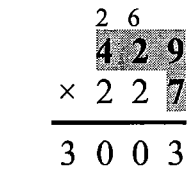
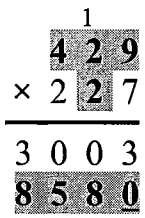
More Multiplication

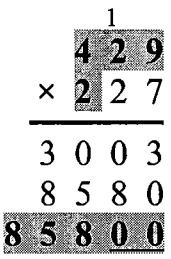
Now we will study the multiplication algorithm with a 3-digit number on the bottom. This means we have three partial products to do, so the multiplication process takes three lines.



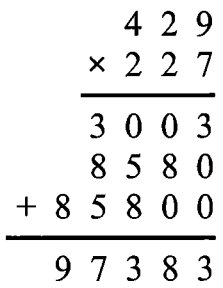
First multiply 7×429, ignoring the 2 and 2 in 227.



Next multiply 20×429. Place a zero in the ones place, and then multiply as if it was just 2×429.



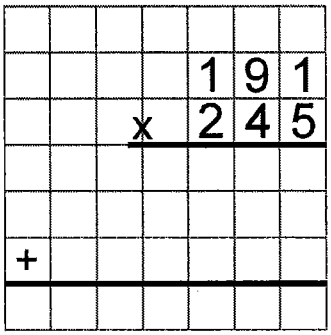
Then, 200×429. Since you are multiplying by 200, place a zero in the ones *and* in the tens places, and then multiply 2×429.



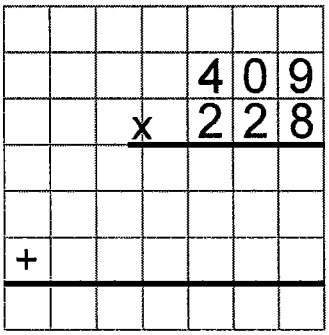
Lastly add.

1. Multiply. Remember: you will need to place *two zeros* in the third line.

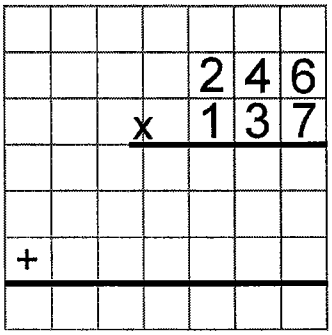
a.



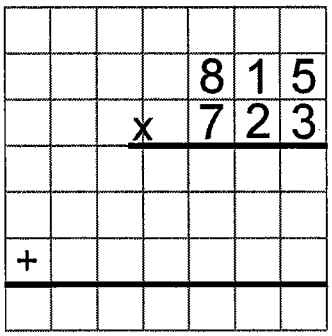
b.



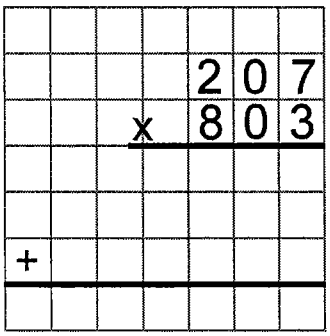
c.



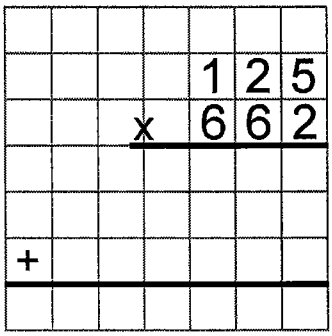
d.



e.



f.



