



5-Minute Check

Over Lesson 7–2

Standardized Test Practice

- 6 Simplify $\left(\frac{2^3xy^3}{8x^2y}\right)^2$. Assume that the denominator does not equal zero.

A. $\frac{y^3}{2x^2}$

B. $\frac{y^2}{x}$

C. $\frac{y^4}{x}$

D. $\frac{y^4}{x^2}$



5-Minute Check

Over Lesson 7–2

Standardized Test Practice

- 6 Simplify $\left(\frac{2^3xy^3}{8x^2y}\right)^2$. Assume that the denominator does not equal zero.

A. $\frac{y^3}{2x^2}$

B. $\frac{y^2}{x}$

C. $\frac{y^4}{x}$

D. $\frac{y^4}{x^2}$

5-Minute Check

Over Lesson 7-2

- 4 Simplify $\frac{(3x^2)^2 y^3}{24x^{-2}y}$. Assume that the denominator does not equal zero.

- A. $\frac{x^6y^2}{8}$
- B. $\frac{3x^6y^2}{8}$
- C. $\frac{3x^4y^3}{8y}$
- D. $\frac{3x^4y^5}{8}$

$$\begin{aligned}\frac{(3x^2)^2 y^3}{24x^{-2}y} &= \frac{3^2 x^4 y^3}{24 x^{-2} y} = \frac{3^2 x^{4-(-2)} y^{3-1}}{8 \cancel{24} x^{-2} y} \\ &= \frac{3 x^{4+2} y^2}{8}.\end{aligned}$$



5-Minute Check

Over Lesson 7–2

- 4 Simplify $\frac{(3x^2)^2 y^3}{24x^{-2}y}$. Assume that the denominator does not equal zero.

A. $\frac{x^6y^2}{8}$

→ B. $\frac{3x^6y^2}{8}$

C. $\frac{3x^4y^3}{8y}$

D. $\frac{3x^4y^5}{8}$

$$(x^a)^b = x^{ab}$$

$$(\sqrt{b^2})^{\frac{1}{2}} = (b^2)^{\frac{1}{2}} \quad b = \sqrt[2]{b^2}$$

 Key Concept $b^{\frac{1}{2}}$

Words For any nonnegative real number b , $b^{\frac{1}{2}} = \sqrt{b}$.

Examples $16^{\frac{1}{2}} = \sqrt{16}$ or 4 $38^{\frac{1}{2}} = \sqrt{38}$

EXAMPLE 1 Radical and Exponential Forms

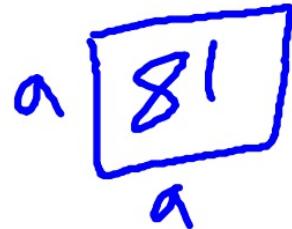
Write each expression in radical form, or write each radical in exponential form.

A. $81^{\frac{1}{2}}$

$$= \sqrt{81} \quad \cancel{81}$$

$$\frac{81}{a \cdot a}$$

square root...
Q: What is the length of
the side of a square?



EXAMPLE 1 Radical and Exponential Forms

Write each expression in radical form, or write each radical in exponential form.

B. $\sqrt{38}$

$$\sqrt{38} = 38^{\frac{1}{2}}$$

Definition of $b^{\frac{1}{2}}$

Answer: $38^{\frac{1}{2}}$

EXAMPLE 1 Radical and Exponential Forms

Write each expression in radical form, or write each radical in exponential form.

C. $12m^{\frac{1}{2}}$

$$12m^{\frac{1}{2}} = 12\sqrt{m}$$

Definition of $b^{\frac{1}{2}}$

Answer: $12\sqrt{m}$

EXAMPLE 1 Radical and Exponential Forms

Write each expression in radical form, or write each radical in exponential form.

D. $\sqrt{32w}$

$$\sqrt{32w} = (32w)^{\frac{1}{2}}$$

Definition of $b^{\frac{1}{2}}$

Answer: $(32w)^{\frac{1}{2}}$

Example 1 Write each expression in radical form, or write each radical in exponential form.

