

## 4.1 Puissances et racines

Ex 4.1.1

$$a) 2^4 \cdot 3^4 = (2 \cdot 3)^4 = \underline{6^4}$$

$$b) 2^3 \cdot (-3)^3 \cdot 4^3 = (2 \cdot (-3) \cdot 4)^3 = \underline{-24^3} \quad (= (-24)^3)$$

$$c) 3^6 \cdot 5^6 = (3 \cdot 5)^6 = \underline{15^6}$$

$$d) 5^0 \cdot 5^1 \cdot 5^2 \cdot \dots \cdot 5^{10} = 5^{0+1+2+\dots+10} = \underline{5^{55}}$$

$$e) 3^2 \cdot 5^2 \cdot 15^3 = (3 \cdot 5)^2 \cdot 15^3 = 15^2 \cdot 15^3 = 15^{2+3} = \underline{15^5}$$

$$f) \frac{5^8}{5^6} = 5^{8-6} = \underline{5^2}$$

$$g) \frac{5^6}{5^8} = \underline{\frac{1}{5^2}}$$

$$h) \left(-\frac{2}{3}\right)^5 = \underline{-\frac{2^5}{3^5}}$$

$$i) \frac{7 \cdot 7^5 \cdot 7^0 \cdot 7}{7^3 \cdot 7^4} = \frac{7^{1+5+0+1}}{7^{3+4}} = \frac{7^7}{7^7} = \underline{1}$$

Ex 4.1.2

$$a) (2^2)^3 = \underline{2^6}$$

$$b) 2^{(2^3)} = \underline{2^8}$$

$$c) ((-4)^2)^4 = \underline{4^8} = (2^2)^8 = \underline{2^{16}}$$

$$d) \left(\left(\frac{1}{3}\right)^3\right)^6 = \left(\frac{1}{3}\right)^{18} = \underline{\frac{1}{3^{18}}}$$

$$e) \left(-\frac{2^4}{3^3}\right)^2 = \frac{2^8}{3^6}$$

$$f) \left(\frac{2}{3}\right)^3 \div \left(\frac{5}{3}\right)^3 = \frac{2^3}{3^3} : \frac{5^3}{3^3} = \frac{2^3}{\cancel{3^3}} \cdot \frac{\cancel{3^3}}{5^3} = \frac{2^3}{5^3}$$

$$g) 4^2 \cdot 2^5 \cdot 8^2 = (2^2)^2 \cdot 2^5 \cdot (2^3)^2 = 2^4 \cdot 2^5 \cdot 2^6 = 2^{4+5+6} = 2^{15}$$

$$h) \left(\frac{3}{4}\right)^4 \div \left(\frac{9}{8}\right)^4 = \frac{3^4}{4^4} : \frac{9^4}{8^4} = \frac{3^4}{4^4} \cdot \frac{8^4}{9^4} = \left(\frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{4}}} \cdot \frac{\overset{2}{\cancel{8}}}{\underset{3}{\cancel{9}}}\right)^4 = \left(\frac{2}{3}\right)^4 = \frac{2^4}{3^4}$$

$$i) \frac{(3 \cdot 9 \cdot 27 \cdot 81)^5}{3^{50}} = \frac{(3 \cdot 3^2 \cdot 3^3 \cdot 3^4)^5}{3^{50}} = \frac{(3^{1+2+3+4})^5}{3^{50}} = \frac{3^{50}}{3^{50}} = 1$$

### Ex 4.1.3

$$a) 4^{-2} = \frac{1}{4^2} = \frac{1}{16}$$

$$b) 2^{-1} = \frac{1}{2}$$

$$c) 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$$

$$d) \left(\frac{1}{4}\right)^{-1} = 4^1 = 4$$

$$e) \left(\frac{-1}{2}\right)^{-2} = 2^2 = 4$$

$$f) \left(\frac{2}{3}\right)^{-3} = \left(\frac{3}{2}\right)^3 = \frac{3^3}{2^3} = \frac{27}{8}$$

