Surds

Things you need to learn to do

- Simplify surds.
- Rationalize denominator/numerator.

Simplifying surds

In mathematics which of the following $3\sqrt{2}$ or $\sqrt{18}$ is simpler depends on the context.

Simplifying surds

In mathematics which of the following $3\sqrt{2}$ or $\sqrt{18}$ is simpler depends on the context. You need to be able to change from one form to the other quickly.

Simplifying surds

If we have an expression like $3\sqrt{2}$ and we want to move the 3 under the square root sign we simply make sure to adjust its power. For example:

- $3\sqrt{2} = \sqrt{3^2 \times 2} = \sqrt{18}$,

Simplifying surds

If we have an expression like $3\sqrt{2}$ and we want to move the 3 under the square root sign we simply make sure to adjust its power. For example:

- $3\sqrt{2} = \sqrt{3^2 \times 2} = \sqrt{18}$,
- $3\sqrt[3]{2} = \sqrt[3]{3^3 \times 2} = \sqrt[3]{54}$,

Simplifying surds

If we have an expression like $3\sqrt{2}$ and we want to move the 3 under the square root sign we simply make sure to adjust its power. For example:

- $3\sqrt{2} = \sqrt{3^2 \times 2} = \sqrt{18}$,
- $3\sqrt[3]{2} = \sqrt[3]{3^3 \times 2} = \sqrt[3]{54}$,
- $3\sqrt[4]{2} = \sqrt[4]{3^4 \times 2} = \sqrt[4]{162}$,

Simplifying surds

If we have an expression like $3\sqrt{2}$ and we want to move the 3 under the square root sign we simply make sure to adjust its power. For example:

- $3\sqrt{2} = \sqrt{3^2 \times 2} = \sqrt{18}$,
- $3\sqrt[3]{2} = \sqrt[3]{3^3 \times 2} = \sqrt[3]{54}$,
- $3\sqrt[4]{2} = \sqrt[4]{3^4 \times 2} = \sqrt[4]{162}$,
- $3\sqrt[5]{2} = \sqrt[5]{3^5 \times 2} = \sqrt[5]{486}$.

Simplifying surds

Some practice:

- $2\sqrt{3} =$

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} =$

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,
- $3\sqrt{5} =$

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,
- $3\sqrt{5} = \sqrt{3^2 \times 5} = \sqrt{45}$,

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,
- $3\sqrt{5} = \sqrt{3^2 \times 5} = \sqrt{45}$,
- $4\sqrt{3} =$

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,
- $3\sqrt{5} = \sqrt{3^2 \times 5} = \sqrt{45}$,
- $4\sqrt{3} = \sqrt{4^2 \times 3} = \sqrt{48}$,

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,
- $3\sqrt{5} = \sqrt{3^2 \times 5} = \sqrt{45}$,
- $4\sqrt{3} = \sqrt{4^2 \times 3} = \sqrt{48}$,
- $3\sqrt{3} =$

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,
- $3\sqrt{5} = \sqrt{3^2 \times 5} = \sqrt{45}$,
- $4\sqrt{3} = \sqrt{4^2 \times 3} = \sqrt{48}$,
- $3\sqrt{3} = \sqrt{3^2 \times 3} = \sqrt{27}$,

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,
- $3\sqrt{5} = \sqrt{3^2 \times 5} = \sqrt{45}$,
- $4\sqrt{3} = \sqrt{4^2 \times 3} = \sqrt{48}$,
- $3\sqrt{3} = \sqrt{3^2 \times 3} = \sqrt{27}$,
- $5\sqrt{2} =$

Simplifying surds

Some practice:

- $2\sqrt{3} = \sqrt{2^2 \times 3} = \sqrt{12}$,
- $4\sqrt{2} = \sqrt{4^2 \times 2} = \sqrt{32}$,
- $3\sqrt{5} = \sqrt{3^2 \times 5} = \sqrt{45}$,
- $4\sqrt{3} = \sqrt{4^2 \times 3} = \sqrt{48}$,
- $3\sqrt{3} = \sqrt{3^2 \times 3} = \sqrt{27}$,
- $5\sqrt{2} = \sqrt{5^2 \times 2} = \sqrt{50}$.

