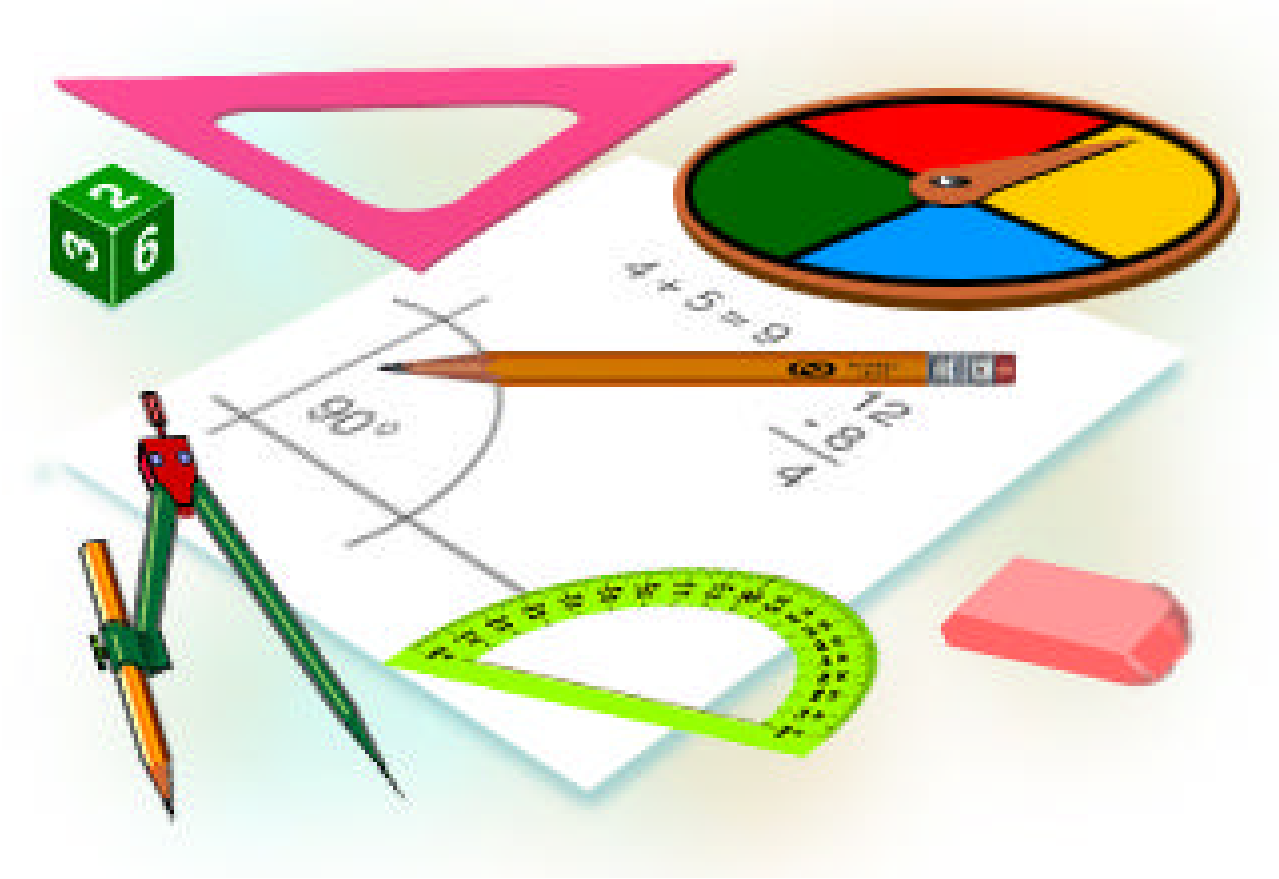
The Next Step

Mathematics Applications for Adults



Book 14014 – Whole Numbers

INTRODUCTION

Why Math?

The most important reason for learning math is that it teaches us how to think. Math is more than adding and subtracting, which can easily be done on a calculator; it teaches us how to organize thoughts, analyze information, and better understand the world around us.

Employers often have to re-educate their employees to meet the demands of our more complex technological society. For example, more and more, we must be able to enter data into computers, read computer displays, and interpret results. These demands require math skills beyond simple arithmetic.

Everyone Is Capable of Learning Math

There is no **type** of person for whom math comes easily. Even mathematicians and scientists spend a lot of time working on a single problem. Success in math is related to practice, patience, confidence in ability, and hard work.

It is true that some people can solve problems or compute more quickly, but speed is not always a measure of understanding. Being "faster" is related to **more practice or experience.**

For example, the reason why math teachers can work problems quickly is because they've done them so many times before, not because they have "mathematical minds".

Working with something that is familiar is natural and easy. For example, when cooking from a recipe we have used many times before or playing a familiar game, we feel confident. We automatically know what we need to do and what to expect. Sometimes, we don't even need to think. However, when using a recipe for the **first** time or playing a game for the **first** time, we must concentrate on each step. We double-check that we have done everything right, and even then we fret about the outcome. The same is true with math. When encountering problems for the very first time, **everyone must have patience** to understand the problem and work through it correctly.

It's Never Too Late to Learn

One of the main reasons people don't succeed in math is that they don't start at the right place. **IMPORTANT! You must begin where *you* need to begin.** Could you hit a homerun if you hadn't figured out which end of the bat had to make contact with the ball? Why should learning math be any different?

If it has been a while since your last math class, **you must determine what level math you should take.** A teacher or trained tutor can help determine this with a few placement tests and questions.

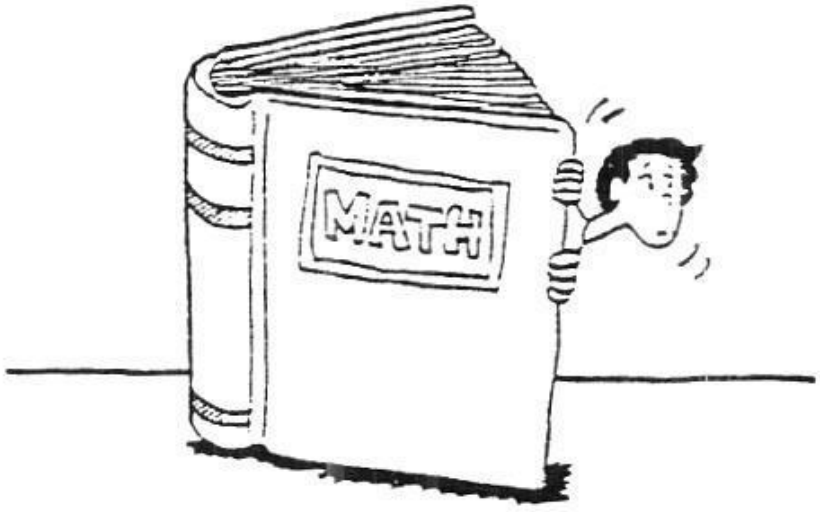
Sometimes a few tutoring sessions can help you fill gaps in your knowledge or help you remember some of the things you

have simply forgotten. It could also be the case where your foundations may be weak and it would be better for you to relearn the basics. **Get some help** to determine what is best for you.

Feeling good about ourselves is what all of us are ultimately striving for, and nothing feels better than conquering something that gives us difficulty. This takes a great deal of courage and the ability to rebound from many setbacks. This is a natural part of the learning process, and when the work is done and we can look back at our success, nothing feels better.

Where's the best place to hide if you're scared?

Inside a math book because there is safety in numbers.



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OUTLINE

Mathematics - Book 14014

Whole Numbers
Number/Word Recognition
orally name each number when presented with a list of random Arabic numbers (1,000+).
convert Arabic numbers to Roman numerals and vice versa (I – XXXIX…1 – 39).
correctly write the number words for Arabic numbers (0 – 1,000).
correctly write the Arabic numerals for any number word (0 – 1,000).
Place Value
recognize the place value of each digit of a number to the million's place.
determine how many hundred thousands, thousands, hundreds, tens and ones in any number (0 – 1,000,000).
Counting
count orally from 0 – 1,000,000 starting at any point in between those numbers.
count orally by 2's, 5's, and 10's to 100.
write all the even numbers from 2 - 100 and all the odd numbers from 1 - 99.
order numbers from greatest to least and least to greatest. (0 – 1,000,000).

