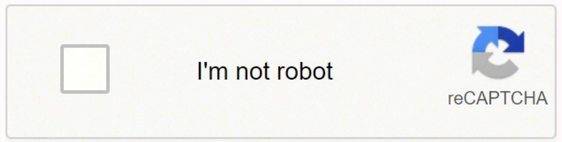


Open

# Rationalising the denominator worksheet and answers

Addition for Fractions
Different Denominators 6
Math Worksheet 1

Name: **Answer Key**

**Solve the fraction problem and reduce the answer to simplest form:**

$5\frac{2}{14} + 2\frac{16}{22} = 5\frac{22}{154} + 2\frac{112}{154} \triangleright 7\frac{134}{154} \triangleright 7\frac{67}{77}$

$6\frac{16}{25} + 8\frac{3}{16} = 6\frac{256}{400} + 8\frac{75}{400} \triangleright 14\frac{331}{400}$

$11\frac{2}{9} + 12\frac{6}{14} = 11\frac{28}{126} + 12\frac{54}{126} \triangleright 23\frac{82}{126} \triangleright 23\frac{41}{63}$

$6\frac{3}{34} + 9\frac{14}{28} = 6\frac{42}{476} + 9\frac{238}{476} \triangleright 15\frac{280}{476} \triangleright 15\frac{10}{17}$

$2\frac{15}{24} + 6\frac{5}{15} = 2\frac{75}{120} + 6\frac{40}{120} \triangleright 8\frac{115}{120} \triangleright 8\frac{23}{24}$

$9\frac{5}{16} + 3\frac{1}{36} = 9\frac{45}{144} + 3\frac{4}{144} \triangleright 12\frac{49}{144}$

$6\frac{5}{10} + 18\frac{4}{9} = 6\frac{45}{90} + 18\frac{40}{90} \triangleright 24\frac{85}{90} \triangleright 24\frac{17}{18}$

$3\frac{2}{9} + 19\frac{7}{35} = 3\frac{70}{315} + 19\frac{63}{315} \triangleright 22\frac{133}{315} \triangleright 22\frac{19}{45}$

$5\frac{1}{16} + 18\frac{16}{26} = 5\frac{13}{208} + 18\frac{128}{208} \triangleright 23\frac{141}{208}$

$16\frac{6}{9} + 6\frac{1}{18} = 16\frac{12}{18} + 6\frac{1}{18} \triangleright 22\frac{13}{18}$



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Name: ..... Class: .....

Add and subtract fractions with unlike denominators

Add or subtract the following fractions.

a. $\frac{3}{4} + \frac{1}{5}$

Multiples of 4: 4, 8, 12, 16, 20...
Multiples of 5: 5, 10, 15, 20, 25...
The LCM of 4 and 5 is 20

$\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$ and $\frac{1 \times 4}{5 \times 4} = \frac{4}{20}$

$\frac{15}{20} + \frac{4}{20} = \frac{15+4}{20} = \frac{19}{20}$

Therefore, $\frac{3}{4} + \frac{1}{5} = \frac{19}{20}$

b. $\frac{3}{4} - \frac{1}{5}$

Add the following fractions and write the correct answer.

c. $\frac{5}{12} + \frac{1}{3} = \frac{9}{12}$ $\quad \frac{3}{5} + \frac{6}{10} =$ $\quad \frac{11}{20} + \frac{7}{8} =$

d. $\frac{6}{10} + \frac{17}{20} =$ $\quad \frac{17}{20} + \frac{22}{25} =$ $\quad \frac{13}{18} + \frac{1}{27} =$

Subtract the following fractions and write the correct answer.

e. $\frac{2}{3} - \frac{4}{7} =$ $\quad \frac{6}{9} - \frac{3}{5} =$ $\quad \frac{7}{9} - \frac{8}{15} =$

f. $\frac{3}{4} - \frac{5}{9} =$ $\quad \frac{2}{3} - \frac{7}{11} =$ $\quad \frac{4}{5} - \frac{1}{10} =$