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} =$

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} =$

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,
- $3\sqrt[4]{5} =$

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,
- $3\sqrt[4]{5} = \sqrt[4]{3^4 \times 5} = \sqrt[4]{405}$,

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,
- $3\sqrt[4]{5} = \sqrt[4]{3^4 \times 5} = \sqrt[4]{405}$,
- $2\sqrt[4]{2} =$

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,
- $3\sqrt[4]{5} = \sqrt[4]{3^4 \times 5} = \sqrt[4]{405}$,
- $2\sqrt[4]{2} = \sqrt[4]{2^4 \times 2} = \sqrt[4]{32}$,

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,
- $3\sqrt[4]{5} = \sqrt[4]{3^4 \times 5} = \sqrt[4]{405}$,
- $2\sqrt[4]{2} = \sqrt[4]{2^4 \times 2} = \sqrt[4]{32}$,
- $2\sqrt[5]{5} =$

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,
- $3\sqrt[4]{5} = \sqrt[4]{3^4 \times 5} = \sqrt[4]{405}$,
- $2\sqrt[4]{2} = \sqrt[4]{2^4 \times 2} = \sqrt[4]{32}$,
- $2\sqrt[5]{5} = \sqrt[5]{2^5 \times 5} = \sqrt[5]{160}$,

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,
- $3\sqrt[4]{5} = \sqrt[4]{3^4 \times 5} = \sqrt[4]{405}$,
- $2\sqrt[4]{2} = \sqrt[4]{2^4 \times 2} = \sqrt[4]{32}$,
- $2\sqrt[5]{5} = \sqrt[5]{2^5 \times 5} = \sqrt[5]{160}$,
- $3\sqrt[5]{3} =$

Simplifying surds

Some more practice:

- $2\sqrt[3]{3} = \sqrt[3]{2^3 \times 3} = \sqrt[3]{24}$,
- $4\sqrt[3]{2} = \sqrt[3]{4^3 \times 2} = \sqrt[3]{128}$,
- $3\sqrt[4]{5} = \sqrt[4]{3^4 \times 5} = \sqrt[4]{405}$,
- $2\sqrt[4]{2} = \sqrt[4]{2^4 \times 2} = \sqrt[4]{32}$,
- $2\sqrt[5]{5} = \sqrt[5]{2^5 \times 5} = \sqrt[5]{160}$,
- $3\sqrt[5]{3} = \sqrt[5]{3^5 \times 3} = \sqrt[5]{729}$.

Simplifying surds

Of course if we want to go in the opposite direction (as is often the case) we do the exact opposite.

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- $\sqrt{75} = \sqrt{25 \times 3} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$,

Simplifying surds

Of course if we want to go in the opposite direction (as is often the case) we do the exact opposite.

- $\sqrt{75} = \sqrt{25 \times 3} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$,
- $\sqrt{72} = \sqrt{36 \times 2} = \sqrt{36} \times \sqrt{2} = 6\sqrt{2}$,

Simplifying surds

Of course if we want to go in the opposite direction (as is often the case) we do the exact opposite.

- $\sqrt{75} = \sqrt{25 \times 3} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$,
- $\sqrt{72} = \sqrt{36 \times 2} = \sqrt{36} \times \sqrt{2} = 6\sqrt{2}$,
- $\sqrt[3]{16} = \sqrt[3]{8 \times 2} = \sqrt[3]{8} \times \sqrt[3]{2} = 2\sqrt[3]{2}$,

Simplifying surds

Of course if we want to go in the opposite direction (as is often the case) we do the exact opposite.

- $\sqrt{75} = \sqrt{25 \times 3} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$,
- $\sqrt{72} = \sqrt{36 \times 2} = \sqrt{36} \times \sqrt{2} = 6\sqrt{2}$,
- $\sqrt[3]{16} = \sqrt[3]{8 \times 2} = \sqrt[3]{8} \times \sqrt[3]{2} = 2\sqrt[3]{2}$,
- $\sqrt[3]{108} = \sqrt[3]{27 \times 4} = \sqrt[3]{27} \times \sqrt[3]{4} = 3\sqrt[3]{4}$.

