Dividing Integers

Divide a negative number by a positive

The image illustrates \((-8) \div 4\), or eight negatives divided into four groups. We can see the answer is \(-2\).

Any time a negative integer is divided by a positive integer, we can illustrate it as so many negative counters divided into groups. The answer will be negative. So each time you divide a negative integer by a positive integer, the answer is negative.

Divide a positive integer by a negative. For example, \(24 \div (-8) = ?\)

Remember multiplication is the opposite operation of division. Let's write the answer of \(24 \div (-8)\) as \(s\). Then we write a multiplication equation using the division:

\[
24 \div (-8) = s \quad \Rightarrow \quad (-8)s = 24
\]

(You could use an empty line instead of \(s\), if the variable \(s\) confuses you.)

The only number that fulfills the equation \((-8)s = 24\) is \(s = -3\). Therefore, \(24 \div (-8) = -3\). Similarly, each time you divide a positive integer by a negative integer, the answer is negative.

Divide a negative integer by a negative. For example, \((-24) \div (-8) = ?\)

Again, let's mark the answer to \(-24 \div (-8)\) with \(y\), and then write a multiplication sentence.

\[
-24 \div (-8) = y \quad \Rightarrow \quad (-8)y = -24
\]

The only number that fulfills the equation \((-8)y = -24\) is \(y = 3\). Therefore, \(-24 \div (-8) = 3\). Similarly, each time you divide a negative integer by a negative integer, the answer is positive.

Summary. The symbols below show whether you get a positive or negative answer, when you multiply or divide integers. Notice that the rules for multiplication and division are the same!

<table>
<thead>
<tr>
<th>Multiplication</th>
<th>Examples</th>
<th>Division</th>
<th>Examples</th>
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<tbody>
<tr>
<td>(\oplus \times \ominus)</td>
<td>(4 \times (-5) = -20)</td>
<td>(\ominus \div \ominus = \oplus)</td>
<td>(20 \div (-5) = -4)</td>
</tr>
<tr>
<td>(\ominus \times \ominus)</td>
<td>(-4 \times 5 = -20)</td>
<td>(\ominus \div \ominus = \ominus)</td>
<td>(-20 \div 5 = -4)</td>
</tr>
<tr>
<td>(\ominus \times \oplus)</td>
<td>(-4 \times (-5) = 20)</td>
<td>(\oplus \div \ominus = \ominus)</td>
<td>(-20 \div (-5) = 4)</td>
</tr>
<tr>
<td>(\oplus \times \oplus)</td>
<td>(4 \times 5 = 20)</td>
<td>(\oplus \div \oplus = \oplus)</td>
<td>(20 \div 5 = 4)</td>
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Here's a shortcut for multiplication and division (NOT addition or subtraction):

- If both numbers have the same sign (both are positive or negative), the answer is positive.
- Otherwise, the answer is negative.
1. Divide.

a. \(-50 \div (-5) = _____\)  
   \(-12 \div 2 = _____\)  
   \(14 \div (-2) = _____\)  
   \(-100 \div (-10) = _____\)

b. \(-5 \times (-5) = _____\)  
   
   ____ ÷ ____ = _____

2. Multiply. Then write a division equation for each multiplication, using the same numbers.

a. \(-5 \times (-5) = _____\)  
   
   ____ ÷ ____ = _____

b. \(9 \times (-6) = _____\)  
   
   ____ ÷ ____ = _____

c. \(-80 \times 8 = _____\)  
   
   ____ ÷ ____ = _____

3. Complete the patterns.

<table>
<thead>
<tr>
<th>a.</th>
<th>b.</th>
<th>c.</th>
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<tr>
<td>12 ÷ 4 = _____</td>
<td>_____ ÷ (-7) = -3</td>
<td>60 ÷ _____ = 2</td>
</tr>
<tr>
<td>8 ÷ 4 = _____</td>
<td>_____ ÷ (-7) = -2</td>
<td>40 ÷ _____ = 2</td>
</tr>
<tr>
<td>4 ÷ 4 = _____</td>
<td>_____ ÷ (-7) = -1</td>
<td>20 ÷ _____ = 2</td>
</tr>
<tr>
<td>0 ÷ 4 = _____</td>
<td>_____ ÷ (-7) = 0</td>
<td>-20 ÷ _____ = 2</td>
</tr>
<tr>
<td>(-4) ÷ 4 = _____</td>
<td>_____ ÷ (-7) = 1</td>
<td>-40 ÷ _____ = 2</td>
</tr>
<tr>
<td>(-8) ÷ 4 = _____</td>
<td>_____ ÷ (-7) = 2</td>
<td>-60 ÷ _____ = 2</td>
</tr>
<tr>
<td>(-12) ÷ 4 = _____</td>
<td>_____ ÷ (-7) = 3</td>
<td>-80 ÷ _____ = 2</td>
</tr>
<tr>
<td>(-16) ÷ 4 = _____</td>
<td>_____ ÷ (-7) = 4</td>
<td>-100 ÷ _____ = 2</td>
</tr>
</tbody>
</table>

4. Here’s a funny riddle. Solve the math problems to uncover the answer.

E ____ ÷ (-8) = 2  
E 3 \times (-12) = ___  
N -12 \times (-5) = _____  
E (-144) \div 12 = _____

E 3 \times (-12) = ___  
H ____ ÷ 12 = -5  
T -4 \times (-9) = ___

N -15 ÷ ____ = -5  
E ____ \times (-6) = 0  
V -45 ÷ _____ = 5

G -1 \times (-9) = _____  
I -27 ÷ 9 = _____  
I -7 \times ____ = -84

S -48 ÷ 6 = _____  
N 3 \times _____ = -24

Why is six afraid of seven? Because....