1　平方根/平方根の簡約

次の数を簡単にしなさい.

(1) $\sqrt{16} = \underline{\underline{4}}$
(2) $\sqrt{81} = \underline{\underline{9}}$
(3) $\sqrt{25} = \underline{\underline{5}}$
(4) $\sqrt{9} = \underline{\underline{3}}$
(5) $\sqrt{36} = \underline{\underline{6}}$
(6) $\sqrt{4} = \underline{\underline{2}}$
(7) $\sqrt{100} = \underline{\underline{10}}$
(8) $\sqrt{1} = \underline{\underline{1}}$
(9) $\sqrt{49} = \underline{\underline{7}}$
(10) $\sqrt{64} = \underline{\underline{8}}$
(11) $\sqrt{121} = \underline{\underline{11}}$
(12) $\sqrt{0.04} = \underline{\underline{0.2}}$
(13) $\sqrt{\frac{16}{9}} = \underline{\underline{\frac{4}{3}}}$
(14) $\sqrt{0.0025} = \underline{\underline{0.05}}$
(15) $\sqrt{\frac{1}{4}} = \underline{\underline{\frac{1}{2}}}$
(16) $\sqrt{150} = \underline{\underline{5\sqrt{6}}}$
(17) $\sqrt{32} = \underline{\underline{4\sqrt{2}}}$
(18) $\sqrt{12} = \underline{\underline{2\sqrt{3}}}$
(19) $\sqrt{108} = \underline{\underline{6\sqrt{3}}}$
(20) $\sqrt{54} = \underline{\underline{3\sqrt{6}}}$
(21) $\sqrt{8} = \underline{\underline{2\sqrt{2}}}$
(22) $\sqrt{27} = \underline{\underline{3\sqrt{3}}}$
(23) $\sqrt{24} = \underline{\underline{2\sqrt{6}}}$
(24) $\sqrt{63} = \underline{\underline{3\sqrt{7}}}$
(25) $\sqrt{48} = \underline{\underline{4\sqrt{3}}}$
(26) $\sqrt{80} = \underline{\underline{4\sqrt{5}}}$
(27) $\sqrt{48} = \underline{\underline{4\sqrt{3}}}$
(28) $\sqrt{75} = \underline{\underline{5\sqrt{3}}}$
(29) $\sqrt{18} = \underline{\underline{3\sqrt{2}}}$
(30) $\sqrt{45} = \underline{\underline{3\sqrt{5}}}$
(31) $\sqrt{27} = \underline{\underline{3\sqrt{3}}}$
(32) $\sqrt{630} = \underline{\underline{3\sqrt{70}}}$
(33) $\sqrt{972} = \underline{\underline{18\sqrt{3}}}$
(34) $2\sqrt{63} = \underline{\underline{6\sqrt{7}}}$
(35) $2\sqrt{32} = \underline{\underline{8\sqrt{2}}}$
(36) $2\sqrt{96} = \underline{\underline{8\sqrt{6}}}$
(37) $4\sqrt{45} = \underline{\underline{12\sqrt{5}}}$
(38) $5\sqrt{8} = \underline{\underline{10\sqrt{2}}}$
(39) $5\sqrt{32} = \underline{\underline{20\sqrt{2}}}$
(40) $3\sqrt{24} = \underline{\underline{6\sqrt{6}}}$
(41) $2\sqrt{112} = \underline{\underline{8\sqrt{7}}}$
(42) $4\sqrt{80} = \underline{\underline{16\sqrt{5}}}$
(43) $2\sqrt{50} = \underline{\underline{10\sqrt{2}}}$
(44) $3\sqrt{18} = \underline{\underline{9\sqrt{2}}}$
(45) $3\sqrt{54} = \underline{\underline{9\sqrt{6}}}$
(46) $3\sqrt{20} = \underline{\underline{6\sqrt{5}}}$
(47) $3\sqrt{96} = \underline{\underline{12\sqrt{6}}}$
(48) $2\sqrt{72} = \underline{\underline{12\sqrt{2}}}$
(49) $3\sqrt{27} = \underline{\underline{9\sqrt{3}}}$
(50) $3\sqrt{150} = \underline{\underline{15\sqrt{6}}}$

2　平方根/有理化（基本）

次の数を有理化しなさい.