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Of course if we want to go in the opposite direction (as is often the case) we do the exact opposite.

- $\sqrt{75} = \sqrt{25 \times 3} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$,
- $\sqrt{72} = \sqrt{36 \times 2} = \sqrt{36} \times \sqrt{2} = 6\sqrt{2}$,
- $\sqrt[3]{16} = \sqrt[3]{8 \times 2} = \sqrt[3]{8} \times \sqrt[3]{2} = 2\sqrt[3]{2}$,
- $\sqrt[3]{108} = \sqrt[3]{27 \times 4} = \sqrt[3]{27} \times \sqrt[3]{4} = 3\sqrt[3]{4}$.

The point is that if we are dealing with square roots $\sqrt{\ }$ we want to express the number as a product of a square number (4,9,16,25,...) times something,

Simplifying surds

Of course if we want to go in the opposite direction (as is often the case) we do the exact opposite.

- $\sqrt{75} = \sqrt{25 \times 3} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$,
- $\sqrt{72} = \sqrt{36 \times 2} = \sqrt{36} \times \sqrt{2} = 6\sqrt{2}$,
- $\sqrt[3]{16} = \sqrt[3]{8 \times 2} = \sqrt[3]{8} \times \sqrt[3]{2} = 2\sqrt[3]{2}$,
- $\sqrt[3]{108} = \sqrt[3]{27 \times 4} = \sqrt[3]{27} \times \sqrt[3]{4} = 3\sqrt[3]{4}$.

The point is that if we are dealing with square roots $\sqrt{\ }$ we want to express the number as a product of a square number (4,9,16,25,...) times something, if we're dealing with a cube root $\sqrt[3]{\ }$ we want a cube number (8,27,64,125,...) times something, etc.

Simplifying surds

Practice:

- $\sqrt{32} =$

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} =$

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,
- $\sqrt{147} =$

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,
- $\sqrt{147} = \sqrt{49 \times 3} = 7\sqrt{3}$,

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,
- $\sqrt{147} = \sqrt{49 \times 3} = 7\sqrt{3}$,
- $\sqrt{63} =$

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,
- $\sqrt{147} = \sqrt{49 \times 3} = 7\sqrt{3}$,
- $\sqrt{63} = \sqrt{9 \times 7} = 3\sqrt{7}$,

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,
- $\sqrt{147} = \sqrt{49 \times 3} = 7\sqrt{3}$,
- $\sqrt{63} = \sqrt{9 \times 7} = 3\sqrt{7}$,
- $\sqrt{80} =$

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,
- $\sqrt{147} = \sqrt{49 \times 3} = 7\sqrt{3}$,
- $\sqrt{63} = \sqrt{9 \times 7} = 3\sqrt{7}$,
- $\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$,

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,
- $\sqrt{147} = \sqrt{49 \times 3} = 7\sqrt{3}$,
- $\sqrt{63} = \sqrt{9 \times 7} = 3\sqrt{7}$,
- $\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$,
- $\sqrt{125} =$

Simplifying surds

Practice:

- $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$,
- $\sqrt{162} = \sqrt{81 \times 2} = 9\sqrt{2}$,
- $\sqrt{147} = \sqrt{49 \times 3} = 7\sqrt{3}$,
- $\sqrt{63} = \sqrt{9 \times 7} = 3\sqrt{7}$,
- $\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$,
- $\sqrt{125} = \sqrt{25 \times 5} = 5\sqrt{5}$.