Addition
find the sum of whole numbers up to 6 digits.
use addition facts to compute sums up to and including 18.
Subtraction
subtract two whole numbers up to 6 digits (using borrowing/regrouping).
use subtraction facts to compute differences up to and including 18.
apply addition/subtraction skills by completing an incomplete equation (e.g. 14 + ? = 37).
Multiplication
multiply 3 digit factors by 3 digit factors.
write the times tables to 12 x 12 (within a specified time).
multiply by 1, 10, 100 quickly (within a specified time).
Division
divide 3 digit factors by 3 digit factors, expressing any remainders by “r”.
write division facts to 144 ÷ 12.
divide by 1, 10, 100 quickly (within a specified time).
Word Problems with Whole Numbers
solve one/two step problems with addition, subtraction, multiplication or division of whole numbers.

THE NEXT STEP

Book 14014

Whole Numbers

Number Recognition

Digit is a counting word. A digit is any of the numerals from **1** to **9.** The word "digit" is also the name for a finger. So number digits can be counted on finger digits.

Our modern system of counting probably came from counting on fingers. Fingers and hands were among the earliest known calculators!

A CLOSER LOOK AT ROMAN NUMERALS

Roman numerals were created over 2,000 years ago. They are still used today. You can find Roman numerals on clock and watch faces, on monument and building inscriptions, and on official papers, magazines, and books.

The Roman numeral system uses letters to represent numbers. Combinations of these letters represent other numbers.

I = 1
V = 5
X = 10

Combining Roman Numerals

To make the Roman numeral for 2, I is added to I, so II = 2 (and II + I = III, or 3).

1 = I
2 = I + I or **II**
3 = I + I + I or **III**

1) As a rule, no letter should be repeated more than three times.

2) When a letter representing a number of lesser value appears to the left of a letter of greater value, the lesser value is subtracted from the greater value.

To make the Roman 4, subtract one from five, or V – I = IV

4 = V – I or **IV**
five minus one **one less than five**

9 = X – I or **IX**
ten minus one **one less than ten**

Get to know the Roman numerals from 1 to 39:

1 = I	**21 = XXI**
2 = II	**22 = XXII**
3 = III	**23 = XXIII**
4 = IV	**24 = XXIV**
5 = V	**25 = XXV**
6 = VI	**26 = XXVI**
7 = VII	**27 = XXVII**
8 = VIII	**28 = XXVIII**
9 = IX	**29 = XXIX**
10 = X	**30 = XXX**
11 = XI	**31 = XXXI**
12 = XII	**32 = XXXII**
13 = XIII	**33 = XXXIII**
14 = XIV	**34 = XXXIV**
15 = XV	**35 = XXXV**
16 = XVI	**36 = XXXVI**
17 = XVII	**37 = XXXVII**
18 = XVIII	**38 = XXXVIII**
19 = XIX	**39 = XXXIX**
20 = XX	

Practice Exercise

Fill in the blanks with the correct Roman Numeral.

31_____	5 _____	29_____
6 _____	30 _____	12 _____
15 _____	37 _____	21 _____
3_____	20 _____	23 _____

Fill in the blanks:

XXXI _____	IV _____	XI_____
XV _____	XXXIII_____	XXX_____
XXXV_____	XX _____	XVI _____
II _____	I _____	VI _____

Number/Word Recognition

Every number can be written two ways.
It can be written as a numeral.
Or it can be written as a word.
The numeral and word stand for the same thing.

Numeral	Word
0	zero
1	one
2	two

3	three
4	four
5	five
6	six
7	seven
8	eight
9	nine

Learn to say these 2-place numbers:

10	ten
11	eleven
12	twelve
13	thirteen
14	fourteen
15	fifteen
16	sixteen
17	seventeen
18	eighteen
19	nineteen

The 2-place numbers go from 10 (ten) to 99 (ninety-nine).
We have just learned about the 2-place numbers from 10 to 19.
Now learn these 2-place numbers:

20	twenty
21	twenty-one
22	twenty-two
23	twenty-three
24	twenty-four
25	twenty-five
26	twenty-six
27	twenty-seven

28	twenty-eight
29	twenty-nine
30	thirty
31	thirty-one
32	thirty-two
33	thirty-three
34	thirty-four
35	thirty-five
36	thirty-six
37	thirty-seven
38	thirty-eight
39	thirty-nine
40	forty
41	forty-one
42	forty-two
43	forty-three
44	forty-four
45	forty-five
46	forty-six
47	forty-seven
48	forty-eight
49	forty-nine
50	fifty
51	fifty-one
52	fifty-two
53	fifty-three
54	fifty-four
55	fifty-five
56	fifty-six
57	fifty-seven
58	fifty-eight
59	fifty-nine
60	sixty

61	sixty-one
62	sixty-two
63	sixty-three
64	sixty-four
65	sixty-five
66	sixty-six
67	sixty-seven
68	sixty-eight
69	sixty-nine
70	seventy
71	seventy-one
72	seventy-two
73	seventy-three
74	seventy-four
75	seventy-five
76	seventy-six
77	seventy-seven
78	seventy-eight
79	seventy-nine
80	eighty
81	eighty-one
82	eighty-two
83	eighty-three
84	eighty-four
85	eighty-five
86	eighty-six
87	eighty-seven
88	eighty-eight
89	eighty-nine
90	ninety
91	ninety-one
92	ninety-two
93	ninety-three

94	ninety-four
95	ninety-five
96	ninety-six
97	ninety-seven
98	ninety-eight
99	ninety-nine

The number 99 is the greatest 2-place number.
The next number in order is 100 (one hundred).

100 is one more than 99.
It is a 3-place number.
It has three numerals: 1, 0, and 0.
They stand for 1 hundred, 0 tens, and 0 ones

The greatest 3-place number is 999 (nine hundred ninety-nine).
It stands for 9 hundreds, 9 tens, and 9 ones.

Every 3-place number tells how many hundreds, tens, and ones the number stands for.

The number 999 is the greatest 3-place number.
The next number in order is 1,000 (one thousand).
It is one more than 999.
It is a 4-place number.
It has four numerals: 1, 0, 0, and 0.
They stand for 1 thousand, 0 hundreds, 0 tens, and 0 ones.

We use a comma after the number in the thousands' place.
The comma makes large numbers easier to read.

Practice Exercise

Read the number word and write the number.

1. one hundred fifty-four **154**
2. twenty-seven _____
3. one thousand, four hundred seventy-eight _____
4. six hundred fifty-nine _____
5. ninety _____
6. one thousand, four hundred sixty-four _____
7. four hundred fifty-eight _____
8. sixty-six _____
9. one thousand, eight hundred ninety-eight _____
10. five hundred twenty _____
11. four hundred fifty-three _____
12. one thousand, four hundred seventy-two _____
13. five hundred fifty-five _____
14. two hundred five _____

Write the numeral as a number word.
The first one is already done for you.

1. 505 **five hundred five**
2. 308 _____
3. 1,557 _____
4. 63 _____

5. 1,325 _____
6. 98 _____
7. 23 _____
8. 1,624 _____
9. 87 _____
10. 6 _____
11. 1,050 _____
12. 831 _____
13. 50 _____
14. 774 _____
15. 85 _____
16. 1,321 _____
17. 1,694 _____
18. 117 _____

Place Value

In the number ***111***, each numeral ***1*** means a different number: ***one, ten,*** and ***one hundred.*** How can the numeral ***1*** stand for so many numbers? That's called ***place value***. The ***value*** of a numeral depends on what ***place*** it's in. If our number system didn't use place value, we would need a lot more than ten numerals (0, 1, 2, 3, 4, 5, 6, 7, 8, and 9)----we'd need millions!

hundreds		**tens**		**ones**
1		**1**		**1**
1 x 10 x 10	**®**	**1 x 10**	**®**	**1**
100	**+**	**10**	**+**	**1 = 111**

To read the place value of numerals in a number, read from left to right.
Each column has a value 10 times greater than the column to its right.

What do these numbers have in common?

4,321 1,234 3,412 2,143

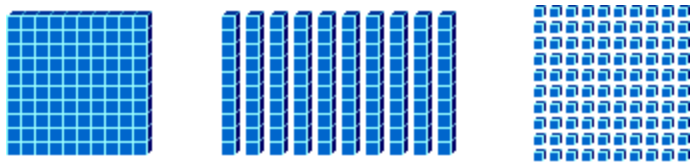
You probably noticed that they are all 4-**digit** numbers, but did you notice that all four numbers are made up of the same digits: 1, 2, 3, and 4? The digits are the same, but each number has a different value. This is because the digits are in different **places** in each number, and in our number system the place of the digit tells you its value. In other words, each digit in a number has a **place value**.