2. First estimate. Then multiply. Lastly, check that your final answer is reasonably close to your estimate.

a. Estimate: _____ _____ 1 4 9 1 × 2 7	**b.** Estimate: _____ _____ 2 0 8 5 × 3 5	**c.** Estimate: _____ _____ 6 2 7 0 4 × 4 5
d. Estimate: _____ _____ 9 0 5 1 6 × 8 2	**e.** Estimate: _____ _____ 2 1 4 4 × 3 8 1	**f.** Estimate: _____ _____ 5 5 2 9 × 3 3 6

3. Let's review! Multiply mentally. Remember the shortcut? Multiply without the zeros, then tag as many zeros at the end of the answer as there are in the factors.

a. 500 × 200 =	**b.** 30 × 210 =
c. 250 × 40 =	**d.** 2,000 × 400 =
e. 1,200 × 800 =	**f.** 30 × 40 × 50 =
g. 20 × 800 × 200 =	**h.** 50 × 80 × 300 =

When the factors end in zeros, we can take a shortcut! Study the examples carefully.

Example 1:

$$\begin{array}{r} {\scriptstyle 1\ 1\ \ } \\ 956 \\ \times\ 200 \\ \hline 191200 \end{array}$$

Here, you can first place two zeros in the ones and tens places in the answer, and then just multiply 2 × 956.

Example 2:

$$\begin{array}{r} {\scriptstyle 4\ 1\ 1\ \ } \\ 950 \\ \times\ 820 \\ \hline 0000 \\ 19000 \\ +76000 \\ \hline 779000 \end{array}$$

Be careful... the first "line" consists totally of zeros. On the second line, first place a zero, then multiply. On the third line, first place TWO zeros, then multiply.

$$\begin{array}{r} {\scriptstyle 4\ 1\ 1\ \ } \\ 95 \\ \times\ 82 \\ \hline 190 \\ +7600 \\ \hline 7790 \end{array}$$

It is easier to multiply 82 × 95 and tag two zeros to the final answer to get 779,000.

4. Multiply.

a. 500 × 29 = _____

Simply multiply 5 × 29, then tag _____ zeros to the final answer.

b. 340 × 210 = _____

Multiply _____ × _____, then tag ____ zeros to the final answer.

c. 280 × 700 = _____

Multiply _____ × _____, then tag ____ zeros to the final answer.

d. 99 × 9,900 = _____

e. 600 × 1,800 = _____

f. 24,500 × 30 = _____

A Two-Digit Divisor 2

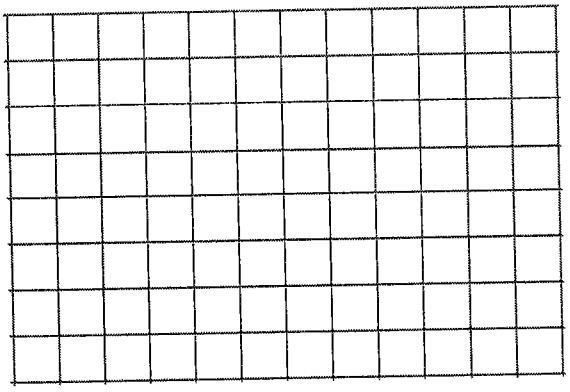
1. Divide. Use the space on the left to write a multiplication table of the divisor. Lastly check.

$2 \times 37 = 74$	**a.** $37\overline{)4\ 1\ 0\ 7}$	$\times\ 3\ 7$
	b. $58\overline{)4\ 4\ 0\ 8}$	$\times\ 5\ 8$
	c. $96\overline{)9\ 7\ 9\ 2}$	$\times\ 9\ 6$

2. Divide. Use the space on the left to write a multiplication table of the divisor. Lastly check.

	a. $48\overline{)6011}$	
	b. $92\overline{)8712}$	
	c. $55\overline{)6745}$	

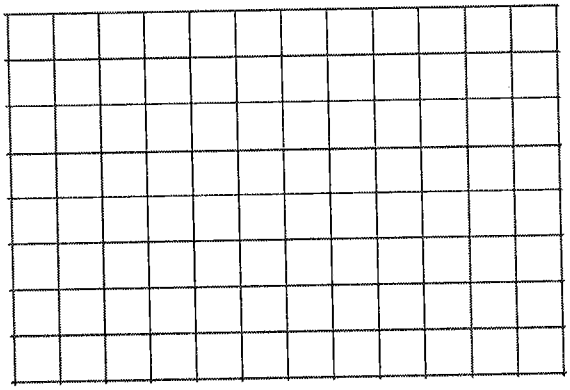
3. Angela is going to borrow money so she can purchase three beds for $156 each. She will pay back the loan in 12 equal payments, over one year.
How much is one payment?