Simplifying surds

More practice:

- $\sqrt[3]{32} =$

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} =$

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,
- $\sqrt[3]{250} =$

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,
- $\sqrt[3]{250} = \sqrt[3]{125 \times 2} = 5\sqrt[3]{2}$,

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,
- $\sqrt[3]{250} = \sqrt[3]{125 \times 2} = 5\sqrt[3]{2}$,
- $\sqrt[3]{56} =$

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,
- $\sqrt[3]{250} = \sqrt[3]{125 \times 2} = 5\sqrt[3]{2}$,
- $\sqrt[3]{56} = \sqrt[3]{8 \times 7} = 2\sqrt[3]{7}$,

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,
- $\sqrt[3]{250} = \sqrt[3]{125 \times 2} = 5\sqrt[3]{2}$,
- $\sqrt[3]{56} = \sqrt[3]{8 \times 7} = 2\sqrt[3]{7}$,
- $\sqrt[4]{162} =$

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,
- $\sqrt[3]{250} = \sqrt[3]{125 \times 2} = 5\sqrt[3]{2}$,
- $\sqrt[3]{56} = \sqrt[3]{8 \times 7} = 2\sqrt[3]{7}$,
- $\sqrt[4]{162} = \sqrt[4]{81 \times 2} = 3\sqrt[4]{2}$,

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,
- $\sqrt[3]{250} = \sqrt[3]{125 \times 2} = 5\sqrt[3]{2}$,
- $\sqrt[3]{56} = \sqrt[3]{8 \times 7} = 2\sqrt[3]{7}$,
- $\sqrt[4]{162} = \sqrt[4]{81 \times 2} = 3\sqrt[4]{2}$,
- $\sqrt[4]{80} =$

Simplifying surds

More practice:

- $\sqrt[3]{32} = \sqrt[3]{8 \times 4} = 2\sqrt[3]{4}$,
- $\sqrt[3]{81} = \sqrt[3]{27 \times 3} = 3\sqrt[3]{3}$,
- $\sqrt[3]{250} = \sqrt[3]{125 \times 2} = 5\sqrt[3]{2}$,
- $\sqrt[3]{56} = \sqrt[3]{8 \times 7} = 2\sqrt[3]{7}$,
- $\sqrt[4]{162} = \sqrt[4]{81 \times 2} = 3\sqrt[4]{2}$,
- $\sqrt[4]{80} = \sqrt[4]{16 \times 2} = 2\sqrt[4]{5}$.

Rationalizing

Sometimes we may want to have a rational number in a denominator/numerator.

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Sometimes we may want to have a rational number in a denominator/numerator. We start with a number like $\frac{5}{\sqrt{2}}$ and we don't want the irrational number in the denominator. The trick here is to multiply this number by 1 (we can't multiply by anything else as it would change the number), but 1 written in the form $\frac{\sqrt{2}}{\sqrt{2}}$:

Rationalizing

Sometimes we may want to have a rational number in a denominator/numerator. We start with a number like $\frac{5}{\sqrt{2}}$ and we don't want the irrational number in the denominator. The trick here is to multiply this number by 1 (we can't multiply by anything else as it would change the number), but 1 written in the form $\frac{\sqrt{2}}{\sqrt{2}}$:

$$\frac{5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{5 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{5\sqrt{2}}{2}$$

Rationalizing

Sometimes we may want to have a rational number in a denominator/numerator. We start with a number like $\frac{5}{\sqrt{2}}$ and we don't want the irrational number in the denominator. The trick here is to multiply this number by 1 (we can't multiply by anything else as it would change the number), but 1 written in the form $\frac{\sqrt{2}}{\sqrt{2}}$:

$$\frac{5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{5 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{5\sqrt{2}}{2}$$

And we no longer have an irrational number in the denominator.

