

High School Exit Program

Lesson 24

EXERCISE 1 ALGEBRA MULTIPLICATION-1

Workbook practice

a. Open your workbook to lesson 24 and find part 1. ✓

• (Teacher reference:)

• Any value turned upside down is a value's reciprocal.

• The reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$.

[C]

b. You're going to learn about reciprocals. Say reciprocal.

(Signal.) *Reciprocal.*

• Listen: Any value turned upside down is the value's reciprocal. The box shows an example. The reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$.

c. What's the reciprocal of $\frac{2}{3}$? (Signal.) $\frac{3}{2}$.

• What's the reciprocal of $\frac{7}{10}$? (Signal.) $\frac{10}{7}$.

• What's the reciprocal of $\frac{1}{9}$? (Signal.) *9 over 1.*

That's 9.

(Repeat step c until firm.)

- (Teacher reference:)

<ul style="list-style-type: none"> • Any value multiplied by its reciprocal = 1. 	
$\frac{5}{3} \times \frac{3}{5} = \frac{15}{15} = 1$	$\frac{5}{3} \times \frac{3}{5} = \frac{3}{3} \times \frac{5}{5}$ $= 1 \times 1 \times 1$
[C]	

- d. The next box shows a rule you'll use to work a lot of problems with letters: Any value multiplied by its reciprocal equals 1.

- Listen again: Any value multiplied by its reciprocal equals 1.

e. Say the rule with me. (Signal.) *Any value multiplied by its reciprocal equals 1.*

- Your turn: Say the rule. (Signal.) *Any value multiplied by its reciprocal equals 1.*

- (Repeat step e until firm.)

f. Listen: The reciprocal of 9 is 1/9.

- What's the reciprocal of 56? (Signal.) *1/56.*
- What's the reciprocal of B? (Signal.) *1 over B.*
- What's the reciprocal of 2 C? (Signal.) *1 over 2C.*
- What's the reciprocal of 1/7? (Signal.) *7.*

- (Repeat step f until firm.)

- g. The first problem in the box shows why you end up with 1 when you multiply a value by its reciprocal.
- $5/3$ is multiplied by $3/5$. The value for the numerator is 15. The value for the denominator is 15. $15/15 = 1$.
- h. The next problem shows another reason it works. We rearrange the numbers in the numerator and we have $3/3 \times 5/5$. That's 1×1 , which equals 1.
- i. Remember, any value multiplied by its reciprocal equals 1.
- Say that rule. (Signal.) *Any value multiplied by its reciprocal equals 1.*

Workbook practice

- a. Find part 2. $\sqrt{\quad}$
- (Teacher reference:)

$4 \times j = 20$ $\left(\frac{1}{4}\right) 4 \times j = 20 \left(\frac{1}{4}\right)$ $j = \frac{20}{4}$ <div style="border: 1px solid black; display: inline-block; padding: 2px 10px; margin-top: 5px;"> $j = 5$ </div>	<ul style="list-style-type: none"> • Multiply both sides by the reciprocal. • Do the multiplication. • Write the simple equation.
--	--

- b. The problem in the box is: $4 \times J = 20$.
- Read everything on the side with the letter.
(Signal.) $4 \times J$.
 - 4 is multiplied, not added or subtracted. So we can't add or subtract anything to get rid of 4. But we can multiply the side by the reciprocal of 4.
 - What's the reciprocal of 4? (Signal.) $1/4$.
 - We change the value of the side if we multiply by $1/4$. So we must change the other side in the same way.
- c. The second equation shows both sides multiplied by $1/4$. When you multiply on the side with J, you get 4 fourths J. That's 1 J or just J.
- On the other side, you get $20/4$ when you multiply.
So $J = 5$.
 - That's the answer you'd get if you worked the problem $4 \times J = 20$ in your head. You ask, 4 times what number equals 20?
 - What's the answer? (Signal.) 5. So J is 5.
- d. You'll work each problem in part 2.

- e. Read problem A. (Signal.) $\frac{3}{5} \times M = 6$.
- Read everything on the side with the letter.
(Signal.) $\frac{3}{5} \times M$.
 - You're multiplying M by $\frac{3}{5}$, so you multiply that side by the reciprocal of $\frac{3}{5}$. What's the reciprocal of $\frac{3}{5}$? (Signal.) $\frac{5}{3}$.
 - Multiply both sides by $\frac{5}{3}$. Below, write what M equals. Pencils down when you're finished.
(Observe students and give feedback.)
 - (Write on the board:)

a. $\left(\frac{5}{3}\right) \frac{3}{5} \times m = 6 \left(\frac{5}{3}\right)$

$$m = \frac{30}{3}$$

$m = 10$

- Here's what you should have.
- On the side with the letter, you get: $\frac{15}{15} \times M$.
That's: $1 \times M$.

