Users should treat this material as a working draft. This material can be used in its current form, customized, and/or printed by the user.

The author(s) request feedback on all materials so that they can be continually improved and updated.

This material may contain references to additional resources and links to external websites

that are provided by the contributing author(s) as supplemental materials. The author(s)

neither endorse these references nor are responsible for their content or availability. Also,

the inclusion of any reference to an external resource or link to a website does not imply

endorsement by the author(s) of their owners, products or services.

This material is licensed under the Creative Commons Attribution-Share Alike license

(<http://creativecommons.org/licenses/by-sa/3.0/>).

**Author:**

**Kevin Hall**

Wording for the legal statement above is adapted from the legal statement for *Trigonometry*, published in 2009 by The CK-12 Foundation: <http://about.ck12.org/>

Part 1: Making Difficult Proportions Easy

2.4

Some proportions are hard to solve with Equivalent Fractions (the method we know). We’re going to learn a new way to solve proportions to help us with ones like that.

* Below, please solve the proportions that are easy to solve by equivalent fractions.

1).

* Please circle the harder ones and put a question mark next to them.

It’s actually pretty easy to solve proportions like . What we do first is get a common denominator for both fractions. Then it’s easy to solve. Let’s think about proportions where the denominators are the same.

• 2

• 2

*x* = 6

What’s harder about this one? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

?

**Example**

**Example**

2).

a). What do you notice about the denominators?

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b). What does *x* have to be? Show work or explain your reasoning:

3).

4).

Please solve each of the following for *x*. Show work or explain your reasoning for each.

5).

6).

7).

8).

Now let’s see the whole process. It’s called “Cross-Multiplying”. There are just 5 steps.

**Cross-Multiplying to Solve Proportions**

• 10

• 10

• 4

• 4

• 10

• 10

• 4

• 4

• 10

• 10

• 4

• 4

**Step 2:**

**Multiply each fraction by the other denominator.**

**Step 3:**

**Simplify each fraction.**

**Step 4:**

**The fractions are equal. And the denominators are the same….**

**…So the numerators have to be equal, too.**

• 10

• 10

• 4

• 4

**Step 5:**

**Solve for *x*.**

7.5 = *x*

 **Step 1:**

**Original**

**problem**

**The denominators will be the same.**

• 5

• 5

• 3

• 3

9).

*x* =1.2

11).

10).

12).

13).

If you tip at a 15% rate, how much do you tip on a $35 meal?

14).

15).

How much do they take off the price of a $15 DVD if it’s 30% off?

In the end, how much will the DVD cost? \_\_\_\_\_\_\_\_

Here’s a proportion that solves a percent question. What did the question say?

16).

17).

What did the question say? (It was on percents). \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Here’s a proportion that solves a percent question. What did the question say?

What did the question say? (It was on percents). \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Part 2: Making Rate Problems Easier

There are two ways to write any rate: as a **fractional rate** or as a **unit rate.**

**Fractional Rate**

8 ÷ 2 = 4

This means “$4 every hour”

This means “$8 every 2 hours”

**Unit**

**Rate**

What is the difference between a fractional rate and a unit rate? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

16).

**Fractional Rate**

This means

This means

**Unit**

**Rate**

Please fill in

Please fill in

17).

 18). Please label each example as a “fractional rate” or a “unit rate”:

 **Example Is it a Fractional Rate or a Unit Rate?**

$2.10 for 3 pens \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

$0.70 for each pen \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Now let’s focus on how we use rates.

 19). There is a big mistake in the problem below. Can you see what doesn’t make sense?

 **Incorrect**:

 (0.75 days per inch) • 4 days

Hint: this is the rate for **each inch**

 What needs to be changed for the problem to make sense?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 20). Let’s use a picture to explain the mistake:

 **Incorrect**:

 (0.75 days per inch) • 4 days

**4 days**

To add it all up, we need the rate for **each \_\_\_\_\_\_**

But “0.75 days per inch” is the rate for each \_\_\_\_\_\_.

 21). Here is a rate problem that is correct. Why is this one correct, unlike the last one?

 **Correct**:

 (1.2 lbs/dollar) • 170 dollars

Hint: this is the rate for **each** \_\_\_\_\_

 Why is this one correct? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 22). One way of doing the problem below is correct. The other is not. Please circle the correct way, and

 put a big “X” through the incorrect way.

 0.25 • 11 hours or 4 • 11 hours

This is rate the

for each \_\_\_\_\_\_

This is rate the

for each \_\_\_\_\_\_

Small Group Practice

We’ve been setting up problems with unit rates. But sometimes, it’s easier to use a fractional rate.

**Unit Rate method**

**Fractional Rate method**

Unit Rate:

SCENARIO: You make $15 every 3 hrs. How much will you make in 17 hrs?

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

23). What’s the difference between setting up a problem with a unit rate versus a fractional rate?

24). How would the two different methods look for the problem below?

SCENARIO: How far could you go on 4 gallons of gas, if your car went 385 miles on 11 gallons?

**Unit Rate method**

**Fractional Rate method**

Please fill in

Unit Rate:

Please fill in

25). Please label each example as a “fractional rate” or a “unit rate”:

 **Example Is it a Fractional Rate or a Unit Rate?**

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

50 miles per hour \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Worked example:

26). Can you explain this example?

 **Incorrect** **Correct**

 • 30 days or • 30 days

 Why is this way wrong, and why is the other way right? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

27). Please use the table below to set up a fractional rate problem for each question like #26.

|  |  |  |
| --- | --- | --- |
| **Student** | **Minutes spent typing** | **Words typed** |
| Carole | 10.5 | 653 |
| Quinton | 6 | 490 |
| DeLisa | 3 | 173 |

a). How long would it take Quinton to type 150 words?

• 150 words

b). How many words could Carole type in 8 minutes? (Just set up the problem).

28). In this question, let *x* = the number of dollars earned. Which way to set up the problem is correct? (Please circle the correct way, and put a big “X” through the incorrect way).

 • *x* • *x*

or

5 • *x*

0.2 • *x*

29). Please create your own example of correct and incorrect ways to set up a fractional rate problems like #28. In your example, **let *x* = number of shirts washed.**

 **Correct: Incorrect:**

Worked example:

30). You ask the DJ to play hip-hop songs 60% of the time. If he plays 114 songs tonight, how many hip-hop songs will he play?

**2: Unit Rate**

**3: Answer**

68.4

He will play about 68 hip-hop songs.

**1: Fractional Rate**

Question: How would you solve this problem differently if the DJ played hip-hop 75% of the time (out of 114 songs)? Explain or show work below:

Practice:

31). 27.5% of the students in the class have A’s. There are 40 students in the class. Please fill in:

**2: Unit Rate**

**3: Answer**

**1: Fractional Rate**

Worked Example

32). 88% of the shirts were XL. Please answer the questions below.

b). *y* represents \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c). How did we get 0.88? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

a). *x* represents \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

33). In a can of peaches, 2% of the contents were insect parts. The can’s total contents weighed 14 ounces (oz). How many ounces of insect parts were in the can? Solve this like #30.

34). You got 105% on a quiz (because of extra credit). The quiz was out of 40 points. How many points did you earn?

35). Below is an equation that solves a percent question. What did the question say?

What did the question say? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

37). If you tip 18% on a bill of $65, how much do you tip? Please solve this with a **proportion.**

38). If you tip 18% on a bill of 65, how much do you tip? Please solve this using the method shown in #30.

Please solve for the variable:

39).

40).