How to Rationalise the Denominator Easily

$\frac{5}{\sqrt{2}}$ $\quad \frac{7}{3\sqrt{5}}$ $\quad \frac{5}{2\sqrt{8}}$

## Subtracting Fractions

Name: _____ Score: _____

Calculate and show your answers in the lowest terms

| | | |
|---|---|---|
| $\frac{5}{6} - \frac{1}{2} =$ | $\frac{2}{3} - \frac{1}{6} =$ |  |
| $\frac{5}{8} - \frac{1}{4} =$ | $\frac{4}{6} - \frac{1}{3} =$ | |
| $\frac{2}{2} - \frac{1}{4} =$ | $\frac{3}{8} - \frac{1}{4} =$ | |
| $\frac{1}{4} - \frac{1}{8} =$ | $\frac{3}{5} - \frac{2}{10} =$ | $\frac{6}{9} - \frac{1}{3} =$ |
| $\frac{1}{2} - \frac{1}{8} =$ | $\frac{3}{4} - \frac{1}{8} =$ | $\frac{1}{3} - \frac{1}{9} =$ |
| $\frac{1}{5} - \frac{1}{10} =$ | $\frac{4}{6} - \frac{1}{2} =$ | $\frac{1}{2} - \frac{1}{6} =$ |
| $\frac{2}{5} - \frac{2}{10} =$ | $\frac{3}{9} - \frac{0}{3} =$ | $\frac{4}{6} - \frac{1}{3} =$ |
| $\frac{4}{4} - \frac{2}{8} =$ | $\frac{3}{4} - \frac{3}{8} =$ | $\frac{5}{6} - \frac{1}{6} =$ |
| $\frac{5}{6} - \frac{1}{3} =$ | $\frac{3}{8} - \frac{1}{8} =$ | $\frac{6}{8} - \frac{1}{2} =$ |
| $\frac{2}{3} - \frac{1}{6} =$ | $\frac{4}{8} - \frac{1}{4} =$ | $\frac{1}{5} - \frac{1}{10} =$ |



Multiplying Mixed Numbers
Worksheet 1
Item 3402a

Name _____

## Multiplying Mixed Numbers

Worksheet 1

Find the product.