Rationalizing

Examples:

- $\frac{4}{\sqrt{3}} =$

Rationalizing

Examples:

- $\dfrac{4}{\sqrt{3}} = \dfrac{4}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} =$

Rationalizing

Examples:

- $\dfrac{4}{\sqrt{3}} = \dfrac{4}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{4\sqrt{3}}{3}$,

Rationalizing

Examples:

- $\dfrac{4}{\sqrt{3}} = \dfrac{4}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{4\sqrt{3}}{3}$,
- $\dfrac{2}{\sqrt{5}} =$

Rationalizing

Examples:

- $\dfrac{4}{\sqrt{3}} = \dfrac{4}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{4\sqrt{3}}{3}$,
- $\dfrac{2}{\sqrt{5}} = \dfrac{2}{\sqrt{5}} \times \dfrac{\sqrt{5}}{\sqrt{5}} =$

Rationalizing

Examples:

- $\dfrac{4}{\sqrt{3}} = \dfrac{4}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{4\sqrt{3}}{3}$,
- $\dfrac{2}{\sqrt{5}} = \dfrac{2}{\sqrt{5}} \times \dfrac{\sqrt{5}}{\sqrt{5}} = \dfrac{2\sqrt{5}}{5}$,

Rationalizing

Examples:

- $\dfrac{4}{\sqrt{3}} = \dfrac{4}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{4\sqrt{3}}{3}$,
- $\dfrac{2}{\sqrt{5}} = \dfrac{2}{\sqrt{5}} \times \dfrac{\sqrt{5}}{\sqrt{5}} = \dfrac{2\sqrt{5}}{5}$,
- $\dfrac{6}{\sqrt{3}} =$

Rationalizing

Examples:

- $\frac{4}{\sqrt{3}} = \frac{4}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{4\sqrt{3}}{3}$,
- $\frac{2}{\sqrt{5}} = \frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$,
- $\frac{6}{\sqrt{3}} = \frac{6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} =$

Rationalizing

Examples:

- $\frac{4}{\sqrt{3}} = \frac{4}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{4\sqrt{3}}{3}$,
- $\frac{2}{\sqrt{5}} = \frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$,
- $\frac{6}{\sqrt{3}} = \frac{6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{6\sqrt{3}}{3} = 2\sqrt{3}$,

Rationalizing

Examples:

- $\frac{4}{\sqrt{3}} = \frac{4}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{4\sqrt{3}}{3}$,
- $\frac{2}{\sqrt{5}} = \frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$,
- $\frac{6}{\sqrt{3}} = \frac{6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{6\sqrt{3}}{3} = 2\sqrt{3}$,
- $\frac{10}{\sqrt{2}} =$

Rationalizing

Examples:

- $\dfrac{4}{\sqrt{3}} = \dfrac{4}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{4\sqrt{3}}{3}$,
- $\dfrac{2}{\sqrt{5}} = \dfrac{2}{\sqrt{5}} \times \dfrac{\sqrt{5}}{\sqrt{5}} = \dfrac{2\sqrt{5}}{5}$,
- $\dfrac{6}{\sqrt{3}} = \dfrac{6}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{6\sqrt{3}}{3} = 2\sqrt{3}$,
- $\dfrac{10}{\sqrt{2}} = \dfrac{10}{\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} =$

Rationalizing

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Now consider a harder example. Suppose we want to rationalize the denominator in the expression $\dfrac{1}{\sqrt{3}-1}$.

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$$\frac{1}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{\sqrt{3}+1}{(\sqrt{3}-1)(\sqrt{3}+1)} = \frac{\sqrt{3}+1}{3-1} = \frac{\sqrt{3}+1}{2}$$

Rationalizing

Examples:

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- $\frac{2}{\sqrt{2}-1} = \frac{2}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} = \frac{2\sqrt{2}+2}{2-1} = 2\sqrt{2}+2,$

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More examples:

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- $\dfrac{5}{\sqrt{3}+1} = \dfrac{5}{\sqrt{3}+1} \times \dfrac{\sqrt{3}-1}{\sqrt{3}-1} = \dfrac{5\sqrt{3}-5}{3-1} = \dfrac{5\sqrt{3}-5}{2}$,

