Tip. When simplifying radical expressions, it is helpful to rewrite a number using its prime factorization and cancel powers.

Example. $108 = 2^2 3^3$ so $\sqrt[3]{108} = \sqrt[3]{2^2 3^3} = 3\sqrt[3]{2^2} = 3\sqrt[3]{4}$

1. Evaluate each expression.

   (a) $(-3)^4$

   (b) -3^4

   (c) $\left(\dfrac{1}{8}\right)^2 \cdot (-2)^3$

   (d) $(-2)^5$

   (e) -2^5

   (f) $(-6)^2 \cdot \left(\dfrac{1}{6}\right)^2$

   (g) $\left(\dfrac{2}{5}\right)^0 \cdot 3^{-1}$

   (h) $\dfrac{3^{-2}}{5^0}$

   (i) $\left(\dfrac{-2}{5}\right)^{-2}$

   (j) $5^2 \cdot 5$

   (k) $5^8 \cdot 5^{-6}$

   (l) $5^{-8} \cdot 5^6$

   (m) $\left(2^3\right)^2$

   (n) $\dfrac{10^8}{10^5}$

   (o) $\dfrac{10^2}{10^{-2}}$

2. Simplify.

   (a) $\sqrt{12}$

   (b) $\sqrt{18}$

   (c) $\sqrt[3]{250}$

   (d) $\sqrt[5]{243}$

   (e) $\sqrt[5]{486}$

   (f) $\sqrt[4]{162}$

   (g) $\sqrt{\dfrac{27}{16}}$

   (h) $\dfrac{\sqrt{18}}{\sqrt{36}}$

   (i) $5\sqrt[3]{81}$

   (j) $\sqrt{2} \cdot \sqrt{6}$

   (k) $\sqrt{14} \cdot \sqrt{32}$

   (l) $\dfrac{\sqrt{80}}{\sqrt{5}}$

   (m) $\sqrt[3]{500}$

   (n) $\sqrt[4]{24} \cdot \sqrt[4]{14}$

   (o) $\dfrac{\sqrt{63}}{\sqrt{7}}$

   (p) $\sqrt[5]{\dfrac{1}{2}} \cdot \sqrt[5]{\dfrac{1}{16}}$

3. Simplify each expression and eliminate negative exponents.

   (a) $x^5 \cdot x^8$

   (b) $(2x^3)^2$

   (c) $x^{-3} \cdot x^5$

   (d) $y^6 \cdot y^9$

   (e) $(3x)^3$

   (f) $y^7 \cdot y^{-3}$

   (g) $z^{-8} \cdot z^3$

   (h) $x^{-2}x^{-6}x^4$

   (i) $\dfrac{x^{15}}{x^{10}}$

(j) $y^3 \cdot y^{-9}$

(k) $w^5 w^{-8} w^4$

(l) $\dfrac{x^8 x^0}{x^{12}}$

(m) $\dfrac{b^8 b^{-3}}{b}$

(n) $(z^3 z^5)^2$

(o) $(3x^4)\left(\dfrac{x}{3}\right)^3$

(p) $\dfrac{y^3 y^5}{y^2 y^{-3}}$

(q) $(-2b^3 b^3)^3$

(r) $(-3x^2)^2 (2x^{-2})^3$

4. Simplify each expression and eliminate negative exponents.

(a) $\dfrac{xy}{7x^{-4}y^{-2}}$

(b) $\dfrac{7y^6}{4y^5 z^4}$

(c) $(x^3 y^{-5})(2x^{-4}y^2)(4xy^5)$

(d) $(xw)(6x^{-6}w^{-4})$

(e) $(w \cdot 4w^2 \cdot w^2)^3$

(f) $\left(\dfrac{y^2}{y}\right)^3$

(g) $(3x \cdot 4x^2)^3$

(h) $\left(\dfrac{2y^4}{4y}\right)^2$

(i) $\left(\dfrac{9z}{8z^6}\right)^3$

(j) $\dfrac{x^{-3}y^{-2}}{y^{-1}}$

(k) $\left(\dfrac{a^3 b^{-2}}{a^{-3} b^2}\right)^3$

(l) $\left(\dfrac{x}{y^2}\right)^5 \left(\dfrac{x^2 y^3}{z^2}\right)^3$

(m) $\dfrac{(a^{-1}b^3)^2}{(a^2 b^{-3})^3}$

(n) $\left(\dfrac{x^2 z^4}{2y^5}\right)\left(\dfrac{3x^2 y^3}{z^2}\right)^2$

(o) $\dfrac{(w^2 v)^3}{(w^2 v^{-3})^2}$

(p) $\dfrac{16x^3 y^{-5}}{4x^{-6}y^8}$