### Ex 4.1.5

$$a) 2^4 \cdot 2^{-2} \cdot 2 = 2^{4+(-2)+1} = 2^3$$

$$b) (2^3)^{-5} = 2^{-15} = \frac{1}{2^{15}}$$

$$c) \frac{5^3}{5^{-2}} = 5^{3-(-2)} = 5^5$$

$$d) ((-1)^{-2})^{-3} = (-1)^6 = \underline{1}$$

$$e) (2^{-1} \cdot 5^{-1})^{-1} = 2 \cdot 5 = \underline{10}$$

$$f) \left(\frac{11^{-2}}{11^8}\right)^{-5} = (11^{-10})^{-5} = \underline{11^{50}}$$

$$g) 7^{-3} \cdot \frac{49}{7^8} \cdot 7 = 7^{-3} \cdot \frac{7^2}{7^8} \cdot 7 = 7^{-3} \cdot 7^{-6} \cdot 7 = 7^{-3-6+1} = 7^{-8} = \underline{\frac{1}{7^8}}$$

$$h) 10'000 \cdot \frac{100}{100'000} \cdot 10^{-3} = 10^4 \cdot \frac{10^2}{10^5} \cdot 10^{-3} = 10^4 \cdot 10^{-3} \cdot 10^{-3} = 10^{-2} = \underline{\frac{1}{10^2}}$$

$$i) \frac{1280 \cdot 5^7 \cdot 125}{(0,2 \cdot 25)^3} \stackrel{\otimes}{=} \frac{2^8 \cdot 5 \cdot 5^7 \cdot 5^3}{(5^{-1} \cdot 5^2)^3} = \frac{2^8 \cdot 5^{11}}{5^3} = 2^8 \cdot 5^8 = (2 \cdot 5)^8 = \underline{10^8}$$

$$\otimes \quad 1280 = 128 \cdot 10 = 2^7 \cdot 2 \cdot 5 = 2^8 \cdot 5$$

$$0,2 = \frac{1}{5} = 5^{-1}$$

### Ex 4.1.6

$$a) x^2 y z^3 \cdot 3xy \cdot \underbrace{27}_{3^3} x^3 z^5 = 3^4 x^{2+1+3} y^{1+1} z^{3+5} = \underline{3^4 x^6 y^2 z^8} = \underline{81 x^6 y^2 z^8}$$

$$b) (2a^2 b^3 c)^4 = \underline{2^4 a^8 b^{12} c^4} = \underline{16 a^8 b^{12} c^4}$$

$$c) \left(\frac{2r^3}{s}\right)^2 \cdot \left(\frac{s}{r}\right)^3 = \frac{2^2 r^6}{s^2} \cdot \frac{s^3}{r^3} = \underline{2^2 r^3 s} = \underline{4r^3 s}$$

$$d) \frac{(4x^2 y^3)^5}{(2xy)^3} \div \frac{x^7}{(y^3)^4} = \frac{2^{10} x^{10} y^{15}}{2^3 x^3 y^3} \cdot \frac{y^{12}}{x^7} = \frac{2^{10} x^{10} y^{27}}{2^3 x^{10} y^3} = \underline{2^7 y^{24}}$$

$$e) (u^2 v^3)^{-3} = u^6 v^{-9} = \underline{\frac{u^6}{v^9}}$$

$$f) \frac{8x^3 y^5}{4x^{-1} y^2} = 2x^{3-(-1)} y^{-5-2} = 2x^4 y^{-7} = \underline{\frac{2x^4}{y^7}}$$

$$g) \left(\frac{x}{3}\right)^{-2} \div \left(\frac{x}{9}\right)^{-3} = \left(\frac{3}{x}\right)^2 \div \left(\frac{9}{x}\right)^3 = \frac{3^2}{x^2} \cdot \frac{x^3}{9^3} = \frac{3^2 x}{(3^2)^3} = \frac{3^2 x}{3^6} = \frac{x}{3^4} = \frac{x}{81}$$

$$h) \left(\frac{9y^3(3y^2)^{-2}}{(y^{-4})^{-3}}\right)^5 = \left(\frac{3^2 y^3 \cdot 3^{-2} y^{-4}}{y^{12}}\right)^5 = \left(3^0 y^{3+(-4)-12}\right)^5 = (y^{-13})^5 = y^{-65} = \frac{1}{y^{65}}$$