- On the other side, you get $30/3$. So the simple equation is: $M = 10$.
- f. Read problem B. (Signal.) $11 = G \times 7/2$.
- Read everything on the side with the letter.
(Signal.) $G \times 7/2$.
- You're multiplying G by $7/2$.
- What's the reciprocal of $7/2$? (Signal.) $2/7$.
- Multiply both sides by $2/7$. Below, write the fraction that equals G. Pencils down when you're finished.
(Observe students and give feedback.)
- (Write on the board:)

b. $\left(\frac{2}{7}\right) 11 = g \times \frac{7}{2} \left(\frac{2}{7}\right)$

$\frac{22}{7} = g$

- Here's what you should have.
- On the side with the letter, you get: $G \times 14/14$.
- On the other side, you get $22/7$. So the simple equation is: $22/7 = G$.

- g. Read problem C. (Signal.) $K \times 6 = 18$.
- Read everything on the side with the letter.
(Signal.) $K \times 6$.
 - You're multiplying K by 6, so you multiply that side by the reciprocal of 6.
 - What's the reciprocal of 6? (Signal.) $1/6$.
 - Multiply both sides by $1/6$. Below, write what K equals. Pencils down when you're finished.
(Observe students and give feedback.)
 - (Write on the board:)

$$\mathbf{c.} \quad \left(\frac{1}{6}\right) k \times 6 = 18 \left(\frac{1}{6}\right)$$

$$k = \frac{18}{6}$$

$k = 3$

- Here's what you should have.
- On the side with the letter, you get: $6/6 \times K$.
That's: 1 times K.
- On the other side, you get $18/6$. So the simple equation is: $K = 3$.

- h. Read problem D. (Signal.) $1/8 \times D = 2$.
- Read everything on the side with the letter.
(Signal.) $1/8 \times D$.
 - You're multiplying by $1/8$.
 - What's the reciprocal of $1/8$? (Signal.) 8 .
 - Multiply both sides by 8 . Below, write what D equals. Pencils down when you're finished.
(Observe students and give feedback.)
 - (Write on the board:)

d. $(8) \frac{1}{8} \times d = 2 (8)$

$$d = 16$$

- Here's what you should have.
- On the side with the letter, you get: $8/8 \times D$.
- On the other side, you get 16 .
- So the simple equation is: $D = 16$.

High School Exit Program

Lesson 24

EXERCISE 2 ALGEBRA CLASSIFICATION

Textbook practice

- a. Open your textbook to lesson 24 and find part 1. ✓
- These are problems that tell about a whole and the parts that are added.
- b. Problem A: There are 48 used cars and 56 new cars on the lot. How many cars are on the lot?
- What's the name for the whole? (Signal.) *Cars.*
 - What's the name for the parts? (Signal.) *Used cars and new cars.*
 - What do you do to find the whole? (Signal.) *Add the parts.*
- Yes, you add the parts.
- (Repeat step b until firm.)
- c. Work problem A. First write the equation with letters. Below, write the equation with numbers. Then figure out the simple equation for the letter. Pencils down when you're finished.

(Observe students and give feedback.)

- (Write on the board:)

$$\begin{array}{l} \mathbf{a.} \quad c = uc + nc \\ \quad \quad c = 48 + 56 \\ \hline \quad \quad \boxed{c = 104} \end{array}$$

- (Point to the equation.) Here's the equation with letters.
- Below you have: $C = 48 + 56$.
- What's the simple equation? (Signal.) $C = 104$.
- There are 104 cars on the lot. You boxed the answer.
- c. Work problem B. Pencils down when you're finished.

(Observe students and give feedback.)

- (Teacher reference:)
- b.** 255 raffle tickets are in a drum. 128 of the tickets have an odd number. How many even-number tickets are there?

- (Write on the board:)

$$\begin{array}{l} \mathbf{b.} \quad t = ot + et \\ \quad \quad 255 = 128 + et \\ \quad \quad - 128 \quad - 128 \\ \hline \quad \quad \boxed{127 = \quad et} \end{array}$$

- Here's what you should have.

- Below you have: $255 = 128 + ET$.
 - What's the simple equation? (Signal.) $127 = ET$.
 - There are 127 even-number tickets in the drum.
- d. Work problem C. Pencils down when you're finished.

(Observe students and give feedback.)