1. $12^{\frac{1}{2}} \sqrt{12}$

2. $3x^{\frac{1}{2}} \sqrt[3]{x}$

3. $\sqrt{33} 33^{\frac{1}{2}}$

4. $\sqrt{8n} (8n)^{\frac{1}{2}}$

 KeyConcept *n*th Root

Words For any real numbers a and b and any positive integer n , if $a^n = b$, then a is an n th root of b .

Symbols If $a^n = b$, then $\sqrt[n]{b} = a$.

Example Because $2^4 = 16$, 2 is a fourth root of 16; $\sqrt[4]{16} = 2$.

Groups of 4

$$\sqrt[4]{16} = 2.$$

$$\begin{array}{c} 4 \quad 4 \\ \swarrow \quad \searrow \\ 2 \cdot 2 \cdot 2 \cdot 2 \end{array}$$

LESSON
7–3 Rational Exponents

EXAMPLE 2 *n*th Roots

A. Simplify $\sqrt[4]{256}$.

$$\sqrt[4]{256} = \sqrt[4]{4 \bullet 4 \bullet 4 \bullet 4}$$

EXAMPLE 2 *n*th RootsB. Simplify $\sqrt[6]{15,625}$.

$$\textcircled{5} \quad \sqrt[3]{512} = 2 \cdot 2 \cdot 2$$

$$\begin{array}{r} 250 \\ 2 \overline{) 512} \\ 2 \overline{) 12} \\ 2 \overline{) 28} \\ 2 \overline{) 56} \\ 2 \overline{) 112} \\ 2 \overline{) 224} \\ 2 \overline{) 448} \\ 2 \overline{) 896} \\ 2 \overline{) 1792} \\ 2 \overline{) 3584} \\ 2 \overline{) 7168} \\ 2 \overline{) 14336} \\ 2 \overline{) 28672} \\ 2 \overline{) 57344} \\ 2 \overline{) 114688} \\ 2 \overline{) 229376} \\ 2 \overline{) 458752} \\ 2 \overline{) 917504} \\ 2 \overline{) 1835008} \\ 2 \overline{) 3670016} \\ 2 \overline{) 7340032} \\ 2 \overline{) 14680064} \\ 2 \overline{) 29360128} \\ 2 \overline{) 58720256} \\ 2 \overline{) 117440512} \\ 2 \overline{) 234881024} \\ 2 \overline{) 469762048} \\ 2 \overline{) 939524096} \\ 2 \overline{) 1879048192} \\ 2 \overline{) 3758096384} \\ 2 \overline{) 7516192768} \\ 2 \overline{) 15032385536} \\ 2 \overline{) 30064771072} \\ 2 \overline{) 60129542144} \\ 2 \overline{) 120259084288} \\ 2 \overline{) 240518168576} \\ 2 \overline{) 481036337152} \\ 2 \overline{) 962072674304} \\ 2 \overline{) 1924145348608} \\ 2 \overline{) 3848290697216} \\ 2 \overline{) 7696581394432} \\ 2 \overline{) 1539316278864} \\ 2 \overline{) 3078632557728} \\ 2 \overline{) 6157265115456} \\ 2 \overline{) 12314530230912} \\ 2 \overline{) 24629060461824} \\ 2 \overline{) 49258120923648} \\ 2 \overline{) 98516241847296} \\ 2 \overline{) 197032483694592} \\ 2 \overline{) 394064967389184} \\ 2 \overline{) 788129934778368} \\ 2 \overline{) 1576259869556736} \\ 2 \overline{) 3152519739113472} \\ 2 \overline{) 6305039478226944} \\ 2 \overline{) 12610078956453888} \\ 2 \overline{) 25220157912907776} \\ 2 \overline{) 50440315825815552} \\ 2 \overline{) 10088063165163112} \\ 2 \overline{) 20176126330326224} \\ 2 \overline{) 40352252660652448} \\ 2 \overline{) 80704505321304896} \\ 2 \overline{) 161409010642609792} \\ 2 \overline{) 322818021285219584} \\ 2 \overline{) 645636042570439168} \\ 2 \overline{) 1291272085140878336} \\ 2 \overline{) 2582544170281756672} \\ 2 \overline{) 5165088340563513344} \\ 2 \overline{) 10330176681127026688} \\ 2 \overline{) 20660353362254053376} \\ 2 \overline{) 41320706724508106752} \\ 2 \overline{) 82641413449016213504} \\ 2 \overline{) 165282826898032427008} \\ 2 \overline{) 330565653796064854016} \\ 2 \overline{) 661131307592129708032} \\ 2 \overline{) 1322262615184259416064} \\ 2 \overline{) 2644525230368518832128} \\ 2 \overline{) 5289050460737037664256} \\ 2 \overline{) 10578100921474075328512} \\ 2 \overline{) 21156201842948150656024} \\ 2 \overline{) 42312403685896301312048} \\ 2 \overline{) 84624807371792602624096} \\ 2 \overline{) 169249614743585205248192} \\ 2 \overline{) 338499229487170410496384} \\ 2 \overline{) 676998458974340820992768} \\ 2 \overline{) 