

N.RN.A.2: Radicals and Rational Exponents 1

1 For all positive values of x , which expression is

equivalent to $x^{\frac{3}{4}}$?

- 1) $\sqrt[4]{x^3}$
- 2) $\sqrt[3]{x^4}$
- 3) $(x^3)^4$
- 4) $3(x^4)$

2 Which expression is an equivalent form of $a^5\sqrt{a^4}$?

- 1) a
- 2) $a^{\frac{9}{5}}$
- 3) $a^{\frac{9}{4}}$
- 4) $a^{\frac{1}{5}}$

3 The expression $\sqrt[4]{81x^8y^6}$ is equivalent to

- 1) $3x^2y^{\frac{3}{2}}$
- 2) $3x^4y^2$
- 3) $9x^2y^{\frac{3}{2}}$
- 4) $9x^4y^2$

4 Given $x > 0$, the expression $\frac{x^{\frac{1}{5}}}{x^{\frac{1}{2}}}$ can be rewritten as

- 1) $\sqrt[3]{x}$
- 2) $-\sqrt[10]{x^3}$
- 3) $\frac{1}{\sqrt[10]{x^3}}$
- 4) $\sqrt[3]{x^{10}}$

5 The expression $\left(\frac{m^2}{m^{\frac{1}{3}}}\right)^{-\frac{1}{2}}$ is equivalent to

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

6 When $b > 0$ and d is a positive integer, the expression $(3b)^{\frac{2}{d}}$ is equivalent to

- 1) $\frac{1}{\left(\sqrt[d]{3b}\right)^2}$
- 2) $\left(\sqrt{3b}\right)^d$
- 3) $\frac{1}{\sqrt{3b^d}}$
- 4) $\left(\sqrt[d]{3b}\right)^2$

7 Which equation is equivalent to $P = 210x^{\frac{4}{3}}y^{\frac{7}{3}}$

- 1) $P = \sqrt[3]{210x^4y^7}$
- 2) $P = 70xy^2\sqrt[3]{xy}$
- 3) $P = 210xy^2\sqrt[3]{xy}$
- 4) $P = 210xy^2\sqrt[3]{x^3y^5}$

8 What does $\left(\frac{-54x^9}{y^4}\right)^{\frac{2}{3}}$ equal?

- 1) $\frac{9ix^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$
- 2) $\frac{9ix^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$
- 3) $\frac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y}}$
- 4) $\frac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$

9 For $x \neq 0$, which expressions are equivalent to one divided by the sixth root of x ?

I. $\frac{\sqrt[6]{x}}{\sqrt[3]{x}}$ II. $\frac{x^{\frac{1}{6}}}{x^{\frac{1}{3}}}$ III. $x^{-\frac{1}{6}}$

- 1) I and II, only
- 2) I and III, only
- 3) II and III, only
- 4) I, II, and III

10 Given x and y are positive, which expressions are equivalent to $\frac{x^3}{y}$?

I. $\left(\frac{y}{x^3}\right)^{-1}$ II. $\sqrt[3]{x^9}(y^{-1})$ III. $\frac{x^{64}\sqrt[4]{y^8}}{x^3y^3}$

- 1) I and II, only
- 2) I and III, only
- 3) II and III, only
- 4) I, II, and III

11 For $x \geq 0$, which equation is *false*?

- 1) $(x^{\frac{3}{2}})^2 = \sqrt[4]{x^3}$
- 2) $(x^3)^{\frac{1}{4}} = \sqrt[4]{x^3}$
- 3) $(x^{\frac{3}{2}})^{\frac{1}{2}} = \sqrt[4]{x^3}$
- 4) $(x^{\frac{2}{3}})^2 = \sqrt[3]{x^4}$

12 If $n = \sqrt{a^5}$ and $m = a$, where $a > 0$, an expression for $\frac{n}{m}$ could be

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

13 Simplify: $\sqrt{a^{\frac{1}{2}}}$

14 Simplify: $\left(\sqrt{a^6}\right)^{\frac{1}{2}}$

15 Kenzie believes that for $x \geq 0$, the expression $\left(\sqrt[7]{x^2}\right)\left(\sqrt[5]{x^3}\right)$ is equivalent to $\sqrt[35]{x^6}$. Is she correct? Justify your response algebraically.

