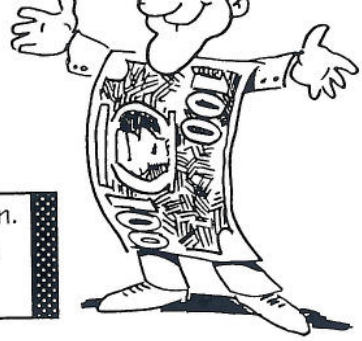
What Did Dr. Drone Say To the Guy Who Thought He Was a $100 Bill?



Simplify the expression and find your answer in the adjacent answer column. Write the letter of the exercise in the box that contains the number of the answer. Assume that all variables represent nonnegative numbers.

G $\sqrt{12}$	9 $5\sqrt{2}$	A $2\sqrt{18}$	6 36
I $\sqrt{50}$	2 $5\sqrt{5}$	O $8\sqrt{28}$	37 $-30\sqrt{3}$
O $\sqrt{45}$	35 $6\sqrt{2}$	G $-3\sqrt{1000}$	18 $6\sqrt{2}$
E $\sqrt{600}$	33 $4\sqrt{3}$	E $5\sqrt{75}$	21 $25\sqrt{3}$
S $\sqrt{98}$	14 $10\sqrt{6}$	D $-4\sqrt{490}$	16 $-28\sqrt{6}$
U $\sqrt{48}$	20 $2\sqrt{3}$	L $9\sqrt{72}$	26 $54\sqrt{2}$
O $\sqrt{125}$	5 $4\sqrt{5}$	H $-7\sqrt{80}$	29 $16\sqrt{7}$
W $\sqrt{162}$	23 $9\sqrt{2}$	O $3\sqrt{144}$	13 $-28\sqrt{5}$
	36 $3\sqrt{5}$		24 $45\sqrt{3}$
	19 $5\sqrt{3}$		11 $-30\sqrt{10}$
	4 $7\sqrt{2}$		38 $-28\sqrt{10}$

$

Y $\sqrt{16n^2}$	17 $7n\sqrt{n}$	O $\sqrt{25x^2y}$	8 $30x^4y\sqrt{5}$
N $\sqrt{20n^2}$	7 $30n^2\sqrt{n}$	D $\sqrt{90x^4y^2}$	34 $-22x^2\sqrt{xy}$
H $\sqrt{49n^3}$	15 $3n^2\sqrt{5n}$	G $\sqrt{81x^3y^4}$	28 $3x^2y\sqrt{10}$
T $\sqrt{63n^3}$	10 $2n\sqrt{5}$	I $\sqrt{24x^2y^6}$	5 $8x^3y^2\sqrt{11y}$
O $\sqrt{36n^4}$	25 $-10n^2\sqrt{2}$	C $\sqrt{15xy^3}$	22 $xy\sqrt{15}$
L $-\sqrt{200n^4}$	12 $3n\sqrt{7n}$	P $3\sqrt{500x^8y^2}$	24 $2xy^3\sqrt{6}$
P $\sqrt{900n^5}$	27 $4n^4\sqrt{5}$	N $-2\sqrt{121x^3y}$	37 $5x\sqrt{y}$
G $\sqrt{60n^8}$	1 $2n^4\sqrt{15}$	H $4\sqrt{44x^6y^5}$	19 $-22x\sqrt{xy}$
	31 $4n$		16 $y\sqrt{15xy}$
	32 $6n^2$		3 $30y^4\sqrt{5y}$
	30 $-10n^2\sqrt{2n}$		35 $9xy^2\sqrt{x}$

1	2	3	4	5	6	7	8	9	10	11

12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38

Did you hear about...

A	B	C	D	E	F	G	H
I	J	K	L	M	N	O	P ?

Rationalize the denominator and simplify each expression below. Find your answer in the adjacent answer column and notice the word next to it. Write this word in the box containing the letter of that exercise. Keep working and you will hear about a mistake.

(A) $\frac{5}{\sqrt{3}}$

(B) $\frac{2}{\sqrt{7}}$

(C) $\frac{20}{\sqrt{5}}$

(D) $\frac{14}{\sqrt{2}}$

(E) $\frac{3}{\sqrt{6}}$

(F) $\frac{4}{\sqrt{10}}$

(G) $\frac{11}{\sqrt{11}}$

(H) $\frac{3}{\sqrt{12}}$

(I) $\frac{30}{\sqrt{18}}$

(J) $\frac{8}{\sqrt{20}}$

(K) $\frac{9}{2\sqrt{45}}$

(L) $\frac{\sqrt{7}}{\sqrt{3}}$

(M) $\frac{\sqrt{5}}{\sqrt{10}}$

(N) $\frac{3\sqrt{6}}{\sqrt{2}}$

(O) $\frac{\sqrt{3}}{2\sqrt{6}}$

(P) $\frac{2\sqrt{3}}{\sqrt{15}}$

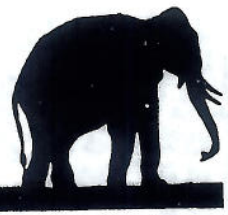
Answers A–H:

