

Lesson 3 Negative Numbers, Multiplication

Multiplication is fast adding of the same number. In this case, it is fast adding of a negative number. $(3) \times (-2)$ is a way of writing (-2) counted 3 times, or $(-2) + (-2) + (-2)$, or (-6) . Think of this as borrowing \$2 from someone for three days in a row. After three days you will owe six dollars.

Example 1 $(-6)(+3) = (-18)$

Example 2 $(+7)(-6) = (-42)$

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Now after multiplying a negative number times a positive number clicks, consider what you would have if you were multiplying a negative number times a negative number. This will be the opposite of what we just learned, so we are back to being positive. There are only two options for a number, either it is negative or positive. Since we first learned about multiplication, we always multiplied positive numbers times positive numbers. To understand a negative number times a negative number, let's review what we know so far with several more examples.

Example 3 $(+3)(+7) = (+21)$

Example 4 $(-3)(+7) = (-21)$

Example 5 $(+3)(-7) = (-21)$

The only option remaining is Example 6.

Example 6 $(-3)(-7) = (+21)$

Think of negative anything as the opposite of what it was. We know that two wrongs don't make a right, but when multiplying two negative numbers, the product is a positive number. Here are a couple more ways of thinking of this to help us understand a difficult concept.

In language we know that a double negative is a positive. I used to ask students if they were going to the local town fair. They would reply that they weren't not going. I would respond by saying that I would see them there. To their puzzled expressions I would explain that if they were "Not, not going", then they were going.

Another way to think of it is using the idea of opposites in the previous lesson. Recall that $-(-21)$ is the same as $+21$. Using brackets for clarification, I can write $(-3)(-7)$ as $-[(3)(-7)]$ by moving the negative sign in front of the 3 outside of the brackets. After multiplying $(3)(-7)$, we have (-21) inside the brackets. Then putting it all together, we have $-[-21]$ which is $(+21)$.

Example 7 $(-12)(-5) = (+60)$

Have you observed the pattern that if you have two negative signs, you are positive? The same holds for four negative signs. Whenever you have an even number of negative signs the answer is positive, and an odd number of negative signs produces a negative answer. See Figure 1.

Figure 1	$(-12) = (-12)$	$-[-(-12)] = (-12)$
	$-(-12) = (+12)$	$-{-[-(-12)]} = (+12)$

Sample Student Text Page

Multiply.

1) $(+5) \times (-6) =$

2) $(-6) \times (-7) =$

3) $(-9) \times (-10) =$

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

5) $(-5) \times (-8) =$

6) $(-16) \times (-11) =$

7) $(+4) \times (-15) =$

8) $(-18) \times (-6) =$

9) $(-16) \times (+12) =$

10) $(-17) \times (+3) =$

11) $(-18) \times (-4) =$

12) $(-24) \times (-5) =$

13) $(-11) \times (+16) =$

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

15) $(+8) \times (-12) =$

16) $(-10) \times (-16) =$

Write your answers as negative or positive numbers.

17) The team lost 3 games a week. What is its record at the end of six weeks?

18) Jim managed to lose 25 cents a day for 10 days. Express his loss as -25 cents a day. What was his total loss?

19) Karen's budget was short \$30 more every month. Express her shortfall as -30. How much was she short at the end of a year?

20) Peter's feet are twelve inches long. He stepped out the length and width of a room and found it was 10 feet by 12 feet. What is the area of the room?

Note for #20. Distance is expressed with a positive number. The area of a rectangle is found by multiplying the length times the width. The answer is always in square units.

Sample Student Text Page

Multiply.

1) $(+36) \times (-4) =$

2) $(-4) \times (-19) =$

3) $(-6) \times (-8) =$

4) $(-24) \times (-6) =$

5) $(-25) \times (-3) =$

6) $(-10) \times (+19) =$

7) $(-8) \times (+6) =$

8) $(-42) \times (+16) =$

9) $(-50) \times (-19) =$

10) $(+25) \times (-6) =$

11) $(+23) \times (-13) =$

12) $(-46) \times (-8) =$

13) $(-16) \times (-24) =$

14) $(-8) \times (-16) =$

15) $(-42) \times (-15) =$

16) $(-17) \times (+48) =$

Write your answers as negative or positive numbers.

