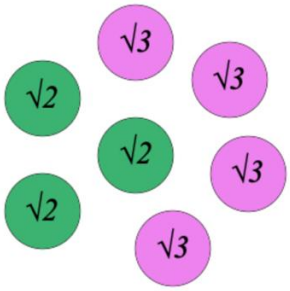
# Adding and Subtracting Surds

**1** The diagrams below shows a number of counters. The value of the counter is shown on each counter.
Write down the **total** value of all of the counters.

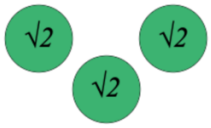
**Example**



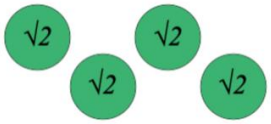

There are three $\sqrt{2}$ counters and four $\sqrt{3}$ counters.

Total = $\sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{3} + \sqrt{3}$
= $3 \times \sqrt{2} + 4 \times \sqrt{3}$
= $3\sqrt{2} + 4\sqrt{3}$

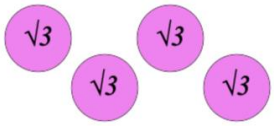
a)



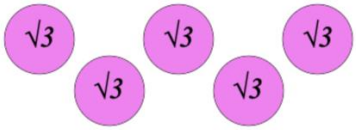

b)



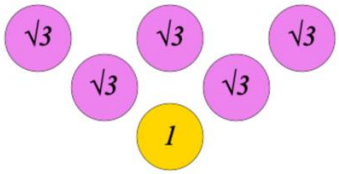

c)



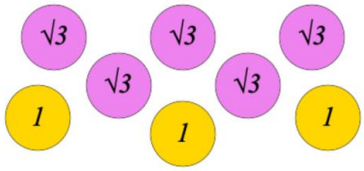

d)



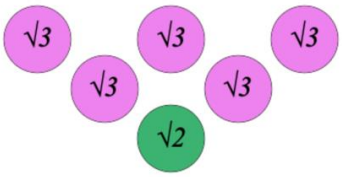

e)



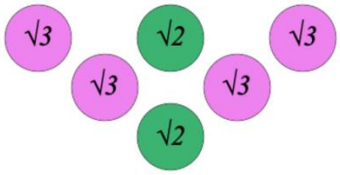

f)



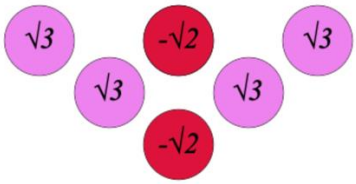

g)



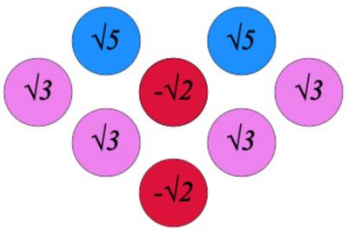

h)



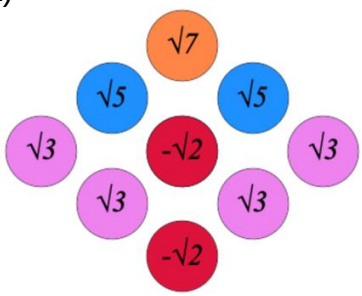

i)



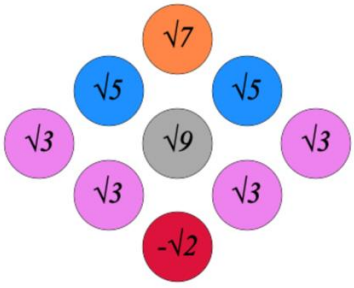

j)




k)




l)



**2** Write each of the following as a surd in the form $a\sqrt{b}$.

a) $\sqrt{3} + \sqrt{3}$ b) $\sqrt{3} + \sqrt{3} + \sqrt{3} + \sqrt{3}$ c) $\sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{2}$

d) $\sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{3}$ e) $\sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{3}$ f) $\sqrt{2} + \sqrt{2} + \sqrt{5} + \sqrt{5}$

g) $\sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{5}$ h) $\sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{5}$ i) $(\sqrt{2})^2 + \sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{5}$

**3** Write each of the following as a surd in the form $a\sqrt{b}$.

a) $\sqrt{3} - \sqrt{3}$ b) $\sqrt{3} + \sqrt{3} + \sqrt{3} - \sqrt{3}$ c) $\sqrt{2} - \sqrt{2} + \sqrt{2} + \sqrt{2}$

