

Exercises of Powers and roots

1) Simplify the following expressions into a single power:

a) $\frac{(5^3)^2 \times 5^3 \times 5^3}{5^2 \times 5^3}$

b) $(7^6)^3 \times 7^3 \times 7^3 \times 7^4$

c) $(11^3 \times 11^2)^3 \times 11^4$

d) $\frac{(2^3)^3 \times 2^2 \times 2^7}{2^3 \times 2^2}$

e) $(3^9 \times 3^3)^4 \times 3^2$

f) $\frac{(2^3)^9 \times 2^3 \times 2^2}{2^2 \times 2^3}$

2) Simplify the following expressions into a single power:

a) $2^2 \times 4^3 \times 8^7$

b) $3^3 \times 9^3 : 9^4$

c) $\frac{(3^3)^4 : 9^2}{27^2}$

d) $(3^4 \times 27^3)^4 : 81^4$

e) $5^3 \times 25^2 \times 125^4$

f) $3^3 \times 27^4 : 81^3$

3) Simplify the following expressions into a single power with positive exponent:

a) $\left[\left(\frac{2}{3} \right)^4 \times \left(\frac{2}{3} \right)^5 \right]^2 \times \left(\frac{3}{2} \right)^{-2}$

b) $\frac{\left[\left(\frac{2}{3} \right)^2 \right]^4 \times \left(\frac{3}{2} \right)^3 \times \left(\frac{2}{3} \right)^{-4}}{\left(\frac{2}{3} \right)^3 \times \left(\frac{2}{3} \right)^{-3}}$

c) $\left[\left(\frac{3}{4} \right)^{-3} \right]^3 \times \left(\frac{4}{3} \right)^5 \times \left(\frac{3}{4} \right)^{-3} \times \left(\frac{4}{3} \right)^5$

d) $\left[\left(\frac{5}{3} \right)^{-3} \times \left(\frac{5}{3} \right)^{-3} \right]^{-3} \times \left(\frac{5}{3} \right)^3$

e) $\frac{\left[\left(\frac{4}{3} \right)^{-3} \right]^3 \times \left(\frac{4}{3} \right)^{-3} \times \left(\frac{3}{4} \right)^{-3}}{\left(\frac{3}{4} \right)^2 \times \left(\frac{4}{3} \right)^{-2}}$

f) $\left[\left(\frac{7}{3} \right)^{-2} \right]^3 \times \left(\frac{7}{3} \right)^3 \times \left(\frac{7}{3} \right)^2 \times \left(\frac{7}{3} \right)^3$

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4) Simplify the following expressions into a single power with positive exponent:

a) $\left(\frac{4}{7}\right)^{-4} \times \left(\frac{343}{64}\right)^3 \times \left(\frac{49}{16}\right)^{-4}$

b) $\frac{\left[\left(\frac{7}{4}\right)^{-3}\right]^3 \cdot \left(\frac{64}{343}\right)^{-2}}{\left(\frac{64}{343}\right)^3}$

c) $\left(\frac{3}{5}\right)^{-4} \times \left(\frac{25}{9}\right)^3 \div \left(\frac{25}{9}\right)^2$

d) $\frac{\left[\left(\frac{4}{3}\right)^9\right]^{-3} \cdot \left(\frac{64}{27}\right)^{-3}}{\left(\frac{64}{27}\right)^2}$

e) $\left[\left(\frac{3}{4}\right)^3 \times \left(\frac{64}{27}\right)^2\right]^3 \div \left(\frac{16}{9}\right)^{-2}$

f) $\left(\frac{4}{3}\right)^4 \times \left(\frac{64}{27}\right)^{-8} \times \left(\frac{81}{256}\right)^{-4}$

5) Calculate the following square roots in your head (do not use calculator):

a) $\sqrt{9}$

b) $\sqrt{25}$

c) $\sqrt{121}$

d) $\sqrt{64}$

e) $\sqrt{16}$

f) $\sqrt{100}$

6) Find out the integer root and the remainder using the square root algorithm:

a) $\sqrt{67962}$

b) $\sqrt{400}$

c) $\sqrt{7843}$

d) $\sqrt{51529}$

e) $\sqrt{80140}$

f) $\sqrt{6332}$

7) Rationalize the following expressions:

a) $\frac{\sqrt{15}}{\sqrt{7}}$

b) $\frac{36}{\sqrt{26}}$

c) $\frac{36}{\sqrt{33}}$

d) $\frac{\sqrt{19}}{\sqrt{5}}$

e) $\frac{11}{\sqrt{5}}$

f) $\frac{35}{\sqrt{55}}$

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8) Rationalize the following expressions:

a) $\frac{11}{\sqrt{27-2}}$

b) $\frac{\sqrt{47}}{\sqrt{47-7}}$

c) $\frac{7}{\sqrt{13+5}}$

d) $\frac{16}{\sqrt{20-9}}$

e) $\frac{\sqrt{5}}{\sqrt{5-4}}$

f) $\frac{17}{\sqrt{34+4}}$

9) Rationalize the following expressions:

a) $\frac{78}{\sqrt[5]{69^4}}$

b) $\frac{15}{\sqrt[8]{51^5}}$

c) $\frac{26}{\sqrt[9]{74^5}}$

d) $\frac{10}{\sqrt[5]{17^4}}$

e) $\frac{27}{\sqrt[8]{5^3}}$

f) $\frac{2}{\sqrt[6]{10}}$

10) Calculate these expressions:

a) $\sqrt{45} - 5\sqrt{5}$

b) $3\sqrt{48} - 3\sqrt{48}$

c) $5\sqrt{12} - 2\sqrt{75}$

d) $4\sqrt{50} - 3\sqrt{8}$

e) $4\sqrt{5} - 6\sqrt{80}$

f) $4\sqrt{175} - 3\sqrt{175} + 6\sqrt{28}$

11) Simplify the following expressions into a single root:

a) $\frac{\sqrt[6]{7^4}}{\sqrt[3]{5^2}}$

b) $\sqrt[5]{11^4 \sqrt{11}}$

c) $\sqrt{7^7} \times \sqrt[5]{5^2}$

d) $\frac{\sqrt[3]{2^2}}{\sqrt[9]{19^3}}$

e) $\sqrt[3]{2^4} \times \sqrt[4]{3^3}$

f) $\frac{\sqrt[5]{5^3}}{\sqrt[3]{3^4}}$

Answers:

1) a) 5^7 b) 7^{28} c) 11^{19} d) 2^{13} e) 3^{50} f) 2^{27}

2) a) 2^{29} b) 3 c) 3^2 d) 3^{36} e) 5^{19} f) 3^3

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4) a) $\left(\frac{7}{4}\right)^5$ b) $\left(\frac{4}{7}\right)^6$ c) $\left(\frac{5}{3}\right)^6$ d) $\left(\frac{3}{4}\right)^{24}$ e) $\left(\frac{4}{3}\right)^{13}$ f) $\left(\frac{3}{4}\right)^4$

5) a) 3 b) 5 c) 11 d) 8 e) 4
f) 10

6) a) *Integer root = 260. Remainder = 362* b) *Integer root = 20. Remainder = 0*
c) *Integer root = 88. Remainder = 99* d) *Integer root = 227. Remainder = 0*
e) *Integer root = 283. Remainder = 51* f) *Integer root = 79. Remainder = 91*

7) a) $\frac{\sqrt{105}}{7}$ b) $\frac{18\sqrt{26}}{13}$ c) $\frac{12\sqrt{33}}{11}$ d) $\frac{\sqrt{95}}{5}$

e) $\frac{11\sqrt{5}}{5}$ f) $\frac{7\sqrt{55}}{11}$

8) a) $\frac{11\sqrt{27} + 22}{23}$ b) $\frac{-47 - 7\sqrt{47}}{2}$ c) $\frac{-7\sqrt{13} + 35}{12}$ d) $\frac{-16\sqrt{20} - 144}{61}$

e) $\frac{-5 - 4\sqrt{5}}{11}$ f) $\frac{17\sqrt{34} - 68}{18}$

9) a) $\frac{26\sqrt[5]{69}}{23}$ b) $\frac{5\sqrt[8]{51^3}}{17}$ c) $\frac{13\sqrt[9]{74^4}}{37}$ d) $\frac{10\sqrt[5]{17}}{17}$

e) $\frac{27\sqrt[8]{5^5}}{5}$ f) $\frac{\sqrt[6]{10^5}}{5}$

10) a) $-2\sqrt{5}$ b) 0 c) 0 d) $14\sqrt{2}$

e) $-20\sqrt{5}$ f) $17\sqrt{7}$

11) a) $\sqrt[3]{\frac{7^2}{5^2}}$ b) $\sqrt[10]{11^9}$ c) $\sqrt[10]{7^{35} \times 5^4}$ d) $\sqrt[3]{\frac{2^2}{19}}$

e) $\sqrt[12]{2^{16} \times 3^9}$ f) $\sqrt[15]{\frac{5^9}{3^{20}}}$