17) I owed Sara \$3. Express my debt as -3 dollars. Because I forgot, she wants me to pay back 2 times as much. What is my debt?

18) The jar of face cream said it would take 10 years off the user's age with each application. If Ashley has used it 5 times, what is the effect on her age?

19) Tom's mortgage is \$682 a month. If he fails to pay for four months, what is the effect on his budget?

20) A pitcher gave up 3 runs in each inning. (-3) What is the effect after 9 innings?

Sample Student Text Page

Multiply.

1) $(+8) \times (-5) =$

2) $(-6) \times (+10) =$

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

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

5) $(+17) \times (+3) =$

6) $(-8) \times (-9) =$

7) $(-90) \times (+4) =$

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

9) $(+42) \times (-6) =$

10) $(-10) \times (-10) =$

11) $(+7) \times (-6) =$

12) $(-18) \times (-4) =$

13) $(-36) \times (+4) =$

14) $(+13) \times (-4) =$

15) $(-17) \times (-3) =$

16) $(+19) \times (-51) =$

Write your answers as negative or positive numbers.

17) Chris borrowed \$2 from me each day for five days. Express his debt for one day as a negative number, then multiply to find his total debt.

18) Mr. Brown loses 32 hairs every day. What is the result in 21 days?

19) The team lost 4 games a week. What is its record at the end of 10 weeks?

20) Anna's garden is a rectangle that measures 7 feet by 14 feet. What is the area of her garden?

Sample Student Text Page

Multiply.

1) $(+17) \times (-6) =$

2) $(+22) \times (-11) =$

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

4) $(-10) \times (+5) =$

5) $(+6) \times (-7) =$

6) $(-16) \times (+9) =$

Change the signs as needed and solve.

7) $(+5) - (+10) =$

8) $(-6) + (-9) =$

9) $(+14) + (-3) =$

Find the fraction of the number.

10) $\frac{1}{2}$ of 20 =

11) $\frac{2}{3}$ of 15 =

12) $\frac{4}{9}$ of 27 =

Add or subtract. Leave answers in the form in which they occur.

13) $\frac{1}{10} + \frac{7}{10} =$

14) $\frac{5}{7} - \frac{1}{7} =$

15) $\frac{4}{8} + \frac{1}{8} =$

16) $\frac{7}{12} - \frac{3}{12} =$

❖ Quick Review

When the numerator and denominator of a fraction are multiplied by the same number, the resulting fraction is “equivalent.” It has the same value as the original fraction, but is expressed in a different form.

Example 1 $\frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$ $\frac{1}{2} \times \frac{3}{3} = \frac{3}{6}$ $\frac{1}{2} \times \frac{4}{4} = \frac{4}{8}$

Example 2 $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10} = \frac{6}{12}$ You could continue to find as many equivalent fractions for $\frac{1}{2}$ as you wish.

Fill in the missing numbers to make equivalent fractions.

17) $\frac{1}{3} = \frac{\quad}{6} = \frac{\quad}{9} = \frac{4}{\quad}$

18) $\frac{2}{5} = \frac{4}{\quad} = \frac{6}{15} = \frac{\quad}{20}$

Write your answers as positive or negative numbers.

19) The fuel tank leaks at a rate of 2 gallons a week. What is the effect on the contents after 13 weeks?

20) Matthew walked 9 miles from the starting point. Then he turned around and walked 2 miles back. How far is he from his starting point?

Sample Student Text Page

Multiply.

1) $(+16) \times (-10) =$

2) $(+17) \times (-10) =$

3) $(+23) \times (+11) =$

4) $(-8) \times (-4) =$

5) $(-7) \times (-8) =$

6) $(+10) \times (-11) =$

Change the signs as needed and solve.

7) $(+8) - (+19) =$

8) $(+17) + (-5) =$

9) $(-63) - (-50) =$

Find the fraction of the number.

10) $\frac{1}{3}$ of 18 =

11) $\frac{3}{7}$ of 49 =

12) $\frac{2}{11}$ of 44 =

Add or subtract. Leave answers in the form in which they occur.