- (Teacher reference:)
- c. There are brown bottles and green bottles in a box. There are 75 bottles in the box. 19 of the bottles are brown. How many green bottles are there?
- (Write on the board:)

$$\begin{array}{r}
 \text{c.} \quad b = bb + gb \\
 \quad \quad 75 = 19 + gb \\
 \quad \quad \underline{-19 \quad -19} \\
 \quad \quad \boxed{56 = gb}
 \end{array}$$

- Here's what you should have.
 - Below you have: $75 = 19 + GB$.
 - What's the simple equation? (Signal.) $56 = GB$.
 - There are 56 green bottles.
- e. Work problem D. Pencils down when you're finished.
- (Observe students and give feedback.)

- (Teacher reference:)
- d. 98 of the 105 items in the gallery are for sale.
How many of the gallery items are not for sale?

- (Write on the board:)

$$\begin{array}{r}
 \text{d.} \quad i = s + ns \\
 105 = 98 + ns \\
 \underline{-98 \quad -98} \\
 \boxed{7 = ns}
 \end{array}$$

- Here's what you should have.
 - Below you have: $105 = 98 + NS$.
 - What's the simple equation? (Signal.) $7 = NS$.
 - 7 of the items are not for sale.
- f. Work problem E. Pencils down when you're finished.
(Observe students and give feedback.)

- (Teacher reference:)
- e. 38 seventh-grade students and 45 eighth-grade students from Wilson Middle School went on a joint field trip to the museum. How many students went on the field trip?

- (Write on the board:)

$$\begin{array}{r}
 \text{e.} \quad s = sg + eg \\
 s = 38 + 45 \\
 \underline{\hspace{1.5cm}} \\
 \boxed{s = 83}
 \end{array}$$

- Here's what you should have.
- Below you have: $S = 38 + 45$.
- What's the simple equation? (Signal.) $S = 83$.
- 83 students went on the trip.

High School Exit Program

Lesson 24

EXERCISE 3

FRACTION MULTIPLICATION SIMPLIFICATION

Textbook practice

- a. Find part 2. $\sqrt{\quad}$
- You've simplified fractions.
 - You can also simplify values that are multiplied together.
 - (Teacher reference:)

$6 \times \frac{5}{2} = \frac{30}{2} = 15$
$\frac{6}{2} \times 5 = \frac{30}{2} = 15$

• Rewrite these expressions:

• $4 \times \frac{3}{5}$ • $\frac{3}{5} \times 3$

- b. The box shows: $6 \times 5/2$. That can be rewritten as:
 $6/2 \times 5$. When you multiply, you get the same
answer for both problems: $30/2$. That's 15.

c. The next example is: $4 \times \frac{3}{5}$. That expression equals $\frac{12}{5}$. Rewrite the expression so the fraction has 4 as a numerator. Pencils down when you're finished. (Observe students and give feedback.)

• (Write on the board:)

$$\frac{4}{5} \times 3$$

• Here's what you should have: $\frac{4}{5} \times 3$.

What does $\frac{4}{5} \times 3$ equal? (Signal.) $\frac{12}{5}$.

d. The next expression is: $3 \times \frac{3}{5}$.

• Rewrite the expression. ✓

• (Write on the board:)

$$3 \times \frac{3}{5}$$

• Here's what you should have: $3 \times \frac{3}{5}$.

• Remember, if you multiply, you'll get the same answer no matter which value has the denominator.

e. (Teacher reference:)

$\cancel{3} \times \frac{5}{\cancel{2}} = 15$	• If a value is multiplied by a fraction, you can simplify across values .
---	---

- The box below has a rule about simplifying: If a value is multiplied by a fraction, you can simplify **across values**.
 - The box shows: $6 \times \frac{5}{2}$. The part that can be simplified is 6 over 2. That equals 3.
 - When you multiply 3×5 , you get 15. That's the same answer we got when we multiplied first then divided. For the numerator, we got 30. For the denominator, we got 2. That equals 15.
 - Remember, if a value is multiplied by a fraction, you can simplify across values.
- f. (Teacher reference:)

$6 \times \frac{5^1}{10_2} =$	• Simplify the fraction first if you can.
$\overset{3}{\cancel{6}} \times \frac{\overset{5}{\cancel{10}}}{2}$	• Then simplify across values.

- The next box shows that you can simplify more than once.
- The problem is: $6 \times \frac{5}{10}$.
- The first simplification is for the fraction. The simplified fraction is $\frac{1}{2}$.

- The next simplification is $6/2$. That simplifies to 3.

So, 3×1 is 3.

- g. Remember, simplify the fraction first if you can.

Then simplify **across values**.

