

JobTestPrep's Numeracy Review

Decimals & Percentages



Job Test Prep



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What is a decimal?

Decimal means “based on 10”. Every fraction can be portrayed as a decimal in addition to the standard fraction form. Dividing the numerator of a fraction by its denominator in a calculator would present you with the fraction's value in the decimal system. In it, the figures left to the decimal point represent whole numbers while the figures to the right of the decimal point are fractions.

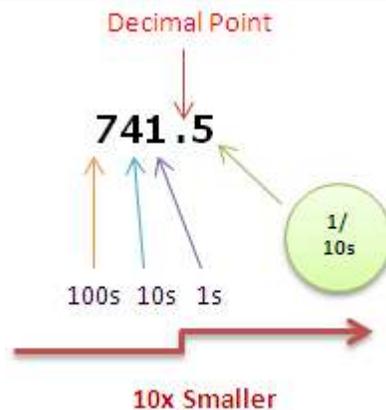
Tips

You can think of Decimal numbers as whole numbers plus tenths, hundredths, etc.
For example: What is 14.37 as a fraction?

On the left side of the decimal point is "14", which is the whole number part.

The 3 is in the "tenths" position, meaning "3 tenths", or $\frac{3}{10}$. The 7 is in the “hundredths” position, meaning “7 hundredths”, or $\frac{7}{100}$.

In total then, we have “14 and 3 tenths and 7 hundredths”. Alternatively, we can call the same number “14 and 37 hundredths”, as 1 tenth is equal to 10 hundredths.



The decimal system is actually a set of decimal fractions. A decimal fraction is a fraction where the denominator (the bottom number) is a number such as 10, 100, 1000, etc (in other words a power of ten). For whole numbers, and beginning with the one placed closest to the decimal point, each place value is multiplied by increasing powers of 10.

Hundreds (10^2)	Tens (10^1)	Units (10^0)	DecimalPoint	Tenths (10^{-1})	Hundredths (10^{-2})	Thousandths (10^{-3})
100	10	1	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

For example, the value of the first place on the left of the decimal point is "one", the value of the place to the left of it is "ten," which is 10 times 1. The place to the left of the tens place is hundreds, which is 10 times 10, and so forth. This progression exists on the opposite side of the decimal point, where the numbers farther away from the decimal point grow smaller by a power of ten. The first figure to the right of the decimal is measured in tenths ($\frac{1}{10}$), the second is by hundredths ($\frac{1}{100}$), the third by a thousandths ($\frac{1}{1,000}$) and so on.



The decimal point is the most important part of a Decimal Number, as it positions the units' location, and allows us to read the number correctly.

We use this representation for fractions as it is easy to display on a calculator and to perform arithmetic functions on every decimal number that, by the nature of being decimal, has the same denominator and can thus be added without first finding it out.

For example: The number 34.92 is equal to 34 plus 9/10 plus 2/100, or alternatively $34 + 92/100$

When multiplying a decimal by 10, 100 or 1000 we shift the decimal point 1, 2 or 3 places to the right just as in these examples.

- (1) $7.46 \times 10 = 74.6$ (decimal point 1 place to the right)
- (2) $2.91 \times 100 = 291.0$ (decimal point 2 places to the right)
- (3) $4.78 \times 1000 = 4780.0$ (decimal point 3 places to the right) and so on...

When dividing a decimal by 10, 100 or 1000 we shift the decimal point 1, 2 or 3 places to the left

- (1) $74.6 / 10 = 7.46$ (decimal point 1 place to the left)
- (2) $291 / 100 = 2.91$ (decimal point 2 places to the left)
- (3) $4780 / 1000 = 4.78$ (decimal point 3 places to the left) and so on...

Therefore, each multiple of 10 equals moving the decimal point one place to the right, while a division by 10 moves the point to the left by the same distance.

Converting fractions to decimals

In order to convert a fraction to decimal we need to express the fraction with a power of 10 in the denominator. Remember that you can multiply the numerator and the denominator of the fraction by the same number and it would maintain the same total value.

Example #1: Let us assume we wish to present the fraction $1/2$ in decimal.

We begin by converting the fraction to have a denominator that is a power of 10. Multiplying both the numerator and denominator by 5 will achieve this result.

$$1/2 = (1 \times 5) / (2 \times 5) = 5/10 = 0.5$$

Example #2: What is $3/8$ in decimal?

