

FOR PREVIEW

hundred trillions
 ten trillions
 trillions
 hundred billions
 ten billions
 billions
 hundred millions
 ten millions
 millions
 hundred thousands
 ten thousands
 thousands
 hundreds
 tens
 ones

8	2	3	6	7	5	2	0	1	0	0	8	7	9	6
trillions			billions			millions			thousands			hundreds		

eight hundred twenty three TRILLION
 six hundred seventy five BILLION
 two hundred one MILLION
 eight THOUSAND
 seven hundred ninety six

ROMAN NUMERALS and their equivalents:

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

Normally values are added:

VI	XII	XVII	LXXI	CCXVI	DCI	MM
6	12	17	71	216	601	2000

A smaller numeral before a larger one is subtracted from it.

IV	IX	XIV	XCI	CDVI	MCM	MMIX
4	9	42	91	406	1950	2009

Uses: years (in movies, books, buildings); pages in introductions; outlines; titles (Henry VIII); series (Super Bowl XXVI); clock faces; movie sequels...

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ESTIMATING ANSWERS

Adding $312 + 588$ is more than the rounded down $300 + 500$ but less than the rounded up $400 + 600$. Thus the sum must be between 800 and $1,000$.

$723 + 868$	$> 1,500$ $< 1,700$	$807 - 63$	> 130 < 150
$1,358 + 2,896$	$> 4,100$ $< 4,300$	$\$153.74 + \67.97	$> \$210$ $< \$230$

ROUNDING OFF

Rounding $2??$ to the nearest **hundred**:

If the next digit is less than 5, as in $2\underline{1}3$, round it to 200 .

If the next digit is 5 or more, as in $2\underline{5}8$, round it up to 300 .

Number	Rounded to nearest thousand	Rounded to nearest hundred	Rounded to nearest ten
1,089	1,000	1,100	1,090
2,891	3,000	2,900	2,890
19,992	20,000	20,000	19,990

COMPARISONS

To determine whether a number is greater than ($>$) or less than ($<$), check the **leftmost** column first. Then check the next column; then the next...

first digit in different columns:	$8\underline{3}0 > \underline{9}5$	$1\underline{2}89 > \underline{9}87$
first digit in same column but unequal:	$68 > 72$	$54 > 48$
first digit in same column and equal:	$812 < 830$	$2,511 > 2,482$
first digits in same columns and equal:	$189 > 186$	$8,609 > 8,607$

Counting proceeds in a column until reaching a power of the base. **Then the next column is used.** In base ten: ...7, 8, 9, 10, 11, 12...

In modular arithmetic, once the modulus (base) is reached, numbering begins again. This is true for “clock arithmetic”.

FOR PREVIEW

	base ten	base five	base twelve	mod twelve
one	• 1	• 1	• 1	1
two	•• 2	•• 2	•• 2	2
three	••• 3	••• 3	••• 3	3
four	•••• 4	•••• 4	•••• 4	4
five	••••• 5	••••• 10	••••• 5	5
six	•••••• 6	••••• 11	•••••• 6	6
seven	••••••• 7	••••• 12	••••••• 7	7
eight	•••••••• 8	••••• 13	•••••••• 8	8
nine	••••••••• 9	••••• 14	••••••••• 9	9
ten	•••••••••• 10	••••• 20	••••••••• A	10
eleven	••••••••••• 11	••••• 21	•••••••••• B	11
twelve	•••••••••••• 12	••••• 22	•••••••••• 10	0
thirteen	••••••••••••• 13	••••• 23	••••••••••• 11	1
fourteen	•••••••••••••• 14	••••• 24	•••••••••••• 12	2
fifteen	••••••••••••••• 15	••••• 30	••••••••••••• 13	3
twenty six	•••••••••••••••• 26	••••• 101	•••••••••••••• 22	2
forty one	••••••••••••••••• 41	••••• 131	•••••••••••••••• 35	5

Computers use base two, as electronic systems have two values, open or closed (on or off). All data is converted to **bits** (from the **b**inary **d**igits in base two).

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1	10	11	100	101	110	111	1000	1001	1010	1011	1100
1	2	3	4	5	6	7	8	9	10	11	12

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

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

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

FOR PRIVATE USE

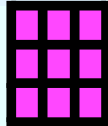
A prime number has no factors other than 1 and itself. So
 multiples of 2 (after 2),
 multiples of 5 (after 5),
 multiples of 3 (after 3)
 cannot be prime numbers.
 Multiples beyond 7, 11, 13, 17,
 19, 23,... are also excluded.

PRIME NUMBERS under 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

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

SQUARE NUMBERS are products of a number times itself. Each square has sides of a number and the area of its square. The first perfect squares are:

$1 \times 1 = 1$ $2 \times 2 = 4$ $3 \times 3 = 9$

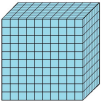
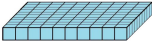




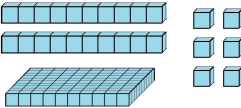
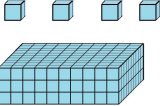

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Number	1	2	3	4	5	6	7	8	9	10
Square	1	4	9	16	25	36	49	64	81	100

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Number	11	12	13	14	15	16	17	18	19	20
Square	121	144	169	196	225	256	289	324	361	400

			
$1000/1000 = 1$	$100/1000 = 1/10 = 0.1$	$10/1000 = 1/100 = 0.01$	$1/1000 = 0.001$
<i>one</i>	<i>one tenth</i>	<i>one hundredth</i>	<i>one thousandth</i>