1353996917948681641985536} \\ 2 \overline{) 2707993835897363283971072} \\ 2 \overline{) 5415987671794726567942144} \\ 2 \overline{) 10831975343589453135884288} \\ 2 \overline{) 21663950687178906271768576} \\ 2 \overline{) 43327901374357812543537152} \\ 2 \overline{) 86655802748715625087074304} \\ 2 \overline{) 173311605497431250174148608} \\ 2 \overline{) 346623210994862500348297216} \\ 2 \overline{) 693246421989725000696594432} \\ 2 \overline{) 1386492843979450001393188864} \\ 2 \overline{) 2772985687958900002786377728} \\ 2 \overline{) 5545971375917800005572755456} \\ 2 \overline{) 1109194275183560001154550912} \\ 2 \overline{) 2218388550367120002309101824} \\ 2 \overline{) 4436777100734240004618203648} \\ 2 \overline{) 8873554201468480009236407296} \\ 2 \overline{) 17747108402936960018472814592} \\ 2 \overline{) 35494216805873920036945629184} \\ 2 \overline{) 70988433611747840073891258368} \\ 2 \overline{) 14197686722349568014778257736} \\ 2 \overline{) 28395373444699136029556515472} \\ 2 \overline{) 56790746889398272059113030944} \\ 2 \overline{) 113581493778796544118226661888} \\ 2 \overline{) 227162987557593088236453323776} \\ 2 \overline{) 454325975115186176472906647552} \\ 2 \overline{) 908651950230372352945813290104} \\ 2 \overline{) 1817303900460744705891626580208} \\ 2 \overline{) 3634607800921489411783253160416} \\ 2 \overline{) 7269215601842978823566506320832} \\ 2 \overline{) 14538431203685957647133012641664} \\ 2 \overline{) 29076862407371915294266025283328} \\ 2 \overline{) 58153724814743830588532050566656} \\ 2 \overline{) 116307449629487661177064101133216} \\ 2 \overline{) 232614899258975322354128202266432} \\ 2 \overline{) 465229798517950644708256404532864} \\ 2 \overline{) 930459597035901289416512809065728} \\ 2 \overline{) 1860919194071802578833025618131456} \\ 2 \overline{) 3721838388143605157666051236262912} \\ 2 \overline{) 7443676776287210315332102472525824} \\ 2 \overline{) 1488735352857442063066420494505648} \\ 2 \overline{) 2977470705714884126132840989011296} \\ 2 \overline{) 5954941411429768252265681978022592} \\ 2 \overline{) 11909882822859536504531363956045184} \\ 2 \overline{) 23819765645718873008562727912090368} \\ 2 \overline{) 47639531291437746016125455824180736} \\ 2 \overline{) 95279062582875492032250911648361472} \\ 2 \overline{) 190558125645750984064501823296722944} \\ 2 \overline{) 381116251291501968129003646593445888} \\ 2 \overline{) 762232502583003936258007293186891776} \\ 2 \overline{) 1524465045166007872560014863733783552} \\ 2 \overline{) 3048930090332015745120029347467567104} \\ 2 \overline{) 6097860180664031490240058689335342088} \\ 2 \overline{) 12195720361328062950480117786670684176} \\ 2 \overline{) 24391440722656125900960235573341368352} \\ 2 \overline{) 48782881445312251801920471146682736704} \\ 2 \overline{) 97565762890624503603840942293365473408} \\ 2 \overline{) 195131525781248072077681884586730947216} \\ 2 \overline{) 390263051562496144155363769173461894432} \\ 2 \overline{) 78052610312499228831072753834692378864} \\ 2 \overline{) 15610522062499445766214506766938555768} \\ 2 \overline{) 31221044124998891532429013533877115344} \\ 2 \overline{) 62442088249997783064858027067754230688} \\ 2 \overline{) 124884176499985566129716054135508461376} \\ 2 \overline{) 249768352999971132259432108271016922752} \\ 2 \overline{) 499536705999942264518864216542033845504} \\ 2 \overline{) 99907341199988452903772843308406769008} \\ 2 \overline{) 199814682399976905807545686616813538016} \\ 2 \overline{) 