

Surds

Q1. Write as a single power

a. $\sqrt{3}$

b. $\sqrt[3]{5}$

c. $\sqrt{k^4}$

d. $\sqrt{x^3}$

e. $1/\sqrt{x^3}$

f. $\sqrt{t^2}$

g. $\sqrt{m^3}$

h. $1/\sqrt{7}$

i. $1/\sqrt[3]{2}$

j. $1/\sqrt[3]{2^2}$

Q2. Express the following surds in the form of $a\sqrt{b}$

a. $\sqrt{18}$

b. $\sqrt{24}$

c. $\sqrt{12}$

d. $\sqrt{50}$

e. $\sqrt{8}$

f. $\sqrt{27}$

g. $\sqrt{48}$

h. $\sqrt{75}$

i. $\sqrt{45}$

j. $\sqrt{63}$

k. $\sqrt{32}$

l. $\sqrt{200}$

Q3. Simplify each of the following surds. Leave your answers in surd form.

a. $\sqrt{2} \times \sqrt{3}$

b. $\sqrt{5} \times \sqrt{3}$

c. $\sqrt{2} \times \sqrt{2}$

d. $\sqrt{2} \times \sqrt{8}$

e. $\sqrt{5} \times \sqrt{8}$

f. $\sqrt{3} \times \sqrt{3}$

g. $\sqrt{6} \times \sqrt{2}$

h. $\sqrt{7} \times \sqrt{3}$

Q4. Simplify each of the following. Leave your answers in surd form.

a. $\sqrt{12} \div \sqrt{3}$

b. $\sqrt{15} \div \sqrt{3}$

c. $\sqrt{12} \div \sqrt{2}$

d. $\sqrt{24} \div \sqrt{8}$

e. $\sqrt{40} \div \sqrt{8}$

f. $\sqrt{3} \div \sqrt{3}$

g. $\sqrt{6} \div \sqrt{2}$

h. $\sqrt{21} \div \sqrt{3}$

i. $\sqrt{28} \div \sqrt{7}$

j. $\sqrt{48} \div \sqrt{8}$

k. $\sqrt{6} \div \sqrt{6}$

l. $\sqrt{54} \div \sqrt{6}$

Q5. Simplify each of the following. Leave your answers in surd form.

a $\sqrt{2} \times \sqrt{3} \times \sqrt{2}$

b $\sqrt{5} \times \sqrt{3} \times \sqrt{15}$

c $\sqrt{2} \times \sqrt{2} \times \sqrt{8}$

d $\sqrt{2} \times \sqrt{8} \times \sqrt{3}$

e $\sqrt{5} \times \sqrt{8} \times \sqrt{8}$

f $\sqrt{3} \times \sqrt{3} \times \sqrt{3}$

g $\sqrt{6} \times \sqrt{2} \times \sqrt{48}$

h $\sqrt{7} \times \sqrt{3} \times \sqrt{3}$

i $\sqrt{2} \times \sqrt{7} \times \sqrt{2}$

j $\sqrt{2} \times \sqrt{18} \times \sqrt{5}$

k $\sqrt{6} \times \sqrt{6} \times \sqrt{3}$

l $\sqrt{5} \times \sqrt{6} \times \sqrt{30}$

Q6. Simplify each of these.

a $2\sqrt{18} \times 3\sqrt{2}$

b $4\sqrt{24} \times 2\sqrt{5}$

c $3\sqrt{12} \times 3\sqrt{3}$

d $2\sqrt{8} \times 2\sqrt{8}$

e $2\sqrt{27} \times 4\sqrt{8}$

f $2\sqrt{48} \times 3\sqrt{8}$

g $2\sqrt{45} \times 3\sqrt{3}$

h $2\sqrt{63} \times 2\sqrt{7}$

i $2\sqrt{32} \times 4\sqrt{2}$

j $\sqrt{1000} \times \sqrt{10}$

k $\sqrt{250} \times \sqrt{10}$

l $2\sqrt{98} \times 2\sqrt{2}$

Q7. Simplify each of these.

