# REAL NUMBERS AND SURDS

Simplify all the expressions in this exercise, writing each answer with a rational denominator (or no denominator).

1 $\sqrt{8}$ 2 $\sqrt{20}$ 3 $\sqrt{27}$ 4 $\sqrt{32}$

① $\sqrt{8} = \sqrt{2^3} = \sqrt{2^2 \times 2} = \sqrt{2^2} \times \sqrt{2} = 2\sqrt{2}$

② $\sqrt{20} = \sqrt{2^2 \times 5} = \sqrt{2^2} \times \sqrt{5} = 2\sqrt{5}$

③ $\sqrt{27} = \sqrt{3^3} = \sqrt{3^2 \times 3} = \sqrt{3^2} \times \sqrt{3} = 3\sqrt{3}$

④ $\sqrt{32} = \sqrt{2^5} = \sqrt{2^4 \times 2} = \sqrt{2^4} \times \sqrt{2} = \sqrt{4^2} \times \sqrt{2} = 4\sqrt{2}$

6 $\sqrt{45}$ 7 $\sqrt{72}$ 8 $\sqrt{84}$ 9 $\sqrt{98}$ 10 $\sqrt{108}$ 11 $\sqrt{125}$

⑥ $\sqrt{45} = \sqrt{3^2 \times 5} = 3\sqrt{5}$

⑦ $\sqrt{72} = \sqrt{2^3 \times 3^2} = 6\sqrt{2}$

⑧ $\sqrt{84} = \sqrt{2^2 \times 3 \times 7} = 2\sqrt{21}$

⑨ $\sqrt{98} = \sqrt{2 \times 7^2} = 7\sqrt{2}$

⑩ $\sqrt{108} = \sqrt{2^2 \times 3^3} = 6\sqrt{3}$

⑪ $\sqrt{125} = \sqrt{5^3} = 5\sqrt{5}$

12 $\sqrt{162}$ 13 $\sqrt{200}$ 14 $5\sqrt{128}$ 15 $4\sqrt{800}$ 16 $2\sqrt{150}$ 17 $3\sqrt{52}$

⑫ $\sqrt{162} = \sqrt{2 \times 3^4} = 9\sqrt{2}$

⑬ $\sqrt{200} = \sqrt{2 \times 10^2} = 10\sqrt{2}$

⑭ $5\sqrt{128} = 5\sqrt{2^7} = 5 \times 2^3\sqrt{2} = 40\sqrt{2}$

⑮ $4\sqrt{800} = 4\sqrt{2^5 \times 5^2} = 4 \times 5 \times 2^2\sqrt{2} = 80\sqrt{2}$

⑯ $2\sqrt{150} = 2\sqrt{2 \times 3 \times 5^2} = 2 \times 5\sqrt{6} = 10\sqrt{6}$

⑰ $3\sqrt{52} = 3\sqrt{2^2 \times 13} = 3 \times 2\sqrt{13} = 6\sqrt{13}$

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25 $\sqrt{3}\times\sqrt{5}$ 26 $\sqrt{8}\times\sqrt{2}$ 27 $\sqrt{6}\times\sqrt{2}$ 28 $\sqrt{6}\times\sqrt{10}$ 29 $2\sqrt{3}\times4\sqrt{2}$

(25) $\sqrt{3}\times\sqrt{5}=\sqrt{15}$

(26) $\sqrt{8}\times\sqrt{2}=\sqrt{16}=\sqrt{4^2}=4$

(27) $\sqrt{6}\times\sqrt{2}=\sqrt{2\times3}\times\sqrt{2}=2\sqrt{3}$

(28) $\sqrt{6}\times\sqrt{10}=\sqrt{60}=\sqrt{2^2\times3\times5}=2\sqrt{15}$

(29) $2\sqrt{3}\times4\sqrt{2}=8\sqrt{6}$

35 $2\sqrt{8}\times\sqrt{12}$ 36 $4\sqrt{5}\times\sqrt{20}$ 37 $\frac{\sqrt{3}}{\sqrt{2}}$ 38 $\frac{2}{\sqrt{3}}$ 39 $\frac{\sqrt{28}}{\sqrt{7}}$

(35) $2\sqrt{8}\times\sqrt{12}=2\sqrt{96}=2\sqrt{2^5\times3}=8\sqrt{6}$

(36) $4\sqrt{5}\times\sqrt{20}=4\sqrt{100}=40$

(37) $\frac{\sqrt{3}}{\sqrt{2}}=\frac{\sqrt{3}\times\sqrt{2}}{\sqrt{2}\times\sqrt{2}}=\frac{\sqrt{6}}{2}$

(38) $\frac{2}{\sqrt{3}}=\frac{2.\times\sqrt{3}}{\sqrt{3}\times\sqrt{3}}=\frac{2\sqrt{3}}{3}$

(39) $\frac{\sqrt{28}}{\sqrt{7}}=\frac{\sqrt{4\times7}}{\sqrt{7}}=\frac{\sqrt{4}\times\sqrt{7}}{\sqrt{7}}=\sqrt{4}=2$

40 $\frac{7}{\sqrt{7}}$ 41 $\frac{\sqrt{80}}{\sqrt{5}}$ 42 $\frac{3\sqrt{2}}{\sqrt{6}}$ 43 $\frac{7\sqrt{2}}{\sqrt{98}}$ 44 $\frac{2\sqrt{18}}{\sqrt{8}}$

(40) $\frac{7}{\sqrt{7}}=\frac{\sqrt{7}\times\sqrt{7}}{\sqrt{7}}=\sqrt{7}$

(41) $\frac{\sqrt{80}}{\sqrt{5}}=\frac{\sqrt{2^4\times5}}{\sqrt{5}}=\frac{\sqrt{2^4}\times\sqrt{5}}{\sqrt{5}}=\sqrt{2^4}=2^2=4$

(42) $\frac{3\sqrt{2}}{\sqrt{6}}=\frac{3\sqrt{2}}{\sqrt{3}\times\sqrt{2}}=\frac{3}{\sqrt{3}}=\frac{\sqrt{3}\times\sqrt{3}}{\sqrt{3}}=\sqrt{3}$

(43) $\frac{7\sqrt{2}}{\sqrt{98}}=\frac{7\sqrt{2}}{\sqrt{2\times7^2}}=\frac{7\sqrt{2}}{7\sqrt{2}}=1$

(44) $\frac{2\sqrt{18}}{\sqrt{8}}=\frac{2\sqrt{3^2\times2}}{\sqrt{2^3}}=\frac{2\times3\sqrt{2}}{2\sqrt{2}}=3$