13) $\frac{4}{5} - \frac{2}{5} =$

14) $\frac{5}{6} + \frac{1}{6} =$

15) $\frac{4}{13} + \frac{5}{13} =$

Fill in the missing numbers to make equivalent fractions.

16) $\frac{1}{4} = \frac{\quad}{8} = \frac{3}{\quad} = \frac{\quad}{16}$

17) $\frac{5}{8} = \frac{\quad}{\quad} = \frac{15}{24} = \frac{\quad}{\quad}$

- 18) By working very hard, George painted $\frac{1}{8}$ of the house on Monday and $\frac{2}{8}$ on Tuesday. What part of the house has been painted?

Write your answers as positive or negative numbers.

- 19) Bill ordered a book that cost \$25. By mistake he sent the company \$30. They sent back an invoice that showed his account balance as a negative number. What was the number?
- 20) A stunt pilot flew around the perimeter of our town. If the town is a square that measures five miles on each side, what is the area of the town? (A square is a special kind of rectangle)

Sample Student Text Page

Multiply.

1) $(+14) \times (-5) =$

2) $(-18) \times (+11) =$

3) $(-9) \times (-12) =$

4) $(+14) \times (-6) =$

5) $(-19) \times (-23) =$

6) $(-19) \times (+17) =$

Change the signs as needed and solve.

7) $(+32) + (-18) =$

8) $(-94) + (-7) =$

9) $(+58) - (+100) =$

Find the fraction of the number.

10) $\frac{1}{5}$ of 20 =

11) $\frac{2}{3}$ of 21 =

12) $\frac{3}{10}$ of 50 =

Add or subtract. Leave answers in the form in which they occur.

13) $\frac{2}{3} - \frac{1}{3} =$

14) $\frac{4}{7} - \frac{2}{7} =$

15) $\frac{1}{9} + \frac{5}{9} =$

Fill in the missing numbers to make equivalent fractions.

16) $\frac{1}{6} = \frac{\quad}{\quad} = \frac{\quad}{18} = \frac{4}{\quad}$

17) $\frac{3}{7} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{12}{28}$

- 18) Five twelfths of the pizza was left over. Austin then ate three twelfths of a whole pizza. How much pizza was left when Austin was finished?

Write your answers as positive or negative numbers.

- 19) Kelly's uncle sent her \$15 a month. What was the effect on her income in four months?
- 20) Thinking her uncle was going to send her twenty dollars a month, Kelly promised that amount to her sister. What is the combined effect of #19 and #20 on Kelly's budget during that four months?

Sample Test Booklet Page

Multiply.

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

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

3) $(-30) \times (-17) =$

4) $(-27) \times (+8) =$

5) $(-9) \times (+2) =$

6) $(-7) \times (-29) =$

Change the signs as needed and solve.

7) $(+33) - (-46) =$

8) $(-27) + (-10) =$

9) $(-41) - (-20) =$

Find the fraction of the number.

10) $\frac{1}{3}$ of 24 =

11) $\frac{2}{5}$ of 15 =

12) $\frac{3}{7}$ of 28 =

Add or subtract. Leave answers in the form in which they occur.

13) $\frac{5}{8} - \frac{3}{8} =$

14) $\frac{7}{10} - \frac{1}{10} =$

15) $\frac{1}{4} + \frac{1}{4} =$

Fill in the missing numbers to make equivalent fractions.

16) $\frac{1}{5} = \frac{\quad}{\quad} = \frac{\quad}{15} = \frac{4}{\quad}$

17) $\frac{2}{3} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{8}{12}$

18) Emily did $\frac{1}{5}$ of the chores and Madison did $\frac{3}{5}$ of them. What part of the chores have been done?

Write your answers as positive or negative numbers.

19) Elizabeth spent \$4 a day on lunch for 5 days. Write the daily cost of the lunch as a negative number and multiply to find the total change in the amount of money she has.

20) During the drought, the water level in the lake fell two feet (-2) every week. What was the effect on the water level in six weeks?