399629364799953811615091373233627076032} \\ 2 \overline{) 799258729599907623230182746467254152064} \\ 2 \overline{) 1598517459198953244660365492934508304128} \\ 2 \overline{) 3197034918398906489320730985869016608256} \\ 2 \overline{) 6394069836798812978641461971738033216512} \\ 2 \overline{) 12788139673588245957282923943476066432024} \\ 2 \overline{) 2557627934717649191456584788695213286048} \\ 2 \overline{) 5115255869435298382913169577390426572096} \\ 2 \overline{) 10230511738870596765826339154780853441932} \\ 2 \overline{) 20461023477741193531652678309561706883864} \\ 2 \overline{) 40922046955482387063255356619123413767728} \\ 2 \overline{) 81844093910964774126510713238246827535456} \\ 2 \overline{) 163688187821929548252205426476493655070912} \\ 2 \overline{) 327376375643859096504410852952987310140824} \\ 2 \overline{) 654752751287718193008821705905974620281648} \\ 2 \overline{) 1309505502575436386017643411811949240563296} \\ 2 \overline{) 2619011005150872772035286823623898481126592} \\ 2 \overline{) 5238022010301745544070573647247796962253184} \\ 2 \overline{) 10476044020603491088141147294495939324506368} \\ 2 \overline{) 20952088041206982176282294588989878649112736} \\ 2 \overline{) 41904176082413964352564589177979757398225472} \\ 2 \overline{) 83808352164827928705129178355959514796450944} \\ 2 \overline{) 16761670432965585741025835671191902952901988} \\ 2 \overline{) 33523340865931171482051671342383805855803976} \\ 2 \overline{) 67046681731862342964103342684767611711607952} \\ 2 \overline{) 134093363463724685928206685369535223423215904} \\ 2 \overline{) 268186726927449371856413370738770446846431808} \\ 2 \overline{) 536373453854898743712826741477540893692863616} \\ 2 \overline{) 107274690770979748742565482855508177385773232} \\ 2 \overline{) 214549381541959497485130965711016354771546464} \\ 2 \overline{) 429098763083918994970261931422032709543092928} \\ 2 \overline{) 858197526167837989940523862844064490860985856} \\ 2 \overline{) 1716395052335675979881047725688128981721971712} \\ 2 \overline{) 3432790104671351959762095451376257963443943424} \\ 2 \overline{) 6865580209342703919524190902752515926887886848} \\ 2 \overline{) 13731160418685407838548381805505031853755773696} \\ 2 \overline{) 27462320837370815677096763611010063707511547392} \\ 2 \overline{) 54924641674741631354193527222020127415023094784} \\ 2 \overline{) 109849283349483262708387554444040254300461894568} \\ 2 \overline{) 219698566698966525416775108888080508600923789136} \\ 2 \overline{) 439397133397933050833550217776161017201847578272} \\ 2 \overline{) 878794266795866101667100435552322034403691556544} \\ 2 \overline{) 175758853359173220334050871110464406880738311088} \\ 2 \overline{) 351517706718346440668101742220928813761476621776} \\ 2 \overline{) 703035413436692881336203484441857627522953343552} \\ 2 \overline{) 140607082687348576267240696888371525045586687104} \\ 2 \overline{) 281214165374697152534481393776743050091173374208} \\ 2 \overline{) 562428330749394305068962787553486100182346748416} \\ 2 \overline{) 112485666149878861013792557510692200364673496832} \\ 2 \overline{) 224971332299757722027585115021384400729346993664} \\ 2 \overline{) 449942664599515444055170230042768801458693987328} \\ 2 \overline{) 899885329198785888110340460085537602917387974656} \\ 2 \overline{) 179977065839757177622068092017107520583475594912} \\ 2 \overline{) 359954131679514355244136184034215041166951189824} \\ 2 \overline{) 719908263359028710488272368068430822333902379648} \\ 2 \overline{) 143981652671805742097654673613686164466780479296} \\ 