4. Mark paid 4/15 of his $3,600 salary in taxes.

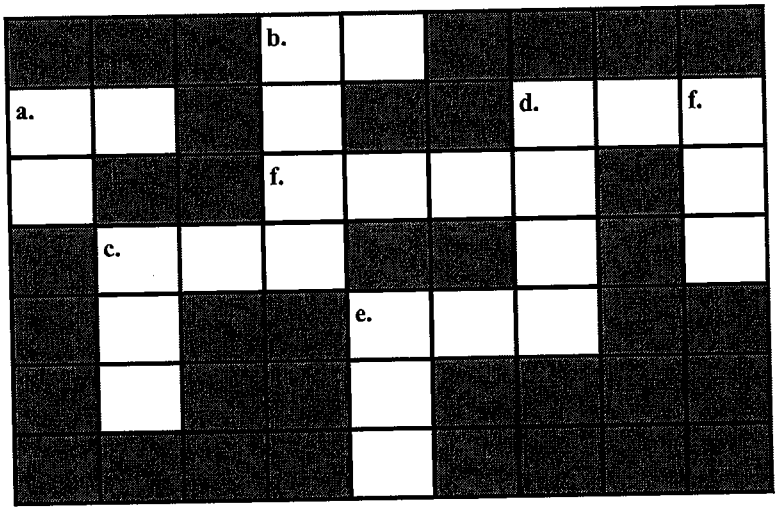
a. How much did Mark pay in taxes?
(Hint: First find 1/15 of his salary.)

b. How much does Mark have left after taxes?



5. If you need more practice, solve the problems below and fill in the cross-number puzzle. Use your notebook for long divisions.

Down	Across
a. 3,762 ÷ 66	**a.** 2,295 ÷ 45
b. 19,750 ÷ 5	**b.** 2,870 ÷ 82
c. 9,960 ÷ 12	**c.** 9,240 ÷ 11
d. 27,339 ÷ 13	**d.** 9,660 ÷ 35
e. 9,384 ÷ 23	**e.** 9,306 ÷ 22
f. 9,135 ÷ 15	**f.** 15,243 ÷ 3



Puzzle Corner

Check if you can solve these long divisions with a 3-digit divisor! These may have a remainder. Use your notebook.

a. 12,408 ÷ 118

b. 70,854 ÷ 235

Adding and Subtracting Large Numbers

Just like 25 marbles + 54 marbles = 79 marbles, so will 25 million + 54 million = 79 million.

Just keep in mind: **a thousand thousands makes a million**, and **a thousand millions makes a billion**.

800,000 + 200,000 Think of it as 800 thousand + 200 thousand. The answer is 1,000 thousand or 1,000,000.	**Half a million** Think of it as half of a thousand thousands, or 500 thousands = 500,000.
34,999,000 + 1,000 This is 34 million 999 thousand + 1 thousand, making 34 million 1000 thousand or 35 million.	**2 billion − 300 million** Think of it as 2,000 million − 300 million, which makes 1,700 million or 1,700,000,000.