16 Write $\frac{x\sqrt{x^3}}{\sqrt[3]{x^5}}$ as a single term in simplest form, with a rational exponent.

17 Justify why $\frac{\sqrt[3]{x^2y^5}}{\sqrt[4]{x^3y^4}}$ is equivalent to $x^{\frac{-1}{12}}y^{\frac{2}{3}}$ using properties of rational exponents, where $x \neq 0$ and $y \neq 0$.

18 When $\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4$ is written in the form y^n , what is the value of n ? Justify your answer.

19 For n and $p > 0$, is the expression $\left(p^2n^{\frac{1}{2}}\right)^8\sqrt{p^5n^4}$ equivalent to $p^{18}n^6\sqrt{p}$? Justify your answer.

20 Express the fraction $\frac{2x^{\frac{3}{2}}}{(16x^4)^{\frac{1}{4}}}$ in simplest radical form.

21 Given the equal terms $\sqrt[3]{x^5}$ and $y^{\frac{5}{6}}$, determine and state y , in terms of x .

22 Use the properties of rational exponents to determine the value of y for the equation:

$$\frac{\sqrt[3]{x^8}}{(x^4)^{\frac{1}{3}}} = x^y, x > 1$$

23 Simplify: $(16a^4b^5 - 8a^6b^3)^{\frac{1}{3}}$

24 Find the numeric value of the following expression when $x = 4$, $y = 3$, $m = 1$, $n = 2$:

$$\frac{3x^n}{ny} - 2mx^{-\frac{1}{2}}y^m + 2nx^{-m}y^2$$

25 Find the value of the following expression when $x = 4$, $y = 8$, $a = 3$, $b = 5$:

$$(4x^{\frac{1}{2}} - a^{-1}(y^{\frac{1}{3}} + \sqrt{x+b}))^3$$

26 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.

27 For $x \neq 0$ and $y \neq 0$, $\sqrt[3]{81x^{15}y^9} = 3^a x^5 y^3$. Determine the value of a .

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Answer Section

1 ANS: 1 REF: 062201aii

2 ANS: 2

$$a^5 \sqrt[5]{a^4} = a^{\frac{5}{5}} \cdot a^{\frac{4}{5}} = a^{\frac{9}{5}}$$

REF: 062306aii

3 ANS: 1

$$\sqrt[4]{81x^8y^6} = 81^{\frac{1}{4}} x^{\frac{8}{4}} y^{\frac{6}{4}} = 3x^2y^{\frac{3}{2}}$$

REF: 012001aii

4 ANS: 3

$$\frac{x^{\frac{1}{5}}}{x^{\frac{1}{2}}} = x^{\frac{1}{5} - \frac{1}{2}} = x^{-\frac{3}{10}} = \frac{1}{x^{\frac{3}{10}}} = \frac{1}{\sqrt[10]{x^3}}$$

REF: 012312aii

5 ANS: 2

$$\left(m^{\frac{5}{3}}\right)^{-\frac{1}{2}} = m^{-\frac{5}{6}} = \frac{1}{\sqrt[6]{m^5}}$$

REF: 011707aii

6 ANS: 4 REF: 061601aii

7 ANS: 3

$$P = 210x^{\frac{4}{3}}y^{\frac{7}{3}} = 210x^{\frac{3}{3}}x^{\frac{1}{3}}y^{\frac{6}{3}}y^{\frac{1}{3}} = 210x \cdot x^{\frac{1}{3}}y^2y^{\frac{1}{3}} = 210xy^2\sqrt[3]{xy}$$

REF: 012413aii

8 ANS: 4

$$\left(\frac{-54x^9}{y^4}\right)^{\frac{2}{3}} = \frac{(2 \cdot -27)^{\frac{2}{3}} x^{\frac{18}{3}}}{y^{\frac{8}{3}}} = \frac{2^{\frac{2}{3}} \cdot 9x^6}{y^2 \cdot y^{\frac{2}{3}}} = \frac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$$