2 \overline{) 287963305343611484195309347227372328933560958592} \\ 2 \overline{) 575926610687222968390618694454744657867121917184} \\ 2 \overline{) 1151853221374445936781237388909489315734243834368} \\ 2 \overline{) 2303706442748891873562474777818978631468487668736} \\ 2 \overline{) 4607412885497783747124949555637957262936955337472} \\ 2 \overline{) 921482577099556749424989911127591452587390667444} \\ 2 \overline{) 184296515419851349844979882225593890517478133488} \\ 2 \overline{) 368593030839702699689959764451187781034956266976} \\ 2 \overline{) 737186061679405399379919528902375562069812533952} \\ 2 \overline{) 147437212335881079875983855780475112413962566784} \\ 2 \overline{) 294874424671762159751967711560950224827925333568} \\ 2 \overline{) 589748849343524319503935423121904449655850667136} \\ 2 \overline{) 1179497698687048639007870846243808893111701334272} \\ 2 \overline{) 2358995397374097278015741692487617786223402668544} \\ 2 \overline{) 4717985794748194556031483384975235556446805337088} \\ 2 \overline{) 9435971589496389112062966769950471112893610674176} \\ 2 \overline{) 1887194317899277822412593353990094222578722134832} \\ 2 \overline{) 3774388635798555644825186707980188445157444268664} \\ 2 \overline{) 7548777271597111289650373415960377890314888537328} \\ 2 \overline{) 1509755454319422257930074683192075578062977707464} \\ 2 \overline{) 3019510908638844515860149366384151156125955414928} \\ 2 \overline{) 603902181727768903172029873276830231225191082956} \\ 2 \overline{) 120780436345553780634405774655366046245382176592} \\ 2 \overline{) 241560872691107561268811549310732092490764353184} \\ 2 \overline{) 483121745382215122537623098621464184981528706368} \\ 2 \overline{) 966243490764430245075246197242928369763057412736} \\ 2 \overline{) 1932486981528860490150492394485857739526148825472} \\ 2 \overline{) 3864973963057720980300984788971715479052377650944} \\ 2 \overline{) 772994792611544196060196957794343095810475530188} \\ 2 \overline{) 154598958522308839212039391558868619162095106376} \\ 2 \overline{) 309197917044617678424078783117737238324190213532} \\ 2 \overline{) 618395834089235356848157566235474676648380427064} \\ 2 \overline{) 1236791668178470713696311132470949353296760854128} \\ 2 \overline{) 2473583336356941427392622264941898706593521708256} \\ 2 \overline{) 4947166672713882854785244529883797413187043416512} \\ 2 \overline{) 9894333345427765709570489059767594826374086832024} \\ 2 \overline{) 19788666690855531419140978119535189652748173664048} \\ 2 \overline{) 39577333381711062838281956238470379305496347328096} \\ 2 \overline{) 79154666763422125676563912476940758601986694656192} \\ 2 \overline{) 15830933352684425335131824853880151720393338931232} \\ 2 \overline{) 3166186670536885067026364970776030344078677786256} \\ 2 \overline{) 6332373341073770134052729941552060688157555572512} \\ 2 \overline{) 1266474668214754026810545982304012137631511114524} \\ 2 \overline{) 2532949336429508053621091964608024273263022229048} \\ 2 \overline{) 5065898672859016107242183929216048546526044458096} \\ 2 \overline{) 1013179734571803221488436785843209659352088911612} \\ 2 \overline{) 2026359469143606442976873571686419318704177823224} \\ 2 \overline{) 4052718938287212885953747143372838637408355646448} \\ 2 \overline{) 8105437876574425771907494286745677348166711292896} \\ 2 \overline{) 16210875733148851543814988573491554696334222585792} \\ 2 \overline{) 32421751466297703087629977146983109392668445171584} \\ 2 \overline{) 6484350293259540617$$