Below, each number is arranged with each digit under the name of the place in which it stands:

thousands	**hundreds**	**tens**	**units** *or* **ones**
4	3	2	1
1	2	3	4
3	4	1	2
2	1	4	3

Notice that the 4 in the first number is in the thousands place. That means it is worth 4 thousand. In the second number, the 4 is in the units or ones place. It is worth 4 ones or just plain 4. In the third number, the 4 is in the hundreds place, and it is worth 4 hundred. In the last number, the 4 is in the tens place. That means it is worth 4 tens or 40.

Hundred



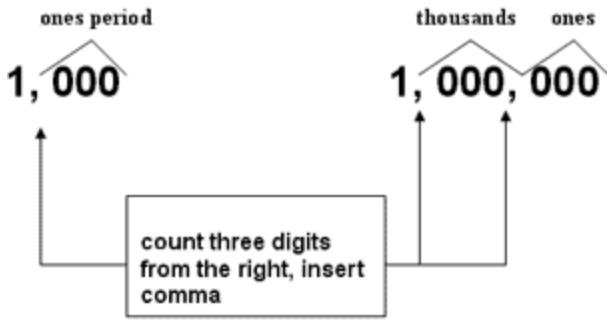
1 **hundred** = 10 tens = 100 ones

Tens **Ones**

20 ones = 2 tens 3 ones

Periods

Three places in the place value chart make up a ***period***. Periods are always counted from the right---from the "ones" column---of a number. Periods are separated in numerals by commas.



Millions Period			Thousands Period			Ones Period		
Hundred Millions	**Ten Millions**	**Millions**	**Hundred Thousands**	**Ten Thousands**	**Thousands**	**Hundreds**	**Tens**	**Ones**
100,000,000	**10,000,000**	**1,000,000**	**100,000**	**10,000**	**1,000**	**100**	**10**	**1**
900,000,000	**90,000,000**	**9,000,000**	**900,000**	**90,000**	**9,000**	**900**	**90**	**9**

Practice Exercise

Millions, Thousands, Hundreds, Tens, and Ones

Write the place value of the bold number in each numeral.

1. 732,6**8**7	Tens	2. 3,**7**44	_____
3. 493,67**4**,512	_____	4. 1**8**,491	_____
5. 46,643,7**7**7	_____	6. 4,12**3**,693	_____
7. 1,763,5**4**2	_____	8. 4,64**5**	_____
9. 73,96**3**	_____	10. 89**9**,484,776	_____
11. 1**2**,886,455	_____	12. 922,61**1**	_____
13. 353,491,67**7**	_____	14. 88,4**1**3	_____
15. 6,53**8**	_____	16. 789,5**4**2	_____
17. 7,111,11**6**	_____	18. 75,2**6**8,819	_____
19. 5,885,92**8**	_____	20. 32,**1**59,468	_____
21. 53,12**7**	_____	22. 7,1**6**3	_____
23. 33**3**,595,338	_____	24. 24**3**,797	_____
25. **3**1,934	_____	26. 1,**3**46	_____
27. 5,84**2**,269	_____	28. **9**23,486	_____
29. 541,689,85**6**	_____	30. 81,2**3**9,213	_____

Which is the greatest number?

That is, which has the most value?

21
29
27

Look at the numbers in the tens' place.
They are all 2s!
So we have to look at the ones' place to find which number is the greatest.

The numbers in the ones' place are 1, 9, and 7.
We know that 9 stands for more ones than 1 or 7.
So 29 is the greatest number.
That is, 29 has the most value.

There is a pattern in our number system.
The more places there are, the greater the number.
The number 40 is greater than 4.
The number 500 is greater than 50.
The number 6,000 is greater than 600.
The number 7,000,000 is greater than 7,000.

Expanded Notation

Each of us knows how to read the number 463. In words we say "four hundred sixty-three." Our number system suggests that the position or place of a digit determines its value. Thus, "four hundred sixty-three" really means four hundreds plus six tens plus three units or ones.

$$463 = 4 \times 100 + 6 \times 10 + 3$$

Any number, no matter how large, can be written in *expanded notation* by simply using decreasing multiples of 10, and working from left to right.

Example: Write 3,962,514 in expanded form.

3,962,514 = 3 x 1,000,000 + 9 x 100,000 + 6 x 10,000 + 2 x 1,000 + 5 x 100 + 1 x 10 + 4

Counting

The set of counting numbers has no end. It can go on forever. The idea that counting numbers can go on and on is called ***infinity***.

The set of ***counting numbers***, or ***natural numbers***, begins with the number **1** and continues into infinity.

{1,2,3,4,5,6,7,8,9,10...}

The set of ***whole numbers*** is the same as the set of counting numbers, except that it begins with **0**.

{0,1,2,3,4,5,6,7,8,9,10...}

☞ ***All counting numbers are whole numbers. Zero is the only whole number that is not a counting number.***

Even numbers include the numbers ***0*** and ***2*** and all numbers that can be divided evenly by ***2***. ***Odd numbers*** are all numbers that cannot be divided evenly by ***2***.

Odd and **Even** Numbers to 100

1	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**17**	**19**	**21**
0	2	4	6	8	10	12	14	16	18	20
23	**25**	**27**	**29**	**31**	**33**	**35**	**37**	**39**	**41**	
22	24	26	28	30	32	34	36	38	40	
43	**45**	**47**	**49**	**51**	**53**	**55**	**57**	**59**	**61**	
42	44	46	48	50	52	54	56	58	60	
63	**65**	**67**	**69**	**71**	**73**	**75**	**77**	**79**	**81**	
62	64	66	68	70	72	74	76	78	80	
83	**85**	**87**	**89**	**91**	**93**	**95**	**97**	**99**		
82	84	86	88	90	92	94	96	98	100	

Skip Counting

To count by 2's, simply count all the even numbers: 0, 2, 4, 6, 8, 10…and so on.

To count by 5's: 0, 5, 10, 15, 20…and so on.

To count by 10's: 0, 10, 20, 30, 40…and so on.

To count by 100's: 0, 100, 200, 300, 400…and so on.

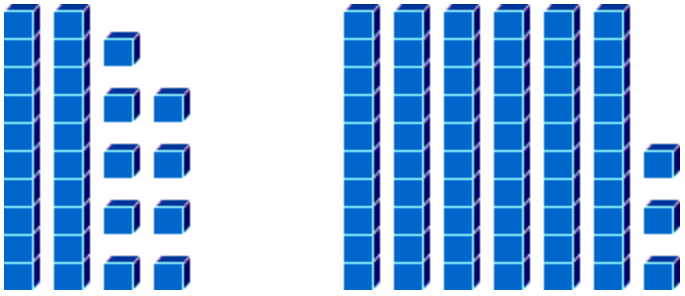
Ordering numbers means listing numbers from least to greatest, or from greatest to least. Two symbols are used in ordering.

<	>
is less than	**is greater**
2 < 10	**10 > 2**

Greater Than >

63 is **greater than** 29.
63 > 29

Less Than <



29 is **less than** 63.
29 < 63

Practice Exercise

1. If you are counting by ones, which number comes before 44?
   - ☐ 36
   - ☐ 45
   - ☐ 43
   - ☐ 41
   - ☐ 54

2. If you are counting by twos, which number comes after 334?
   - ☐ 330
   - ☐ 336
   - ☐ 339
   - ☐ 338
   - ☐ 324

3. Which number is missing in this pattern?
   4540, ___, 4560, 4570, 4580
   - ☐ 4550
   - ☐ 4552
   - ☐ 4555
   - ☐ 4557
   - ☐ 4558

4. Which number is more than 63,000 but less than 68,000?
   - ☐ 71,000
   - ☐ 67,000

	☐ 63,000 ☐ 77,000 ☐ 73,000
5.	If you are counting by fives, which number comes after 890,125? ☐ 890,135 ☐ 890,120 ☐ 890,115 ☐ 890,130 ☐ 890,140
6.	Which pattern needs the number 236 in the blank space? ☐ ___, 237, 238, 239 ☐ 239, 240, ___, 242 ☐ 237, 238, ___, 240 ☐ 240, ___, 242, 243
7.	Which number is missing in this pattern? 43, ___, 33, 28, 23 ☐ 37 ☐ 40 ☐ 35 ☐ 42 ☐ 38
8.	Which answer has two more than 2 paintbrushes? ☐ 

☐ 

☐ 

9. Look at the following list of numbers. If you arrange the numbers from least to greatest, which number would come fifth?
5241, 5266, 5275, 5377, 5236, 5307

☐ 5266
☐ 5241
☐ 5377
☐ 5236
☐ 5307
☐ 5275

10. Look at the following list of numbers. If you arrange the numbers from least to greatest, which number would come fourth?
67,223, 67,241, 67,267, 67,186, 67,180, 67,183

☐ 67,223
☐ 67,267
☐ 67,183
☐ 67,241
☐ 67,223
☐ 67,186

Addition

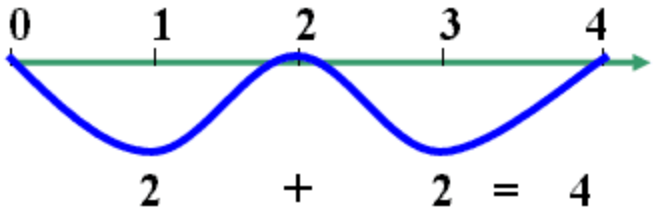
Combining two or more numbers is called ***addition***. The term for addition is ***plus***, and the symbol for plus is +. The numbers that are combined in addition are called ***addends*** and together they form a new number called a ***sum***.