1. Add.

	a. 90,000	b. 99,000,000	c. 999,000
+ 1,000			
+ 10,000			
+ 100,000			
+ 1,000,000			

2. Match.

a.		b.	
1/2 million	750,000	1 million − 50,000	100,000,000
a hundred hundreds	100,000	1 million − 500,000	500,000
1/10 million	10^6	10^8	950,000,000
1/4 million	500,000	1 billion − 500 million	1/2 billion
3/4 million	10^4	1 billion − 50 million	950,000
a thousand thousands	200,000	1 million − 5,000	995,000
2/10 million	250,000	1 billion − 5 million	995,000,000

3. Add or subtract. Simply write the numbers under each other, lining up the digits in the same places . Use the usual addition or subtraction algorithm, regrouping the same way as you have learned before.

a. 329,145,000 + 2,809,125,093

b. 5,049 + 45,390,000 + 5,483,700

c. 45,700 + 90,567,000 + 2,560 + 2,300,560

d. 290,800 + 254,000,230 + 56,391 + 2,381

e. 480,560,000 − 23,980,000

f. 1,000,000 − 156,990

g. 22,300,000 − 4,431,190

h. 7,014,289,000 − 3,103,559,391

4. Subtract and compare.

a. 1 million − 100 thousand =

1 million − 10 thousand =

1 million − 1 thousand =

b. 7 million − 500 thousand =

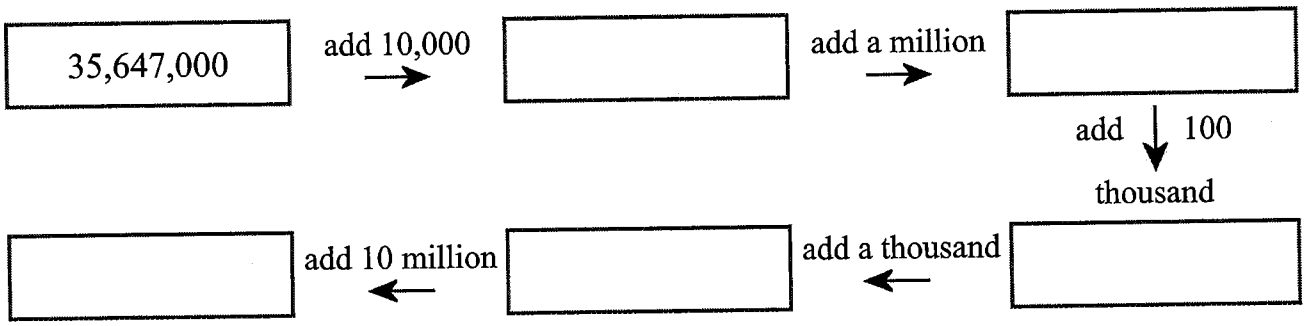
7 million − 50 thousand =

7 million − 5 thousand =

5. Continue counting for seven more numbers in each set:

a.	b.	c.
458,000,000 468,000,000 478,000,000	79,650,000 79,800,000 79,950,000	450,996,000 450,997,000 450,998,000
Each difference is _____	Each difference is _____	Each difference is _____

6. Complete the addition path.



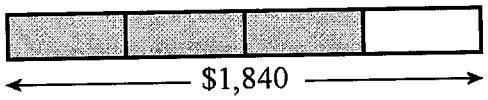
7. Solve for x.

a. $x + 400{,}000 = 4{,}000{,}000$ $x =$ _____	**b.** $x - 350{,}000 = 2{,}000{,}000$ $x =$ _____
c. $200{,}000 + x + 600{,}000 = 7{,}000{,}000$ $x =$ _____	**d.** $2x = 3{,}000{,}000$ $x =$ _____

Problem Solving with Bar Models 1

A fractional part of a whole

Problem. Jackie earns $1,840 monthly and Jessie earns 3/4 as much. How much does Jessie earn?



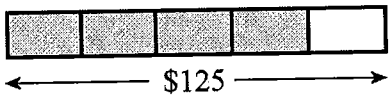
Solution. In the model, Jackie's salary is divided into four equal parts (blocks). To find 3/4 of it, first find 1/4 of it, which is **one block** in the model.

$$\$1{,}840 \div 4 = \$460$$

Then multiply that result by three: $3 \times \$460 = \$1{,}380$.
So, Jessie earns $1,380.

Solve. Draw a bar model. Write an expression (number sentence) for each calculation you do.