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- $\frac{5}{\sqrt{3}+1} = \frac{5}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} = \frac{5\sqrt{3}-5}{3-1} = \frac{5\sqrt{3}-5}{2}$,
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- $\dfrac{5}{\sqrt{3}+1} = \dfrac{5}{\sqrt{3}+1} \times \dfrac{\sqrt{3}-1}{\sqrt{3}-1} = \dfrac{5\sqrt{3}-5}{3-1} = \dfrac{5\sqrt{3}-5}{2}$,
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- $\dfrac{3}{3+\sqrt{2}} = \dfrac{3}{3+\sqrt{2}} \times \dfrac{3-\sqrt{2}}{3-\sqrt{2}} = \dfrac{9-3\sqrt{2}}{9-2} = \dfrac{9-3\sqrt{2}}{7}$,
- $\dfrac{2}{\sqrt{3}-\sqrt{2}} =$

Rationalizing

More examples:

- $$\frac{5}{\sqrt{3}+1}=\frac{5}{\sqrt{3}+1}\times\frac{\sqrt{3}-1}{\sqrt{3}-1}=\frac{5\sqrt{3}-5}{3-1}=\frac{5\sqrt{3}-5}{2},$$
- $$\frac{2}{\sqrt{5}+1}=\frac{2}{\sqrt{5}+1}\times\frac{\sqrt{5}-1}{\sqrt{5}-1}=\frac{2\sqrt{5}-2}{5-1}=\frac{\sqrt{5}-1}{2},$$
- $$\frac{3}{3+\sqrt{2}}=\frac{3}{3+\sqrt{2}}\times\frac{3-\sqrt{2}}{3-\sqrt{2}}=\frac{9-3\sqrt{2}}{9-2}=\frac{9-3\sqrt{2}}{7},$$
- $$\frac{2}{\sqrt{3}-\sqrt{2}}=\frac{2}{\sqrt{3}-\sqrt{2}}\times\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}}=$$

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More examples:

- $\dfrac{5}{\sqrt{3}+1} = \dfrac{5}{\sqrt{3}+1} \times \dfrac{\sqrt{3}-1}{\sqrt{3}-1} = \dfrac{5\sqrt{3}-5}{3-1} = \dfrac{5\sqrt{3}-5}{2}$,
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- $\dfrac{2}{\sqrt{3}-\sqrt{2}} = \dfrac{2}{\sqrt{3}-\sqrt{2}} \times \dfrac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}} = \dfrac{2\sqrt{3}-2\sqrt{2}}{3-2} = 2\sqrt{3}-2\sqrt{2}$,

Rationalizing

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- $\dfrac{5}{\sqrt{3}+1} = \dfrac{5}{\sqrt{3}+1} \times \dfrac{\sqrt{3}-1}{\sqrt{3}-1} = \dfrac{5\sqrt{3}-5}{3-1} = \dfrac{5\sqrt{3}-5}{2}$,
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- $\dfrac{2}{\sqrt{3}-\sqrt{2}} = \dfrac{2}{\sqrt{3}-\sqrt{2}} \times \dfrac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}} = \dfrac{2\sqrt{3}-2\sqrt{2}}{3-2} = 2\sqrt{3}-2\sqrt{2}$,
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Rationalizing

More examples:

- $\dfrac{5}{\sqrt{3}+1} = \dfrac{5}{\sqrt{3}+1} \times \dfrac{\sqrt{3}-1}{\sqrt{3}-1} = \dfrac{5\sqrt{3}-5}{3-1} = \dfrac{5\sqrt{3}-5}{2}$,
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- $\dfrac{2}{\sqrt{3}-\sqrt{2}} = \dfrac{2}{\sqrt{3}-\sqrt{2}} \times \dfrac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}} = \dfrac{2\sqrt{3}-2\sqrt{2}}{3-2} = 2\sqrt{3}-2\sqrt{2}$,
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- $\dfrac{4}{\sqrt{5}-\sqrt{3}} = \dfrac{4}{\sqrt{5}-\sqrt{3}} \times \dfrac{\sqrt{5}+\sqrt{3}}{\sqrt{5}+\sqrt{3}} = \dfrac{4\sqrt{5}+4\sqrt{3}}{5-3} = 2\sqrt{5}+2\sqrt{3}$.

The short test at the beginning of the next class will consist simplifying expressions with roots and rationalizing the denominator.

If you have any questions or doubts email me at T.J.Lechowski@gmail.com