2 ---- addends ---- 3

\+ 2 + 1

4 ---- sum --------- 4

Adding whole numbers is as simple as 2 + 2! To add two whole numbers, you can simply follow the number line and complete the addition fact.



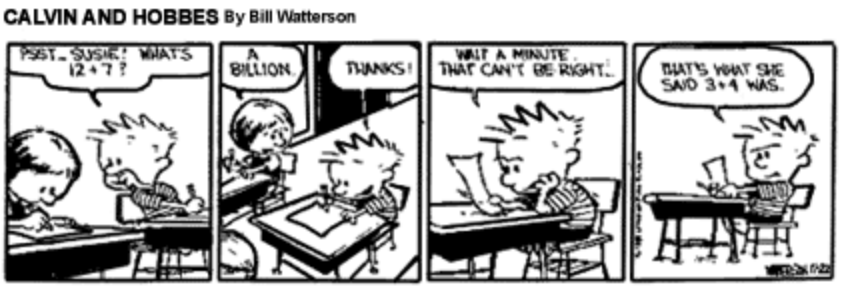
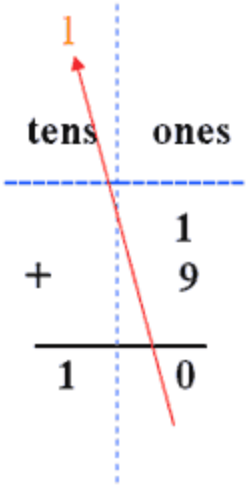


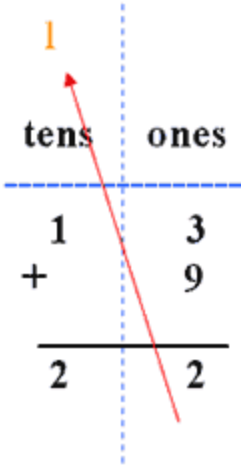
Table of Addition Facts

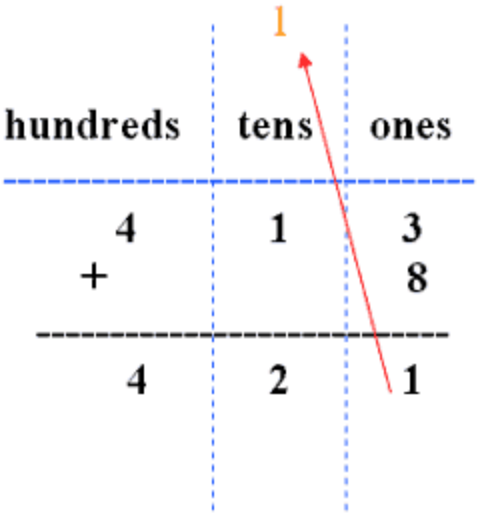
+	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
2	3	4	5	6	7	8	9	10	11	12
3	4	5	6	7	8	9	10	11	12	13
4	5	6	7	8	9	10	11	12	13	14
5	6	7	8	9	10	11	12	13	14	15
6	7	8	9	10	11	12	13	14	15	16
7	8	9	10	11	12	13	14	15	16	17
8	9	10	11	12	13	14	15	16	17	18
9	10	11	12	13	14	15	16	17	18	19
10	11	12	13	14	15	16	17	18	19	20

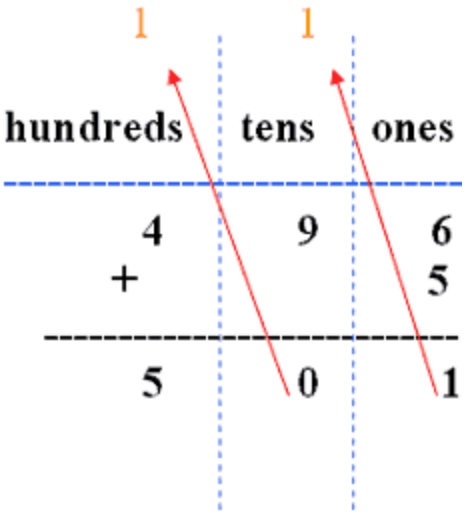
Regrouping Numbers in Addition

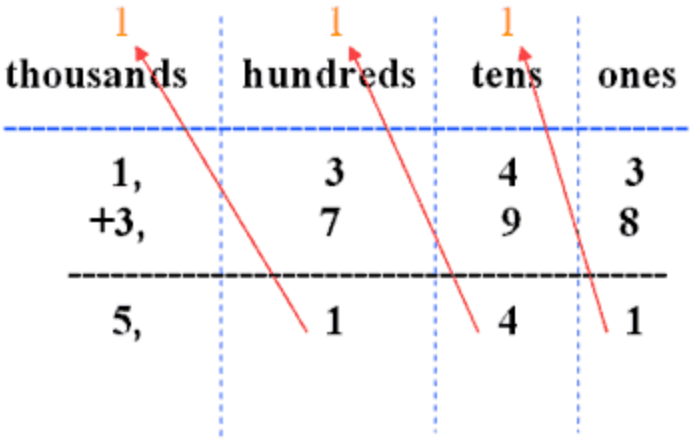
Addition often produces sums with a value greater than ***9*** in a given place. The value of ten is then ***regrouped*** (or ***carried***) to the next place.











To explain addition another way, it can be done by adding the place value amounts separately.

e.g. 69
+ 8
17
60 (the 6 in the tens place means 6 tens or "60")
77

⇒ If there are not enough digits in each number to make even columns under each place value, then zeros may be used **before** a given number to make adding easier. Do **not** add zeros **after** a number because it changes the value of the whole number.

e.g. 69 + 8 + 125 could be added as:

069
008
+125

Practice Exercise

Solve for each of the given problems.

1.	97 + 92	**2.**	57 + 88	**3.**	32 + 38	**4.**	6 + 7
5.	430 + 696	**6.**	755 + 959	**7.**	31 + 175	**8.**	14 + 995
9.	236 + 221	**10.**	238 + 46	**11.**	203 + 107	**12.**	266 + 51
13.	88 + 602	**14.**	26 + 771	**15.**	305 + 451	**16.**	199 + 22
17.	5,555 + 867	**18.**	6,161 + 4,319	**19.**	2,724 + 7,867	**20.**	3,040 + 9,267
21.	42,309 +46,923	**22.**	41,801 +43,703	**23.**	12,603 +85,133	**24.**	10,976 +41,271
25.	573,785 +309,841	**26.**	672,778 +471,112	**27.**	991,124 +719,054	**28.**	211,126 +572,372

Solve for each of the given problems.

1. **31 + 40 =**
2. **564 + 313 =**
3. **133 + 67 =**
4. **717 + 638 =**
5. **8422 + 2785 =**
6. **21,847 + 70,892 =**
7. **754,789 + 984,711 =**
8. **50,618 + 63,436 + 661,520 =**
9. **6824 + 1130 + 32,554 + 48,291 =**
10. **89 + 724 + 2927 + 6460 =**

Subtraction

"Taking away" one or more numbers from another number is called ***subtraction***. The term for subtraction is ***minus***, and the symbol for minus is **-**. The number being subtracted is called a ***subtrahend***. The number being subtracted from is called a ***minuend***. The new number left after subtracting is called a ***remainder*** or ***difference***.