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|----|--|----|--|----|---|----|--|----|---|----|---|
| 3A | 1) -30
2) +42
3) +90
4) -120
5) +40
6) +176
7) -60
8) +108
9) -192
10) -51
11) +72
12) +120
13) -176
14) -72
15) -96
16) +160
17) $-3 \times 6 = -18$
18) $\$-25 \times 10 = \-2.50
19) $\$-30 \times 12 = \-360
20) $10 \times 12 = 120$ sq. ft. | 3B | 1) -144
2) +76
3) +48
4) +144
5) +75
6) -190
7) -48
8) -672
9) +950
10) -150
11) -299
12) +368
13) +384
14) +128
15) +630
16) -816
17) $\$-3 \times 2 = \-6
18) $-10 \times 5 = -50$ yrs.
19) $\$-682 \times 4 = \-2728
20) $-3 \times 9 = -27$ | 3C | 1) -40
2) -60
3) +12
4) -240
5) +51
6) +72
7) -360
8) -192
9) -252
10) +100
11) -42
12) +72
13) -144
14) -52
15) +51
16) -969
17) $\$-2 \times 5 = \-10
18) $-32 \times 21 = -672$
19) $-4 \times 10 = -40$
20) $7 \times 14 = 98$ sq. ft. | 3D | 1) -102
2) -242
3) +45
4) -50
5) -42
6) -144
7) -5
8) -15
9) +11
10) $20 \div 2 = 10$
11) $10 \times 1 = 10$
12) $15 \div 3 = 5$
13) $5 \times 2 = 10$
14) $27 \div 9 = 3$
15) $3 \times 4 = 12$
16) $\frac{1}{10} + \frac{7}{10} = \frac{8}{10}$
17) $\frac{5}{7} - \frac{1}{7} = \frac{4}{7}$
18) $\frac{4}{8} + \frac{1}{8} = \frac{5}{8}$
19) $\frac{7}{12} - \frac{3}{12} = \frac{4}{12}$
20) $\frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \frac{4}{12}$
21) $\frac{2}{5} = \frac{4}{10} = \frac{6}{15} = \frac{8}{20}$
22) $-2 \times 13 = -26$ gal.
23) $9 - 2 = 7$ mi. | 3E | 1) -160
2) -170
3) +253
4) +32
5) +56
6) -110
7) -11
8) +12
9) -13
10) $18 \div 3 = 6$
11) $49 \div 7 = 7$
12) $7 \times 3 = 21$
13) $44 \div 11 = 4$
14) $4 \times 2 = 8$
15) $\frac{4}{5} - \frac{2}{5} = \frac{2}{5}$
16) $\frac{5}{6} + \frac{1}{6} = \frac{6}{6}$
17) $\frac{4}{13} + \frac{5}{13} = \frac{9}{13}$
18) $\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \frac{4}{16}$
19) $\frac{5}{8} = \frac{10}{16} = \frac{15}{24} = \frac{20}{32}$
20) $\frac{1}{8} + \frac{2}{8} = \frac{3}{8}$
21) $\$25 - \$30 = \$-5$
22) $5 \times 5 = 25$ sq. mi. | 3F | 1) -70
2) -198
3) +108
4) -84
5) +437
6) -323
7) +14
8) -101
9) -42
10) $20 \div 5 = 4$
11) $21 \div 3 = 7$
12) $7 \times 2 = 14$
13) $50 \div 10 = 5$
14) $5 \times 3 = 15$
15) $\frac{2}{3} - \frac{1}{3} = \frac{1}{3}$
16) $\frac{4}{7} - \frac{2}{7} = \frac{2}{7}$
17) $\frac{1}{9} + \frac{5}{9} = \frac{6}{9}$
18) $\frac{1}{6} = \frac{2}{12} = \frac{3}{18} = \frac{4}{24}$
19) $\frac{3}{7} = \frac{6}{14} = \frac{9}{21} = \frac{12}{28}$
20) $\frac{5}{12} - \frac{3}{12} = \frac{2}{12}$
21) $\$15 \times 4 = \60
22) $\$-20 \times 4 = \-80
23) $\$-80 + \$60 = \$-20$ |
|----|--|----|--|----|---|----|--|----|---|----|---|