(1) $\frac{1}{2\sqrt{3}} = \underline{\underline{\frac{\sqrt{3}}{6}}}$
(2) $\frac{3}{\sqrt{6}} = \underline{\underline{\frac{\sqrt{6}}{2}}}$

(3) $\dfrac{1}{\sqrt{5}} = \underline{\underline{\dfrac{\sqrt{5}}{5}}}$

(4) $\dfrac{2}{\sqrt{10}} = \underline{\underline{\dfrac{\sqrt{10}}{5}}}$

(5) $\dfrac{1}{3\sqrt{3}} = \underline{\underline{\dfrac{\sqrt{3}}{9}}}$

(6) $\dfrac{1}{\sqrt{10}} = \underline{\underline{\dfrac{\sqrt{10}}{10}}}$

(7) $\dfrac{1}{3\sqrt{2}} = \underline{\underline{\dfrac{\sqrt{2}}{6}}}$

(8) $\dfrac{1}{2\sqrt{5}} = \underline{\underline{\dfrac{\sqrt{5}}{10}}}$

(9) $\dfrac{1}{\sqrt{3}} = \underline{\underline{\dfrac{\sqrt{3}}{3}}}$

(10) $\dfrac{3}{2\sqrt{5}} = \underline{\underline{\dfrac{3\sqrt{5}}{10}}}$

(11) $\dfrac{1}{\sqrt{2}} = \underline{\underline{\dfrac{\sqrt{2}}{2}}}$

(12) $\dfrac{2}{3\sqrt{3}} = \underline{\underline{\dfrac{2\sqrt{3}}{9}}}$

(13) $\dfrac{2}{\sqrt{6}} = \underline{\underline{\dfrac{\sqrt{6}}{3}}}$

(14) $\dfrac{2\sqrt{2}-\sqrt{5}}{\sqrt{6}} = \underline{\underline{\dfrac{4\sqrt{3}-\sqrt{30}}{6}}}$

(15) $\dfrac{\sqrt{3}+3}{\sqrt{2}} = \underline{\underline{\dfrac{\sqrt{6}+3\sqrt{2}}{2}}}$

(16) $\dfrac{\sqrt{2}-\sqrt{6}}{\sqrt{3}} = \underline{\underline{\dfrac{\sqrt{6}-3\sqrt{2}}{3}}}$

(17) $\dfrac{\sqrt{2}-\sqrt{6}}{\sqrt{5}} = \underline{\underline{\dfrac{\sqrt{10}-\sqrt{30}}{5}}}$

(18) $\dfrac{\sqrt{3}+2}{\sqrt{3}} = \underline{\underline{\dfrac{3+2\sqrt{3}}{3}}}$

(19) $\dfrac{\sqrt{6}+\sqrt{7}}{\sqrt{2}} = \underline{\underline{\dfrac{2\sqrt{3}+\sqrt{14}}{2}}}$

(20) $\dfrac{\sqrt{7}-\sqrt{2}}{\sqrt{2}} = \underline{\underline{\dfrac{\sqrt{14}-2}{2}}}$

(21) $\dfrac{1+\sqrt{2}}{\sqrt{3}} = \underline{\underline{\dfrac{\sqrt{3}+\sqrt{6}}{3}}}$

(22) $\dfrac{1-\sqrt{2}}{\sqrt{2}} = \underline{\underline{\dfrac{\sqrt{2}-2}{2}}}$

(23) $\dfrac{\sqrt{3}-1}{\sqrt{2}} = \underline{\underline{\dfrac{\sqrt{6}-\sqrt{2}}{2}}}$

(24) $\dfrac{\sqrt{6}-2}{\sqrt{7}} = \underline{\underline{\dfrac{\sqrt{42}-2\sqrt{7}}{7}}}$

(25) $\dfrac{\sqrt{3}-\sqrt{5}}{\sqrt{3}} = \underline{\underline{\dfrac{3-\sqrt{15}}{3}}}$

3　平方根/乗除

次の式を計算しなさい.