4 ---- minuend ---- 4
- 2 --subtrahend - - 1
2 – difference ---- 3

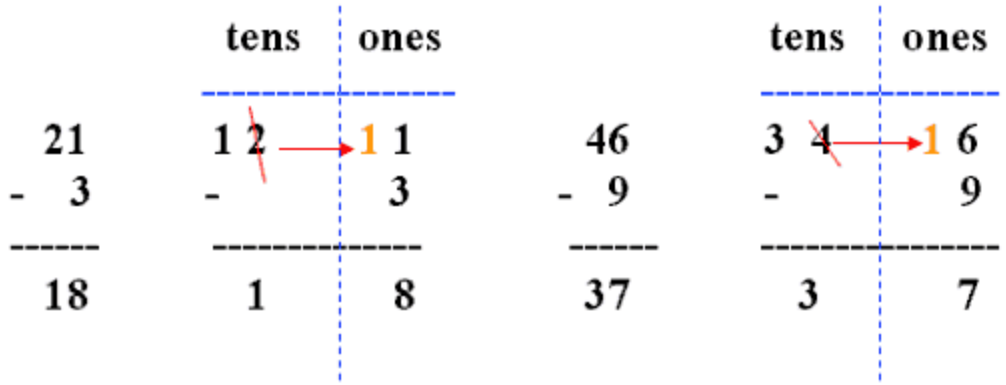
The complete addition or subtraction "sentence" is called an ***equation***. An equation has two parts. The two parts are separated by the ***equal sign***, =. For example, ***the minuend minus the subtrahend equals the difference***. An ***addition fact***

or a ***subtraction fact*** is the name given to specific addition or subtraction equations.

0 + 1 = 1	**1 – 1 = 0**
1 + 1 = 2	**2 – 1 = 1**
2 + 1 = 3	**3 – 1 = 2**
3 + 1 = 4	**4 – 1 = 3**
4 + 1 = 5	**5 – 1 = 4**
5 + 1 = 6	**6 – 1 = 5**
6 + 1 = 7	**7 – 1 = 6**
7 + 1 = 8	**8 – 1 = 7**
8 + 1 = 9	**9 – 1 = 8**

Regrouping in Subtraction

Regrouping, sometimes called ***borrowing***, is used when the subtrahend is greater than the minuend in a given place. Regrouping means to take a group of tens from the next greatest place to make a minuend great enough to complete the subtraction process.



	hundreds	tens	ones
343	3	3 4 →	1 3
- 9	-		9
334	3	3	4

	hundreds	tens	ones
521	4 5 →	1 1 2 →	1 1
- 62	-	6	2
459	4	5	9

	hundreds	tens	ones
506	4 5 →	9 1 0 →	1 6
- 8	-		8
498	4	9	8

Practice Exercise

Solve for each of the given problems.

1.	**59 – 41 =**	**2.**	**26** **- 5**	**3.**	**95** **-40**	**4.**	**63** **-60**
5.	**343 - 55 =**	**6.**	**460** **-363**	**7.**	**65** **-13**	**8.**	**152** **-148**
9.	**169 - 112 =**	**10.**	**43** **- 36**	**11.**	**128** **- 11**	**12.**	**132** **- 18**
13.	**368 – 77 =**	**14.**	**453** **- 154**	**15.**	**106** **- 54**	**16.**	**209** **- 128**
17.	**4,562 - 1,107 =**	**18.**	**9,378** **- 3,908**	**19.**	**662** **- 442**	**20.**	**6,514** **- 3,806**
21.	**64,756** **- 60,697**	**22.**	**79,421** **- 64,232**	**23.**	**53,891** **- 51,823**	**24.**	**42,634** **- 6,367**
25.	**846,768** **- 219,311**	**26.**	**887,818** **-275,682**	**27.**	**552,579** **-228,458**	**28.**	**744,631** **-233,943**

Solving Addition and Subtraction Equations

Inverse (opposite) operations are used to simplify an equation for solving.
One operation is involved with the unknown and the inverse operation is used to solve the equation.

Addition and subtraction are inverse operations.
Given an equation such as 7 + x = 10, the unknown x and 7 are *added*. Use the inverse operation subtraction. To solve for n, subtract 7 from 10. The unknown value is therefore 3.

Examples for addition and subtraction

Addition Problem	Solution
x + 15 = 20	x = 20 - 15 = 5

Subtraction Problem	Solution
x - 15 = 20	x = 20 + 15 = 35

Solve each equation.
(Hint: Use inverse operation rules to solve)

1. **3 + y = 55** **52**

2. **x - 28 = 61** _____

3. **11 = a - 54** _____

4. **x + 68 = 167** _____

5.	**4 = a - 16**	**_____**	**6.**	**x + 85 = 138**	**_____**
7.	**x - 46 = 51**	**_____**	**8.**	**33 + y = 36**	**_____**
9.	**5 = a - 30**	**_____**	**10.**	**45 + y = 89**	**_____**
11.	**x + 35 = 91**	**_____**	**12.**	**9 = a - 82**	**_____**
13.	**x - 38 = 31**	**_____**	**14.**	**40 = a - 51**	**_____**
15.	**x - 3843 = 5909**	**_____**	**16.**	**x + 97 = 181**	**_____**
17.	**18 + y = 100**	**_____**	**18.**	**2 = a - 57**	**_____**

Multiplication

Multiplication is a quick form of addition. By multiplying numbers together, you are really adding a series of one number to itself. For example, you can add ***2*** plus ***2***. Both ***2 plus 2*** and ***2 times 2*** equal ***4***.

2 + 2 = 4
2 x 2 = 4

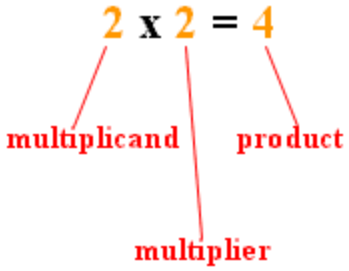
```
  2     2
+ 2   x 2
----  ----
  4     4
```

But what if you wanted to calculate the number of days in five

weeks? You could add *7* days + *7* days + *7* days + *7* days + *7* days or you could multiply *7* days times ***5***. Either way you arrive at ***35***, the number of days in five weeks.

7 + 7 + 7 + 7 + 7 = 35
5 x 7 = 35

Although multiplication is related to addition, the parts of multiplication are not known as addends. Instead, the parts are known as ***multiplicands*** and ***multipliers***. A multiplication sentence, like an addition sentence, is called an ***equation***. But a multiplication sentence results in a ***product***, not a sum.



2 —— multiplicand
x 2 —— multiplier
----
4 —— product

Multiples

Find the ***multiples*** of a number by multiplying it by other whole numbers. The multiples of ***2***, for example, are:

0 x 2 = 0
1 x 2 = 2
2 x 2 = 4
2 x 3 = 6
2 x 4 = 8
2 x 5 = 10

… and so on.

As you can see, the multiples of ***2*** include ***0, 2, 4, 6, 8,*** and ***10***. The list continues into infinity!

X	0	1	2	3	4	5	6	7	8	9	10	11	12
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108
10	0	10	20	30	40	50	60	70	80	90	100	110	120
11	0	11	22	33	44	55	66	77	88	99	110	121	132
12	0	12	24	36	48	60	72	84	96	108	120	132	144

Multiplication, Step-by-Step

When the multiplicand and the multiplier are numbers with two or more digits, multiplication becomes a step-by-step process.

Look at 15 x 13:

```
  1  5
x    3
_____
```

First, multiply the ones –- 3 x 5. Write down the product so the ones columns

```
  1  5
  1  5
x    3
---------
  1  5
```

line up. Next, multiply the tens – 3 x 1 ten. Line up the product with the tens column.

```
  3  0
---------
```

— Zero is the place holder.

```
  1  5
x    3
---------
  1  5

+ 3  0
---------
  4  5
```

Last, add the ones and tens to find the product of the equation.

Here is a shorter way:

```
   1
  1  5
x    3
---------
  4  5
```

1. Multiply the ones: 3 x 5 = 15. Put the 5 in the ones column and regroup the 1 to the tens column.

2. Multiply the tens: 3 x 1 = 3.

3. Add the 1 that you regrouped to the 3, put the sum in the tens column.

Look at 265 x 23:

```
  265
x  23
-----
  15
 180
 600
```

First, multiply the multiplicand by the ones in the multiplier – 3 x 5, 3 x 6, and 3 x 2. Zero is the place holder.

```
  265
x  23
-----
  15
 180
 600
-----
 100
1,200
4,000
```

Next multiply by the tens – 2 x 5, 2 x 6, and 2 x 2. Zero is the place holder.

```
   265
 x  23
 -----
    15
+  180
+  600
 -----
+  100
+ 1,200
+ 4,000
 -----
 6,095
```

Last, add.

