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Quick Tricks for Multiplication

Why multiply?

A computer can multiply thousands of numbers in less than a second. A human is lucky to multiply two numbers in less than a minute. So we tend to have computers do our math.

But you should still know how to do math on paper, or even in your head. For one thing, you have to know a little math even to use a calculator. Besides, daily life tosses plenty of math problems your way. Do you really want to haul out Trusty Buttons every time you go shopping?

Of course, normal multiplication can get boring. Here's the secret: **shortcuts**. You might think of numbers as a dreary line from 0 to forever. Numbers do go on forever, but you can also think of them as **cycles**. Ten ones make 10. Ten tens make 100. Ten hundreds make 1000.

If numbers were just a straight highway, there'd be no shortcuts. But they're more like a winding road. If you know your way around, you can cut across the grass and save lots of time.

Multiply by 10: Just add 0

The easiest number to multiply by is 10. Just “add 0.”

3 x 10 = 3**0**   140 x 10 = 140**0**

Isn't that easy? This “trick” is really just using our number system. **3** means “3 ones.” Move 3 once to the left and you get **30**, which means, “3 tens.” See how our numbers cycle in tens? Whenever you move the digits once to the left, that's the same as multiplying by 10.

And that's the quick way to multiply by 10. **Move each digit once to the left. Fill the last place with a 0.**

Easy.

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Exercise A:

1. Give two reasons to get good at doing math in your head.

2. Give two situations where you might need or want to do math in your head, not with a calculator.

3. Explain the quick way to multiply by ten.

4. Solve these problems without using a calculator.
   a. 4 x 10

   b. 15 x 10

   c. 400 x 10

   d. 23 x 10

   e. 117 x 10

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Multiply by 9: It All Adds Up to 9

Have you ever heard of the *Amazing Facts of Nine?* Let's take a look.

2 x 9 = **18**	**1** + **8** = 9
3 x 9 = **27**	**2** + **7** = 9
4 x 9 = **36**	**3** + **6** = 9
5 x 9 = **45**	**4** + **5** = 9
6 x 9 = **54**	**5** + **4** = 9
7 x 9 = **63**	**6** + **3** = 9
8 x 9 = **72**	**7** + **2** = 9
9 x 9 = **81**	**8** + **1** = 9

See the pattern? When we multiply a single-digit number times 9:

- The tens digit is **one less** than our **original** number.

- The **tens** digit **plus** the **ones** digit **equals nine**!

This makes it easy to multiply any single digit times 9. Suppose you want to multiply 5 times 9. First, **subtract 1 from the original number to get the tens digit.**

5 - 1 = **4** tens digit of answer

Then **subtract this tens digit from 9 to get the ones digit.**

9 - 4 = **5** ones digit of answer

So the answer is **45**. Let's double check. Do the digits add up to 9?

4 + 5 = **9**

Yes! Isn't this a great trick?

Remember, it only works for single digits. Don't try it on 13 x 9 or 6,425 x 9!

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Exercise B:

1. Explain the quick way to multiply a single digit times 9.

2. Solve the following problems without a calculator.

a. 4 x 9	b. 9 x 9
c. 9 x 8	d. 5 x 9
e. 7 x 9	f. 9 x 2
g. 3 x 9	h. 6 x 9

3. Look at these problems. Circle the problems that you could **not** use this lesson's trick for. Explain why not.

    a. 14 x 9

    b. 9 x 9

    c. 9 x 7

    d. 115 x 9

    e. 8 x 7

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Multiply by 5: It's All 5s and 0s

Is there a trick to multiply by 5? Let's look at a few facts:

2 x 5 = 1**0**	3 x 5 = 1**5**
4 x 5 = 2**0**	5 x 5 = 2**5**
6 x 5 = 3**0**	7 x 5 = 3**5**

See a pattern? If we multiply by an **even** number, the ones digit is **0**. If the number's **odd**, the ones digit is **5**.

So what's the shortcut? Look at the tens digit. If we multiply by an **even** number, the **tens** digit is **half** that number. The ones digit is always 0.

2 x 5 = **1**0	2 / 2 = **1**
4 x 5 = **2**0	4 / 2 = **2**
6 x 5 = **3**0	6 / 2 = **3**

What if we multiply by an **odd** number? First subtract 1 from that number. Then take half the answer, and that's the tens digit. The ones digit is always 5.