**4** Write each of the following as a surd in the form $a\sqrt{b}$.

a) $4\sqrt{2} + \sqrt{2}$ b) $5\sqrt{2} + \sqrt{2}$ c) $5\sqrt{2} + 2\sqrt{2}$

d) $5\sqrt{3} + 2\sqrt{3}$ e) $2\sqrt{3} + 5\sqrt{3}$ f) $7\sqrt{3} + 5\sqrt{3}$

g) $7\sqrt{3} - 5\sqrt{3}$ h) $5\sqrt{3} - 7\sqrt{3}$ i) $5\sqrt{3} - 7\sqrt{3} + \sqrt{5}$

j) $\sqrt{5} + 5\sqrt{3} - 7\sqrt{3}$ k) $2\sqrt{5} + 10\sqrt{3} - 14\sqrt{3}$ l) $(2\sqrt{5})^2 + 10\sqrt{3} - 14\sqrt{3}$

**5**

**5** Simplify the following:

a) $\sqrt{80} + \sqrt{20}$ b) $\sqrt{80} - \sqrt{20}$ c) $\sqrt{80} - \sqrt{20} + \sqrt{75}$

d) $\sqrt{160} - \sqrt{40}$ e) $2\sqrt{80} + 3\sqrt{20}$ f) $\sqrt{80} + \sqrt{20} - \sqrt{100}$

**6** Write each of the following as a surd in the form $a\sqrt{b}$.

a) $3\sqrt{2} + \sqrt{2}$

b) $3\sqrt{2} + 2\sqrt{2}$

c) $3\sqrt{2} + \sqrt{8}$

d) $5\sqrt{2} + \sqrt{8}$

e) $5\sqrt{2} + \sqrt{32}$

f) $5\sqrt{2} + \sqrt{50}$

g) $5\sqrt{2} + \sqrt{90}$

h) $5\sqrt{10} + \sqrt{90}$

i) $5\sqrt{10} + \sqrt{90} + \sqrt{10}$

j) $5\sqrt{10} + \sqrt{90} - \sqrt{10}$

k) $5\sqrt{10} + \sqrt{80} - \sqrt{10}$

l) $5\sqrt{10} + \sqrt{80} - \sqrt{5}$

m) $5\sqrt{10} + \sqrt{80} - 6\sqrt{5}$

n) $5\sqrt{10} + \sqrt{80} - 5\sqrt{5}$

o) $6\sqrt{10} + \sqrt{80} - 6\sqrt{5}$

p) $\frac{6\sqrt{10}}{2} + \frac{\sqrt{80}}{2} - \frac{6\sqrt{5}}{2}$

q) $\frac{6\sqrt{10} + \sqrt{80} - 6\sqrt{5}}{2}$

r) $\frac{6\sqrt{10} + 2\sqrt{80} - 6\sqrt{5}}{2}$

s) $\frac{6\sqrt{10} + 2\sqrt{80} - 10\sqrt{5}}{2}$

t) $\frac{6\sqrt{10} - 2\sqrt{80} - 10\sqrt{5}}{2}$

u) $\frac{6\sqrt{10} - 2\sqrt{80} - 10\sqrt{5}}{3}$

v) $\frac{2(6\sqrt{10} + 2\sqrt{80} - 10\sqrt{5})}{6}$

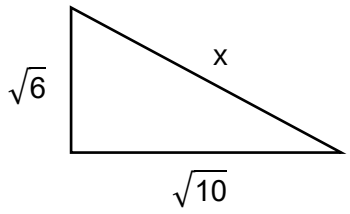
w) $\frac{12(6\sqrt{10} + 2\sqrt{80} - 10\sqrt{5})}{6}$

x) $2(5\sqrt{10} + \sqrt{80} - 5\sqrt{5})$

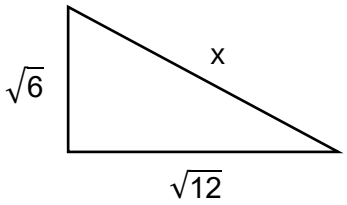
**7** Use Pythagoras' Theorem to find the missing side. Give your answer as a surd in its simplest form.

Do NOT use a calculator.

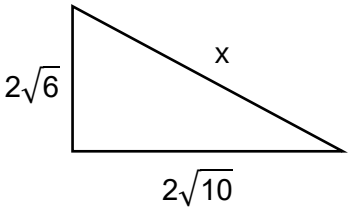
a)



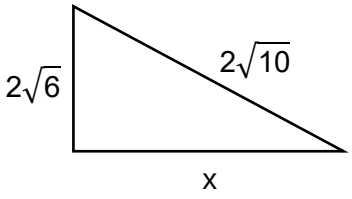

b)




c)




d)




**8** Work out the perimeter of this shape. Give your answer as a surd in the form $a\sqrt{b} + c\sqrt{d}$.