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

(2) $\sqrt{5}\times\sqrt{2} = \underline{\underline{\sqrt{10}}}$

(3) $\sqrt{8}\times\sqrt{3} = \underline{\underline{2\sqrt{6}}}$

(4) $\sqrt{7}\times\sqrt{3} = \underline{\underline{\sqrt{21}}}$

(5) $\sqrt{8}\times\sqrt{2} = \underline{\underline{4}}$

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

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

(8) $\sqrt{6}\times\sqrt{2} = \underline{\underline{2\sqrt{3}}}$

(9) $\sqrt{5}\times\sqrt{8} = \underline{\underline{2\sqrt{10}}}$

(10) $\sqrt{5}\times\sqrt{7} = \underline{\underline{\sqrt{35}}}$

(11) $\sqrt{2}\times\sqrt{6} = \underline{\underline{2\sqrt{3}}}$

(12) $\sqrt{3}\times\sqrt{8} = \underline{\underline{2\sqrt{6}}}$

(13) $\sqrt{6}\times\sqrt{5} = \underline{\underline{\sqrt{30}}}$

(14) $\sqrt{21}\div\sqrt{3} = \underline{\underline{\sqrt{7}}}$

(15) $\sqrt{21}\div\sqrt{7} = \underline{\underline{\sqrt{3}}}$

(16) $\sqrt{30}\div\sqrt{5} = \underline{\underline{\sqrt{6}}}$

(17) $\sqrt{15}\div\sqrt{3} = \underline{\underline{\sqrt{5}}}$

(18) $\sqrt{15}\div\sqrt{5} = \underline{\underline{\sqrt{3}}}$

(19) $\sqrt{48} \div \sqrt{8} = \underline{\underline{\sqrt{6}}}$
(20) $\sqrt{35} \div \sqrt{5} = \underline{\underline{\sqrt{7}}}$
(21) $\sqrt{24} \div \sqrt{8} = \underline{\underline{\sqrt{3}}}$
(22) $\sqrt{10} \div \sqrt{2} = \underline{\underline{\sqrt{5}}}$
(23) $\sqrt{14} \div \sqrt{7} = \underline{\underline{\sqrt{2}}}$
(24) $\sqrt{16} \div \sqrt{2} = \underline{\underline{2\sqrt{2}}}$
(25) $\sqrt{48} \div \sqrt{6} = \underline{\underline{2\sqrt{2}}}$
(26) $\sqrt{56} \div \sqrt{8} = \underline{\underline{\sqrt{7}}}$
(27) $-2\sqrt{5} \times \left(-3\sqrt{7}\right) = \underline{\underline{6\sqrt{35}}}$
(28) $-3\sqrt{10} \times \left(-3\sqrt{2}\right) = \underline{\underline{18\sqrt{5}}}$
(29) $-2\sqrt{10} \times \sqrt{7} = \underline{\underline{-2\sqrt{70}}}$
(30) $\sqrt{8} \times \sqrt{5} = \underline{\underline{2\sqrt{10}}}$
(31) $-\sqrt{10} \times \sqrt{2} = \underline{\underline{-2\sqrt{5}}}$
(32) $\sqrt{5} \times \sqrt{7} = \underline{\underline{\sqrt{35}}}$
(33) $-3\sqrt{10} \div \sqrt{5} = \underline{\underline{-3\sqrt{2}}}$
(34) $2\sqrt{16} \times \sqrt{6} = \underline{\underline{8\sqrt{6}}}$
(35) $\sqrt{15} \div \left(-3\sqrt{3}\right) = \underline{\underline{-\dfrac{\sqrt{5}}{3}}}$
(36) $-\sqrt{21} \div \left(-3\sqrt{3}\right) = \underline{\underline{\dfrac{\sqrt{7}}{3}}}$
(37) $\sqrt{2} \div \left(-\sqrt{5}\right) \div \left(-\sqrt{2}\right) = \underline{\underline{\dfrac{\sqrt{5}}{5}}}$
(38) $-\sqrt{5} \div \left(-\sqrt{5}\right) \times \sqrt{3} = \underline{\underline{\sqrt{3}}}$
(39) $-2\sqrt{6} \times \left(-3\sqrt{5}\right) \div \sqrt{2} = \underline{\underline{6\sqrt{15}}}$
(40) $\sqrt{2} \times \left(-2\sqrt{2}\right) \times \left(-\sqrt{3}\right) = \underline{\underline{4\sqrt{3}}}$
(41) $\sqrt{3} \times \sqrt{2} \div \sqrt{3} = \underline{\underline{\sqrt{2}}}$
(42) $2\sqrt{5} \times 2\sqrt{6} \times \sqrt{2} = \underline{\underline{8\sqrt{15}}}$
(43) $-\sqrt{3} \div 2\sqrt{3} \times \left(-\sqrt{3}\right) = \underline{\underline{\dfrac{\sqrt{3}}{2}}}$
(44) $\sqrt{2} \times 2\sqrt{5} \times \sqrt{2} = \underline{\underline{4\sqrt{5}}}$
(45) $\sqrt{8} \div \sqrt{3} \div \left(-\sqrt{2}\right) = \underline{\underline{-\dfrac{2\sqrt{3}}{3}}}$
(46) $2\sqrt{6} \times \left(-3\sqrt{3}\right) \div \sqrt{2} = \underline{\underline{-18}}$
(47) $-3\sqrt{5} \div \sqrt{2} \div \left(-\sqrt{3}\right) = \underline{\underline{\dfrac{\sqrt{30}}{2}}}$
(48) $2\sqrt{5} \div \left(-3\sqrt{3}\right) \times \left(-\sqrt{3}\right) = \underline{\underline{\dfrac{2\sqrt{5}}{3}}}$
(49) $2\sqrt{5} \div \sqrt{3} \div \sqrt{2} = \underline{\underline{\dfrac{\sqrt{30}}{3}}}$
(50) $2\sqrt{3} \times 2\sqrt{5} \div \left(-\sqrt{3}\right) = \underline{\underline{-4\sqrt{5}}}$