$\sqrt{11}$	TO
$\frac{\sqrt{5}}{2}$	WAS
$\frac{\sqrt{2}}{6}$	HUG
$\frac{2\sqrt{10}}{5}$	TRIED
$4\sqrt{5}$	SAD
$\frac{5\sqrt{3}}{3}$	THE
$\frac{3\sqrt{5}}{10}$	BIG
$\frac{\sqrt{6}}{2}$	WHO
$\frac{\sqrt{3}}{2}$	KISS
$\frac{2\sqrt{7}}{7}$	VERY
$7\sqrt{2}$	GUY
$\frac{2\sqrt{6}}{3}$	GIRL

Answers I–P:

$\frac{3\sqrt{2}}{4}$	BUT
$\frac{\sqrt{2}}{4}$	AND
$\frac{\sqrt{21}}{3}$	IN
$\frac{4\sqrt{5}}{5}$	GIRL
$\frac{6\sqrt{2}}{5}$	LOST
$3\sqrt{3}$	FOG
$\frac{3\sqrt{5}}{10}$	FRIEND
$\frac{\sqrt{2}}{2}$	THE
$5\sqrt{2}$	HIS
$\frac{2\sqrt{2}}{5}$	A
$\frac{2\sqrt{5}}{5}$	MIST
$\frac{9\sqrt{3}}{10}$	TODAY

Do Elephants Know How to Gamble?



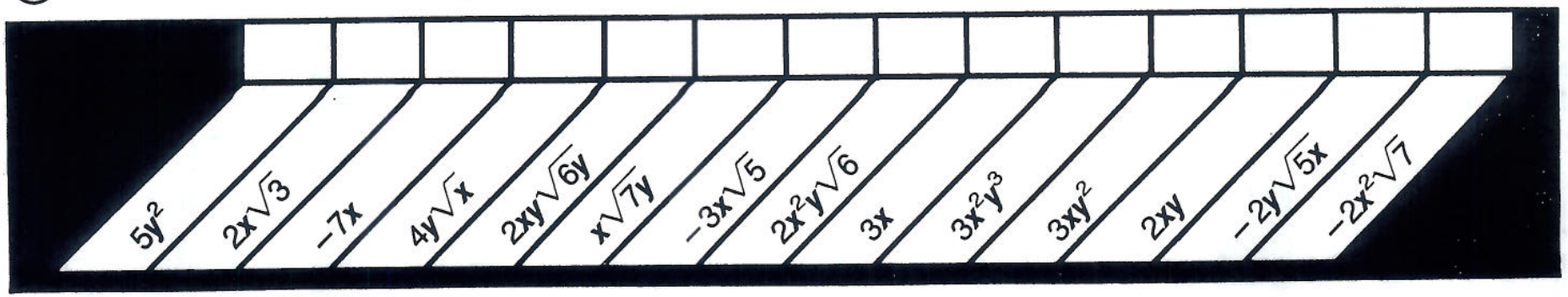
Simplify each expression below. Assume that all variables represent nonnegative numbers. Find your answer in the corresponding set of answer boxes. Print the letter of the exercise in the box above the answer.