A. $5\frac{5}{8} \times 1\frac{1}{2} =$ _____

B. $5 \times 3\frac{2}{5} =$ _____

C. $8\frac{4}{5} \times 10 =$ _____

D. $81\frac{5}{12} \times 84 =$ _____

E. $12 \times 3\frac{5}{6} =$ _____

F. $16 \times 14\frac{5}{8} =$ _____

G. $9 \times 8\frac{5}{6} =$ _____

H. $13\frac{3}{5} \times 9 =$ _____

I. $12 \times 7\frac{5}{8} =$ _____

J. $22\frac{3}{8} \times 15 =$ _____

K. $8 \times 5\frac{5}{7} =$ _____

L. $12\frac{3}{8} \times 5 =$ _____

M. $2\frac{1}{9} \times 27 =$ _____

N. $15\frac{5}{7} \times 28 =$ _____

O. $13 \times 6\frac{8}{9} =$ _____

P. $11 \times \frac{1}{3} =$ _____

Q. $12\frac{5}{6} \times 18 =$ _____

R. $7\frac{1}{4} \times 7 =$ _____

S. $24 \times 15\frac{7}{8} =$ _____

T. $3\frac{1}{6} \times 12 =$ _____



There are two types of question you may encounter, one harder then the other. \sqrt{\textcolor{red}{a}} \times \sqrt{\textcolor{blue}{b}} = \sqrt{\textcolor{red}{a}\times \textcolor{blue}{b}} Example: \sqrt{7} \times \sqrt{2} = \sqrt{7 \times 2} = \sqrt{14} 2\sqrt{2} \times 3\sqrt{5} = 2\times 3 \times \sqrt{2\times5} = 6\sqrt{10} \sqrt{6}^2 = \sqrt{6} \times \sqrt{6} = \sqrt{6\times6} =\sqrt{36} = 6 Level 6-7 GCSE When dividing surds you simply divide the numbers inside the square root. \dfrac{\textcolor{red}{a}}{\sqrt{\textcolor{blue}{b}}} = \dfrac{\textcolor{red}{a}}{\sqrt{\textcolor{blue}{b}}} \times \dfrac{\sqrt{\textcolor{blue}{b}}}{\sqrt{\textcolor{blue}{b}}} = \dfrac{\textcolor{red}{a}\sqrt{\textcolor{blue}{b}}}{\textcolor{blue}{b}} Level 8-9 GCSE Rationalising the denominator when there are other terms as well as the surd can be much more tricky. Example: Rationalise the denominator of the following fraction \dfrac{\textcolor{red}{a}}{\sqrt{\textcolor{blue}{b}}} Simply multiply the top and bottom of the fraction by the denominator of the fraction. Example: Write \sqrt{28} in simplified surd form. So, the numerator becomes 7\times(\sqrt{10}+1)=7\sqrt{10}+7 Then, using FOIL, the denominator becomes (\sqrt{10}-1)(\sqrt{10}+1)=\sqrt{10}\times\sqrt{10}+1\times\sqrt{10}-1\times\sqrt{10}-1\times1 Completing each multiplication, including applying the multiplication law to the first term, we get \sqrt{10\times10}+\sqrt{10}-\sqrt{10}-1 The first term is \sqrt{10\times10}=\sqrt{100}=10. Level 6-7 GCSE When multiplying surds you simply multiply the numbers inside the square root. \begin{aligned} \dfrac{\textcolor{red}{5}}{\textcolor{blue}{3+\sqrt{5}}} &= \dfrac{\textcolor{red}{5}}{\textcolor{blue}{3+\sqrt{5}}} \times \dfrac{\textcolor{limegreen}{3-\sqrt{5}}}{\textcolor{limegreen}{3-\sqrt{5}}} \\ &= \dfrac{\textcolor{red}{5}\textcolor{limegreen}{(3-\sqrt{5})}}{\textcolor{blue}{(3+\sqrt{5})}\textcolor{limegreen}{(3-\sqrt{5})}} \\ &= \dfrac{15-5\sqrt{5}}{9-3\sqrt{5} + 3\sqrt{5} -5} \\ &= \dfrac{15-5\sqrt{5}}{9 - 5} \\ &= \dfrac{15-5\sqrt{5}}{4} \end{aligned} Level 8-9 GCSE Level 6-7 GCSE Rationalise the denominator of \dfrac{3}{\sqrt{5}} [2 marks] This would be Type 1 so we simply need to multiply the top and bottom of the fraction by the denominator of the fraction \dfrac{3}{\sqrt{5}} \times \dfrac{\sqrt{5}}{\sqrt{5}} = \dfrac{3\sqrt{5}}{\sqrt{5}\sqrt{5}} We know, \sqrt{5}\sqrt{5} = \sqrt{25} = 5 So, \dfrac{3\sqrt{5}}{\sqrt{5}\sqrt{5}} = \dfrac{3\sqrt{5}}{5} The denominator no longer involves a surd, only a 5 – which is a rational number – and so we have successfully rationalised the denominator. Specifically, 72=25\times3 Using the multiplication rule, we can write, \sqrt{75}=\sqrt{3\times25}=\sqrt{3}\times\sqrt{25} The square root of 25 is 5, so this becomes, \sqrt{3}\times\sqrt{25}=\sqrt{3}\times5=5\sqrt{3} Thus, the answer in simplified surd form is 5\sqrt{3} \sqrt{63}=\sqrt{9\times7}=\sqrt{9}\times\sqrt{7}=3\sqrt7 Using, \sqrt{\frac{a}{b}}=\frac{\sqrt{a}}{\sqrt{b}}, the