Ex 4.1.7

$$a) \sqrt{25} = \sqrt{5^2} = \underline{5}$$

$$b) \sqrt[3]{1000} = \sqrt[3]{10^3} = \underline{10}$$

$$c) \sqrt[4]{625} = \sqrt[4]{5^4} = \underline{5}$$

$$d) \sqrt[5]{32} = \sqrt[5]{2^5} = \underline{2}$$

$$e) \sqrt[6]{729} = \sqrt[6]{3^6} = \underline{3}$$

$$f) \sqrt[3]{0,027} = \sqrt[3]{27 \cdot 10^{-3}} = \sqrt[3]{3^3 \cdot 10^{-3}} = 3 \cdot 10^{-1} = \underline{0,3} \text{ ou } \sqrt[3]{0,3^3} = 0,3$$

$$g) \sqrt[3]{0,125} = \sqrt[3]{125 \cdot 10^{-3}} = \sqrt[3]{5^3 \cdot 10^{-3}} = 5 \cdot 10^{-1} = \underline{0,5} \text{ ou } \sqrt[3]{0,5^3} = 0,5$$

$$h) \sqrt[3]{0,015625} = \sqrt[3]{15625 \cdot 10^{-6}} = 25 \cdot 10^{-2} = \underline{0,25} \text{ ou } \sqrt[3]{0,25^3} = 0,25$$

$$i) \sqrt{0} = \underline{0}$$

$$j) \sqrt[3]{0,000008} = \sqrt[3]{8 \cdot 10^{-6}} = \sqrt[3]{2^3 \cdot 10^{-6}} = 2 \cdot 10^{-2} = \underline{0,02}$$

ou  $\sqrt[3]{0,02^3} = 0,02$

Ex 4.1.8

$$a) \sqrt{24} = \sqrt{4 \cdot 6} = \sqrt{4} \sqrt{6} = \underline{2\sqrt{6}}$$

$$b) \sqrt{18} = \sqrt{9 \cdot 2} = \sqrt{9} \sqrt{2} = \underline{3\sqrt{2}}$$

$$c) \sqrt{243} = \sqrt{81 \cdot 3} = \sqrt{81} \sqrt{3} = \underline{9\sqrt{3}}$$

$$d) \sqrt{50} = \sqrt{25 \cdot 2} = \sqrt{25} \sqrt{2} = \underline{5\sqrt{2}}$$

$$e) \sqrt{300} = \sqrt{100 \cdot 3} = \underline{10\sqrt{3}}$$

$$f) \sqrt{54} = \sqrt{9 \cdot 6} = \underline{3\sqrt{6}}$$

$$g) \sqrt{125} = \sqrt{25 \cdot 5} = \underline{5\sqrt{5}}$$

$$h) \sqrt{147} = \sqrt{49 \cdot 3} = \underline{7\sqrt{3}}$$

$$i) \sqrt{80} = \sqrt{16 \cdot 5} = \underline{4\sqrt{5}}$$

$$j) \sqrt{1000} = \sqrt{100 \cdot 10} = \underline{10\sqrt{10}}$$

$$k) \sqrt{250} = \sqrt{25 \cdot 10} = \underline{5\sqrt{10}}$$

$$l) \sqrt{7000} = \sqrt{100 \cdot 70} = \underline{10\sqrt{70}}$$

$$\begin{aligned} m) \quad 3\sqrt{5} - 4\sqrt{20} + 5\sqrt{45} - 3\sqrt{80} &= 3\sqrt{5} - 4\sqrt{4 \cdot 5} + 5\sqrt{9 \cdot 5} - 3\sqrt{16 \cdot 5} \\ &= 3\sqrt{5} - 4 \cdot 2\sqrt{5} + 5 \cdot 3\sqrt{5} - 3 \cdot 4\sqrt{5} \\ &= 3\sqrt{5} - 8\sqrt{5} + 15\sqrt{5} - 12\sqrt{5} \\ &= \underline{-2\sqrt{5}} \end{aligned}$$

