-24}$	$(-24) \div (+8) = (-3)$	$(-24) \div (-3) = (+8)$
$(-6) \times (-3) = \underline{+18}$	$(+18) \div (-6) = (-3)$	$(+18) \div (-3) = (-6)$

What do you notice about the sign of the quotient in a division question?

It does not stay the same.

There is a **Sign Rule** for division of integers, just as with multiplication:

$(+) \div (+) = (+)$	just like	$(+) \times (+) = (+)$
$(+) \div (-) = (-)$	just like	$(+) \times (-) = (-)$
$(-) \div (+) = (-)$	just like	$(-) \times (+) = (-)$
$(-) \div (-) = (+)$	just like	$(-) \times (-) = (+)$

Anakin borrows \$120 from Obi Wan to buy Padme a new tiara. He promises to pay it back over 4 months. Represents Anakin's money for each month.

$$(-\$120) \div 4 = -\$30$$

Anakin needs to pay \$30 back each month.

It's very cold in space, and R2D2 has fallen out of the airlock. In 20 minutes, his temperature will drop by 40 degrees. What is his temperature change per minute?

$$-40$$

$$-40 \div 20 = -2$$

Temperature drops 2 degrees per minute.