1. A camera that cost $125 was discounted by 1/5 of its price. What is the new price?



_____ ÷ _____ = _____

_____

2. A pizza that weighs 680 g is divided into five equal pieces. How much do two pieces weigh?

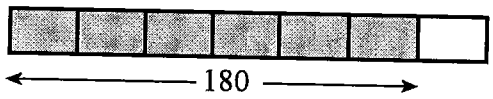
_____ ÷ _____ = _____

_____ × _____ = _____

3. A bottle of water costs 2/3 as much as a bottle of juice that costs $1.50. How much do *two* bottles of water and *two* bottles of juice cost?

A Fractional Part More

Problem. The school year in country A is 180 days long. In country B it is 1/6 part longer than that. How long is the school year in country B?



Solution. First, we divide the 180-day school year into 6 parts, to find how much one "block" is in the model:

$180 \div 6 = 30$. So, one block is 30 days.

Then we *add* one-sixth more to the whole bar model, and that is how long the school year is in country B.

$$180 + 30 = 210$$

So, the school year in country B is 210 days long.

Solve. Draw a bar model. Write an expression (number sentence) for each calculation you do.

4. The price of a train ride is \$12. It went up by 1/6. What is the new price?

_____ ÷ _____ = _____

_____ + _____ = _____

5. A cafeteria lunch used to cost \$4.50 but the price was increased by 1/5. What is the price now?

6. A one-way bus ride from Helen's home to town costs \$1. The bus company will raise the price by 1/10 in June.

a. How much will a one-way ride cost in June?

b. How much more will a two-way ride (home to town to home) cost Helen in June than in May?

7. A T-shirt cost $10.50, but now it is discounted by 2/5 of its price.
Annie buys *ten* shirts with the discounted price. What is the total cost?

8. Duckville has 3,687 inhabitants, which is 3/5
of the number of inhabitants in Eagleby.
How many people *in total* live in Eagleby and Duckville?

9. A package of 10 small envelopes costs $2.50,
and a package of 10 large ones costs 2/5 more.
Find the total cost of buying 50 envelopes of each kind.

Long Division with Decimals

It is very easy to use long division to divide a decimal by a whole number.

During the division process, divide normally, as if there were no decimal point. Then, simply **put the decimal point in the quotient in the same place** as it is in the dividend.

Study the example on the right. Finish the check by multiplication yourself and verify you get the dividend, 41.51.

```
  0 5.9 3
7)4 1.5 1
 -3 5
    6 5
  - 6 3
      2 1
    - 2 1
        0
```

Check:

```
  5.9 3
×     7
-------
```

1. Divide. Check each division result with multiplication.

Check:

a. $5\overline{)5.30}$

Check:

b. $3\overline{)0.72}$

Check:

c. $7\overline{)6.23}$

Check:

d. $6\overline{)2.388}$

2. Divide. Check each division result with multiplication.

Check: **a.** $19\overline{)23.94}$	Check: **b.** $23\overline{)57.638}$

3. **a.** Fill in the explanation and find the price of one roll.

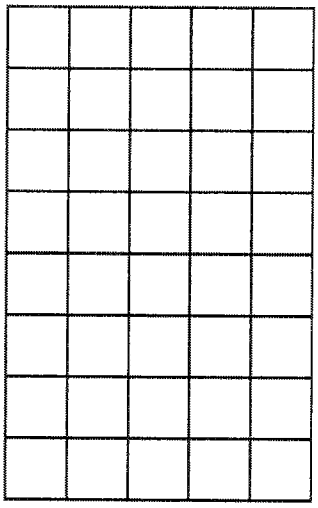
Twenty-four wheat rolls and one loaf of rye bread cost $10.70. If the bread costs $2.30, find the cost of one roll.

First subtract $_____ from $_____.