Workbook practice

- a. Find part 3 of your workbook. ✓
- b. All these problems have a whole number answer.
For each problem, you'll simplify first, then multiply.
- Remember, cross out the numerator and denominator and show the numbers for the simplified value.
- c. Problem A. Show the simplifications and write the answer. (Observe students and give feedback.)
- (Write on the board:)

a. $16 \frac{8}{3} \left(\frac{\cancel{3}}{\cancel{6}} \right) = \boxed{8}$

- Here's what you should have. You simplified $3/6$ first.
Then you simplified $16/2$. The answer is 8.
- d. Work the rest of the problems in part 2. Pencils down when you're finished.

(Observe students and give feedback.)

e. Check your work.

• (Write on the board:)

b. $\overset{3}{\cancel{15}} \left(\frac{\overset{9}{\cancel{18}}}{\cancel{10}} \right) = \boxed{27}$

c. $\overset{2}{\cancel{10}} \left(\frac{14}{\cancel{5}} \right) = \boxed{28}$

d. $\overset{1}{\cancel{11}} \left(\frac{\overset{4}{\cancel{8}}}{\cancel{22}} \right) = \boxed{4}$

e. $\overset{3}{7} \left(\frac{\overset{3}{\cancel{12}}}{\cancel{4}} \right) = \boxed{21}$

• For problem B, you simplified twice.

$$15 \left(\frac{18}{10} \right) = 27.$$

• For problem C, you simplified once.

$$10 \left(\frac{14}{5} \right) = 28.$$

• For problem D, you simplified twice.

$$11 \text{ over } 22 = 4.$$

- For problem E, you simplified once.

$$7 (12/4) = 21.$$

High School Exit Program

Lesson 24

EXERCISE 4 RATE EQUATIONS

Textbook practice

- a. Find part 3 of your textbook. \surd
- These are problems that tell about related units.
You're going to read the part that tells about the related units.
- b. Problem A: There are 12 cats in every 4 boxes. If there are 11 boxes, how many cats are there?
- Read the part that tells about the related units.
(Signal.) *There are 12 cats in every 4 boxes.*
- c. Problem B: Every 6 years, the tree grows 1 foot, and the tree grows for 5 years. How much does the tree grow?
- Read the part that tells about the related units.
(Signal.) *Every 6 years the tree grows 1 foot.*
- d. Problem C: How many children are in 5 groups if there are 36 children in 6 groups?

- Read the part that tells about the related units.
(Signal.) *There are 36 children in 6 groups.*
 - e. Problem D: How far would a boat travel in 3 hours if the boat traveled 75 miles every 4 hours?
 - Read the part that tells about the related units.
(Signal.) *The boat traveled 75 miles every 4 hours.*
- (Repeat steps b – e until firm.)

Textbook practice

- a. Find part 4. ✓
- b. Some word problems that tell about related units use the words **each** or **every**.
 - What words? (Signal.) *Each or every.*
- c. The box gives a new rule: If a problem doesn't give a number for **each** or **every**, the number is **1**.
- d. Below the box is a sentence that does that does not give a number with **every**: There are 12 oars for every boat.
 - **Every** boat means **one** boat.
 - What number do you write for boat? (Signal.) *1.*

e. The next sentence does not give a number with **each**: For each rainy day there were 3 sunny days.

- What number do you write for rainy days?

(Signal.) 1.

f. Listen: What does **each car** mean? (Signal.) 1 car.

- What does **every boy** mean? (Signal.) 1 boy.

- What does **each container** mean? (Signal.)

1 container.

g. (Teacher reference:) ((2nd color))

<ul style="list-style-type: none"> • There were 78 chairs, with 13 chairs in each row. <p>How many rows were there?</p>	$c \left(\frac{r}{c} \right) = r$ $c \left(\frac{\mathbf{1}}{\mathbf{13}} \right) = r$
---	--

((2nd color))

- I'll read the sample problem: There were 78 chairs, with 13 chairs in each row.

- The equation uses letters for chairs and rows:

C x R over C = R.

- Here's the part of the problem that tells about the relationship: There were 13 chairs in each row.

- Everybody, what does **each row** mean?

(Signal.) 1 row.

- So the fraction is: $1/13$. 1 for the row, and 13 for the chairs.
- h. For problems A through D, you'll write the fraction for each relationship.
- i. Problem A: There are 4 hamsters for every cat. There are 12 cats. How many hamsters are there?
- The equation with letters is shown. Copy it. Below, write the equation with numbers that show the relationship. Pencils down when you're finished.
(Observe students and give feedback.)
 - Check your work.
 - Everybody, read the equation with numbers.
(Signal.) $C \times 4/1 = H$.
- Yes, the fraction should have 4 for hamsters and 1 for cat.
- j. Problem B: The car went 45 miles every hour and traveled 200 miles. How many hours did the trip take?
- Copy the equation with letters. Below, write the equation with numbers that show the relationship.
Pencils down when you're finished.