$$\begin{aligned}
 n) \quad 2\sqrt{40} - 2\sqrt{90} + \sqrt{4000} - 5\sqrt{10} &= 2\sqrt{4 \cdot 10} - 2\sqrt{9 \cdot 10} + \sqrt{400 \cdot 10} - 5\sqrt{10} \\
 &= 2 \cdot 2\sqrt{10} - 2 \cdot 3\sqrt{10} + 20\sqrt{10} - 5\sqrt{10} \\
 &= 4\sqrt{10} - 6\sqrt{10} + 20\sqrt{10} - 5\sqrt{10} \\
 &= \underline{13\sqrt{10}}
 \end{aligned}$$

Ex 4.1.9

$$\begin{aligned}
 a) \quad (9\sqrt{12} + 3)(\sqrt{3} + 8) &= (9 \cdot 2\sqrt{3} + 3)(\sqrt{3} + 8) \\
 &= (18\sqrt{3} + 3)(\sqrt{3} + 8) \\
 &= 18\sqrt{3}\sqrt{3} + 18 \cdot 8\sqrt{3} + 3\sqrt{3} + 3 \cdot 8 \\
 &= 54 + 144\sqrt{3} + 3\sqrt{3} + 24 \\
 &= \underline{78 + 147\sqrt{3}}
 \end{aligned}$$

$$\begin{aligned}
 b) \quad (4\sqrt{3} + \sqrt{45})(\sqrt{5} - 2\sqrt{27}) &= (4\sqrt{3} + 3\sqrt{5})(\sqrt{5} - 2 \cdot 3\sqrt{3}) \\
 &= (4\sqrt{3} + 3\sqrt{5})(\sqrt{5} - 6\sqrt{3}) \\
 &= 4\sqrt{3}\sqrt{5} - 4 \cdot 6 \cdot 3 + 3 \cdot 5 - 3 \cdot 6 \cdot \sqrt{5}\sqrt{3} \\
 &= 4\sqrt{15} - 72 + 15 - 18\sqrt{15} \\
 &= \underline{-57 - 14\sqrt{15}}
 \end{aligned}$$

$$\begin{aligned}
 c) \quad \sqrt{3-2\sqrt{2}} \sqrt{3+2\sqrt{2}} &= \sqrt{(3-2\sqrt{2})(3+2\sqrt{2})} = \sqrt{9 - (2\sqrt{2})^2} \\
 &= \sqrt{9 - 4 \cdot 2} = \sqrt{1} = \underline{1}
 \end{aligned}$$

$$\begin{aligned}
 d) \quad (\sqrt{3} + 1)^4 &= ((\sqrt{3} + 1)^2)^2 \\
 &= (3 + 2\sqrt{3} + 1)^2 \\
 &= (4 + 2\sqrt{3})^2 \\
 &= 16 + 2 \cdot 4 \cdot 2\sqrt{3} + 4 \cdot 3 \\
 &= \underline{28 + 16\sqrt{3}}
 \end{aligned}$$

Ex 4.1.10

a)  $\sqrt[3]{\sqrt{7}} = \sqrt[6]{7}$

b)  $\sqrt[3]{2^{18} \cdot 5^{12} \cdot 3^3} = 2^6 \cdot 5^4 \cdot 3$

c)  $\sqrt[4]{64} \cdot \sqrt[4]{4} = \sqrt[4]{4^3} \sqrt[4]{4} = \sqrt[4]{4^4} = 4$

d)  $\sqrt[5]{3^{15}} = 3^3 = 27$

e)  $(\sqrt[8]{\sqrt[4]{\sqrt{2}}})^{128} = (\sqrt[64]{2})^{128} = \sqrt[64]{2^{128}} = 2^2 = 4$