		
$126/1000 = 0.126$	$304/1000 = 0.304$	$20/1000 = 2/100 = 0.02$
<i>126 thousandths</i>	<i>304 thousandths</i>	<i>2 hundredths</i>

COMPARISONS: < = >		
To determine if a decimal is less than (<), equal to (=), or greater than (>) another decimal, look at the leftmost column. If those columns are equal, compare the next one...		
first digit in different columns:	$0.02 < 0.10$	$0.003 < 0.02$
first digit in same column but unequal:	$0.2 > 0.1$	$0.03 < 0.04$
first digit in same column and equal:	$0.23 > 0.21$	$0.015 < 0.018$
first digits in same columns and equal:	$1.13 < 1.16$	$7.234 < 7.237$
Zeroes at the end of a decimal do not increase its value.		
equal digits in same columns & 0 after:	$2.1 = 2.10$	$3.12 = 3.120$

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To change a decimal to a percentage, move the decimal point two spaces to the right...

To convert a percentage to a fraction, divide by 100 and simplify.

	decimal	percent	fraction
	0.01	1%	1/100
	0.05	5%	5/100=1/20
	0.1	10%	10/100=1/10
	0.25	25%	25/100=1/4
	0.5	50%	50/100=1/2

To convert a percentage to a decimal, divide by 100...

To convert the percentage to a fraction, divide by 100 and simplify.

	percent	decimal	fraction
	3%	0.03	3/100
	8%	0.08	8/100=2/25
	33%	0.33	33/100
	99%	0.99	99/100
	100%	1.00	100/100=1

To add and subtract, line up the decimals. That keeps the numbers in the right columns.

3.25	For 3-2.57
1.	3.00
0.05	- 2.57
<u>+1.522</u>	0.43
5.822	

To multiply, the number of digits to the right of the decimal in the answer equals the number of digits to the right in the problem.

6.243
X 2.1
<u>6243</u>
+ 12486
<u>73103</u>

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Estimating answers: Rounding down each number will get the low end of the range in the addition problem ($6+1+0+1=8$); rounding up will get the high end ($4+1+1+2=8$). So the answer will be between 5 and 8. For the multiplication problem, the low end of the range is 6×2 or 12; the high end is 7×3 or 21.

NEGATIVE NUMBERS

Imagine you start at 0 and **walk to the right 6 feet.**
Then **walk back 9 feet** in the opposite direction.
You would be at -3 feet relative to your starting point.

6

-9

-3



I. O. U. \$9

If you have \$5. but you owe \$9, Your worth is -\$4.



When she dug this hole,
the amount of dirt in it was
minus seven cubic feet.

EXPONENTS

tell how many times a number is multiplied by itself.

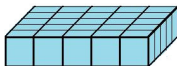
$$5^1 = 5$$

“5 to the 1st power”



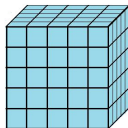
$$5^2 = 5 \times 5 = 25$$

“5 squared”



$$5^3 = 5 \times 5 \times 5 = 125$$

“5 cubed”



$$2^{10} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 1024$$

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SCIENTIFIC NOTATION uses powers of 10 to

show very large (or very small) numbers.

$$5 \times 10^5 = 5 \times 10 \times 10 \times 10 \times 10 \times 10 = 500,000$$

There are 6.02×10^{23} gas molecules in a cubic meter of air.

That means 602,000,000,000,000,000,000,000 molecules.

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AVERAGES

What would the average be if a city were to have these high temperatures for the days of a month:

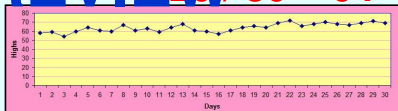
58 59 54 60 64 61 60 67
61 63 59 64 68 61 60 57
61 64 66 64 69 72 66 68
70 68 67 69 71 69?



Add the temperatures and divide by the number of days:

$$\text{Aver.} = \Sigma \text{ temp.} / \# \text{ days}$$

$$= 1920 / 30 = 64$$



There are two other measures of central tendency:

MEAN: arithmetic average

MEDIAN: middle number in a series

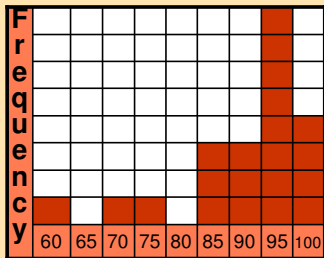
MODE: most frequent number

What is the average grade for a class of 21 students receiving these grades on a Spelling test: 60 70 75 85 85 85 90 90 90 95 95 95 95 95 95 95 95 95 95 100 100 100 100?

The average is $1890 / 21 = 90$.

The median score is 95.

The mode is 95.



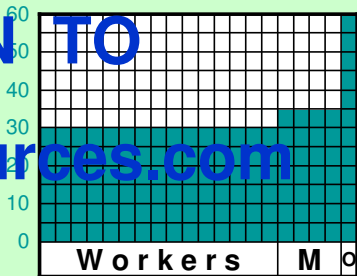
A small company has 15 workers receiving \$20,000, 4 managers receiving \$35,000, and an owner receiving \$60,000.

The sum of salaries divided by 20 workers is $\$500,000 / 20$ or $\$32,500$.

The mean is \$32,500.

The median is \$30,000.

The mode is \$30,000.



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