**Key Concept** $b^{\frac{1}{n}}$

Words For any positive real number b and any integer $n > 1$, $b^{\frac{1}{n}} = \sqrt[n]{b}$.

Example $8^{\frac{1}{3}} = \sqrt[3]{8} = \sqrt[3]{2 \cdot 2 \cdot 2}$ or 2

EXAMPLE 3

Evaluate $b^{\frac{1}{n}}$ Expressions

- A. Simplify $1331^{\frac{1}{3}}$.

EXAMPLE 3**Evaluate $b^{\frac{1}{n}}$ Expressions****B.** Simplify $2401^{\frac{1}{4}}$.

7. $343^{\frac{1}{3}}$

8. $\left(\frac{1}{16}\right)^{\frac{1}{4}}$

 KeyConcept $b^{\frac{m}{n}}$

Words For any positive real number b and any integers m and $n > 1$,

$$b^{\frac{m}{n}} = (\sqrt[n]{b})^m \text{ or } \sqrt[n]{b^m}.$$

Example $8^{\frac{2}{3}} = (\sqrt[3]{8})^2 = 2^2 \text{ or } 4$

EXAMPLE 4**Evaluate $b^{\frac{m}{n}}$ Expressions****A. Simplify $32^{\frac{2}{5}}$.**

$$= (32^{\frac{1}{5}})^2$$

$$32^{\frac{2}{5}} = (\sqrt[5]{32})^2 \quad b^{\frac{m}{n}} = (\sqrt[n]{b})^m$$

$$= 2^2$$

$$2^5 = 32$$

$$= 4$$

Simplify.

EXAMPLE 4**Evaluate $b^{\frac{m}{n}}$ Expressions****B. Simplify $81^{\frac{5}{2}}$.****Answer:** 59,049

**KeyConcept** Power Property of Equality

Words For any real number $b > 0$ and $b \neq 1$, $b^x = b^y$ if and only if $x = y$.

Examples If $5^x = 5^3$, then $x = 3$. If $n = \frac{1}{2}$, then $4^n = 4^{\frac{1}{2}}$.

What if the bases are not the same?

→ How can I make the bases the same?

EXAMPLE 5 Solve Exponential Equations**A.** Solve $9^x = 729$.

EXAMPLE 5 Solve Exponential Equations

B. Solve $16^{2x-1} = 8$.

EXAMPLE 5**Check Your Progress**

Solve $9^{3x+1} = 27^4$.

- A. $\frac{1}{9}$
- B. $\frac{5}{3}$
- C. $\frac{11}{6}$
- D. 2

Example 5

Solve each equation.

13. $8^x = 4096$

14. $3^{3x+1} = 81$

15. $4^{x-3} = 32$



Check Your Understanding



= Step-by-Step Solutions begin on page R13.



Example 1 Write each expression in radical form, or write each radical in exponential form.

1. $12^{\frac{1}{2}} \sqrt{12}$

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

3. $\sqrt{33} 33^{\frac{1}{2}}$

4. $\sqrt{8n} (8n)^{\frac{1}{2}}$

Examples 2–4 Simplify.