(T) $\sqrt{9x^2}$
(E) $-\sqrt{49x^2}$
(A) $\sqrt{4x^2y^2}$

(H) $\sqrt{12x^2}$
(O) $-\sqrt{45x^2}$
(T) $\sqrt{25y^4}$

(E) $-\sqrt{28x^4}$
(Y) $\sqrt{16xy^2}$
(V) $-\sqrt{20xy^2}$

(D) $\sqrt{7x^2y}$
(H) $\sqrt{9x^2y^4}$
(N) $\sqrt{24x^4y^2}$

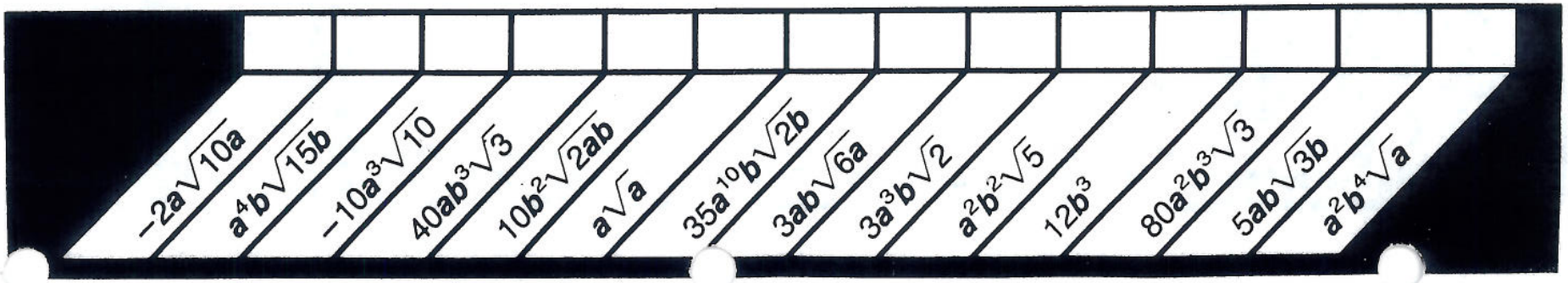


(E) $\sqrt{a^3}$
(T) $-\sqrt{40a^3}$
(A) $\sqrt{54a^3b^2}$

(E) $\sqrt{75a^2b^3}$
(I) $\sqrt{144b^6}$
(E) $-\sqrt{1000a^6}$

(S) $\sqrt{18a^6b^2}$
(H) $\sqrt{15a^8b^3}$
(A) $\sqrt{a^5b^8}$

(V) $2\sqrt{50ab^5}$
(D) $8\sqrt{300a^4b^6}$
(G) $5\sqrt{98a^{20}b^3}$



What Has Four Legs, Is Green and Fuzzy, and Could Kill You If It Fell Out of a Tree?

Simplify the expression. Find your answer below and cross out the letter under it. The letters that remain will answer the title question.

1. $\sqrt{\frac{49}{4}}$
2. $\sqrt{\frac{20}{81}}$
3. $\sqrt{\frac{75}{x^4}}$
4. $\sqrt{\frac{64}{36a^2}}$
5. $\sqrt{\frac{54}{24}}$
6. $-\sqrt{\frac{60}{5}}$
7. $\sqrt{\frac{3x^3}{16x}}$
8. $\sqrt{\frac{22a^5}{200a}}$
9. $\frac{5}{\sqrt{2}}$
10. $\frac{4}{\sqrt{7}}$
11. $\frac{20}{\sqrt{5}}$
12. $\frac{10}{\sqrt{30}}$
13. $\sqrt{\frac{1}{18}}$
14. $\frac{5}{\sqrt{40}}$
15. $-\frac{9}{2\sqrt{45}}$
16. $\sqrt{\frac{8}{3}}$
17. $\sqrt{\frac{7}{2t}}$
18. $\frac{5\sqrt{3}}{\sqrt{10}}$
19. $\frac{2\sqrt{11t^2}}{\sqrt{6t}}$
20. $\frac{10\sqrt{6}}{\sqrt{15}}$

Answers – Even-Numbered Exercises

$\frac{4}{3a}$	$\frac{\sqrt{10}}{4}$	$\frac{\sqrt{7}}{14}$	$\frac{\sqrt{30}}{2}$	$\frac{2\sqrt{5}}{5}$	$\frac{4\sqrt{7}}{7}$	$-2\sqrt{3}$	$\frac{a^2\sqrt{2}}{5}$	$2\sqrt{10}$	$\frac{\sqrt{30}}{3}$	$-\sqrt{6}$	$\frac{2\sqrt{6}}{3}$	$\frac{2\sqrt{5}}{9}$	$\frac{\sqrt{10}}{6}$	$\frac{a^2\sqrt{11}}{10}$
S	T	A	U	P	A	S	O	N	T	O	P	A	L	D

Answers – Odd-Numbered Exercises

$\frac{\sqrt{7}}{4t}$	$\frac{5\sqrt{3}}{x^2}$	$\frac{\sqrt{66t}}{3}$	$\frac{\sqrt{2}}{6}$	$\frac{7}{2}$	$-\frac{\sqrt{3}}{20}$	$\frac{\sqrt{33t}}{6}$	$\frac{\sqrt{14t}}{2t}$	$\frac{x\sqrt{3}}{4}$	$4\sqrt{5}$	$\frac{\sqrt{15}}{4x^2}$	$-\frac{3\sqrt{5}}{10}$	$\frac{3}{2}$	$\frac{5\sqrt{5}}{2}$	$\frac{5\sqrt{2}}{2}$
T	O	R	E	D	A	B	I	G	O	L	D	M	E	N

What Do You Call a Group of Factory Foremen Who Sing While Drinking Tab Cola and Eating Crab Apples ?