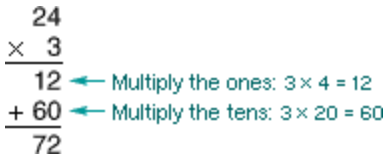
Here is a shorter way:

```
   11
   11
   265
                    1. Multiply the ones:  3 x 265
                       3 x 5 = 15 regroup the 1
x    23                3 x 6 = 18 plus the regrouped 1 =
19;
---------              regroup the 1
  795                  3 x 2 = 6 plus the regrouped 1 = 7

 5300               2. Multiply the tens:  2 x 265
---------              0 is the place holder
6,095                  2 x 5 = 10 regroup the 1
                       2 x 6 = 12 plus the regrouped 1 =
13;
                       regroup the 1
                       2 x 2 – 4 plus the regrouped 1 = 5

                    3. Add 795 + 5300 = 6,095
```

Partial Product

A method of multiplying where the ones, tens, hundreds, and so on are multiplied separately and then the products added together

Examples:



36 x 17 = 42 + 210 + 60 + 300 = 612

When you multiply whole numbers, the ***product*** usually has a greater value than either the ***multiplicand*** or the ***multiplier***.

But there are exceptions:
A number multiplied by ***1*** is always equal to itself.

$$\begin{array}{r} 1 \\ \times\ 1 \\ \hline 1 \end{array} \qquad 21 \times 1 = 21 \qquad \begin{array}{r} 36 \\ \times\ 1 \\ \hline 36 \end{array}$$

A number multiplied by ***0*** is always equal to ***0***.

$$\begin{array}{r} 1 \\ \times\ 0 \\ \hline 0 \end{array} \qquad 21 \times 0 = 0 \qquad \begin{array}{r} 36 \\ \times\ 0 \\ \hline 0 \end{array}$$

To multiply a number by 10, add a 0 to the right of the number.

EXAMPLE

$$25 \times 10 = 250 \qquad \text{or} \qquad \begin{array}{r} 25 \\ \times 10 \\ \hline 250 \end{array}$$

To multiply a number by 100, add two 0's to the right of the number.

EXAMPLE

$$36 \times 100 = 3{,}600 \qquad \text{or} \qquad \begin{array}{r} 36 \\ \times 100 \\ \hline 3{,}600 \end{array}$$

Order Property of Multiplication

Two numbers can be multiplied in any order and the product is the same

Example:

3 X 2 = 6

2 X 3 = 6

Solve each problem.

1. 8 × 5	**2.** 7 × 48	**3.** 23 × 8	**4.** 40 × 75	**5.** 78 × 93
6. 8 × 425	**7.** 803 × 7	**8.** 51 × 628	**9.** 787 × 38	**10.** 780 × 71
11. 207 × 46	**12.** 749 × 80	**13.** 289 × 54	**14.** 511 × 40	**15.** 744 × 89
16. 332 × 34	**17.** 664 × 35	**18.** 441 × 72	**19.** 970 × 67	**20.** 288 × 59
21. 402 × 160	**22.** 261 × 929	**23.** 568 × 267	**24.** 409 × 834	**25.** 388 × 358
26. 500 × 749	**27.** 754 × 420	**28.** 103 × 621	**29.** 976 × 570	**30.** 280 × 167

A. Find the value of each of the following.

1. 395 x 10 =
2. 609 x 100 =
3. 236 x 20 =
4. 320 x 3 =
5. 895 x 329 =
6. 993 x 748 =
7. 431 x 100 =
8. 905 x 10 =

Shoe by *Jeff MacNelly* 11/1 Copyright 1999 by Tribune Media Services, Inc.

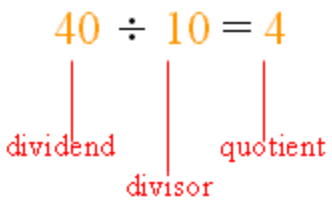
Division

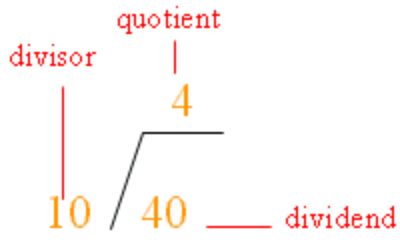
Division is the process of finding out how many times one number, the ***divisor***, will fit into another number, the ***dividend***. The division sentence results in a ***quotient***. The signs of division are ÷ and ⟌, and mean ***divided by***. "/" and "-" are signs that are also used to mean ***divided by*** and are used with fractions (e.g. 1/3**,** $\frac{1}{3}$).

You can think of division as a series of repeated subtractions. For example, ***40 ¸ 10*** could also be solved by subtracting ***10*** from ***40*** four times:

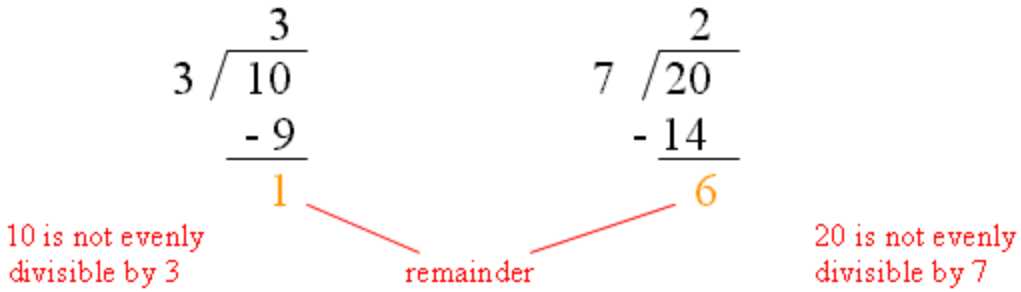
40 – 10 – 10 – 10 – 10 = 0

Because ***10*** can be subtracted four times, you can say that ***40*** can be divided by ***10*** four times, or ***40 ¸ 10 = 4***.



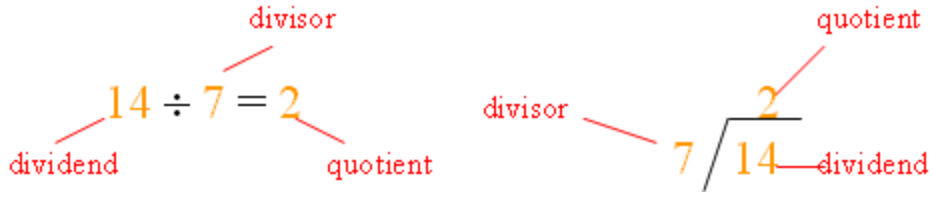


Many numbers do not fit evenly into other numbers. They are ***not evenly divisible by*** those numbers, and the number left over is called the ***remainder***.



We would record the answer for the first question as 3 r 1 and for the second question as 2 r 6. The "r" stands for remainder.

To divide whole numbers, reverse the process of multiplication. For example, if ***2 x 7 = 14*** in a multiplication equation, then in a division sentence, ***14*** is the ***dividend*** and *7* is the ***divisor*** with a ***quotient*** of ***2***.



A whole number divided by ***1*** will always equal itself.

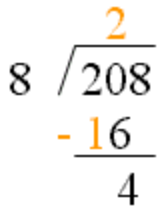
1 ¸ 1 = 1 $\quad 1\overline{)21}$ **21** $\quad$ **36 ¸ 1 = 36**

Zero divided by a whole number will always equal ***0***.

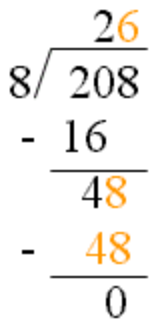
0 ¸ 12 = 0 $\quad 3\overline{)0}$ **0** $\quad$ **0/7 = 2**

Division, Step-by-Step

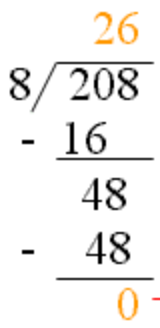
Where the dividend and divisor are numbers with two or more digits, division becomes a step-by-step process.



