Warm Up

Simplify (leave solutions with positive exponents)

a) $(4x^3 b^{-2})^{-3}$ power of product (x exponent)

$= 4^{-3} x^{-9} b^{+6}$ ← neg expon → Reciprocal → flip position

$= \frac{b^6}{4^3 x^9}$

$= \frac{b^6}{64x^9}$

b) $\left(\frac{m^7}{m^{-4} 3m^5}\right)^{-2}$ product law add exp

$= \left(\frac{m^7}{3m^1}\right)^{-2}$ ← quotient Law → subt exp

$= \left(\frac{m^6}{3}\right)^{-2}$ neg exponent on fraction → flip fraction

$\frac{m^{-12}}{3^{-2}}$ power of quotient

$= \left(\frac{3^1}{m^6}\right)^{+2}$ power of quotient

$\frac{3^2}{m^{12}}$

$= \boxed{\frac{9}{m^{12}}}$

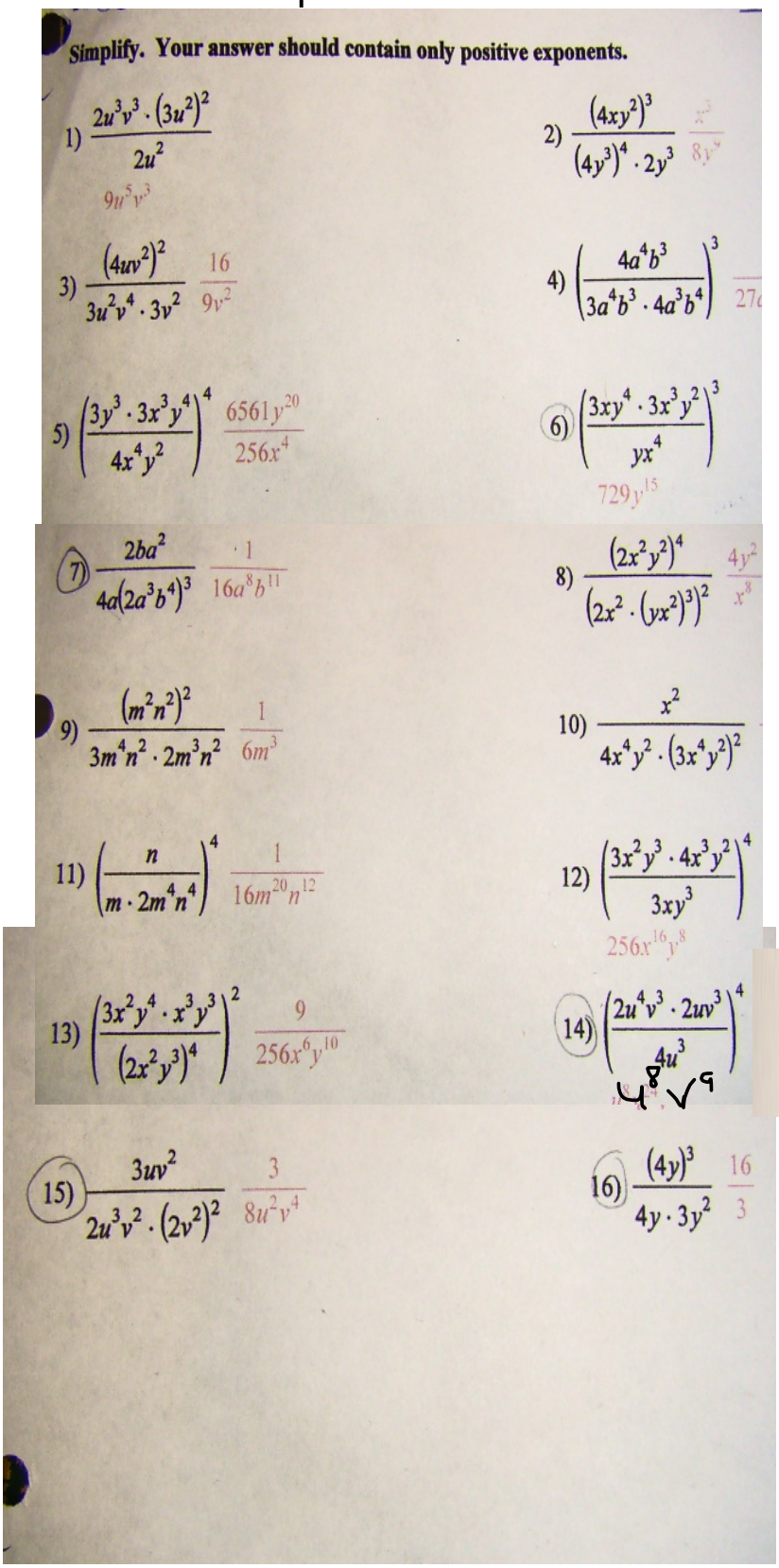
$\frac{3^2}{m^{12}}$

$= \frac{9}{m^{12}}$

Homework

Worksheet Solutions

Laws of exponents Practice Worksheet



Simplify. Your answer should contain only positive exponents.