Simplify each expression below. Assume that all variables represent nonnegative numbers. Find your answer in the corresponding answer column. Write the letter of the exercise in the box that contains the number of the answer.

(E) $\sqrt{5}\cdot\sqrt{3}$

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

(O) $\sqrt{3}\cdot\sqrt{6}$

(A) $\sqrt{5}\cdot\sqrt{10}$

(R) $\sqrt{27}\cdot\sqrt{3}$

(H) $\sqrt{10}\cdot\sqrt{20}$

(E) $\sqrt{90}\cdot\sqrt{40}$

(A) $\sqrt{2x}\cdot\sqrt{3x}$

(D) $\sqrt{6x}\cdot\sqrt{2x}$

(T) $\sqrt{30x^2}\cdot\sqrt{3x^2}$

(E) $\sqrt{3x}\cdot\sqrt{8x^3}$

(P) $\sqrt{40x^2}\cdot\sqrt{10x}$

(E) $\sqrt{12x^5}\cdot\sqrt{12x^5}$

(7) $2x^2\sqrt{6}$

(2) $10\sqrt{2}$

(3) $12x^5$

(9) $\sqrt{15}$

(12) $x\sqrt{6}$

(5) $3\sqrt{2}$

(1) $3x^2\sqrt{10}$

(23) $2\sqrt{3}$

(26) 9

(21) 60

(18) $20x\sqrt{x}$

(14) $5\sqrt{2}$

(16) $2x\sqrt{3}$

(N) $5\sqrt{2}\cdot4\sqrt{3}$

(B) $-7\sqrt{3}\cdot2\sqrt{10}$

(I) $2\sqrt{6}\cdot5\sqrt{3}$

(A) $4\sqrt{10}\ (-3\sqrt{2})$

(R) $2\sqrt{8}\cdot\sqrt{18}$

(L) $-10\sqrt{3}\ (-2\sqrt{21})$

(M) $-\sqrt{6}\cdot7\sqrt{10}$

(N) $3\sqrt{ab}\cdot6\sqrt{ab}$

(P) $\sqrt{2ab^2}\cdot\sqrt{14ab^2}$

(T) $-\sqrt{15a^2b}\ (-\sqrt{5a^2})$

(O) $\sqrt{8ab^2}\cdot(-\sqrt{10a^3b^4})$

(F) $2\sqrt{18a^2b}\cdot6\sqrt{3b^2}$

(C) $5\sqrt{2a^3b^8}\cdot4\sqrt{12a^2}$

(25) $30\sqrt{2}$

(11) $5a^2\sqrt{3b}$

(8) $-14\sqrt{15}$

(4) $36ab\sqrt{6b}$

(17) $-24\sqrt{5}$

(15) $18ab$

(22) $40a^2b^4\sqrt{6a}$

(6) 24

(10) $20\sqrt{6}$

(19) $2ab^2\sqrt{7}$

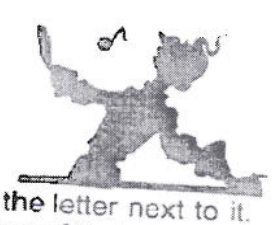
(13) $-14\sqrt{30}$

(24) $-4a^2b^3\sqrt{5}$

(20) $60\sqrt{7}$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

What Should You Do If Nobody Will Sing With You?



Simplify each expression. Find your answer below the exercise and notice the letter next to it. Write this letter in the box at the bottom of the page that contains the number of that exercise.