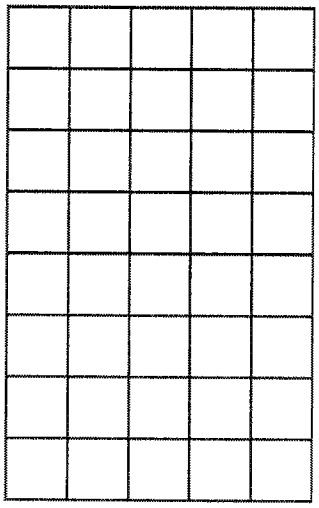
Then _____ that result by _____.

One roll costs $_____.

b. Write a *single* expression to match the explanation above.



4. Seven muffins and one drink cost $7.11. If the drink costs $1.23, find the cost of one muffin.



You know that when dividing whole numbers with long division, there can be a remainder. For example, 24 ÷ 5 = 4 R4. But, we can continue such divisions into decimal digits, and sometimes the quotient comes out even! To do that, add decimal zeros to the dividend. **Example 1.** Let's write 24 as 24.0 and use long division to do 24.0 ÷ 5. It is actually an even division now with a quotient of 4.8. Study the calculations on the right.	$\begin{array}{r} 0\,4.8 \\ 5\overline{)\,2\,4.0} \\ \underline{2\,0} \\ \quad 4\,0 \\ \quad \underline{-\,4\,0} \\ \quad\quad 0 \end{array}$	**Check:** $\begin{array}{r} 4 \\ 4.8 \\ \times\quad 5 \\ \hline 2\,4.0 \end{array}$

5. Divide in two ways: first by indicating a remainder, then by long division. Check by multiplying.

a. 31 ÷ 4 = _____ R _____

$4\overline{)\,3\,1.0\,0}$ Check:

b. 56 ÷ 5 = _____ R _____

$5\overline{)\,5\,6.0}$ Check:

c. 15 ÷ 8 = _____ R _____

$8\overline{)\,1\,5.0\,0\,0}$ Check:

d. 45 ÷ 20 = _____ R _____

$20\overline{)\,4\,5.0\,0}$ Check:

Sometimes a decimal division is not even. In that case, **stop the division** at some point, and **give the answer as a rounded number.** Round to the digit <u>just before</u> the last digit you found for the quotient. That way, the last digit will tell you whether to round up or down.	12.666 3)38.000 -6 20 -18 20 -18 20 -18 2
Example 2. Three girls shared evenly the cost of a \$38 meal. How much did each girl pay? We calculate the answer to <u>three</u> decimal digits so that we can round it to <u>two</u> decimal digits: \$12.666 ≈ \$12.67. But, if each girl pays \$12.67, they would pay 1 cent too much. So in reality, two girls would pay \$12.67 and one girl \$12.66.	

Use the grid below and your notebook for calculations.

6. The PE teacher divided a 2-mile track into seven equal parts. How long are the parts? Give your answer to two decimal digits, in miles.
   Remember to write 2 as 2.000 before you divide.

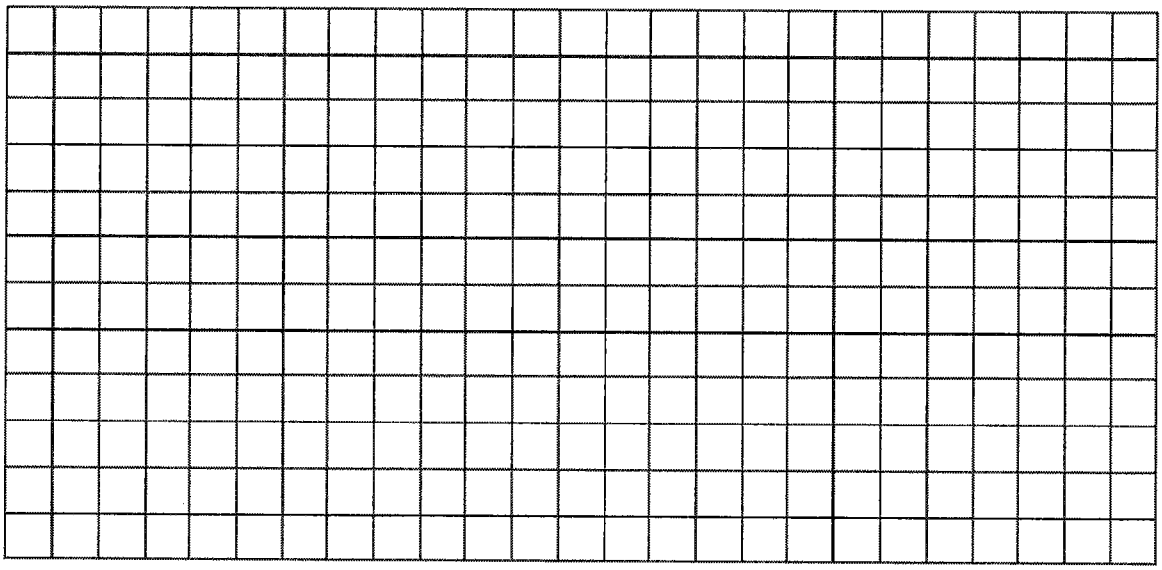
7. A recipe calls for 1.5 kg of beef and it makes six servings. How much beef is in one serving?