First we must find what multiplied by 8 will create a denominator that is a power of 10.

$$100/8 = 50/4 = 25/2 = 12.5$$

Therefore, multiplying 8 by 12.5 will result in the number 100. We multiply both parts of the fraction by 12.5 and find:

$$(3 \times 12.5) / (8 \times 12.5) = 37.5 / 100 = 0.375$$



Tips

- A. A simple way to summarize the method would be:
- 1) Find a number you can multiply to the bottom of the fraction to make it 10, or 100, or 1000, or any power of 10.
 - 2) Multiply both top and bottom by that number.
 - 3) Write down only the top number, putting the decimal point in the correct spot, exactly one space from the right hand side for every zero in the bottom number.
- B. Not all fractions can be converted to simple decimal values without the use of a calculator. Numbers divisible by prime numbers other than 2 or 5 will result in the closest approximation within the decimal system, as a finite representation will not be possible. This approximation will have an infinite decimal expansion ending with recurring decimals.
- While we cannot calculate these values, tests that utilise such fractions in their questions will draw from a very short list. Therefore, it would be a time saver to memorize a set of some of the more commonly used fractions and their equals in decimal beforehand:

As decimal fractions are expressed without a denominator, the decimal separator is inserted into the numerator, with leading zeros added if needed, at the position from the right corresponding to the power of ten of the denominator. In our example, $5/10$ is 0.5.

Fraction	Decimal
1/100	0.01
1/20	0.05
1/10	0.1
1/9	~0.11
1/8	0.125
1/7	~0.1429
1/6	~0.166
1/5	0.2
1/4	0.25
1/3	~0.33
1/2	0.5
1/1	1.0



Tips

A simple way to summarize the method would be:

- 1) Write down the decimal and divide it by one, like so: decimal/1
- 2) Multiply both top and bottom by 10 for every digit after the decimal point.
Example: multiplying by 10 a total of 3 times for the decimal 0.123
- 3) Simplify (or reduce) the fraction to its simplest form.

Converting decimals to fractions

In order to achieve the opposite action we need to express the numbers right to the decimal point as a fraction, and then "cancel down" as much as we can.

For example: $0.125 = 1/10 + 2/100 + 5/1000 = 125/1000$

Now, it is rather easy to see that both 125 and 1000 can be divided by 25. We divide both numerator and denominator by 25 and we get: $5/40$.

From there we see that both 5 and 40 can be divided by 5. We divide by 5 and get $1/8$. It is important to understand that $0.125 = 125/1000 = 1/8$. All expressions have the same value, but when you are required to convert in a test under time constraints, only one expression would be available to you as an answer and you would have to know how to move between equally valuable expressions in order to find it.

Percentages

Percent means "out of 100". Percentages are fractions in which the denominator (the bottom part) always has a value of 100. Since the denominator is always the same, it doesn't need to be written down. That's why percentages are displayed as just one number instead of two like normal fractions.

We truly hope you are familiar with the following percentage formula:

$$\% = (\text{fraction}) \times 100$$

This formula allows us to alternate between fractions and their percent form.

Let's take a look at the following example:

If we decide to put 25 on the % side, we get the following equation: $25\% = \text{fraction} \times 100$

If we divide the equation by 100, we get: $25/100 = 25/(25 \times 4) = 1/4 = \text{Fraction}$.

Therefore, 25% is merely another way of presenting $1/4$. This formula is sometimes elaborated to include the components of a fraction (nominator and denominator), but for our purposes the formula above is satisfactory.



Tips

- A.** A simple way to find a percentage from a fraction would be:
- 1) Find a number you can multiply to the bottom of the fraction to get 100.
 - 2) Multiply both top and bottom by that number.
 - 3) Write down only the top number, putting the decimal point in the correct spot, exactly two spaces from the right hand side (since for percentages the denominator is always 100).
- B.** A percentage can always be written as a decimal, and a decimal can be written as a percentage. This is done by moving the decimal point two places to the right and essentially multiplying the figure by 100. Keep in mind that both are still fractions and are only represented differently.