(1) $2\sqrt{5} + 4\sqrt{5}$

(2) $7\sqrt{3} - 3\sqrt{3}$

(3) $2\sqrt{6} - 7\sqrt{6}$

(4) $5\sqrt{x} + \sqrt{x}$

(5) $9\sqrt{5} - 8\sqrt{5}$

(L) $4\sqrt{5}$ (E) $4\sqrt{3}$

(I) $6\sqrt{x}$ (R) $3\sqrt{x}$

(T) $6\sqrt{5}$ (N) $6\sqrt{3}$

(A) $\sqrt{5}$ (U) $-5\sqrt{6}$

(6) $5\sqrt{10} + 4\sqrt{10} - \sqrt{10}$

(7) $2\sqrt{3} - 6\sqrt{3} - 3\sqrt{3}$

(8) $6\sqrt{7} + 3\sqrt{3} - 2\sqrt{7}$

(9) $\sqrt{2} - 4\sqrt{6} + 5\sqrt{2} + \sqrt{6}$

(10) $3\sqrt{a} + 9\sqrt{b} - \sqrt{b} - 2\sqrt{a}$

(H) $8\sqrt{3}$ (S) $4\sqrt{2} - \sqrt{6}$

(E) $8\sqrt{10}$ (F) $4\sqrt{7} + 3\sqrt{3}$

(R) $\sqrt{a} + 8\sqrt{b}$ (A) $3\sqrt{a} + 7\sqrt{b}$

(T) $-7\sqrt{3}$ (Y) $6\sqrt{2} - 3\sqrt{6}$

(11) $3\sqrt{12} + 4\sqrt{3}$

(12) $8\sqrt{5} - 2\sqrt{45}$

(13) $7\sqrt{18} + 2\sqrt{50}$

(14) $6\sqrt{24} - 5\sqrt{54}$

(15) $-\sqrt{27} + 4\sqrt{48}$

(R) $-3\sqrt{6}$ (E) $10\sqrt{3}$

(S) $-4\sqrt{3}$ (L) $2\sqrt{6}$

(T) $2\sqrt{5}$ (N) $13\sqrt{3}$

(E) $24\sqrt{2}$ (O) $31\sqrt{2}$

(16) $5\sqrt{8} + \sqrt{98} - 2\sqrt{18}$

(17) $2\sqrt{90} - 3\sqrt{20} + \sqrt{40}$

(18) $4\sqrt{63} - 9\sqrt{28} + 2\sqrt{44}$

(19) $2\sqrt{27x} + \sqrt{75x} + 5\sqrt{12x}$

(20) $-6\sqrt{9x} + 3\sqrt{64x} - \sqrt{50x}$

(B) $8\sqrt{3x}$ (U) $6\sqrt{x} - 5\sqrt{2x}$

(L) $11\sqrt{2}$ (S) $-6\sqrt{7} + 4\sqrt{11}$

(S) $\sqrt{10} - 9\sqrt{5}$ (D) $8\sqrt{10} - 6\sqrt{5}$

(K) $21\sqrt{3x}$ (P) $3\sqrt{7} + \sqrt{11}$

10	2	15	7	5	17	20	11	1	9	13	3	14	18	6	16	8	19	4	12

OBJECTIVE 3–j: To simplify sums and differences of radicals.

Why Do They Call the New Dance "The Elevator"?

Simplify the expression, then cross out the letter pair next to your answer. For each letter pair that you DON'T cross out, write the uppercase letter in the box containing the lowercase letter.