1) $\dfrac{2u^3v^3\cdot(3u^2)^2}{2u^2}$ $9u^5v^3$

2) $\dfrac{(4xy^2)^3}{(4y^3)^4\cdot 2y^3}$ $\dfrac{x^3}{8y^5}$

3) $\dfrac{(4uv^2)^2}{3u^2v^4\cdot 3v^2}$ $\dfrac{16}{9v^2}$

4) $\left(\dfrac{4a^4b^3}{3a^4b^3\cdot 4a^3b^4}\right)^3$ $\dfrac{27}{}$

5) $\left(\dfrac{3y^3\cdot 3x^3y^4}{4x^4y^2}\right)^4$ $\dfrac{6561y^{20}}{256x^4}$

6) $\left(\dfrac{3xy^4\cdot 3x^3y^2}{yx^4}\right)^3$ $729y^{15}$

7) $\dfrac{2ba^2}{4a(2a^3b^4)^3}$ $\dfrac{\cdot 1}{16a^8b^{11}}$

8) $\dfrac{(2x^2y^2)^4}{(2x^2\cdot(yx^2)^3)^2}$ $\dfrac{4y^2}{x^8}$

9) $\dfrac{(m^2n^2)^2}{3m^4n^2\cdot 2m^3n^2}$ $\dfrac{1}{6m^3}$

10) $\dfrac{x^2}{4x^4y^2\cdot(3x^4y^2)^2}$

11) $\left(\dfrac{n}{m\cdot 2m^4n^4}\right)^4$ $\dfrac{1}{16m^{20}n^{12}}$

12) $\left(\dfrac{3x^2y^3\cdot 4x^3y^2}{3xy^3}\right)^4$ $256x^{16}y^8$

13) $\left(\dfrac{3x^2y^4\cdot x^3y^3}{(2x^2y^3)^4}\right)^2$ $\dfrac{9}{256x^6y^{10}}$

14) $\left(\dfrac{2u^4v^3\cdot 2uv^3}{4u^3}\right)^4$ u^8v^9

15) $\dfrac{3uv^2}{2u^3v^2\cdot(2v^2)^2}$ $\dfrac{3}{8u^2v^4}$

16) $\dfrac{(4y)^3}{4y\cdot 3y^2}$ $\dfrac{16}{3}$

Test Review Sheet

1) $\sqrt[3]{\frac{125}{8}} = \frac{\sqrt[3]{125}}{\sqrt[3]{8}} = \frac{5}{2}$

2) $\sqrt[3]{100}$ → $\sqrt[3]{64}$ (4) $\sqrt[3]{125}$ (5) — No

$\sqrt[4]{16}$ → 2 — No

$\sqrt[3]{130}$ → $\sqrt[3]{125}$ (5) $\sqrt[3]{216}$ (6) — Yes

$\sqrt{89}$ → $\sqrt{81}$ (9) $\sqrt{100}$ (10) — No

3) $\sqrt{50}$ Not in perfect square list so irrational ,

$\sqrt[3]{-125} = -5$ Rational ,

$\sqrt{4.9} = \frac{\sqrt{49}}{\sqrt{10}}$ can't do so irrational ,

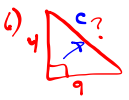
$\sqrt{\frac{81}{36}} = \frac{\sqrt{81}}{\sqrt{36}} = \frac{9}{6}$ Rational

4) $\sqrt{28}$ 5.2915 , $\sqrt[3]{40}$ 3.419 , $\sqrt[5]{301}$ 3.1317 , $\sqrt[3]{-83}$ −4.36 least

5) a) integer but not whole? $\pm1, \pm2, \pm3$ $0,1,2,3$? any negative (Ex -1)

b) is a whole but not integer? $0,1,2,3$ $\pm1, \pm2, \pm3$ 0

c) whole but not natural? $0,1,2,3,4$ $1,2,3,4$ 0

6) 

$c^2 = a^2 + b^2$
$= 4^2 + 9^2$
$= 16 + 81$
$c^2 = 97$
$c = \sqrt{97}$

7) $\sqrt[3]{648}$ ← look in perfect cube list

$\sqrt[3]{216 \times 3}$
$\sqrt[3]{216}\ \sqrt[3]{3}$
$6\sqrt[3]{3}$

8) $\sqrt{605}$ ← look in perfect square list, find largest perfect square that divides into 605