First, round the divisor up - 8 rounds up to 10 - and estimate the number of 10s in 20. Answer: 2. Multiply the divisor – 8 x 2 – and subtract the product from the dividend.

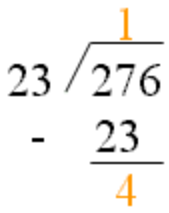


Next, pull down the next digit from the dividend – 8 – and repeat the estimation and subtraction process.



Last, when you can subtract no more you've found the quotient.

No remainder



First, round 23 to 25 and estimate the number of 25s in 27. Answer: 1. Multiply the divisor by 1 – 23 x 1 – and subtract.

```
    12
23 /276
  - 23
    46
  - 46
```

Next, pull down the next digit from the dividend – 6 – and repeat the estimation and subtraction process.

```
    12
23 /276
  - 23
    46
  - 46
     0
```

Then, pull down the next digit, estimate, and subtract, until you can subtract no more.

No remainder

Solve each problem.

1. $5\overline{)22}$ **2.** $9\overline{)77}$ **3.** $2\overline{)15}$

4. $11\overline{)850}$ **5.** $10\overline{)49}$ **6.** $6\overline{)166}$

7. $12\overline{)391}$ **8.** $2\overline{)11}$ **9.** $6\overline{)207}$

10. $8\overline{)522}$ **11.** $2\overline{)9}$ **12.** $10\overline{)62}$

A. Find the value of each of the following.

1. 430 ÷ 101 =
2. 850 ÷ 182 =
3. 40 ÷ 30 =
4. 264 ÷ 3 =
5. 952 ÷ 132 =
6. 934 ÷ 489 =
7. 221 ÷ 16 =
8. 560 ÷ 8 =

Prime numbers are counting numbers that can be divided by only two numbers---***1*** and themselves. A prime number can also be described as a counting number with only two factors, ***1*** and itself. The number ***1***, because it can be divided only by itself, is ***not*** a prime number.

Prime Numbers to 100

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47,

53, 59, 61, 67, 71, 73, 79, 83, 89, 97

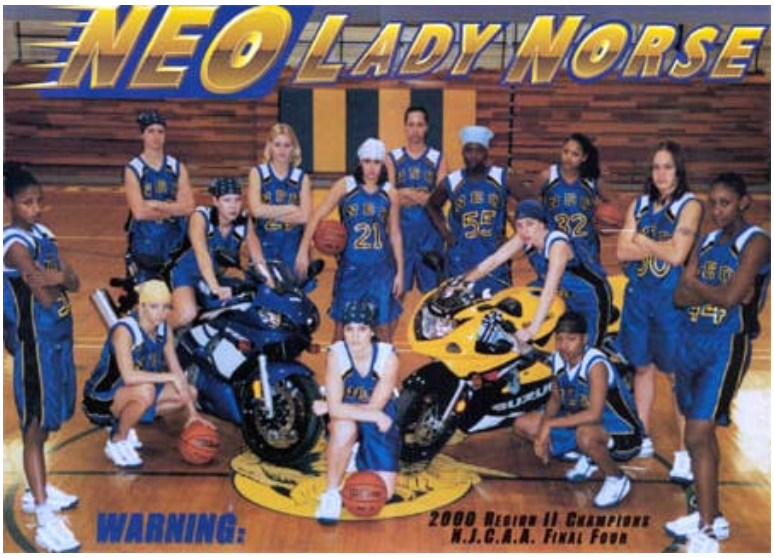
Averages

The most common way to find an ***average*** is to add up a list of numbers and divide the sum by the number of items on the list. Another word for average is ***mean***.

3 + 4 + 6 + 8 + 9 = 30 **number of addends**

sum **30 ÷ 5 = 6** So, the average of the numbers 3, 4, 6, 8, and 9 is 6.

When do you need to calculate an average? Your grades may be based on the average of all your test scores. In sports, you might want to find out the average height of players on your favorite basketball team.



The height of the starters for this team is:

Ann	**60”**	
Jane	**58”**	
Cathy	**57”**	
Joy	**52”**	
Tanya	**48”**	**The average height of these players is 55 inches.**

Word Problems with Whole Numbers

Within every story (word) problem are several ***clue words (key words)***. These words tell you the kind of math sentence (equation) to write to solve the problem.

Addition Clue Words	Subtraction Clue Words
add	subtract
sum	difference
total	take away
plus	less than
in all	are not
both	remain
together	decreased by
increased by	have or are left
all together	change (money problems)
combined	more
	fewer

Multiplication Clue Words	Division Clue Words
times	quotient of
product of	divided by
multiplied by	half [or a fraction]
by (dimension)	split
	separated
	cut up
	parts
	shared equally

⇒ ***Division clue words are often the same as subtraction clue words. Divide when you know the total and are asked to find the size or number of "one part" or "each part."***

Following a system of steps can increase your ability to accurately solve problems. Use these steps to solve word problems.

1. Read the problem carefully. Look up the meanings of unfamiliar words.

2. Organize or restate the given information.

3. State what is to be found.

4. Select a strategy (such as making a chart of working backward) and plan the steps to solve the problem.

5. Decide on an approximate answer before solving the problem.

6. Work the steps to solve the problem.

7. Check the final result. Does your answer seem reasonable?

The Problem Solving System was used to solve the following problem:

Mary has ten marbles. Lennie has thirteen. How many marbles do they have in all?

1. Mary has ten marbles. Lennie has thirteen. How many marbles do they have in all?

2. Mary – 10 marbles
Lennie – 13 marbles

3. How many marbles in all?

4. Add

5. A little over 20 marbles (10 + 10 = 20)

6.
$$\begin{array}{r} 10 \\ +13 \\ \hline 23 \text{ marbles} \end{array}$$

7. The final sum of 23 marbles is close to the estimated answer of 20 marbles. The final result is reasonable.

- ***Be sure to label answers whenever possible. For example: marbles, grams, pounds, feet, dogs, etc.***

- ***Some problems may require several steps to solve. Some may have more than one correct answer. And some problems may not have a solution.***

For some problems, you have to write two or three equations to solve the problem. For others, you may need to make charts or lists of information, draw pictures, find a pattern, or even guess and check. Sometimes you have to work backwards from a sum, product, difference, or quotient, or simply use your best logical thinking.

List/Chart

Marty's library book was six days overdue. The fine is $.05 the first day, $.10, the second, $.20 the third day, and so on. How much does Marty owe?

Marty's library book was six days overdue. The fine is $.05 the first day, $.10, the second, $.20 the third day, and so on. How much does Marty owe?

Days	**1**	**2**	**3**	**4**	**5**	**6**
Fine	**$.05**	**$.10**	**$.20**	**$.40**	**$.80**	**$1.60**

Answer: $1.60

Veronica, Archie, and Betty are standing in line to buy tickets to a concert. How many different ways can they order themselves in line?

Veronica, Archie, and Betty are standing in line to buy tickets to a concert. How many different ways can they order themselves in line?

Veronica	**Veronica**	**Archie**	**Archie**
Archie	**Betty**	**Veronica**	**Betty**
Betty	**Archie**	**Betty**	**Veronica**
Betty	**Betty**		
Veronica	**Archie**		
Archie	**Veronica**		

Answer: 6 ways

Find a Pattern

Jenny's friend handed her a code and asked her to complete it. The code read 1, 2, 3 Z 4, 5, 6 Y 7, 8, 9 X_____. How did Jenny fill in the blanks?

Jenny's friend handed her a code and asked her to complete it. The code read 1, 2, 3 Z 4, 5, 6 Y 7, 8, 9 X_____. How did Jenny fill in the blanks?

Answer: 10, 11, 12 W

Draw a Picture

Mary is older than Jamie. Susan is older than Jamie, but younger than Mary. David is younger than Jamie. Who is oldest?