3 x 5 = **1**5	3 – 1 = 2	2 / 2 = **1**
5 x 5 = **2**5	5 – 1 = 4	4 / 2 = **2**
7 x 5 = **3**5	7 – 1 = 6	6 / 2 = **3**

So here's the shortcut:

To multiply 5 by an **even** number: Get the **tens** digit by dividing the number by 2. The **ones** digit is 0.

To multiply 5 by an **odd** number: Subtract 1 from the number. Get the **tens** digit by dividing that answer by 2. The **ones** digit is 5.

You can use this to check your work, too. What if you multiply 5 by 3 and get 20? Since 3 is an odd number, your answer should end in 5, not 0. You know you made a mistake.

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Exercise C:

1. What's the shortcut to multiply an even number by 5?

2. What's the shortcut to multiply an odd number by 5?

3. Solve these problems without a calculator.
   a. 5 x 4
   b. 5 x 12
   c. 5 x 19
   d. 5 x 15
   e. 5 x 7
   f. 5 x 20
   g. 5 x 13
   h. 5 x 21
4. *Don't* solve these problems. Instead, check whether each answer *could* be right or not. Explain your answer.

   Example: 4 x 5 = 25

   No. An even number x 5 should equal a number that ends in 0.

   a. 11 x 5 = 50

   b. 3 x 5 = 18

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Multiply by 3: It All Adds Up

Remember the *Amazing Facts of Nine*? When you multiply by 9, the digits of the answer eventually add up to 9.

8 x 9 = **72** **7** + **2** = 9

So how about that number 9? It's 3 times 3, isn't it? Let's see if 3 has any special properties.

4 x 3 = 12 1 + 2 = **3**

5 x 3 = 15 1 + 5 = **6**

6 x 3 = 18 1 + 8 = **9**

7 x 3 = 21 2 + 1 = **3**

Whoa! When you **multiply by 3**, **the digits of the answer add up to 3, 6, or 9**.

You can't really use this to multiply faster. But it is a quick way to check your work. Say you multiply 11 by 3 and get 34. Well, 3 + 4 = **7**. Oops. You must have made a mistake. The right answer is 33. And 3 + 3 = 6.

Of course, the trick can only show whether you're wrong. It can't prove you're right. Let's say you multiply 11 x 3 and get 36. Well, 3 plus 6 does equal 9, but 36 is still wrong.

Still, this is a neat trick. If you multiply *any* number by 3, the digits of the answer add up to 3, 6, or 9. Even *big* numbers.

524 x 3 = 1572

1 + 5 + 7 + 2 = 15 and 1 + 5 = **6**

91,317 x 3 = 273,951

2 + 7 + 3 + 9 + 5 + 1 = 27 and 2 + 7 = **9**

You can see that math has **patterns**. Thanks to patterns and cycles, the digits of your answer *have* to add up to three. Math works from every angle. That's what's so cool about it.

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Exercise D:

1. Explain the trick about multiplying by 3.

2. Do you use this trick to solve a problem or check your work?

3. How might you get “tricked” by this trick?

4. *Don't* solve these problems. Instead, circle which answers *can't* be correct. Explain your answer.

    a. 4 x 3 = 13

    b. 19 x 3 = 57

    c. 27 x 3 = 85

    d. 101 x 3 = 303

    e. 15 x 3 = 45

    f. 64 x 3 = 192

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Shortcuts and Chunks

It's easy to multiply by 10, isn't it? Which problem would you rather do?

20 x 7 = ?	19 x 7 = ?

The first, right? Maybe you figured it out just looking at it: 140. You forget about the 0 and multiply 2 by 7. Easy. But the second problem is a real *problem.* You'll have to use a pencil and paper to get the answer: 133. Rather hard.

Well, you can use the *easy* problem as a shortcut to the *harder* problem.

Twenty sevens is 140. Nineteen sevens is *one less seven* than 140. You don't have to figure out 19 x 7. You can jump from 20 x 7 to 140. Then go *back* to 19 x 7 by *subtracting* 7 from 140.