a $4\sqrt{2} \times 5\sqrt{3}$

b $2\sqrt{5} \times 3\sqrt{3}$

c $4\sqrt{2} \times 3\sqrt{2}$

d $2\sqrt{2} \times 2\sqrt{8}$

e $2\sqrt{5} \times 3\sqrt{8}$

f $3\sqrt{3} \times 2\sqrt{3}$

g $2\sqrt{6} \times 5\sqrt{2}$

h $5\sqrt{7} \times 2\sqrt{3}$

i $2\sqrt{2} \times 3\sqrt{7}$

j $2\sqrt{2} \times 3\sqrt{18}$

k $2\sqrt{6} \times 2\sqrt{6}$

l $4\sqrt{5} \times 3\sqrt{6}$

Q8. Simplify each of these.

a $6\sqrt{12} \div 2\sqrt{3}$

b $3\sqrt{15} \div \sqrt{3}$

c $6\sqrt{12} \div \sqrt{2}$

d $4\sqrt{24} \div 2\sqrt{8}$

e $12\sqrt{40} \div 3\sqrt{8}$

f $5\sqrt{3} \div \sqrt{3}$

g $14\sqrt{6} \div 2\sqrt{2}$

h $4\sqrt{21} \div 2\sqrt{3}$

i $9\sqrt{28} \div 3\sqrt{7}$

j $12\sqrt{56} \div 6\sqrt{8}$

k $25\sqrt{6} \div 5\sqrt{6}$

l $32\sqrt{54} \div 4\sqrt{6}$

Q9. Simplify each of these.

a $4\sqrt{2} \times \sqrt{3} \div 2\sqrt{2}$

b $4\sqrt{5} \times \sqrt{3} \div \sqrt{15}$

c $2\sqrt{32} \times 3\sqrt{2} \div 2\sqrt{8}$

d $6\sqrt{2} \times 2\sqrt{8} \div 3\sqrt{8}$

e $3\sqrt{5} \times 4\sqrt{8} \div 2\sqrt{8}$

f $12\sqrt{3} \times 4\sqrt{3} \div 2\sqrt{3}$

g $3\sqrt{8} \times 3\sqrt{12} \div 3\sqrt{48}$

h $4\sqrt{7} \times 2\sqrt{3} \div 8\sqrt{3}$

i $15\sqrt{2} \times 2\sqrt{7} \div 3\sqrt{2}$

j $8\sqrt{2} \times 2\sqrt{18} \div 4\sqrt{3}$

k $5\sqrt{6} \times 5\sqrt{6} \div 5\sqrt{3}$

l $12\sqrt{5} \times 3\sqrt{6} \div \sqrt{30}$

Q10. Find the value of a that makes each of these surds true.

a $\sqrt{5} \times \sqrt{a} = 10$

b $\sqrt{6} \times \sqrt{a} = 12$

c $\sqrt{10} \times 2\sqrt{a} = 20$

d $2\sqrt{6} \times 3\sqrt{a} = 72$

e $2\sqrt{a} \times \sqrt{a} = 6$

f $3\sqrt{a} \times 3\sqrt{a} = 54$

Q11. Simplify the followings.

a) $\left(\frac{\sqrt{3}}{2}\right)^2 = \underline{\hspace{2cm}}$

b) $\left(\frac{5}{\sqrt{2}}\right)^2 = \underline{\hspace{2cm}}$

c) $\left(\frac{\sqrt{3}}{2}\right)^2 = \underline{\hspace{2cm}}$

d) $\left(\frac{\sqrt{5}}{4}\right)^2 = \underline{\hspace{2cm}}$

e) $\left(\frac{6}{\sqrt{3}}\right)^2 = \underline{\hspace{2cm}}$

f) $\left(\frac{\sqrt{8}}{2}\right)^2 = \underline{\hspace{2cm}}$

Q12. Simplify the following surds.

