Name _____

Prime Factoring

When a number written as the product of prime factors, it is called the prime factorization of a number.

 $48 = 3 * 2 * 2 * 2 * 2 = 3 * 2^4$

To make finding the prime factors easy, you need to be a master of "**The Factor Facts**" and **Divisibility Rules** for 2, 3, 5, 7 and 11. This workbook will review those skills before showing you the strategies for finding prime factors. There are 2 attack strategies for quickly and easily finding the prime factors of a given number.

- 1. Easy Primes
- 2. Ladder

Factor Facts

There are 32 numbers that are supposed to be quick and easy to recognize the factors of. Math6.org calls these numbers, "<u>Factor Facts</u>" and offers matching exercises and drills to help you learn them quickly and easily.

12	18	25	32	42	50	63	80
14	20	27	35	45	54	64	81
15	21	28	36	48	56	70	90
16	24	30	40	49	60	72	100

Easy Factors

Often called the tree method, easy primes involves learning to think of an easy factor and write it as the product of its prime factors. Students will think 6 and write 2*3. So when they are thinking 6*8, they write 3*2 *2*2*2. This process isn't difficult, but it does take practice to make it so easy that it's second nature.

 $4 = 2 * 2 \qquad 6 = 3 * 2 \qquad 8 = 2 * 2 * 2 \qquad 9 = 3 * 3 \qquad 10 = 5 * 2$

Take a look at the "Factor Facts" and notice that **all of them** are made out factors that can be easily primed.

28 is 7 * 4 = 7 * 2 * 2; 56 is 7 * 8 = 7 * 2 * 2 * 2; 90 is 9 * 10 = 3 * 3 * 5 * 2

Ladders

When you don't know the "easy factors" of a number,	17
you use the divisibility rules for 2, 3, 5, 7, and 11 to begin	3 51
breaking a number down. Using the divisibility rules and	2 102
short division, you can quickly find all of the prime	2 204
factors of any number.	I

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The "Factor Facts"

Lesson Box			<u>4•3</u> 12	Models	<u>9•6</u> 54	
The following numbers are numbers that you should be able to look at and instantly know the factors of.		<u>7•2</u> 14	<u>6•5</u> 30	<u> 8 • 7 </u> 56		
12	25	42	63	<u>5•3</u> 15	<u>8•4</u> 32	10 • 6 60
14 15	27 28	45 48	64 70	<u>4•4</u> 16	<u>7•5</u> 35	<u>9•7</u> 63
16	28 30	48 49	70	<u>9•2</u> 18	<u>6•6</u> 36	<u>8•8</u> 64
18 20	32 35	50 54	80 81	5•4 20	8•5 40	10•7 70
21 24	36 40	56 60	90 100	7•3 21	7.6 42	9.8 72
If anv of the	se multiplication	on facts are st	ill giving vou	$\frac{7 \cdot 5}{6 \cdot 4} = 24$	<u> </u>	10 - 9 - 90
pause and stu	umbles, please	make flash ca	ards, study	<u>6•4</u> 24	<u>9•5</u> 45	10 • 8 80
" <u>Factor Facts</u> " @ Math6.org, or copy them 10 times each until you are able to instantly declare the factors			<u>5 • 5</u> 25	<u>8•6</u> 48	<u>9•9</u> 81	
for these num	nbers.			<u>9•3</u> 27	<u>9•5</u> 49	<u>10•9</u> 90
				<u>7•4</u> 28	<u>10 • 5</u> 50	<u>10 • 10</u> 100

I want you to be **much faster** and make this skill **even easier**. I don't think you need to use the multiplication sign between the factors the way that I did. As you complete the drill on this page and the drills on the next, you may drop the multiplication sign **and** remember that multiplication is commutative – **order** doesn't matter! $120 = 12 \cdot 10$; you may write 12 10 on your paper and leave the multiplication sign out.

42	40	18	70		
60	24	28	35		
54	64	100	42		
56	20	63	64		
30	25	50	48		
21	45	12	15		
70	35	16	60		
27	80	72	72		
49	81	14	56		
48	90	36	28		
32	15	90	81		
[use Key 1 to check your answers]					

Factor Facts Drills

Use one drill each day as a warm-up before completing the assignments for the next 3 sections of the workbook.

[Key 3]	[Key 4]	[Key 5]	[Key 6]
70	64	90	14
72	70	60	32
48	72	50	25
45	12	54	56
25	40	49	90
14	15	20	21
54	45	12	45
15	48	80	16
27	42	16	20
60	24	63	28
81	56	70	24
100	60	40	60
64	32	35	54
40	18	15	72
24	30	72	48
56	49	27	70
16	25	28	35
32	27	36	18
20	80	32	40
36	90	14	36
63	14	45	64
42	28	48	42
12	16	24	15
18	50	18	63
49	20	64	81

The "Easy Primes"

Lesson Box	Models
We need to learn to think of a few numbers as the product of their primes. The easy primes are 4, 6, 8, 9, and 10!	= 2
$4 = 2 \cdot 2$ $6 = 3 \cdot 2$ $8 = 2 \cdot 2 \cdot 2$ $2 \cdot 2 \cdot 2$	$3 = 3$ $2 \cdot 2 = 4$ $5 = 5$ $3 \cdot 2 = 6$
$9 = 3 \cdot 3$ $10 = 5 \cdot 2$	$\frac{372}{7} = 7$
When you get good at thinking "10" and writing 5 • 2, the rest of the prime factoring skill will be much easier. Use the drills on this page and/or practice " <u>Easy Primes</u> " @ Math6.org!	$\frac{2 \cdot 2 \cdot 2}{3 \cdot 3} = 8$ $\frac{3 \cdot 3}{5 \cdot 2} = 10$

I want you to be **much faster** and make this skill **even easier**. I don't think you need to use the multiplication sign between the factors the way that I did. As you complete the drill on this page, you may drop the multiplication sign **and** remember that multiplication is commutative – **order** doesn't matter! $6 = 3 \cdot 2$; you may write 3 2 on your paper and leave the multiplication sign out.