f)  $\sqrt{3\sqrt{3}} = \sqrt{\sqrt{9 \cdot 3}} = \sqrt[4]{3^3} = \sqrt[4]{27}$

g)  $\sqrt[3]{5\sqrt{5}\sqrt{5}} = \sqrt[3]{5^2 \cdot 5\sqrt{5}} = \sqrt[6]{5^3 \sqrt{5}} = \sqrt[6]{5^6 \cdot 5} = \sqrt[12]{5^7}$

h)  $\sqrt{2\sqrt[3]{2}} = \sqrt{\sqrt[3]{2^3 \cdot 2}} = \sqrt[6]{2^4} = \sqrt[3]{2^2} = \sqrt[3]{4}$

i)  $\sqrt[3]{3\sqrt[3]{3^4\sqrt[3]{3^6}}} = \sqrt[3]{\sqrt[3]{3^3 \cdot 3^4 \cdot 3^2}} = \sqrt[9]{3^9} = 3$

j)  $\sqrt[3]{2\sqrt[6]{\frac{2^{14}}{\sqrt[3]{2^6}}}} = \sqrt[3]{2\sqrt[6]{\frac{2^{14}}{2^2}}} = \sqrt[3]{2 \cdot \sqrt[6]{2^{12}}} = \sqrt[3]{2 \cdot 2^2} = \sqrt[3]{2^3} = 2$

Ex 4.1.11

a)  $\sqrt[5]{a^3} \cdot (\sqrt[5]{a})^2 = a^{\frac{3}{5}} \cdot a^{\frac{2}{5}} = a$

b)  $\sqrt[3]{a} (\sqrt[3]{a})^2 = a^{\frac{1}{3}} \cdot a^{\frac{2}{3}} = a$

c)  $\sqrt[5]{a^3} (\sqrt[5]{a^2})^6 = a^{\frac{3}{5}} \cdot a^{\frac{12}{5}} = a^3$

d)  $\sqrt[4]{a^3} \sqrt[3]{a^4} = a^{\frac{3}{4}} \cdot a^{\frac{4}{3}} = a^{\frac{25}{12}} = \sqrt[12]{a^{25}} = a^2 \cdot \sqrt[12]{a}$

$$e) \sqrt{a} \cdot \sqrt[5]{a^3} \cdot (\sqrt[10]{a})^4 = a^{\frac{1}{2}} \cdot a^{\frac{3}{5}} \cdot a^{\frac{2}{5}} = a^{\frac{15}{10}} = a^{\frac{3}{2}} = \sqrt{a^3} = a\sqrt{a}$$

$$f) \sqrt[3]{a} \cdot \sqrt{a^3} \cdot \sqrt[6]{a} = a^{\frac{1}{3} + \frac{3}{4} + \frac{1}{6}} = a^{\frac{15}{12}} = a^{\frac{5}{4}} = \sqrt[4]{a^5} = a\sqrt[4]{a}$$

$$g) \sqrt[3]{\sqrt{a}} = \sqrt[6]{a}$$

$$h) (\sqrt[10]{\sqrt{a}})^{15} = a^{\frac{15}{50}} = a^{\frac{3}{10}} = \sqrt[10]{a^3}$$

$$i) \frac{\sqrt[3]{a^4}}{\sqrt{a}} = a^{\frac{4}{3} - \frac{1}{2}} = a^{\frac{5}{6}} = \sqrt[6]{a^5}$$

$$j) \frac{\sqrt[6]{a^5}}{\sqrt[4]{a^3}} = a^{\frac{5}{6} - \frac{3}{4}} = a^{\frac{1}{12}} = \sqrt[12]{a}$$

$$k) \frac{\sqrt{a} \cdot \sqrt[3]{a}}{\sqrt[4]{a^3}} = a^{\frac{1}{2} + \frac{1}{3} - \frac{3}{4}} = a^{\frac{1}{12}} = \sqrt[12]{a}$$

$$l) \frac{a^3}{\sqrt[3]{a^5} \cdot \sqrt[6]{a}} = a^{3 - \frac{5}{3} - \frac{1}{6}} = a^{\frac{7}{6}} = \sqrt[6]{a^7} = a\sqrt[6]{a}$$