$\sqrt{121} \times \sqrt{5}$
$11\sqrt{5}$

9) a) $4\sqrt[3]{7}$

$\sqrt[3]{4^3 \times 7}$
$\sqrt[3]{64 \times 7}$
$\sqrt[3]{448}$

b) $5\sqrt{10}$
$= \sqrt{5^2 \times 10}$
$= \sqrt{25 \times 10}$
$= \sqrt{250}$

10) $71^{3/4} = \left(\sqrt[4]{71}\right)^3$ Remember $x^{\frac{m}{n}}$ ← power, ← index

11) a) $\left(\sqrt[3]{6}\right)^2$ $6^{\frac{2}{3}}$ b) $\left(\sqrt[5]{11}\right)^3$ $11^{\frac{3}{5}}$ c) $\sqrt{\frac{7}{9}}^3$ $\left(\frac{7}{9}\right)^{\frac{3}{2}}$ d) $\sqrt[5]{\left(\frac{5}{6}\right)^2}$ $\left(\frac{5}{6}\right)^{\frac{2}{5}}$

Review for test Sheet continued

12) $8.4^{0.75}$ as radical

$8.4^{\frac{3}{4}}$

$\sqrt[4]{(8.4)^3}$ or $\left(\sqrt[4]{8.4}\right)^3$

b) $7.5^{1.25} = (7.5)^{\frac{125}{100}}$ change 125/100 to fraction

$= (7.5)^{\frac{5}{4}}$

$= \left(\sqrt[4]{7.5}\right)^5$ or $\sqrt[4]{(7.5)^5}$

13) Evaluate $\left(\frac{343}{216}\right)^{\frac{2}{3}}$

$= \frac{\left(\sqrt[3]{343}\right)^2}{\left(\sqrt[3]{216}\right)^2}$

$= \frac{7^2}{6^2}$

$= \frac{49}{36}$

b) $\left(\frac{1024}{16807}\right)^{-\frac{3}{5}}$ ← make positive first

$\left(\frac{16807}{1024}\right)^{\frac{3}{5}}$

$= \frac{\left(\sqrt[5]{16807}\right)^3}{\left(\sqrt[5]{1024}\right)^3}$

$= \frac{7^3}{4^3}$

$= \frac{343}{64}$

c) $125^{-\frac{2}{3}}$

$= \left(\frac{1}{125}\right)^{\frac{2}{3}}$

$= \frac{\left(\sqrt[3]{1}\right)^2}{\left(\sqrt[3]{125}\right)^2}$

$= \frac{1}{125^{\frac{2}{3}}}$

14) $\frac{1}{9} = \frac{1}{3^2} = 3^{-2}$ (a)

15) $\left[(-3x^4y^2)(7xy^3)\right]^{-2}$

simplify inside bracket first since like terms

$(-3(7)\, x^4 \cdot x\, y^2 y^3)^{-2}$

$(-21\, x^5\, y^5)^{-2}$ power of power

$= (-21)^{-2}(x^{-10})(y^{-10})$

move all neg exponents to bottom

$= \frac{1}{(-21)^2\, x^{10}\, y^{10}}$

$= \frac{1}{441\, x^{10} y^{10}}$

b) $\left(\frac{x^7 y^3 z}{x^4 y z}\right)^2$ simplify inside bracket first

$(x^{-4} y^2 z^0)^2$ ← this 1 so not needed

$(x^{-4} y^2)^2$ power law

$= x^{-8} y^4$ move neg power to bottom

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

c) $\left(\frac{3x^4}{z^2}\right)^{-5}$ ← nothing simplifies in bracket so flip base

$\left(\frac{z^2}{3x^4}\right)^5$

$\frac{z^{10}}{3^5 x^{20}}$

$= \frac{z^{10}}{243\, x^{20}}$

OR $\left(\frac{3x^4}{z^2}\right)^{-5}$

$= \frac{3^{-5} x^{-20}}{z^{-10}}$

move negative exponent to opposite top/bottom

$= \frac{z^{10}}{3^5 x^{20}}$

$= \frac{z^{10}}{243\, x^{20}}$

d) $\frac{(4xy^2)(3x^2y^3)^4}{12x^{-4}y^3}$

$= \frac{4xy^2\, 3^4 x^8 y^{12}}{12x^{-4}y^3}$

$= \frac{4(3^4)\, x\, x^8\, y^{12}}{12x^{-4}y^3}$

$= \frac{4(81)\, x^9\, y^{12}}{12\, x^{-4}\, y^3}$ ← reduce

$= \frac{81}{3}\, x^{9-(-4)}\, y^{12-3}$

$= 27\, x^{9+4}\, y^9$

$= 27\, x^{13} y^9$

e) $\left(\frac{3}{4} a^{-7} b^5\right)^{-2}$

$= \left(\frac{3\, a^{-7} b^5}{4}\right)^{-2}$

$\left(\frac{4}{3\, a^{-7} b^5}\right)^2$

$= \frac{4^2}{3^2 a^{-14} b^{10}}$

$\frac{16\, a^{14}}{9\, b^{10}}$