5. $\sqrt[3]{512} 8$

6. $\sqrt[5]{243} 3$

7. $343^{\frac{1}{3}} 7$

8. $\left(\frac{1}{16}\right)^{\frac{1}{4}} \frac{1}{2}$

9. $343^{\frac{2}{3}} 49$

10. $81^{\frac{3}{4}} 27$

11. $216^{\frac{4}{3}} 1296$

12. $\left(\frac{1}{49}\right)^{\frac{3}{2}} \frac{1}{343}$

Example 5 Solve each equation.

13. $8^x = 4096 4$

14. $3^{3x+1} = 81 1$

15. $4^{x-3} = 32 5.5$

$$\textcircled{a} \quad 343^{\frac{2}{3}} = (343^{\frac{1}{3}})^2$$

$$\textcircled{11} \quad (216^{\frac{4}{3}})^4 = (2 \cdot 3)^4$$

$$(2^{\frac{16}{3}})^4 = 6^4$$

$$= 7^2 = 49$$

② Power

Practice and Problem Solving

Extra Practice is on page R7.

Example 1 Write each expression in radical form, or write each radical in exponential form.

17. $15^{\frac{1}{2}} \sqrt{15}$

18. $24^{\frac{1}{2}} \sqrt{24}$

19. $4k^{\frac{1}{2}} 4\sqrt{k}$

20. $(12y)^{\frac{1}{2}} \sqrt{12y}$

21. $\sqrt{26} 26^{\frac{1}{2}}$

22. $\sqrt{44} 44^{\frac{1}{2}}$

23. $2\sqrt{ab} 2(ab)^{\frac{1}{2}}$

24. $\sqrt{3xyz} (3xyz)^{\frac{1}{2}}$

Examples 2–4 Simplify.

25. $\sqrt[3]{8} 2$

26. $\sqrt[5]{1024} 4$

27. $\sqrt[3]{216} 6$

28. $\sqrt[4]{10,000} 10$

29. $\sqrt[3]{0.001} 0.1$

30. $\sqrt[4]{\frac{16}{81}} \frac{2}{3}$

31. $1331^{\frac{1}{3}} 11$

32. $64^{\frac{1}{6}} 2 \cdot 64^{\frac{1}{6}}$

33. $3375^{\frac{1}{3}} 15$

34. $512^{\frac{1}{9}} 2$

35. $\left(\frac{1}{81}\right)^{\frac{1}{4}} \frac{1}{3}$

36. $\left(\frac{3125}{32}\right)^{\frac{1}{5}} \frac{5}{2}$

37. $8^{\frac{2}{3}} 4 \cdot 35$

38. $625^{\frac{3}{4}} 125^{\frac{3}{4}}$

39. $729^{\frac{5}{6}} 243^{\frac{5}{6}}$

40. $256^{\frac{3}{8}} 8^{\frac{3}{8}}$

41. $125^{\frac{4}{3}} 625$

42. $49^{\frac{5}{2}} 10,807$

43. $\left(\frac{9}{100}\right)^{\frac{3}{2}} \frac{27}{1000}$

44. $\left(\frac{8}{125}\right)^{\frac{4}{3}} \frac{16}{625}$

$$3375^{\frac{1}{3}}$$

Example 5 Solve each equation.

45. $3^x = 243$ **5**

46. $12^x = 144$ **2**

47. $16^x = 4$ **$\frac{1}{2}$**

48. $27^x = 3$ **$\frac{1}{3}$**

49. $9^x = 27$ **$\frac{3}{2}$**

50. $32^x = 4$ **$\frac{2}{5}$**

51. $2^{x-1} = 128$ **8**

52. $4^{2x+1} = 1024$ **2**

53. $6^{x-4} = 1296$ **8**

54. $9^{2x+3} = 2187$ **$\frac{1}{4}$**

55. $4^{3x} = 512$ **$\frac{3}{2}$**

56. $128^{3x} = 8$ **$\frac{1}{7}$**