REF: 081723aii

9 ANS: 4 REF: 061716aii

10 ANS: 4

$$\text{I. } \left(\frac{y}{x^3}\right)^{-1} = \frac{x^3}{y}; \text{ II. } \sqrt[3]{x^9}(y^{-1}) = \frac{x^{\frac{9}{3}}}{y} = \frac{x^3}{y}; \text{ III. } \frac{x^{64}\sqrt[4]{y^8}}{x^3y^3} = \frac{x^3y^{\frac{8}{4}}}{y^3} = \frac{x^3}{y}$$

REF: 062320aaii

11 ANS: 1

$$(x^{\frac{3}{2}})^2 = x^3$$

REF: 061908aaii

12 ANS: 4

$$\frac{n}{m} = \frac{\sqrt{a^5}}{a} = \frac{a^{\frac{5}{2}}}{a^{\frac{2}{2}}} = a^{\frac{3}{2}} = \sqrt{a^3}$$

REF: 011811aaii

13 ANS:

$$\sqrt[4]{a}$$

REF: 099414al

14 ANS:

$$a\sqrt{a}$$

REF: 119411al

15 ANS:

$$\text{No. } \left(\sqrt[7]{x^2}\right)\left(\sqrt[5]{x^3}\right) = x^{\frac{2}{7}} \cdot x^{\frac{3}{5}} = x^{\frac{31}{35}} = \sqrt[35]{x^{31}}$$

REF: 061929aaii

16 ANS:

$$\frac{x \cdot x^{\frac{3}{2}}}{x^{\frac{5}{3}}} = \frac{x^{\frac{6}{6}} \cdot x^{\frac{9}{6}}}{x^{\frac{10}{6}}} = x^{\frac{5}{6}}$$

REF: 082331aaii

17 ANS:

$$\frac{\sqrt[3]{x^2y^5}}{\sqrt[4]{x^3y^4}} = \frac{x^{\frac{2}{3}}y^{\frac{5}{3}}}{x^{\frac{3}{4}}y^{\frac{12}{4}}} = \frac{x^{\frac{8}{12}}y^{\frac{20}{12}}}{x^{\frac{9}{12}}y^{\frac{12}{12}}} = x^{-\frac{1}{12}}y^{\frac{2}{3}}$$

REF: 011925aaii

18 ANS:

$$\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4 = \frac{y^{\frac{12}{3}}}{y^{\frac{2}{3}}} = y^{\frac{10}{3}} \quad n = \frac{10}{3}$$

REF: 012428aii

19 ANS:

$$\left(p^2 n^{\frac{1}{2}}\right)^8 \sqrt{p^5 n^4} = (p^{16} n^4) p^2 n^2 \sqrt{p} = p^{18} n^6 \sqrt{p}$$

REF: 012025aii

20 ANS:

$$\frac{2x^{\frac{3}{2}}}{2x^{\frac{2}{2}}} = x^{\frac{1}{2}} = \sqrt{x}$$

REF: 081826aii

21 ANS:

$$\left(\frac{5}{x^3}\right)^{\frac{6}{5}} = \left(\frac{5}{y^{\frac{5}{6}}}\right)^{\frac{6}{5}}$$

$$x^2 = y$$

REF: 011730aii

22 ANS:

$$\frac{x^{\frac{8}{3}}}{x^{\frac{4}{3}}} = x^y$$

$$x^{\frac{4}{3}} = x^y$$

$$\frac{4}{3} = y$$

REF: spr1505aii

23 ANS:

$$2ab \sqrt[3]{2ab^2 - a^3}$$

REF: 069812al

24 ANS:
14

REF: 019414al

25 ANS:
125

REF: 039305al

26 ANS:

$$a^{x+1} = a^{\frac{2}{3}}$$

$$x + 1 = \frac{2}{3}$$

$$x = -\frac{1}{3}$$

REF: 012326aii

27 ANS:

$$\sqrt[3]{81} = \sqrt[3]{3^4} = 3^{\frac{4}{3}} \quad a = \frac{4}{3}$$

REF: 062230aii