Ex 4.1.12

$$a) \sqrt{\frac{1}{2}} = \frac{\sqrt{1}}{\sqrt{2}} = \frac{1 \cdot \sqrt{2}}{\sqrt{2} \cdot \sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$b) \frac{2}{\sqrt[4]{5}} = \frac{2 \cdot \sqrt[4]{5^3}}{\sqrt[4]{5} \cdot \sqrt[4]{5^3}} = \frac{2\sqrt[4]{125}}{5}$$

$$c) \frac{1}{\sqrt{3}} = \frac{1 \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{3}} = \frac{\sqrt{3}}{3}$$

$$d) \frac{1}{2+\sqrt{3}} = \frac{1 \cdot (2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})} = \frac{2-\sqrt{3}}{4-3} = 2-\sqrt{3}$$

$$e) \frac{2}{\sqrt{5}+\sqrt{3}} = \frac{2 \cdot (\sqrt{5}-\sqrt{3})}{(\sqrt{5}+\sqrt{3})(\sqrt{5}-\sqrt{3})} = \frac{2(\sqrt{5}-\sqrt{3})}{\underbrace{5-3}_{=2}} = \sqrt{5}-\sqrt{3}$$

$$f) \frac{1}{\sqrt[3]{3}-\sqrt[3]{2}} = \frac{1 \cdot ((\sqrt[3]{3})^2 + \sqrt[3]{3} \cdot 2 + (\sqrt[3]{2})^3)}{(\sqrt[3]{3}-\sqrt[3]{2})(\sqrt[3]{3})^2 + \sqrt[3]{3} \cdot 2 + (\sqrt[3]{2})^3} = \sqrt[3]{9} + \sqrt[3]{6} + \sqrt[3]{8}$$



### Ex 4.1.13

$$a) \sqrt[3]{5^2} = \underline{5^{2/3}}$$

$$b) \sqrt[10]{7} = \underline{7^{1/10}}$$

$$c) -\sqrt[8]{7^2} = -7^{2/8} = \underline{-7^{1/4}}$$

$$d) \sqrt{2} = \underline{2^{1/2}}$$

$$e) \frac{1}{\sqrt{3}} = \frac{1}{3^{1/2}} = \underline{3^{-1/2}}$$

$$f) \frac{8}{\sqrt[7]{4^3}} = \frac{8}{4^{3/7}} = 8 \cdot 4^{-3/7} = 2^3 \cdot 2^{-6/7} = 2^{3-\frac{6}{7}} = \underline{2^{\frac{15}{7}}}$$

$$g) \sqrt[4]{5} = \underline{5^{1/4}}$$

$$h) \sqrt[7]{3^7} = 3^{7/7} = \underline{3}$$

### Ex 4.1.14

$$a) 7^{3/2} = \underline{\sqrt{7^3}}$$

$$b) 3^{2/5} = \underline{\sqrt[5]{3^2}}$$

$$c) 64^{3/2} = \underline{\sqrt{64^3}} = (\sqrt{64})^3 = \underline{8^3}$$

$$d) -11^{0,25} = -11^{1/4} = \underline{-\sqrt[4]{11}}$$

$$e) 36^{-1/2} = \frac{1}{36^{1/2}} = \frac{1}{\sqrt{36}} = \underline{\frac{1}{6}}$$

$$f) 8^{-7/5} = \frac{1}{8^{7/5}} = \frac{1}{\sqrt[5]{8^7}}$$

$$g) 27^{-1/3} = \frac{1}{27^{1/3}} = \frac{1}{\sqrt[3]{27}} = \underline{\frac{1}{3}}$$