4 平方根/四則

次の数を有理化しなさい.

(1) $6\sqrt{3} + 8\sqrt{3} = \underline{\underline{14\sqrt{3}}}$
(2) $3\sqrt{3} + 7\sqrt{3} = \underline{\underline{10\sqrt{3}}}$
(3) $5\sqrt{2} + 2\sqrt{2} = \underline{\underline{7\sqrt{2}}}$
(4) $\sqrt{3} - 8\sqrt{3} = \underline{\underline{-7\sqrt{3}}}$
(5) $7\sqrt{3} - \sqrt{3} = \underline{\underline{6\sqrt{3}}}$
(6) $\sqrt{2} - 8\sqrt{2} = \underline{\underline{-7\sqrt{2}}}$
(7) $\sqrt{20} - 3\sqrt{5} = 2\sqrt{5} - 3\sqrt{5} = \underline{\underline{-\sqrt{5}}}$
(8) $\sqrt{48} - 2\sqrt{3} = 4\sqrt{3} - 2\sqrt{3} = \underline{\underline{2\sqrt{3}}}$
(9) $\sqrt{12} - \sqrt{3} = 2\sqrt{3} - \sqrt{3} = \underline{\underline{\sqrt{3}}}$
(10) $\sqrt{27} - 6\sqrt{3} = 3\sqrt{3} - 6\sqrt{3} = \underline{\underline{-3\sqrt{3}}}$
(11) $\sqrt{45} + \sqrt{20} = 3\sqrt{5} + 2\sqrt{5} = \underline{\underline{5\sqrt{5}}}$
(12) $\sqrt{5} + \sqrt{80} = \sqrt{5} + 4\sqrt{5} = \underline{\underline{5\sqrt{5}}}$
(13) $\sqrt{27} + \sqrt{48} = 3\sqrt{3} + 4\sqrt{3} = \underline{\underline{7\sqrt{3}}}$
(14) $\sqrt{8} - \sqrt{18} = 2\sqrt{2} - 3\sqrt{2} = \underline{\underline{-\sqrt{2}}}$
(15) $\sqrt{8} + \sqrt{18} = 2\sqrt{2} + 3\sqrt{2} = \underline{\underline{5\sqrt{2}}}$
(16) $\sqrt{2} - \sqrt{32} + 2\sqrt{18} = \sqrt{2} - 4\sqrt{2} + 6\sqrt{2} = \underline{\underline{3\sqrt{2}}}$
(17) $2\sqrt{2} + \sqrt{18} - \sqrt{8} = 2\sqrt{2} + 3\sqrt{2} - 2\sqrt{2} = \underline{\underline{3\sqrt{2}}}$
(18) $\sqrt{3} - \sqrt{48} - 2\sqrt{12} = \sqrt{3} - 4\sqrt{3} - 4\sqrt{3} = \underline{\underline{-7\sqrt{3}}}$
(19) $\sqrt{5} + \sqrt{45} - \sqrt{80} = \sqrt{5} + 3\sqrt{5} - 4\sqrt{5} = \underline{\underline{0}}$