1 $\sqrt{2}\left(\sqrt{8}-5\right)$

2 $\sqrt{3}\left(1+\sqrt{27}\right)$

3 $\sqrt{5}\left(\sqrt{15}+\sqrt{2}\right)$

4 $2\sqrt{7}\left(\sqrt{7}-4\right)$

5 $8\sqrt{3}\left(2\sqrt{3}+\sqrt{8}\right)$

6 $\sqrt{18}\left(5\sqrt{2}-\sqrt{18}\right)$

Answers 1-6

f • C $5\sqrt{3}+\sqrt{10}$

i • O $14-16\sqrt{3}$

n • E $48+16\sqrt{6}$

m • V $4-5\sqrt{2}$

k • J $14-8\sqrt{7}$

d • H $\sqrt{3}+\sqrt{10}$

h • G 12

a • T $\sqrt{3}+9$

o • S $48+8\sqrt{2}$

7 $\left(5\sqrt{2}+\sqrt{3}\right)\left(\sqrt{2}+2\sqrt{3}\right)$

8 $\left(\sqrt{5}+9\sqrt{2}\right)\left(4\sqrt{5}-\sqrt{2}\right)$

9 $\left(\sqrt{3}+8\right)^2$

10 $\left(\sqrt{6}-\sqrt{3}\right)^2$

11 $\left(7+\sqrt{2}\right)\left(7-\sqrt{2}\right)$

12 $\left(\sqrt{15}+\sqrt{6}\right)\left(\sqrt{15}-\sqrt{6}\right)$

Answers 7-12

l • F 47

h • B $16+11\sqrt{6}$

m • E 12

e • O $9-6\sqrt{2}$

f • S $9-8\sqrt{3}$

k • P $2+35\sqrt{10}$

n • T 9

a • I $16+35\sqrt{5}$

b • H $67+16\sqrt{3}$

13 $\dfrac{4}{\sqrt{5}+\sqrt{2}}$

14 $\dfrac{15}{\sqrt{11}-\sqrt{6}}$

15 $\dfrac{9}{\sqrt{3}+1}$

16 $\dfrac{36}{4-\sqrt{7}}$

Answers 13-16

k • S $\dfrac{4\sqrt{5}-4\sqrt{6}}{2}$

l • R $3\sqrt{11}+3\sqrt{6}$

b • T $\dfrac{9\sqrt{3}-3}{4}$

h • L $16+4\sqrt{7}$

c • T $\dfrac{4\sqrt{5}-4\sqrt{2}}{3}$

e • A $8+3\sqrt{7}$

n • D $\dfrac{9\sqrt{3}-9}{2}$

17 $\dfrac{56}{\sqrt{3}+\sqrt{10}}$

18 $\dfrac{-20}{\sqrt{6}-\sqrt{2}}$

19 $\dfrac{10}{\sqrt{22}+4}$

20 $\dfrac{\sqrt{5}}{3-\sqrt{8}}$

Answers 17-20

h • S $\dfrac{5\sqrt{22}-20}{3}$

l • T $5\sqrt{3}+3\sqrt{10}$

g • L $-5\sqrt{6}-5\sqrt{2}$

n • P $\dfrac{3\sqrt{22}-15}{2}$

j • N $3\sqrt{5}+2\sqrt{10}$

l • H $-8\sqrt{3}+8\sqrt{10}$

h • N $2\sqrt{6}-10\sqrt{2}$

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o

NAME _____ DATE _____ PERIOD _____

5-5 Practice

Roots of Real Numbers

Use a calculator to approximate each value to three decimal places.

1. $\sqrt{7.8}$

5. $\sqrt[4]{1.1}$

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

7. $\sqrt[6]{5555}$

Simplify.

9. $\sqrt{0.81}$

13. $\sqrt[3]{-64}$

17. $\sqrt[5]{\frac{-1024}{243}}$

21. $\sqrt{49m^2t^8}$

25. $-\sqrt[4]{625s^8}$

29. $-\sqrt{144m^8n^6}$

33. $-\sqrt{49a^{10}b^{16}}$

5-6 Practice

Radical Expressions

Simplify.

2. $\sqrt[3]{-432}$

5. $\sqrt[3]{-5000}$

8. $\sqrt[4]{48v^8z^{13}}$

11. $\sqrt{\frac{11}{9}}$

14. $\sqrt{\frac{9a^5}{64b^4}}$

17. $(2\sqrt{24})(7\sqrt{18})$

20. $8\sqrt{48} - 6\sqrt{75} + 7\sqrt{80}$

23. $(\sqrt{5} - \sqrt{6})(\sqrt{5} + \sqrt{2})$

26. $(\sqrt{3} + 4\sqrt{7})^2$

29. $\frac{6}{\sqrt{2} - 1}$

32. $\frac{3 + \sqrt{6}}{5 - \sqrt{24}}$

Simplifying Radical Expressions

Simplify.

1. $\sqrt{28}$

2. $3\sqrt{13} + 7\sqrt{13}$

3. $\sqrt{72}$

4. $\sqrt{15} + 8\sqrt{15} - 12\sqrt{15}$

5. $\sqrt{2} \cdot \sqrt{10}$

6. $9\sqrt{6a} - 11\sqrt{6a} + 4\sqrt{6a}$

7. $3\sqrt{5} \cdot \sqrt{5}$

8. $\sqrt{28} + \sqrt{63}$

9. $2\sqrt{3} \cdot 3\sqrt{15}$

10. $8\sqrt{54} - 4\sqrt{6}$

11. $\sqrt{81c^2d^4}$

12. $\sqrt{72} + \sqrt{50} - \sqrt{8}$

13. $\sqrt{75m^5n^2}$

14. $2\sqrt{24} + 4\sqrt{54} + 5\sqrt{96}$

15. $\sqrt{\frac{1}{6}}$

16. $2\sqrt{13} + 4\sqrt{2} - 5\sqrt{13} + \sqrt{2}$

17. $\sqrt{\frac{q}{12}}$

18. $\sqrt{5}(\sqrt{10} - \sqrt{3})$

19. $\sqrt{\frac{12}{b^2}}$

20. $3\sqrt{3}(2\sqrt{6} + 4\sqrt{10})$

21. $\frac{2}{4 + \sqrt{5}}$

22. $(2 - \sqrt{6})^2$

23. $\frac{5}{7 + \sqrt{7}}$

24. $(\sqrt{6} + 4\sqrt{5})(4\sqrt{3} - \sqrt{10})$

NAME _____ DATE _____ PERIOD _____

5-7 Skills Practice

Rational Exponents

Write each expression in radical form.