8. Mary checked the prices of four different hot sauces: \$2.55, \$2.69, \$2.95, and \$2.75. Calculate the average price.

9. Now you will need both division and multiplication.

   a. Find 3/4 of 0.130 kg.

   b. Find 3/5 of 23 seconds.



More Long Division with Decimals

Fractions and division

Remember? **The fraction line is also a division symbol.** So $\frac{1}{8}$ can mean both one-eighth (a fraction) and a division problem $1 \div 8$. This gives us a means of writing fractions as decimals!

Example 1. Write $\frac{8}{9}$ as a decimal, to three decimal digits.

We simply divide 8 by 9, but writing 8 as 8.0000—with lots of decimal zeros. Look at the division on the right. We need to find *four* decimal digits for the quotient before we can round it to *three* decimal digits:

$\frac{8}{9} = 8 \div 9 \approx 0.889.$

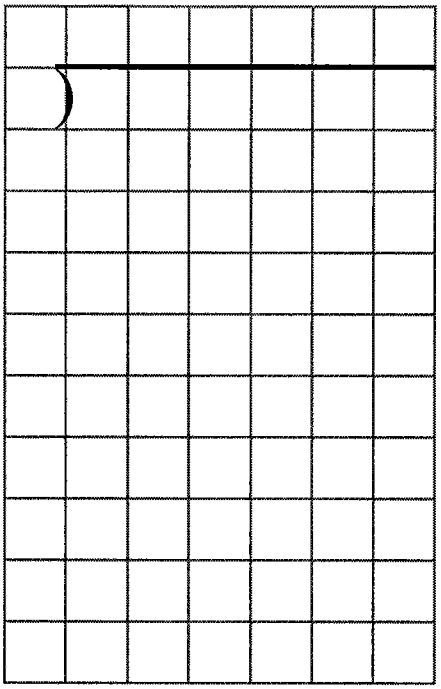
```
  0.8 8 8 8
9)8.0 0 0 0
  7 2
    8 0
  - 7 2
      8 0
    - 7 2
        8 0
      - 7 2
          8
```

