

## 4.5 Adding and subtracting decimals

1.

Back in sections 1.1, 1.2 we added whole numbers and subtracted them by putting them vertically and lining up the ones places.

We do the same with decimals and if the ones are lined up then so are the decimal points.

Example (1) Add:  $47.2 + 9.94$

$$\begin{array}{r} 47.2 \\ + 9.94 \\ \hline \end{array}$$

No

$$\begin{array}{r} 47.20 \\ + 9.94 \\ \hline \end{array}$$

Yes

can add zero  
↓

So we get

$$\begin{array}{r} 47.20 \\ + 9.94 \\ \hline 57.14 \end{array}$$

↑  
decimal point of answer lines up

Answer is  $57.14$  This makes sense because

$47.2$  is close to  $47$  and  $9.94$  close to  $10$ .

Example (2) Find  $47.2 - 9.94$

Solution:

$$\begin{array}{r} 3 \ 16 \ 11 \ 10 \\ \cancel{47.20} \\ - 9.94 \\ \hline 37.26 \end{array} \quad \leftarrow \quad \begin{array}{r} 47.20 \\ - 9.94 \\ \hline \end{array}$$

Answer  $37.26$  (and  $47 - 10 = 37 \checkmark$ )

Example (3) What is the sum of 9.4, 28 and 0.306?

Solution: Remember that  $28 = 28.0$  and since 0.306 has 3 places we can give all the numbers 3 places:

$$\begin{array}{r} \phantom{00} 9.400 \\ 28.000 \\ + 0.306 \\ \hline \text{Sum is } 37.706 \end{array}$$

Example (4) Compute  $1.8 - 5.362$

Solution: 
$$\begin{array}{r} 1.8 \\ - 5.362 \\ \hline \end{array} \quad ? \quad \text{No}$$

Remember how we added and subtracted signed numbers in sections 2.3, 2.4.

$$1.8 - 5.362 = (1.8) + (-5.362)$$

↑      →  
different signs

absolute values 1.8, 5.362

Subtract abs. vals

$$\begin{array}{r} \phantom{00} 5.362 \\ - 1.800 \\ \hline 3.562 \end{array}$$

and use sign of number with biggest abs. value.

Answer  $\boxed{-3.562}$

- See examples p125-128.

## 4.6 Multiplying, dividing decimals by powers of 10

We know that multiplying by ten adds a zero on the right:

$$76 \times 10 = 760$$

Also in 76 the 6 moved from the ones place to the tens place

↑ ↑  
tens ones

760  
↑ ↑  
hundreds tens

and the 7 moved from tens to hundreds.

The same thing happens when you multiply a decimal by ten - all the digits move to the next higher place

$$76.54 \times 10 = 765.4$$

↑ ↑ ↑ ↑      ↑ ↑ ↑ ↑  
tens ones tenths hundredths      hundreds tens ones tenths

or from an easier point of view, the decimal point moves one place right

$$76.54 \times 10 = 765.4$$

Note that multiplying by ten makes the number bigger (yes, ten times bigger).

Example (5) Find  $0.04921 \times 1000$

Solution:  $1000 = 10 \times 10 \times 10 = 10^3$  so we must move the decimal point 3 places right

$0.04921$   
~~~~~  
~~~~~

and the product is  $0049.21 = \boxed{49.21}$   
↑↑  
insignificant

Example (6) Find  $3.8 \times 10^4$

Solution: Move the decimal point 4 places right

$3.8$  ~~~~~ ?

First add insignificant zeros

$3.8 = 3.8000$   
~~~~~

and the answer is  $38000. = \boxed{38000}$

Rule: To multiply a decimal by  $10^n$  you just move the decimal point  $n$  places right.

Dividing by a power of ten is also easy as the decimal point goes in the opposite direction.

Rule: To divide a decimal by  $10^n$  just move the decimal point  $n$  places left.

Example (7) Find  $3.8 \div 10^4$

Solution:  $3.8 = 00003.8$  go left

and  $3.8 \div 10^4 = 0.00038$

If you get confused about moving left or right, remember the answer should be bigger if you multiply by powers of 10 and smaller if you divide by powers of 10.

- More examples p130, 131.

4.7 Multiplication of general decimals

How do you multiply two decimals like 2.3 and 0.05 for example?

We could convert them to fractions first:

$2.3 = 2 \frac{3}{10} = \frac{23}{10}$

and  $0.05 = \frac{5}{100}$

$$\begin{array}{r} 23 \\ \times 5 \\ \hline 115 \end{array}$$

then  $2.3 \times 0.05 = \frac{23}{10} \cdot \frac{5}{100} = \frac{115}{1000}$