19 x 7 = ?	Ugh.
20 x 7 = 140	This is a close, easier answer.
140 – 7 = 133	Now subtract the extra seven...
19 x 7 = 133	And you're at the right place.

So you can **use an easier problem as a shortcut, then add or subtract the difference.**

A similar trick is to multiply by “chunks.” **First multiply the tens, then multiply the ones, then add these sums together.** This is all you really do on paper, but you might not realize it.

32 x 8 = ?	Yikes.
30 x 8 = 240	Multiply the tens.
2 x 8 = 16	Multiply the ones.
240+16 = 256	Add the two answers.
32 x 8 = 256	And we have our final answer.

If you break a problem into smaller chunks, you can often do it more quickly than if you try to do the whole thing at once.

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Exercise E:

1. How do you use an easy problem as a shortcut for a hard one? Write an example that shows how.

2. Write an example that shows how to multiply by chunks.

3. Solve this problem by using one of the tricks you learned in this lesson. Show your work.

    49 x 4

4. Solve these problems by using one of the tricks. Do them *in your head.*

    a. 13 x 6

    b. 71 x 7

    c. 19 x 9

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Exercise F: Review

1. Solve these problems by using one of the tricks you learned in this unit. Show your work.

   a. 11 x 7

   b. 39 x 3

2. Solve these problems by using one of the tricks. Do them all *in your head.*

   a. 9 x 8

   b. 8 x 5

   c. 6 x 5

   e. 3 x 9

   f. 51 x 4

   g. 301 x 10

   h. 7 x 9

   i. 19 x 7

3. *Don't* solve these problems. Instead, circle which answers *can't* be correct. Explain why.

   a. 8 x 5 = 44

   b. 9 x 6 = 56

   c. 21 x 3 = 61

   d. 18 x 5 = 90

   e. 9 x 5 = 55

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Answer Key:

Exercise A

1. You don't need to carry around a calculator.
   It's fun/interesting/strengthening.
2. Answers vary.
3. Move each digit once to the left.
   Fill the last place with a 0.
4. a. 40
   b. 150
   c. 4000
   d. 230
   e. 1170

Exercise B

1. Subtract 1 from the original number to get the tens digit.
   Subtract this tens digit from 9 to get the ones digit.
   Double check by adding the digits together to get 9.
2. a. 36
   b. 81
   c. 72
   d. 45
   e. 63
   f. 18
   g. 27
   h. 54
3. a 14 isn't a single digit
   d. 115 isn't a single digit
   e. 8 x 7 isn't multiplying by 9!

Exercise C

1. Get the **tens** digit by dividing the number by 2. The **ones** digit is 0.
2. Subtract 1 from the number. Get the **tens** digit by dividing that answer by 2. The **ones** digit is 5.
3. a. 20
   b. 60
   c. 95
   d. 75
   e. 35
   f. 100
   g. 65
   h. 105
4. a. No. An odd number x 5 should end in 5.
   b. No. An odd number x 5 should end in 5.

Exercise D

1. If you multiply a number by 3, the digits of the answer add up to 3, 6, or 9.
2. Check your work
3. If your wrong answer is another multiple of 3, the digits will add up to 3 and you'll be fooled.
4. a and c. The digits don't add up to 3, 6, or 9.

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Exercise E

Student examples may vary.

1. 19 x 7 = ?
   20 x 7 = 140
   140 – 7 = 133
   19 x 7 = 133
2. 32 x 8 = ?
   30 x 8 = 240
   2 x 8 = 16
   240 + 16 = 256
   32 x 8 = 256
3. a. 49 x 4
      50 x 4 = 200
      200 – 4 = 196
      49 x 4 = 196
4. a. 78
   b. 497
   c. 171

Exercise F

1. a. 11 x 7
      10 x 7 = 70
       1 x 7 = 7
      70 + 7 = 77
      11 x 7 = **77**
   b. 39 x 3
      40 x 3 = 120
      120 – 3 = 117
      39 x 3 = **117**

2. a. 72
   b. 40
   c. 30
   e. 27
   f. 204
   g. 3,010
   h. 63
   i. 133

3. a. The answer doesn't end in 5.
   b. The digits of the answer don't add up to 9.
   c. The digits of the answer don't add up to 3, 6, or 9.
   e. The digits don't add up to 9.