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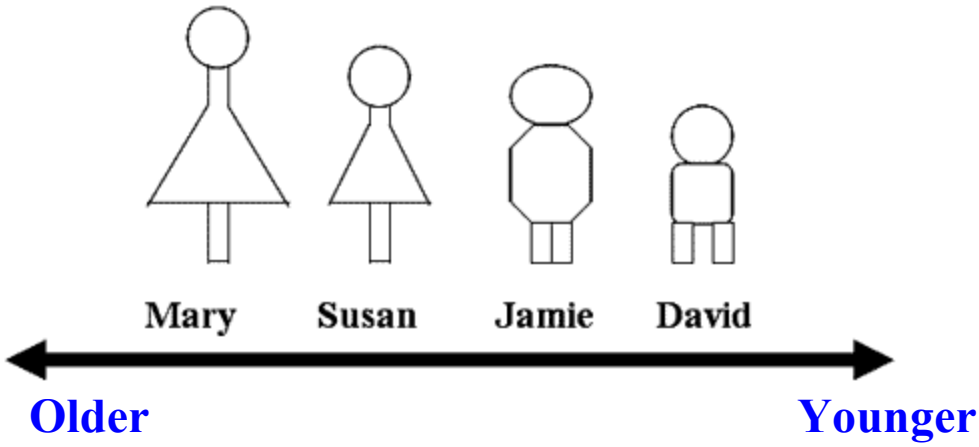

Answer: Mary is oldest.

Guess and Check

Farmer Joe keeps cows and chickens in the farmyard. All together, Joe can count 14 heads and 42 legs. How many cows and how many chickens does Joe have in the farmyard?

Farmer Joe keeps cows and chickens in the farmyard. All together, Joe can count 14 heads and 42 legs. How many cows and how many chickens does Joe have in the farmyard?

6 cows +8 chickens 14 heads	Guess a number of cows. Then add the number of chickens to arrive at the sum of 14 heads. Then check the total legs.	6 cows = 24 legs +8 chickens = 16 legs 40 legs
7 cows +7 chickens 14 heads	Adjust your guesses. Then check again until you solve the problem.	7 cows = 28 legs +7 chickens = 14 legs 42 legs

Answer: 7 cows and 7 chickens

Work Backwards

Marsha was banker for the school play. She took in $175 in ticket sales. She gave Wendy $75 for sets and costumes and Paul $17.75 for advertising and publicity. After paying for the props, Marsha had $32.25 left. How much did the props cost?

Marsha was banker for the school play. She took in $175 in ticket sales. She gave Wendy $75 for sets and costumes and Paul $17.75 for advertising and publicity. After paying for the props, Marsha had $32.25 left. How much did the props cost?

$ 175.00 tickets	$ 82.25
- 75.00 costumes	- 32.25
$ 100.00	$ 50.00 cost of props

- 17.75 advertising
$ 82.25

Logical Reasoning

Jim challenged Sheila to guess his grandmother's age in ten questions or less. It took her six. Here's what Sheila asked:

Jim challenged Sheila to guess his grandmother's age in ten questions or less. It took her six. Here's what Sheila asked:

"Is she less than fifty?" "No."	**50+ years old**
"Less than seventy-five?" "Yes."	**50 to 74 years old**
"Is her age an odd or even number?" "Odd."	**ends in 1, 3, 5, 7 or 9**
"Is the last number less than or equal to five?" "No."	**ends in 7 or 9**
"Is it nine?" "No."	**ends in 7 – 57 or 67**
"Is she in her sixties?" "No."	**57 years old**

Practice Exercise

Solve for each of the given problems.

1. Jane worked twenty-three hours. Michael worked seven. How many more hours did Jane work than Michael?

2. A small business employs 39 men and 18 women. How many more men than women work at this small business?

3. There are only 70 days until Paul's birthday. How many weeks until Paul's birthday?

4. The test your teacher gave you consists of 5 sections, each of which have 12 questions. How many questions are on the test all together?

5. If Jane watched 7 hours of TV on Sunday, 8 hours of TV on Monday, 4 hours of TV on Tuesday, 3 hours of TV on Wednesday, 4 hours of TV on Thursday, 6 hours of TV on Friday, and 9 hours of TV on Saturday. How many hours of TV did Jane watch from Monday to Saturday?

6. Jane can type 5 pages an hour. How many hours will be needed to type 160 pages?

Answer Key

Book 14014 – Whole Numbers

Page 10

Row 1: XXXI, V, XXIX
Row 2: VI, XXX, XII
Row 3: XV, XXXVII, XXI
Row 4: III, XX, XXIII
Row 5: 31, 4, 11
Row 6: 15, 33, 30
Row 7: 35, 20, 16
Row 8: 2, 1, 6

Page 15

2. 27 **3.** 1478 **4.** 659 **5.** 90 **6.** 1464
7. 458 **8.** 66 **9.** 1898 **10.** 520 **11.** 453
12. 1472 **13.** 555 **14.** 205

Page 15

2. three hundred eight **3.** one thousand, five hundred fifty-seven **4.** sixty-three **5.** one thousand, three hundred twenty-five **6.** ninety-eight **7.** twenty-three **8.** one thousand, six hundred twenty-four **9.** eighty-seven **10.** six **11.** one thousand, fifty **12.** eight hundred thirty-one **13.** fifty **14.** seven hundred seventy-four **15.** eighty-five **16.** one thousand, three hundred twenty-one **17.** one thousand, six hundred ninety-four **18.** one hundred seventeen

Page 20

2. Hundreds **3.** Thousands **4.** Thousands
5. Tens **6.** Thousands **7.** Tens **8.** Ones
9. Ones **10.** Millions **11.** Millions
12. Ones **13.** Ones **14.** Tens **15.** Ones
16. Tens **17.** Ones **18.** Ten Thousands
19. Ones **20.** Hundred Thousands **21.** Ones
22. Tens **23.** Millions **24.** Thousands
25. Ten Thousands **26.** Hundreds
27. Thousands **28.** Hundred Thousands
29. Ones **30.** Ten Thousands

Page 25

1. 43 **2.** 336 **3.** 4550 **4.** 67000
5. 890130 **6.** ___, 237, 238, 239 **7.** 38
8. 4 paintbrushes **9.** 5307 **10.** 67223

Page 32

1. 189 **2.** 145 **3.** 70 **4.** 13 **5.** 1126
6. 1714 **7.** 206 **8.** 1009 **9.** 457
10. 284 **11.** 310 **12.** 317 **13.** 690
14. 797 **15.** 756 **16.** 221 **17.** 6422
18. 10480 **19.** 10591 **20.** 12307
21. 89232 **22.** 85504 **23.** 97736
24. 52247 **25.** 883626 **26.** 1143890
27. 1710178 **28.** 783498

Page 33

1. 71 **2.** 877 **3.** 200 **4.** 1355
5. 11207 **6.** 92739 **7.** 1739500
8. 775574 **9.** 88799 **10.** 10200

Page 36

1. 18 **2.** 21 **3.** 55 **4.** 3 **5.** 288
6. 97 **7.** 52 **8.** 4 **9.** 57 **10.** 7
11. 117 **12.** 114 **13.** 291 **14.** 299

15. 51 **16.** 81 **17.** 3455 **18.** 5470
19. 220 **20.** 2708 **21.** 4059 **22.** 15189
23. 2068 **24.** 36267 **25.** 627457
26. 612136 **27.** 324121 **28.** 510688

Page 37 **2.** 89 **3.** 65 **4.** 99 **5.** 20 **6.** 53
7. 97 **8.** 3 **9.** 35 **10.** 44 **11.** 56
12. 91 **13.** 69 **14.** 91 **15.** 9752 **16.** 84
17. 82 **18.** 59

Page 45 **1.** 40 **2.** 336 **3.** 184 **4.** 3000 **5.** 7254
6. 3400 **7.** 5621 **8.** 32028 **9.** 29906
10. 55380 **11.** 9522 **12.** 59920
13. 15606 **14.** 20440 **15.** 66216
16. 11288 **17.** 23240 **18.** 31752
19. 64990 **20.** 16992 **21.** 64320
22. 242469 **23.** 151656 **24.** 341106
25. 138904 **26.** 374500 **27.** 316680
28. 63963 **29.** 556320 **30.** 46760

Page 46 **1.** 3950 **2.** 60900 **3.** 4720 **4.** 960
5. 294455 **6.** 742764 **7.** 43100 **8.** 9050

Page 50 **1.** 4 r 2 **2.** 8 r 5 **3.** 7 r 1 **4.** 77 r 3
5. 4 r 9 **6.** 27 r 4 **7.** 32 r 7 **8.** 5 r 1
9. 34 r 3 **10.** 65 r 2 **11.** 4 r 1 **12.** 6 r 2

Page 51 **1.** 4 r 26 **2.** 4 r 122 **3.** 1 r 10 **4.** 88
5. 7 r 28 **6.** 1 r 445 **7.** 13 r 13 **8.** 70

Page 61 **1.** 16 hours **2.** 21 more men **3.** 10 weeks
4. 60 questions **5.** 34 hours **6.** 32 hours