1. Write the fractions as decimals, to three decimal digits.

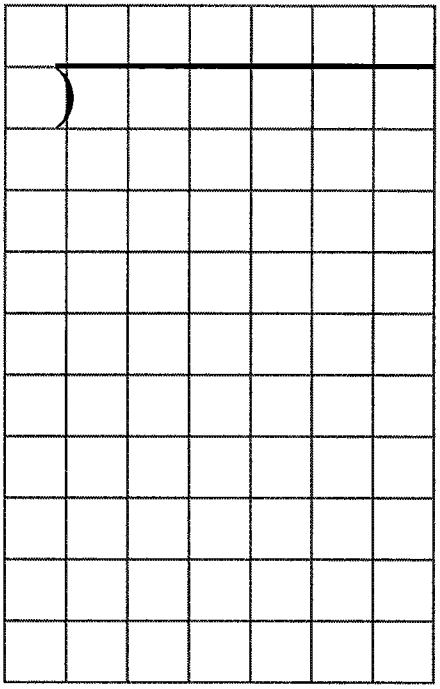
a. $\frac{5}{8} =$

b. $\frac{6}{7} =$

c. $\frac{1}{6}$ =

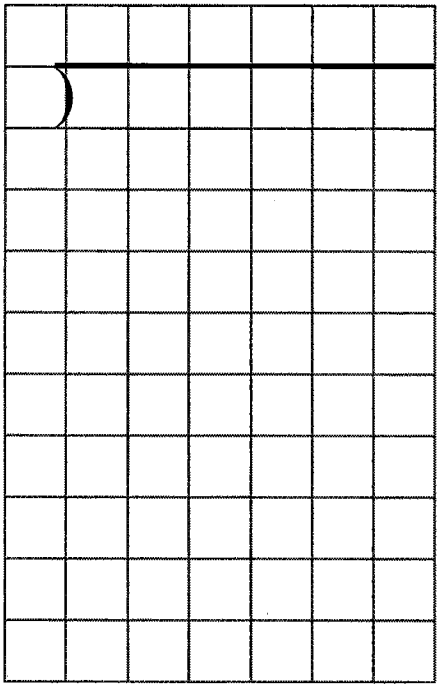


d. $\frac{7}{20}$ =

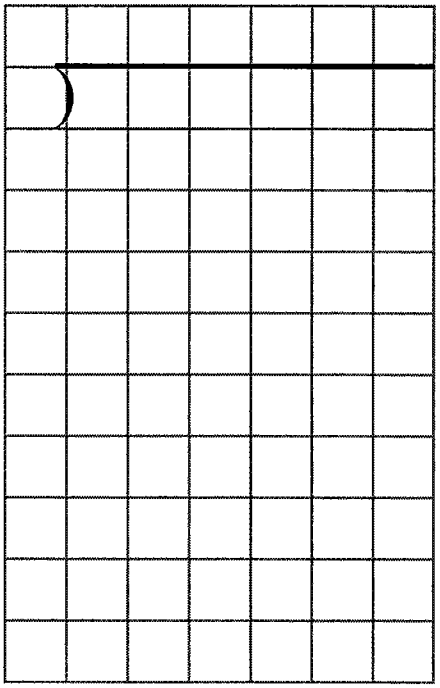


2. Calculate. You will need to add decimal zeros to the dividend.

a. 250 ÷ 6 to two decimal digits



b. 37.5 ÷ 11 to three decimal digits



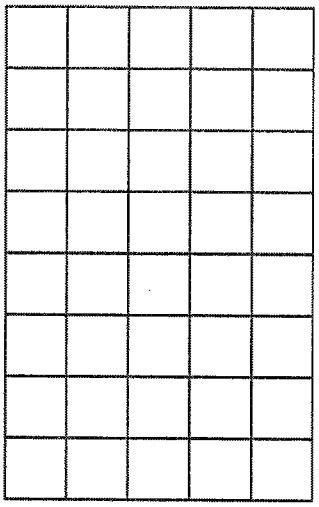
3. **a.** Fill in the explanation as to how to solve the problem.

Three packs of transistors and seven packs of capacitors cost a total of $8.70. One capacitor pack costs $0.60. Find the cost of one transistor pack.

First _____ the cost of seven capacitor packs from _____. Then divide that result by _____.

b. Write a *single* expression to match the explanation above.

c. Solve the problem.



4. Three friends shared equally the cost of a taxi fare, $35.40, and the cost of a meal, $128.95. How much did each person pay?

5. Write a word problem that matches each calculation below. *You don't have to calculate anything.*

a. ($50 − $26) ÷ 3 = $8

b. 25 × $1.40 ÷ 2 = $17.50