Important percentages to remember:

Percentages	Fraction	Decimal
1%	1/100	0.01
5%	1/20	0.05
10%	1/10	0.1
11.11%	1/9	~0.11
12.5%	1/8	0.125
14.29%	1/7	~0.1429
16.66%	1/6	~0.166
20%	1/5	0.2
25%	1/4	0.25
33%	1/3	~0.33
50%	1/2	0.5
100%	1/1	1.0

Adding and subtracting decimals

If you know how to add and subtract whole numbers, then you can add and subtract decimals. Just be sure to line up the figures so that all the decimal points are in a vertical line, and the rest will be the same addition or subtraction operations.

To add decimal numbers:

1. Put the numbers in a vertical column, aligning the decimal points.
2. Add each column of digits, starting on the right and working left. If the sum of a column is more than ten, "carry" digits to the next column on the left.
3. Place the decimal point in the answer directly below the decimal points in the terms.



For example: $124.07 + 108.482 = 232.552$

$$\begin{array}{r} 124.07 \\ + 108.482 \\ \hline 232.552 \end{array}$$

To subtract decimal numbers:

1. Put the numbers in a vertical column, aligning the decimal points.
2. Subtract each column, starting on the right and working left. If the digit being subtracted in a column is larger than the digit above it, "borrow" a digit from the next column to the left.
3. Place the decimal point in the answer directly below the decimal points in the terms.
4. Check your answer by adding the result to the number subtracted. The sum should equal the first number.

For example: $2.56 - 0.148 = 2.412$

$$\begin{array}{r} 2.56 \\ - 0.148 \\ \hline 2.412 \end{array}$$

Multiplying two decimals

While appearing intimidating at first, multiplying two decimals can be made easier by dividing the calculation to two parts:

First, we ignore the decimal points and multiply both numbers as whole numbers. Then, starting from the right of the product, we separate as many decimal digits as there are in the two original numbers combined. The reasoning is that since a decimal is the numerator of a fraction, we are also multiplying the denominators of both numbers. In the case of two decimals, two powers of 10 will be multiplied (for example $10 \times 10 = 1,000$) and the resulting fraction will have a denominator

Tips

- A.** In short, the method of calculation for multiplying two decimals is:
- 1) Multiply normally, ignoring decimal points.
 - 2) Once we have the product of the division, put the decimal point in it. It will have as many decimal places as the two original numbers combined.
- B.** Multiplying by a decimal value is the same as multiplying by a fraction. It is recommended you learn several key decimal values and their corresponding fractional values.

with the total number of zeroes.

For example: $0.5 \times 2.01 = ?$

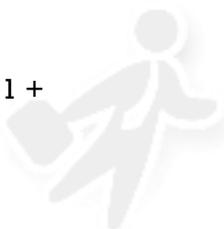
We ignore the decimal points, giving us the calculation $5 \times 201 = 1,005$.

Now we return to fixing the decimal point: 0.5 had one number to the right of the decimal point, while 2.01 had two. Together, both numbers have three decimal digits.

Therefore, starting from the right we separate three digits: 1.005

Utilizing long multiplication is of course acceptable if the need arises.

In fractions the same calculation would be: $5/10 \times 201/100 = (5 \times 201) / (10 \times 100) = 1,005 / 1,000 = 1 + 5/1000$.



Tips

A very common use for multiplying a number by a decimal is to find a percentage from a certain number of items. This is also used when the total number of the items is not necessarily a power of 10. Since the total number of items is considered as the whole number, finding a specified portion of it necessitates the use of fractions.

For example: finding 20% of 35. A percentage of 20 is the same as the fraction 20/100 and the decimal 0.2, and in order to find the portion of the whole group relating to that percent, we must multiply the two.

$35 \times 20/100 = 700/100 = 7$. So in this example, 20% of 35 is equal to 7.

In a calculator, the equivalent formula would be $35 \times 0.2 = 7$

Multiplying a number by a decimal

Multiplying a number by a decimal is identical to multiplying two decimals in that we first ignore the decimal point, and add it after we have the product. This is made easier than with multiplying two decimals as we only have one decimal number, and so it will determine the location of the decimal point in the product.

For example: $13 \times 0.4 = ?$

We ignore the decimal point, giving us the calculation $13 \times 4 = 52$.

Now we return the decimal point. Since 0.4 had only one number to the right of the point (4 tenths), the decimal point on the product will also be one digit from the right, giving us 5.2.

