Rationalising the denominator and making the denominator real

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## Rationalising the denominator

An irrational number is (informally) a number that we cannot write as a fraction with an integer numerator and denominator. For example, is irrational.

For a number in the form ‘’ where is irrational, we call the ‘rational part’ and ‘’ the ‘irrational part’.

In order to rationalise the denominator of a fraction that is in the form , we use the following steps:

1. Take the irrational part of the denominator, and subtract the rational part. Call this value ‘c’.

Eg) For the fraction we would get .

1. Multiply the fraction by .

Eg) = =.

**Note:** We are allowed to do this because = 1, and multiplying anything by 1 does not change its value.

1. Tidy up the numerator and denominator.

Eg) = = .

1. Simplify the fraction, if you can.

Eg) For a fraction such as we would simplify to .

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1. Change the format, if this is needed.

Eg) If we were asked to write in the form , we would rationalise the denominator to give us , and then write this as + .

**Note**

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## Making the denominator real

This process is largely the same as rationalising the denominator.

An imaginary number is (informally) a number that has as a factor. We write as .

A complex number is (informally) a number that has a real part and an imaginary part. For example, is a complex number.

For a number in the form ‘’ where , we call the ‘real part’ and ‘ the ‘imaginary part’.

In order to make the denominator of a fraction that is in the form ‘’ real, we use the following steps:

1. Take the imaginary part of the denominator, and subtract the real part. Call this value ‘c’.

Eg) For the fraction we would get .

1. Multiply the fraction by .

Eg) = =

**Note:** Again, we are allowed to do this because = 1, and multiplying anything by 1 does not change its value.

1. Tidy up the numerator and denominator.

Eg) = = = .

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1. Simplify the fraction, if you can.

Eg) = .

1. Change the format, if this is needed.

Eg) If we were asked to write in the form , we would make the denominator real to give us , and then write this as - .

**Note**

Since , we need to remember that:

Which, without the calculation steps is:

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