(20) $\sqrt{2}+\sqrt{32}+\sqrt{18} = \sqrt{2}+4\sqrt{2}+3\sqrt{2} = \underline{\underline{8\sqrt{2}}}$

(21) $\sqrt{2}-\dfrac{1}{\sqrt{8}} = \sqrt{2}-\dfrac{\sqrt{2}}{4} = \underline{\underline{\dfrac{3\sqrt{2}}{4}}}$

(22) $\sqrt{12}+\dfrac{1}{\sqrt{3}} = 2\sqrt{3}+\dfrac{\sqrt{3}}{3} = \underline{\underline{\dfrac{7\sqrt{3}}{3}}}$

(23) $\sqrt{5}-\dfrac{2}{\sqrt{45}} = \sqrt{5}-\dfrac{2\sqrt{5}}{15} = \underline{\underline{\dfrac{13\sqrt{5}}{15}}}$

(24) $\dfrac{2}{\sqrt{27}}+\sqrt{12} = \dfrac{2\sqrt{3}}{9}+2\sqrt{3} = \underline{\underline{\dfrac{20\sqrt{3}}{9}}}$

(25) $\dfrac{2}{\sqrt{27}}-\sqrt{3} = \dfrac{2\sqrt{3}}{9}-\sqrt{3} = \underline{\underline{-\dfrac{7\sqrt{3}}{9}}}$

(26) $\dfrac{2}{\sqrt{32}}-\sqrt{18}+\sqrt{8} = \dfrac{\sqrt{2}}{4}-3\sqrt{2}+2\sqrt{2} = \underline{\underline{-\dfrac{3\sqrt{2}}{4}}}$

(27) $\dfrac{1}{\sqrt{2}}+\sqrt{8}-\sqrt{18} = \dfrac{\sqrt{2}}{2}+2\sqrt{2}-3\sqrt{2} = \underline{\underline{-\dfrac{\sqrt{2}}{2}}}$

(28) $\sqrt{18}-\sqrt{32}-\dfrac{1}{\sqrt{8}} = 3\sqrt{2}-4\sqrt{2}-\dfrac{\sqrt{2}}{4} = \underline{\underline{-\dfrac{5\sqrt{2}}{4}}}$

(29) $\sqrt{27}+\dfrac{2}{\sqrt{3}}-\sqrt{12} = 3\sqrt{3}+\dfrac{2\sqrt{3}}{3}-2\sqrt{3} = \underline{\underline{\dfrac{5\sqrt{3}}{3}}}$

(30) $\dfrac{1}{\sqrt{32}}-\sqrt{8}-\sqrt{2} = \dfrac{\sqrt{2}}{8}-2\sqrt{2}-\sqrt{2} = \underline{\underline{-\dfrac{23\sqrt{2}}{8}}}$

5 平方根/展開

次の数を計算しなさい.

(1) $\sqrt{3}\left(1-\sqrt{27}\right) = \underline{\underline{\sqrt{3}-9}}$

(2) $3\sqrt{2}\left(\sqrt{2}+1\right) = \underline{\underline{6+3\sqrt{2}}}$

(3) $\sqrt{2}\left(\sqrt{5}+\sqrt{3}\right) = \underline{\underline{\sqrt{10}+\sqrt{6}}}$

(4) $\left(\sqrt{20}+\sqrt{2}\right)\left(\sqrt{20}-\sqrt{2}\right) = \underline{\underline{18}}$

(5) $\left(\sqrt{5}-3\sqrt{2}\right)\left(\sqrt{5}+3\sqrt{2}\right) = \underline{\underline{-13}}$