1. $3^{\frac{1}{6}}$
2. $8^{\frac{1}{5}}$
3. $12^{\frac{2}{3}}$
4. $(s^3)^{\frac{3}{5}}$

Write each radical using rational exponents.

5. $\sqrt{51}$
6. $\sqrt[3]{37}$
7. $\sqrt[4]{15^3}$
8. $\sqrt[3]{6xy^2}$

Evaluate each expression.

9. $32^{\frac{1}{5}}$
10. $81^{\frac{1}{4}}$
11. $27^{-\frac{1}{3}}$
12. $4^{-\frac{1}{2}}$
13. $16^{\frac{3}{2}}$
14. $(-243)^{\frac{4}{5}}$
15. $27^{\frac{1}{3}} \cdot 27^{\frac{5}{3}}$
16. $\left(\frac{4}{9}\right)^{\frac{3}{2}}$

Simplify each expression.

17. $c^{\frac{12}{5}} \cdot c^{\frac{3}{5}}$
18. $m^{\frac{2}{9}} \cdot m^{\frac{16}{9}}$
19. $\left(q^{\frac{1}{2}}\right)^3$
20. $p^{-\frac{1}{5}}$
21. $x^{-\frac{6}{11}}$
22. $\dfrac{x^{\frac{2}{3}}}{x^{\frac{1}{4}}}$
23. $\dfrac{y^{-\frac{1}{2}}}{y^{\frac{1}{4}}}$
24. $\dfrac{n^{\frac{1}{3}}}{n^{\frac{1}{6}} \cdot n^{\frac{1}{2}}}$
25. $\sqrt[12]{64}$
26. $\sqrt[8]{49a^8b^2}$

Lesson 5-7

NAME _____ DATE _____ PERIOD ____

5-7 Study Guide and Intervention *(continued)*

Rational Exponents

Simplify Expressions All the properties of powers from Lesson 5-1 apply to rational exponents. When you simplify expressions with rational exponents, leave the exponent in rational form, and write the expression with all positive exponents. Any exponents in the denominator must be positive integers

When you simplify radical expressions, you may use rational exponents to simplify, but your answer should be in radical form. Use the smallest index possible.

Example 1 **Simplify $y^{\frac{2}{3}} \cdot y^{\frac{3}{8}}$.**

$y^{\frac{2}{3}} \cdot y^{\frac{3}{8}} = y^{\frac{2}{3} + \frac{3}{8}} = y^{\frac{25}{24}}$

Example 2 **Simplify $\sqrt[4]{144x^6}$.**

$$\begin{aligned}\sqrt[4]{144x^6} &= (144x^6)^{\frac{1}{4}} \\ &= (2^4 \cdot 3^2 \cdot x^6)^{\frac{1}{4}} \\ &= (2^4)^{\frac{1}{4}} \cdot (3^2)^{\frac{1}{4}} \cdot (x^6)^{\frac{1}{4}} \\ &= 2 \cdot 3^{\frac{1}{2}} \cdot x^{\frac{3}{2}} = 2x \cdot (3x)^{\frac{1}{2}} = 2x\sqrt{3x}\end{aligned}$$

Exercises

Simplify each expression.

1. $x^{\frac{4}{5}} \cdot x^{\frac{6}{5}}$
2. $\left(y^{\frac{2}{3}}\right)^{\frac{3}{4}}$
3. $p^{\frac{4}{5}} \cdot p^{\frac{7}{10}}$
4. $\left(m^{-\frac{6}{5}}\right)^{\frac{2}{5}}$
5. $x^{-\frac{3}{8}} \cdot x^{\frac{4}{3}}$
6. $\left(s^{-\frac{1}{6}}\right)^{-\frac{4}{3}}$
7. $\dfrac{p}{p^{\frac{1}{3}}}$
8. $\left(a^{\frac{2}{3}}\right)^{\frac{6}{5}} \cdot \left(a^{\frac{2}{5}}\right)^{3}$
9. $\dfrac{x^{-\frac{1}{2}}}{x^{-\frac{1}{3}}}$
10. $\sqrt[6]{128}$
11. $\sqrt[4]{49}$
12. $\sqrt[5]{288}$
13. $\sqrt{32} \cdot 3\sqrt{16}$
14. $\sqrt[3]{25} \cdot \sqrt{125}$
15. $\sqrt[6]{16}$
16. $\dfrac{x - \sqrt[3]{3}}{\sqrt{12}}$
17. $\sqrt{\sqrt[3]{48}}$
18. $\dfrac{a\sqrt[3]{b^4}}{\sqrt{ab^3}}$

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5-7 Skills Practice

Rational Exponents

Write each expression in radical form.