Percentages and decimal numbers

Many people find it easier to calculate percent changes using decimal numbers. Since a percentage is actually a fraction, 1% can be written as 0.01. Therefore, increasing a number by 1% means multiplying it by $1 + 0.01 = 1.01$, and decreasing a number by 1 percent means multiplying it by $1 - 0.01 = 0.99$. Thus, a percent increase means multiplying by numbers greater than one, and a percent decrease means multiplying by numbers that are smaller than one.

Division involving a decimal

Division is the most challenging of the four basic arithmetic operations. In fact, you have to use subtraction and multiplication in order to divide, and you also have to be pretty good at rounding and estimating. Many people have trouble with division, perhaps because most problems don't come out "nice and even". Fortunately, we have calculators to make the job easier, but that doesn't mean you shouldn't learn how to do it yourself.

Dividing by a decimal number:

If the divisor is not a whole number, we must first convert it to one. This is key to solving the calculation.

- Move the decimal point in the divisor all the way to the right, to make it a whole number.
- Move the decimal point in the dividend the same number of places.



Divide as usual. If the divisor doesn't go into the dividend evenly, add zeroes to the right of the last digit in the dividend and keep dividing until it comes out evenly or a repeating pattern shows up.

Position the decimal point in the result directly above the decimal point in the dividend.

Check your answer if possible: Use the calculator and multiply the quotient by the divisor. Does it equal the dividend?

For example: $43.758 \div 1.8 = ?$

$$\begin{array}{r} \underline{024.31} \\ 437.58 \overline{)18} \\ \underline{-36} \\ 77 \\ \underline{-72} \\ 55 \\ \underline{-54} \\ 18 \\ \underline{-18} \\ 0 \end{array}$$

Dividing a decimal by a whole number:

Since the divisor is a whole number, we can skip phase 1, and use standard long division.

Remember to place the decimal point in the dividend in the same place as in the original number.

For example: $129.36 \div 3 = ?$

$$\begin{array}{r} \underline{43.12} \\ 129.36 \overline{)3} \\ \underline{-12} \\ 9 \\ \underline{-9} \\ 3 \\ \underline{-3} \\ 6 \\ \underline{-6} \\ 0 \end{array}$$



Tips

- A.** Dividing decimals is almost the same as dividing whole numbers, with the addition of using the position of the decimal point in the original number to determine the decimal placement of the dividend.
- B.** During tests several decimal values are used more than others in calculations. It is therefore important to be acquainted with them beforehand. The key principle is that dividing by a decimal is the same as dividing by a fraction, as all decimals are fractions.

For example, dividing 5 by 0.1 is equal to the calculation $5 \div \frac{1}{10}$. Therefore, we have to flip the fraction and multiply by it.

Divisor	Dividend
1/0.1	10
1/0.2	5
1/0.3	~3.33
1/0.4	2.5
1/0.5	2
1/0.6	~1.66
1/0.7	~1.429
1/0.8	1.25
1/0.9	~1.11
1/0.01	100



Rounding decimals

Decimals occasionally have too many figures to the right of the decimal point. Since the decimal system works in bases of 10, it is sensitive to being divided by figures composed of prime numbers other than 2 or 5, or any multiplication of the two. Numbers divisible by other prime numbers will cause the calculator to display the closest approximation within the decimal system, as a finite representation will not be available. This approximation will have an infinite decimal expansion ending with recurring decimals.

Sometimes we are asked to be less precise and round the number, using a specified number of figures right to the decimal point. The solution involves first deciding on a cut point after a certain digit according to the requirements of the question.

Some questions will ask you to round to a certain number of decimal places. You need to count this number of places starting from the decimal point and going right, placing the cut point after a certain digit that is now called the rounding digit.

In other instances you would be asked to round to a certain number of significant numbers. In this case, you need to count the total number of digits from left to right and then place the cut point.

Once we have our cut point we look at the digit to the right of the cut point. If it is less than 5, then we leave the rounding digit unchanged. If it is more than five, we add one to the value of the rounding digit. If it is five, the rule is to always round up as well. This rule was created to "break the tie" when you are rounding a number that is exactly between two other numbers. These kinds of rules are called "conventions", and are important so we all get the same answer when doing the same problems.

For example: rounding the number 4.374 to two decimal places would result in dropping the 4 digit at the rightmost part from the decimal point, leaving us with the answer of 4.37.

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