(q) $\left(\dfrac{w}{3x^{-3}}\right)^{-2}$

(r) $\left(\dfrac{2x^{-1}y}{x^{-3}y^{-2}}\right)^{-3}$

5. Express the following in the form x^r.

(a) $(\sqrt[5]{x})^6$

(b) $\sqrt[8]{x^3}$

(c) $\dfrac{1}{(\sqrt{x})^5}$

(d) $\dfrac{1}{\sqrt[3]{x^4}}$

(e) $\sqrt[4]{\sqrt[3]{x}}$

(f) $\sqrt{\dfrac{1}{\sqrt[5]{x}}}$

6. Express the following in the form x^r.

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

(b) $\dfrac{x^{\frac{6}{7}}}{x^4}$

(c) $(x^3)^{-\frac{4}{5}}$

(d) $x^{\frac{7}{5}} x^{-\frac{8}{3}}$

(e) $(x^{\frac{2}{3}})^{\frac{4}{9}}$

(f) $\dfrac{1}{x^{\frac{5}{2}}}$

(g) $\left(\dfrac{1}{x^3}\right)^{-\frac{2}{3}}$

(h) $\dfrac{1}{x\sqrt{x}}$

(i) $x^2(\sqrt[3]{x})$

(j) $\dfrac{x}{x^{\frac{2}{5}}}$

(k) $\dfrac{x^{\frac{1}{3}}}{x}$

(l) $\dfrac{1}{x^{-\frac{5}{4}}}$

7. Simplify and eliminate negative exponents. Assume that all letters denote positive numbers.

(a) $x^{\frac{2}{3}} \cdot x^{\frac{4}{3}}$

(b) $a^{\frac{3}{5}} \cdot a^{\frac{12}{5}}$

(c) $(9x)^{\frac{1}{2}} \cdot (4x^{\frac{1}{4}})$

(d) $((2b)^{\frac{2}{9}})^3 \cdot (2b)^{\frac{1}{3}}$

(e) $\dfrac{x^{\frac{3}{2}} x^{\frac{1}{2}}}{x^{\frac{5}{2}}}$

(f) $(27z^3)^{-\frac{2}{3}}$

(g) $(x^5 y^4)^{-\frac{1}{2}}$

(h) $(-8x^6 y^{-18})^{-\frac{1}{3}}$

$y^{-1}(yx^{\frac{1}{2}})^{\frac{2}{3}}$

(i) $\left(\dfrac{a^{\frac{3}{2}}}{b^{-\frac{1}{2}}}\right)^4 \left(\dfrac{a^{-2}}{b^3}\right)$

(j) $\left(\dfrac{x^6 y^{-3}}{27y^{\frac{3}{5}}}\right)^{-\frac{1}{3}}$

Answers

1. (a) 81   (b) -81 (c) $-1/8$ (d) -32 (e) -32 (f) 1   (g) $1/3$ (h) $1/9$

   (i) $25/4$ (j) 125   (k) 25   (l) $1/25$ (m) 64   (n) 1000   (o) 10,000

2. (a) $2\sqrt{3}$ (b) $3\sqrt{2}$ (c) $5\sqrt[3]{2}$ (d) 3   (e) $3\sqrt[5]{2}$ (f) $3\sqrt[4]{2}$ (g) $\dfrac{3\sqrt{3}}{4}$ (h) $\dfrac{\sqrt{2}}{2}$

   (i) $15\sqrt[3]{3}$ (j) $2\sqrt{3}$ (k) $8\sqrt{7}$ (l) 4   (m) $5\sqrt[3]{4}$ (n) $2\sqrt[4]{21}$ (o) 3   (p) $\dfrac{1}{2}$

3. (a) x^{13} (b) $4x^6$ (c) x^2 (d) y^{15} (e) $27x^3$ (f) y^4 (g) $\dfrac{1}{z^5}$ (h) $\dfrac{1}{x^4}$ (i) x^5

   (j) $\dfrac{1}{y^6}$ (k) w (l) $\dfrac{1}{x^4}$ (m) b^4 (n) z^{16} (o) $\dfrac{x^7}{9}$ (p) y^9 (q) $-8b^{18}$ (r) $\dfrac{72}{x^2}$

4. (a) $\dfrac{x^5 y^3}{7}$ (b) $\dfrac{7y}{4z^4}$ (c) $8y^2$ (d) $\dfrac{6}{x^5 w^3}$ (e) $64w^{15}$ (f) y^3 (g) $1728x^9$ (h) $\dfrac{y^6}{4}$

   (i) $\dfrac{729}{512z^{15}}$ (j) $\dfrac{1}{x^3 y}$ (k) $\dfrac{a^{18}}{b^{12}}$ (l) $\dfrac{x^{11}}{yz^6}$ (m) $\dfrac{b^{15}}{a^8}$ (n) $\dfrac{9x^6 y}{2}$ (o) $w^2 v^9$ (p) $\dfrac{4x^9}{y^{13}}$