$$h) (-3)^{0,5} = (-3)^{1/2} = \sqrt{-3} \quad \text{⚡ pas défini}$$

Ex 4.1.15

$$a) \sqrt[4]{16^3} = \left( \begin{array}{l} (\sqrt[4]{16})^3 = (\sqrt[4]{2^4})^3 \\ 16^{3/4} = (2^4)^{3/4} \end{array} \right) = 2^3 = \underline{8}$$

$$b) (5+16^{1/2})^{1/2} = (5+4)^{1/2} = 9^{1/2} = \underline{3}$$

$$c) 4 \cdot 25^{3/2} = 4 \cdot 5^3 = \underline{500}$$

$$d) (4 \cdot 25)^{3/2} = 100^{3/2} = 10^3 = \underline{1'000}$$

$$e) 19 - 27^{1/3} = 19 - 3 = \underline{16}$$

$$f) (19 - 27)^{1/3} = (-8)^{1/3} = \underline{-2}$$

$$g) (-32)^{1/5} = \underline{-2}$$

$$h) (32)^{-1/5} = (2^5)^{-1/5} = 2^{-1} = \underline{\frac{1}{2}}$$

Ex 4.1.16

$$a) 8^{2/3} + 16^{1/2} + 27^{2/3} + 81^{1/4} - 125^{1/3} - 1000^{2/3}$$

$$= 2^2 + 4 + 3^2 + 3 - 5 - 10^2 = \underline{-85}$$

$$b) (3 \cdot 32^{1/3} + 3 \cdot 108^{1/3} - 256 \cdot 2^{2/3}) \cdot 2^{1/3}$$

$$= 3 \cdot 2^{5/3} \cdot 2^{1/3} + 3 \cdot (2^2 \cdot 3^3)^{1/3} \cdot 2^{1/3} - 2^8 \cdot 2^{2/3} \cdot 2^{1/3}$$

$$= 3 \cdot 2^2 + 3^2 \cdot 2 - 2^9 = 12 + 18 - 512 = \underline{-482}$$

$$c) (3 \cdot 2^{0,25} + 2 \cdot 32^{0,25} - 8^{0,75}) \cdot 8^{0,25}$$

$$= 3 \cdot 2 + 2 \cdot 2^2 - 8 = 6 + 8 - 8 = \underline{6}$$

$$d) \frac{16^{1/3} - 4 \cdot 128^{1/3} + 3 \cdot 250^{1/3}}{2^{1/3}} = (2^{4/3} - 2^{13/3} + 3 \cdot 2^{1/3} \cdot 5) \cdot 2^{-1/3}$$

$$= 2 - 2^4 + 3 \cdot 5 = 2 - 16 + 15 = \underline{1}$$

Ex 4.1.17

$$a) u^{4/3} u^{-3/2} u^{1/6} = u^{4/3 - 3/2 + 1/6} = u^{8/6 - 9/6 + 1/6} = u^{0/6} = u^0 = \underline{1}$$

$$b) (a^{-2/3} b^{-1} c^2)^{-3/2} \cdot (a^{-1/2} b^{1/3} c)^{-2} = a^1 b^{3/2} c^{-3} \cdot a^1 b^{-2/3} c^{-2}$$

$$= a^2 b^{5/6} c^{-5} = \underline{\underline{\frac{a^2 \sqrt[6]{b^5}}{c^5}}}$$

$$c) \left( \frac{x^{-2/3} y^{3/4}}{x^{5/2} y^{2/3}} \right)^{1/5} \div \left( \frac{x^4 y^{-2}}{x^{1/3} y^{-2/5}} \right)^{2/3}$$

$$= \left( x^{-19/6} y^{1/12} \right)^{1/5} \cdot \left( x^{-11/3} y^{8/5} \right)^{2/3} = x^{-19/30 - 22/9} y^{1/60 + 16/15}$$

$$= \underline{x^{-277/90} y^{13/12}} = \frac{\sqrt[12]{y^{13}}}{\sqrt[90]{x^{277}}} = \underline{\underline{\frac{y^{12} \sqrt{y}}{x^{30} \sqrt{x^7}}}}$$