= 5	= 10	=2	= 3		
= 8	=4	= 4	=9		
= 10	= 3	= 9	=4		
=4	=2	= 3	= 5		
=9	= 8	=7	= 6		
= 2	=6	=6	= 8		
= 3	= 5	= 5	=4		
=7	= 10	=2	= 2		
= 6	= 5	= 8	=7		
=7	= 8	= 10	= 10		
=9	=6	=7	=9		
[use Key 7 to check your answers]					

The "Easy Factors"

Lesson Box	Models	
Now that we know the " <u>Easy Primes</u> ", we put it together with the " <u>Factor Facts</u> " and easily factor these numbers! When you see a "Factor Fact" you	7 • 5	= 35
will know the prime factorization!	3•3•7	= 63
$40 = 8 \cdot 5 = 2 \cdot 2 \cdot 2 \cdot 5$	5•3	= 15
$42 = 7 \cdot 6 = 7 \cdot 3 \cdot 2$	5 • 2 • 3 • 3	= 90
$63 = 9 \cdot 7 = 3 \cdot 3 \cdot 7$ 72 = 9 \cdot 8 = 3 \cdot 3 \cdot 2 \cdot 2 \cdot 2	2 • 2 • 2 • 2	= 16
	7 • 2	= 14
Think of the factors and write those factors as easy primes. You will quickly and easily be able to factor most of the fractions that you will soon face! Use the drills on this page and/or practice " <u>Easy Factors</u> " @ Math6.org!	3 • 2 • 2 • 2	= 24

I want you to be **much faster** and make this skill **even easier**. I don't think you need to use the multiplication sign between the factors the way that I did. As you complete the drills on this page and the next, you may drop the multiplication sign **and** remember that multiplication is commutative – **order** doesn't matter! $6 = 3 \cdot 2$; you may write 3 2 on your paper and leave the multiplication sign out.

= 30	= 36	= 18
= 56	= 21	= 35
= 48	= 25	= 40
= 24	= 63	= 42
= 16	= 81	= 54
= 45	= 70	= 80
= 15	= 32	= 12
= 14	= 50	= 64
= 60	= 90	= 100
= 72	= 20	=49
= 28	= 27	= 24
	[use Key 8 to check your answers]	

Easy Factor Drills

Use one drill each day as a warm-up before completing the assignments for the next 3 sections of the workbook.

[Key 9]		[Key 10]	[Key 11]
	= 15	= 40	= 100
	= 35	= 80	= 25
	= 54	= 24	= 35
	=16	= 14	= 36
	= 36	= 81	= 81
	= 49	= 12	= 80
	= 12	= 30	= 21
	= 24	= 28	= 56
	= 81	= 42	=70
	= 32	= 60	= 64
	=72	= 27	= 24
	= 45	= 64	= 27
	= 100	= 100	= 30
	= 27	= 25	= 50
	= 20	= 15	=16
	= 60	= 21	= 60
	= 42	= 90	= 28
	= 30	= 50	= 49
	= 28	= 16	= 14
	= 70	= 20	= 90
	= 14	= 70	= 15
	= 50	= 72	= 45
	= 48	= 45	= 20
	= 56	= 36	= 12
	= 21	= 48	= 42

Factor Ladders

Lesson Box	Models	
When a the prime factorization of a number is not easily known using " <u>Factor Facts</u> ", you apply the <u>divisibility rules</u> for 2, 3, 5, 7, and 11 to find a divisor. Use <u>short division</u> to build a " <u>Factor Ladder</u> ".	$ \begin{array}{c c} 1 & 1 & 3 \\ 2 & 2 & 2 & \underline{6} \end{array} $	53 3 159
1. Check for divisibility by 2, 3, 5, 7, and/or 11.	226 = 113 • 2	$159 = 53 \bullet 3$
 Use short division to find the quotient. Repeat steps 1 and 2 on the quotient. Continue until the quotient is a prime number. 	$ \begin{array}{c c} 2 3 \\ 2 & 4 6 \\ 5 & 2 3 0 \end{array} $	$ \begin{array}{c c} 2 3 \\ 7 \overline{161} \\ 2 \overline{322} \end{array} $
	$230 = 23 \cdot 5 \cdot 2$	$322 = 23 \bullet 7 \bullet 2$

Use factor ladders to find the prime factorization of each of these numbers. Write the prime factorization on the line and check your work. Remember that multiplication is commutative so the **order** of your answers will not matter.

= 129	=74	= 127
= 143	= 133	= 84
= 147	=96	= 118
= 86	= 171	= 166
= 58	= 51	= 122
= 164	= 156	= 56
= 102	= 126	= 34
= 69	= 152	= 132
= 144	= 180	= 38
= 148	= 159	= 168
= 26	= 177	= 172
= 170	= 93	=46
	[use Key 12 to check your answers]	

Find the Prime Factorization of each of the numbers below. You should use exponents to make writing and checking your work easier.

Drill A		Drill B		Drill C	
	= 24		= 17		= 8
	= 25		= 18		= 12
	= 32		= 20		= 16
	= 40		= 21		= 22
	= 42		= 44		= 30
	= 51		= 49		= 34
	= 78		= 50		= 45
	= 80		= 58		= 48
	= 81		= 63		= 64
	= 82		= 72		= 66
	= 84		= 87		=76
	= 90		= 95		= 88
	= 91		= 98		= 100
	= 94		= 220		= 102
	= 210		= 225		= 350
	= 500		= 400		= 474