

Multiply and Divide Numbers in Standard Index Form

The PowerPoint contains the slides shown below and these give an animated presentation explaining how multiply and divide numbers in SIF. There are questions with answers.

Multiply and Divide Numbers in Standard Index Form

Objectives: Multiply and divide numbers in SIF

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$20\,000 \times 30\,000\,000 = 600\,000\,000\,000$

$2 \times 3 = 6$

To do this calculation, we multiply 2 by 3

A simple multiplication

But it's easy to make a mistake with the naughts

The calculation would be much better done using standard index form like this...

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$20\,000 \times 30\,000\,000 = (2 \times 10^4) \times (3 \times 10^7)$

The calculation in SIF

Put the numbers and powers of 10 together

$= (2 \times 3) \times (10^4 \times 10^7)$

$= 6 \times 10^{11}$

Multiply the numbers and add the powers

3

A slightly more difficult example $(7 \times 10^6) \times (5 \times 10^7)$

Put the numbers and powers of 10 together

$= (7 \times 5) \times (10^6 \times 10^7)$

$= 35 \times 10^{13}$

Multiply the numbers and add the powers

$= 3.5 \times 10^{14}$

In SIF, we use a number part greater than 1 and less than 10

So adjust by powers of 10 like this

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An example involving small numbers $(8 \times 10^{-8}) \times (3 \times 10^{-3})$

Put the numbers and powers of 10 together

$= (8 \times 3) \times (10^{-8} \times 10^{-3})$

$= 24 \times 10^{-11}$

Multiply the numbers and add the powers

$= 2.4 \times 10^{-12}$

In SIF, we use a number part greater than 1 and less than 10

So adjust by powers of 10 like this

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An example involving a small and large number $(7 \times 10^9) \times (6 \times 10^{-12})$

Put the numbers and powers of 10 together

$= (7 \times 6) \times (10^9 \times 10^{-12})$

$= 42 \times 10^{9+(-12)}$

$= 42 \times 10^{-3}$

Multiply the numbers and add the powers

$= 4.2 \times 10^{-2}$

In SIF, we use a number part greater than 1 and less than 10

So adjust by powers of 10 like this

6

Evaluate these giving the answer in SIF

- $(4 \times 10^6) \times (2 \times 10^8) = 8 \times 10^{14}$
- $(3 \times 10^3) \times (4 \times 10^7) = 1.2 \times 10^{11}$
- $(4 \times 10^3) \times (7 \times 10^{18}) = 2.8 \times 10^{21}$
- $(6 \times 10^8) \times (4 \times 10^{14}) = 2.4 \times 10^{23}$
- $(9 \times 10^{-3}) \times (7 \times 10^{-9}) = 6.3 \times 10^{-12}$
- $(7 \times 10^{-6}) \times (2 \times 10^{-3}) = 1.4 \times 10^{-9}$
- $(9 \times 10^{14}) \times (6 \times 10^{-3}) = 5.4 \times 10^{11}$
- $(4 \times 10^6) \times (8 \times 10^{-13}) = 3.2 \times 10^{-6}$

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Dividing Numbers in Standard Index Form

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To do a division in SIF like this, we... $(6 \times 10^{12}) \div (2 \times 10^7)$

Put the numbers and powers of 10 together

$= (6 \div 2) \times (10^{12} \div 10^7)$

Divide the numbers and subtract the powers

$= 3 \times 10^5$

Notice how the x and ÷ signs change

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An example involving a negative index... $(8 \times 10^3) \div (4 \times 10^6)$

Put the numbers and powers of 10 together

$= (8 \div 4) \times (10^3 \div 10^6)$

$= 2 \times 10^{3-6}$

Divide the numbers and subtract the powers

$= 2 \times 10^{-3}$

Notice how the x and ÷ signs change

Notice that -6 is $+6$

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An example where we need to readjust the answer... $(3 \times 10^7) \div (4 \times 10^3)$

Put the numbers and powers of 10 together

$= (3 \div 4) \times (10^7 \div 10^3)$

$= 0.75 \times 10^{7-3}$

This number must be greater than 1 and less than 10

$= 0.75 \times 10^4$

Increase the number and decrease the index like this

$= 7.5 \times 10^3$

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Evaluate these giving the answer in SIF

- $(6 \times 10^9) \div (3 \times 10^3) = 2 \times 10^6$
- $(2.4 \times 10^3) \div (2 \times 10^7) = 1.2 \times 10^{-4}$
- $(8 \times 10^3) \div (5 \times 10^7) = 1.6 \times 10^{-4}$
- $(6 \times 10^8) \div (4 \times 10^{11}) = 1.5 \times 10^{-3}$
- $(4 \times 10^{-3}) \div (5 \times 10^{-12}) = 8 \times 10^9$
- $(2.4 \times 10^{-7}) \div (8 \times 10^3) = 3 \times 10^{-11}$
- $(1.2 \times 10^7) \div (3 \times 10^{-3}) = 4 \times 10^{10}$
- $(1.8 \times 10^7) \div (6 \times 10^{-13}) = 3 \times 10^{20}$

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Divide is often written like this... $\frac{8 \times 10^7}{2 \times 10^3} \rightarrow (8 \times 10^7) \div (2 \times 10^3)$

We can do this in the normal way... $\frac{8 \times 10^7}{2 \times 10^3} = \frac{(8 \div 2) \times (10^7 \div 10^3)}{4 \times 10^{(7-3)}} = 4 \times 10^4$

Put the numbers and powers of 10 together

Divide the numbers and subtract the powers

13

Evaluate these giving the answer in SIF

- $\frac{6 \times 10^9}{3 \times 10^4} = 2 \times 10^5$
- $\frac{8 \times 10^7}{4 \times 10^4} = 2 \times 10^3$
- $\frac{4.8 \times 10^8}{4 \times 10^3} = 1.2 \times 10^5$
- $\frac{2.4 \times 10^9}{6 \times 10^4} = 4 \times 10^4$
- $\frac{4.2 \times 10^{-4}}{2 \times 10^2} = 2.1 \times 10^{-6}$
- $\frac{3.6 \times 10^{-9}}{4 \times 10^{-12}} = 9 \times 10^2$
- $\frac{1.4 \times 10^4}{2 \times 10^{-2}} = 7 \times 10^6$
- $\frac{3.5 \times 10^{-6}}{7 \times 10^4} = 5 \times 10^{-11}$

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Calculations Involving Multiplication and Division

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An example of multiplication and division $7 \times 10^3 \times 3 \times 10^7 \div 4 \times 10^2 \times 2 \times 10^3$

Put numbers and powers of 10 together

$\rightarrow (7 \times 3) \times (10^3 \times 10^7) \div (4 \times 2) \times (10^2 \times 10^3)$

Work out top and bottom

$\rightarrow \frac{(21) \times (10^{10})}{(8) \times (10^5)}$

Divide top by bottom

$\rightarrow (21 \div 8) \times (10^{10} \div 10^5)$

$\rightarrow 2.625 \times 10^5$

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Evaluate these giving the answer in SIF

- $\frac{7 \times 10^4 \times 5 \times 10^6}{2 \times 10^3 \times 4 \times 10^3} = 4.375 \times 10^4$
- $\frac{3 \times 10^5 \times 5 \times 10^4}{2 \times 10^3 \times 4 \times 10^{-3}} = 1.875 \times 10^7$
- $\frac{7 \times 10^{-4} \times 9 \times 10^7}{4 \times 10^{-3} \times 5 \times 10^{-3}} = 3.15 \times 10^{11}$

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