a) $\sqrt{12} + \sqrt{75} - \sqrt{27} = \underline{\hspace{2cm}}$

b) $\sqrt{162} + \sqrt{128} - 4\sqrt{50} = \underline{\hspace{2cm}}$

c) $\sqrt{44} - \sqrt{11} + \sqrt{99} = \underline{\hspace{2cm}}$

d) $\sqrt{32} + \sqrt{50} - \sqrt{98} = \underline{\hspace{2cm}}$

e) $\sqrt{48} - \sqrt{75} + \sqrt{108} = \underline{\hspace{2cm}}$

f) $\sqrt{112} + \sqrt{175} + \sqrt{28} = \underline{\hspace{2cm}}$

g) $\sqrt{200} - \sqrt{50} - \sqrt{18} = \underline{\hspace{2cm}}$

h) $\sqrt{176} + \sqrt{8} - \sqrt{99} = \underline{\hspace{2cm}}$

i) $\sqrt{18} + \sqrt{50} - \sqrt{32} = \underline{\hspace{2cm}}$

j) $\sqrt{75} + \sqrt{125} - 4\sqrt{50} = \underline{\hspace{2cm}}$

Example 1 $\frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{7}$

Q13. Rationalize the denominators of the following Questions

a) $\frac{2}{\sqrt{13}} =$

b) $\frac{3}{\sqrt{5}} =$

c) $\frac{3}{\sqrt{7}} =$

d) $\frac{1}{\sqrt{27}} =$

e) $\frac{12}{\sqrt{13}} =$

f) $\frac{9}{\sqrt{6}} =$

g) $\frac{6}{\sqrt{8}} =$

h) $\frac{\sqrt{3}}{\sqrt{21}} =$

i) $\frac{6}{\sqrt{3}} =$

j) $\frac{9}{\sqrt{3}} =$

Q14. Show that:

a) $(2 + \sqrt{3})(1 + \sqrt{3}) = 5 + 3\sqrt{3}$

b) $(1 + \sqrt{2})(2 + \sqrt{3}) = 2 + 2\sqrt{2} + \sqrt{3} + \sqrt{6}$

c) $(4 - \sqrt{3})(4 + \sqrt{3}) = 13$

d) $(\sqrt{32} + \sqrt{2})^2 = 50$

e) $\frac{\sqrt{12} + 6}{\sqrt{3}} = 2(1 + \sqrt{3})$

Q15. Expand and simplify where possible.

a) $\sqrt{3}(2 - \sqrt{3})$

b) $\sqrt{2}(3 - 4\sqrt{2})$

c) $\sqrt{5}(2\sqrt{5} + 4)$

d) $\underline{3\sqrt{7}(4 - 2\sqrt{7})}$

e) $\underline{3\sqrt{2}(5 - 2\sqrt{8})}$

f) $\underline{\sqrt{3}(\sqrt{27} - 1)}$

Expand and simplify where possible.

Q16. $(1 + \sqrt{3})(3 - \sqrt{3}) =$ _____

Q17. $(2 + \sqrt{5})(3 - \sqrt{5}) =$ _____

Q18. $(9 + \sqrt{7})(9 + \sqrt{7}) =$ _____

Q19. $(1 - \sqrt{2})(3 + 2\sqrt{2}) =$ _____

Q20. $(2 + \sqrt{5})^2 =$ _____

Q21. $(1 - \sqrt{2})^2 =$ _____

Q22. $(3 + \sqrt{2})^2 =$ _____

Q23. $(\sqrt{27}+3)(\sqrt{6} - \sqrt{3}) =$ _____

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

Rationalize the following questions

Q.24 $\frac{1}{\sqrt{5}-\sqrt{2}}$ _____

Q.25 $\frac{\sqrt{2}}{\sqrt{7}-\sqrt{2}}$ _____

Q.26 $\frac{3}{\sqrt{7}-\sqrt{2}}$ _____

Q.27 $\frac{5}{\sqrt{8}-\sqrt{2}}$ _____

Q.28 $\frac{9}{\sqrt{11}-\sqrt{2}}$ _____

Q.29 $\frac{5}{\sqrt{9}-\sqrt{4}}$ _____

Q.30 $\frac{a}{\sqrt{b}-\sqrt{c}}$ _____

Q.31 $\frac{9}{\sqrt{3}+1}$ _____

Q.32 $\frac{2}{\sqrt{5}+2}$ _____

Q.33 $\frac{\sqrt{3}+1}{\sqrt{3}-1}$ _____

Q.34 $\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$ _____

Q.35 $\frac{\sqrt{7}}{\sqrt{5}+3}$ _____