   (q) $\dfrac{9}{w^2 x^6}$ (r) $\dfrac{1}{8x^6 y^9}$

5. (a) $x^{\frac{6}{5}}$ (b) $x^{\frac{3}{8}}$ (c) $x^{-\frac{5}{2}}$ (d) $x^{-\frac{4}{3}}$ (e) $x^{\frac{1}{12}}$ (f) $x^{-\frac{1}{10}}$

6. (a) $x^{\frac{11}{2}}$ (b) $x^{-\frac{22}{7}}$ (c) $x^{-\frac{12}{5}}$ (d) $x^{-\frac{19}{15}}$ (e) $x^{\frac{8}{27}}$ (f) $x^{-\frac{5}{2}}$ (g) x^2 (h) $x^{-\frac{3}{2}}$

   (i) $x^{\frac{7}{3}}$ (j) $x^{\frac{3}{5}}$ (k) $x^{-\frac{2}{3}}$ (l) $x^{\frac{5}{4}}$

7. (a) x^2 (b) a^3 (c) $12x^{\frac{3}{4}}$ (d) $2b$ (e) $\dfrac{1}{x^{\frac{1}{2}}}$ (f) $\dfrac{1}{9z^2}$ (g) $\dfrac{1}{x^{\frac{5}{2}} y^2}$ (h) $\dfrac{-y^6}{2x^2}$

   (i) $\dfrac{x^{\frac{1}{3}}}{y^{\frac{1}{3}}}$ (j) $\dfrac{a^4}{b}$ (k) $\dfrac{3y^{\frac{6}{5}}}{x^2}$

Keystone Algebra 1

Name_____

Simplifying Absolute Value Problems

Date_____ Period_____

Evaluate each expression.

1) $\left|-1-2\right|$

2) $9 \div \left(\left|3\right|\right)$

3) $\left|1-4\right| \times -2$

4) $-\dfrac{12}{\left|-1\right|+1}$

5) $\left|1--3\right| + \left|5\right|$

6) $\left(\left|3-3\right|--4\right) \times 5$

Evaluate each using the values given.

7) $b - \left|a\right|$; use $a = 5$, and $b = 6$

8) $\left|x + y\right|$; use $x = 3$, and $y = -5$

9) $q - \left|r\right|$; use $q = 3$, and $r = -1$

10) $\left|j - h\right|$; use $h = 5$, and $j = 6$

11) $x - (|z| + x)$; use $x = 6$, and $z = 3$

12) $6|x + y|$; use $x = 1$, and $y = 1$

13) $(|p + q|) \div 5$; use $p = -2$, and $q = -3$

14) $j(h - |h|)$; use $h = -1$, and $j = 5$

15) $|2| + h + |j|$; use $h = 6$, and $j = -4$

16) $|x - y| + y - 1$; use $x = -3$, and $y = -6$

17) $3 - (p + |m - m|)$; use $m = 4$, and $p = -4$

18) $n(m + |-1|) - n$; use $m = 1$, and $n = -6$

19) $|ab| - |b| + b$; use $a = 3$, and $b = 6$

20) $x - (x + y - |-x|)$; use $x = -2$, and $y = 4$

Keystone Algebra 1   Name_____

Simplifying Absolute Value Problems

Date_____ Period____

Evaluate each expression.

1) $\left|-1-2\right|$

   3

2) $9 \div \left(\left|3\right|\right)$

   3

3) $\left|1-4\right| \times -2$

   −6

4) $-\dfrac{12}{\left|-1\right|+1}$

   −6

5) $\left|1--3\right| + \left|5\right|$

   9

6) $\left(\left|3-3\right| - -4\right) \times 5$

   20

Evaluate each using the values given.

7) $b - \left|a\right|$; use $a = 5$, and $b = 6$

   1

8) $\left|x + y\right|$; use $x = 3$, and $y = -5$

   2

9) $q - \left|r\right|$; use $q = 3$, and $r = -1$

   2

10) $\left|j - h\right|$; use $h = 5$, and $j = 6$

   1

11) $x - (|z| + x)$; use $x = 6$, and $z = 3$

   −3

12) $6|x + y|$; use $x = 1$, and $y = 1$

   12

13) $(|p + q|) \div 5$; use $p = -2$, and $q = -3$

   1

14) $j(h - |h|)$; use $h = -1$, and $j = 5$

   −10

15) $|2| + h + |j|$; use $h = 6$, and $j = -4$

   12

16) $|x - y| + y - 1$; use $x = -3$, and $y = -6$

   −4

17) $3 - (p + |m - m|)$; use $m = 4$, and $p = -4$

   7

18) $n(m + |-1|) - n$; use $m = 1$, and $n = -6$

   −6

19) $|ab| - |b| + b$; use $a = 3$, and $b = 6$

   18

20) $x - (x + y - |-x|)$; use $x = -2$, and $y = 4$

   −2