expresion can be simplified to, \sqrt{\dfrac{3}{16}}=\dfrac{\sqrt3}{\sqrt16}=\dfrac{\sqrt3}{4} We will multiply the top and bottom of this fraction by the surd on the bottom: \sqrt{3} Doing so, we get, \dfrac{12}{\sqrt{3}}=\dfrac{12\times\sqrt{3}}{\sqrt{3}\times\sqrt{3}} The numerator is just 12\sqrt{3}. This means we must multiply by (5-\sqrt{2}). Using the multiplication rule, the denominator is \sqrt{3}\times\sqrt{3}=\sqrt{3\times3}=\sqrt{9}=3 Therefore, the fraction is, \dfrac{12\sqrt{3}}{3} However, this is not in its simplest form. \dfrac{\sqrt{\textcolor{red}{a}}}{\sqrt{\textcolor{blue}{b}}} = \sqrt{\dfrac{\textcolor{red}{a}}{\textcolor{blue}{b}}} Example: \dfrac{\sqrt{10}}{\sqrt{5}} = \sqrt{\dfrac{10}{5}} = \sqrt{2} \dfrac{8\sqrt{12}}{2\sqrt{3}} = \dfrac{8}{2}\times\sqrt{\dfrac{12}{3}} = 4\times\sqrt{4} = 4\times 2 = 8 Level 6-7 GCSE It is only possible to add and subtract “like” surds, this is similar to collecting like terms \sqrt{a} + \sqrt{a} = 2\sqrt{a} 5\sqrt{b} - 2\sqrt{b} = 3\sqrt{b} Do NOT do this: \xcancel{\sqrt{a} + \sqrt{b} = \sqrt{a+b}} Level 6-7 GCSE Level 6-7 GCSE Surds can be simplified if the number within the surd has a square number as one of its factors. So, denominator finally becomes 10-1=9 Thus, the fraction is \dfrac{7\sqrt{10}+7}{9} This can also be written as \dfrac{7(1+\sqrt{10})}{9} Related Topics Worksheet and Example Questions Drill Questions Level 6-7 GCSE Rationalise the denominator of the following fraction. There is one: 25. + becomes - and - becomes +. The Numerator: 8(5-\sqrt{2})=(8\times5)+(8\times(-\sqrt{2}))=40-8\sqrt{2} The Denominator: \begin{aligned}(5+\sqrt{2})(5-\sqrt{2})&=5^2-5\sqrt{2}+5\sqrt{2}-\sqrt{2}^2 \\ &=25-5\sqrt{2}+5\sqrt{2}- 2 \\ &= 25 -2 \\ &= 23 \end{aligned} Therefore, we can now reform our fraction giving our final answer, \dfrac{40-8\sqrt{2}}{23} Level 8-9 GCSE We are looking for a square number that goes into 75. The numerator becomes \dfrac{8}{5+\sqrt{2}} \times \dfrac{(5-\sqrt{2})}{(5-\sqrt{2})} = \dfrac{8(5-\sqrt{2})}{(5+\sqrt{2})(5-\sqrt{2})} Now we need to multiply out the top and the bottom of the fraction, then simplify. 28 = \textcolor{red}{4} \times 7 \sqrt{28}=\sqrt{4\times7}=\sqrt{\textcolor{red}{4}}\times\sqrt{7} We know that \sqrt{\textcolor{red}{4}} = \textcolor{red}{2} \sqrt{28}=\textcolor{red}{2}\times\sqrt{7}=\textcolor{red}{2}\sqrt{7} Level 6-7 GCSE We can multiply out double brackets containing surds the same way as for quadratics using FOIL, then collect like terms. This is going to involve some bracket expanding. The first type is shown below. (m+\sqrt{n}) (m+\sqrt{n})=\textcolor{red}{m^2}+\textcolor{limegreen}{m\sqrt{n}}+\textcolor{purple}{m\sqrt{n}}+\textcolor{blue}{n}\\ = \textcolor{red}{m^2}+\textcolor{maroon}{2m\sqrt{n}}+\textcolor{blue}{n} Example: \begin{aligned} &(\sqrt{10} + \sqrt{3})(\sqrt{10} - \sqrt{3}) \\ &= \sqrt{10}^2 - \sqrt{3}\sqrt{10} + \sqrt{3}\sqrt{10} - \sqrt{3}^2 \\ &= 10 -\sqrt{30} + \sqrt{30} -3 \\ &= 10 - 3 \\ &= 7 \end{aligned} Level 6-7 GCSE Level 6-7 GCSE Rationalising the denominator just means removing the surd from the bottom of a fraction. Example: Rationalise the denominator of the following fraction \dfrac{\textcolor{red}{5}}{\textcolor{blue}{3+\sqrt{5}}} Multiply the top and the bottom of the fraction by the denominator with the sign changed. \dfrac{8}{5+\sqrt{2}} [4 marks] This is a Type 2 so we need to multiply the top and the bottom of the fraction by the denominator with the sign changed. We need need to think of a square number which is a factor of 28. We can cancel a factor of 3 from the top and bottom and get, \dfrac{12\sqrt{3}}{3}=\dfrac{4\sqrt{3}}{1}=4\sqrt{3} We will multiply top and bottom of this fraction by (\sqrt{10}+1).

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