(6) $\left(2\sqrt{2}+1\right)\left(2\sqrt{2}-1\right) = \underline{\underline{7}}$

(7) $\left(\sqrt{2}-2\sqrt{3}\right)^2 = \underline{\underline{14-4\sqrt{6}}}$

(8) $\left(2\sqrt{5}+\sqrt{18}\right)^2 = \underline{\underline{38+12\sqrt{10}}}$

(9) $\left(\sqrt{2}-1\right)^2 = \underline{\underline{3-2\sqrt{2}}}$

(10) $\left(1+\sqrt{2}\right)^2 = \underline{\underline{3+2\sqrt{2}}}$

(11) $\left(\sqrt{2}-2\right)\left(\sqrt{2}+2\right) = \underline{\underline{-2}}$

(12) $\left(1+\sqrt{5}\right)^2 = \underline{\underline{6+2\sqrt{5}}}$

(13) $\left(\sqrt{2}+1\right)^2 = \underline{\underline{3+2\sqrt{2}}}$

(14) $\left(\sqrt{20}+1\right)^2 = \underline{\underline{21+4\sqrt{5}}}$

(15) $\left(\sqrt{5}+2\right)^2 = \underline{\underline{9+4\sqrt{5}}}$

(16) $\left(\sqrt{18}-\sqrt{3}\right)\left(\sqrt{2}-\sqrt{3}\right) = \underline{\underline{9-4\sqrt{6}}}$

(17) $\left(1-\sqrt{12}\right)\left(3+\sqrt{3}\right) = \underline{\underline{-3-5\sqrt{3}}}$

(18) $\left(\sqrt{3}-\sqrt{2}\right)\left(\sqrt{3}+\sqrt{2}\right) = \underline{\underline{1}}$

(19) $\left(\sqrt{3}-\sqrt{18}\right)\left(\sqrt{27}-\sqrt{8}\right) = \underline{\underline{21-11\sqrt{6}}}$

(20) $\left(\sqrt{3}-\sqrt{2}\right)\left(3\sqrt{3}+\sqrt{2}\right) = \underline{\underline{7-2\sqrt{6}}}$

6 平方根/有理化（応用）

次の数を計算しなさい.

(1) $\dfrac{2}{\sqrt{3}-\sqrt{2}} = \underline{\underline{2\sqrt{3}+2\sqrt{2}}}$

(2) $\dfrac{2}{\sqrt{5}-\sqrt{3}} = \underline{\underline{\sqrt{5}+\sqrt{3}}}$

(3) $\dfrac{1}{\sqrt{2}-1} = \underline{\underline{\sqrt{2}+1}}$

(4) $\dfrac{2\sqrt{2}-\sqrt{7}}{2\sqrt{2}+\sqrt{7}} = \underline{\underline{15-4\sqrt{14}}}$

(5) $\dfrac{\sqrt{7}-\sqrt{2}}{\sqrt{7}+\sqrt{2}} = \underline{\underline{\dfrac{9-2\sqrt{14}}{5}}}$

(6) $\dfrac{2\sqrt{2}+1}{2\sqrt{2}-1} = \underline{\underline{\dfrac{9+4\sqrt{2}}{7}}}$

(7) $\dfrac{\sqrt{6}+3}{\sqrt{5}-\sqrt{2}} = \underline{\underline{\dfrac{\sqrt{30}+2\sqrt{3}+3\sqrt{5}+3\sqrt{2}}{3}}}$

(8) $\dfrac{2\sqrt{2}+\sqrt{3}}{\sqrt{6}+\sqrt{5}} = \underline{\underline{4\sqrt{3}-2\sqrt{10}+3\sqrt{2}-\sqrt{15}}}$

(9) $\dfrac{\sqrt{5}-\sqrt{3}}{\sqrt{6}-\sqrt{3}} = \underline{\underline{\dfrac{\sqrt{30}+\sqrt{15}-3\sqrt{2}-3}{3}}}$

(10) $\dfrac{\sqrt{7}+2}{2\sqrt{2}+\sqrt{3}} = \underline{\underline{\dfrac{2\sqrt{14}-\sqrt{21}+4\sqrt{2}-2\sqrt{3}}{5}}}$