(Observe students and give feedback.)

- Check your work.
- Everybody, read the equation with numbers.

(Signal.) $M \times 1/45 = H$.

- What's the fraction with numbers? (Signal.) $1/45$.

Yes, the fraction should have 1 for hours and 45 for miles.

- k. Work the rest of the items. Pencils down when you're finished. (Observe students and give feedback.)

- l. Check your work.

- Problem C. Read the equation with numbers.

(Signal.) $R \times 1/12 = V$.

- Problem D. Read the equation with numbers.

(Signal.) $M \times 1/40 = T$.

- m. Remember, **each** and **every** tell about 1.

High School Exit Program

Lesson 24

EXERCISE 5 FRACTION SIMPLIFICATION

Textbook practice

- a. Find part 5. $\sqrt{\quad}$
- b. You've learned a rule about numbers divisible by 2.
 - If a number is divisible by 2, what do you know about the last digit? (Signal.) *It's even.*
- c. The top box shows a strategy for working problems more quickly: If the last digit shows that a number is divisible by **2**, see if it is divisible by a **multiple of 2**.
 - 2, 4, 6, and 8 are multiples of 2.
Say those multiples of 2. (Signal.) *2, 4, 6, and 8.*
- d. The first number is 44. Its last digit is an even number, so it is divisible by 2.
 - Is it divisible by 4? (Signal.) *Yes.*
Yes, 4×11 is 44. So you could divide by 4.

- e. The next number is 56. It's divisible by 2.
- Figure out if it's divisible by 4, 6, and 8. Raise your hand when you know the **largest** of those multiples that 56 is divisible by. ✓
 - Everybody, what's the largest multiple? (Signal.) 8.
- f. The next number is 14. It's divisible by 2.
- Figure out the largest multiple of 2 it's divisible by. (Pause.) Everybody, what's the largest multiple of 2 it's divisible by? (Signal.) 2.
Yes, the largest multiple is 2.
- g. Here's another strategy: If a number is divisible by **2 and 3**, the number is divisible by **6**.
- If a number is divisible by 2 and 3, what else is the number divisible by? (Signal.) 6.
- h. The next number is 246. Is 246 an even number? (Signal.) Yes.
- So 246 is divisible by 2. Raise your hand when you know if 246 is divisible by 3. ✓
 - Is 246 divisible by 3? (Signal.) Yes.
 - 246 is divisible by both 2 and 3, so it's divisible by 6.

- i Write the number **2 4 6** and show the division and the answer. Pencils down when you're finished.

(Observe students and give feedback.)

- (Write on the board:)

$$\begin{array}{r} \boxed{41} \\ 6 \overline{) 246} \end{array}$$

- Check your work.
- $246 \div 6 = 41$.

Textbook practice

- a. Find part 6. ✓
- Some of these numbers are divisible by 6.
Remember, test to see if they are divisible by 2 **and** by 3.
- b. Number A: 603. Is it divisible by 2? (Signal.) *No*.
So it can't be divisible by 6.
- c. Number B: 94. Is it divisible by 2? (Signal.) *Yes*.
- Raise your hand when you know if it's **also** divisible by 3. ✓
 - Is it divisible by 3? (Signal.) *No*.
So it can't be divisible by 6.
- d. Number C: 612. Is it divisible by 2? (Signal.) *Yes*.

- Raise your hand when you know if it's also divisible by 3. ✓
- Is it divisible by 3? (Signal.) Yes.
So it's divisible by 6.
- e. Write the letters of the numbers that are divisible by 6. Pencils down when you've done that much.
(Observe students and give feedback.)
- f. Check your work.
 - Numbers C, D, F, and G are divisible by 6.
- g. Write the division problems and the answers for those numbers. Pencils down when you're finished.
(Observe students and give feedback.)
- h. Check your work.
 - Read the division problem and the answer for C.
(Signal.) $612 \div 6 = 102$.
 - Read the problem for D. (Signal.) $156 \div 6 = 26$.
 - Read the problem for F. (Signal.) $402 \div 6 = 67$.
 - Read the problem for G. (Signal.) $96 \div 6 = 16$.

EXERCISE 6 INDEPENDENT WORK

Assign Independent Work, textbook parts 7–15.