1. $3^{\frac{1}{6}}$
2. $8^{\frac{1}{5}}$
3. $12^{\frac{2}{3}}$
4. $(s^3)^{\frac{3}{5}}$

Write each radical using rational exponents.

5. $\sqrt{51}$
6. $\sqrt[3]{37}$
7. $\sqrt[4]{15^3}$
8. $\sqrt[3]{6xy^2}$

Evaluate each expression.

9. $32^{\frac{1}{5}}$
10. $81^{\frac{1}{4}}$
11. $27^{-\frac{1}{3}}$
12. $4^{-\frac{1}{2}}$
13. $16^{\frac{3}{2}}$
14. $(-243)^{\frac{4}{5}}$
15. $27^{\frac{1}{3}} \cdot 27^{\frac{5}{3}}$
16. $\left(\frac{4}{9}\right)^{\frac{3}{2}}$

Simplify each expression.

17. $c^{\frac{12}{5}} \cdot c^{\frac{3}{5}}$
18. $m^{\frac{2}{9}} \cdot m^{\frac{16}{9}}$
19. $\left(q^{\frac{1}{2}}\right)^3$
20. $p^{-\frac{1}{5}}$
21. $x^{-\frac{6}{11}}$
22. $\dfrac{x^{\frac{2}{3}}}{x^{\frac{1}{4}}}$
23. $\dfrac{y^{-\frac{1}{2}}}{y^{\frac{1}{4}}}$
24. $\dfrac{n^{\frac{1}{3}}}{n^{\frac{1}{6}} \cdot n^{\frac{1}{2}}}$
25. $\sqrt[12]{64}$
26. $\sqrt[8]{49a^8b^2}$

Lesson 5-7

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5-8 Study Guide and Intervention

Radical Equations and Inequalities

Solve Radical Equations The following steps are used in solving equations that have variables in the radicand. Some algebraic procedures may be needed before you use these steps.

Step 1	Isolate the radical on one side of the equation.
Step 2	To eliminate the radical, raise each side of the equation to a power equal to the index of the radical.
Step 3	Solve the resulting equation.
Step 4	Check your solution in the original equation to make sure that you have not obtained any extraneous roots.

Example 1 **Solve $2\sqrt{4x + 8} - 4 = 8$.**

$2\sqrt{4x + 8} - 4 = 8$	Original equation
$2\sqrt{4x + 8} = 12$	Add 4 to each side.
$\sqrt{4x + 8} = 6$	Isolate the radical.
$4x + 8 = 36$	Square each side.
$4x = 28$	Subtract 8 from each side.
$x = 7$	Divide each side by 4.

Check

$2\sqrt{4(7) + 8} - 4 \stackrel{?}{=} 8$

$2\sqrt{36} - 4 \stackrel{?}{=} 8$

$2(6) - 4 \stackrel{?}{=} 8$

$8 = 8$

The solution $x = 7$ checks.

Example 2 **Solve $\sqrt{3x + 1} = \sqrt{5x} - 1$.**

$\sqrt{3x + 1} = \sqrt{5x} - 1$	Original equation
$3x + 1 = 5x - 2\sqrt{5x} + 1$	Square each side.
$2\sqrt{5x} = 2x$	Simplify.
$\sqrt{5x} = x$	Isolate the radical.
$5x = x^2$	Square each side.
$x^2 - 5x = 0$	Subtract $5x$ from each side.
$x(x - 5) = 0$	Factor.
$x = 0$ or $x = 5$	

Check

$\sqrt{3(0) + 1} = 1$, but $\sqrt{5(0)} - 1 = -1$, so 0 is not a solution.

$\sqrt{3(5) + 1} = 4$, and $\sqrt{5(5)} - 1 = 4$, so the solution is $x = 5$.

Lesson 5-8

Exercises

Solve each equation.

1. $3 + 2x\sqrt{3} = 5$

2. $2\sqrt{3x + 4} + 1 = 15$

3. $8 + \sqrt{x + 1} = 2$

4. $\sqrt{5 - x} - 4 = 6$

5. $12 + \sqrt{2x - 1} = 4$

6. $\sqrt{12 - x} = 0$

7. $\sqrt{21} - \sqrt{5x - 4} = 0$

8. $10 - \sqrt{2x} = 5$

9. $\sqrt{x^2 + 7x} = \sqrt{7x - 9}$

10. $4\sqrt[3]{2x + 11} - 2 = 10$

11. $2\sqrt{x + 11} = \sqrt{x + 2} + \sqrt{3x - 6}$

12. $\sqrt{9x - 11} = x + 1$

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5-8 Study Guide and Intervention *(continued)*

Radical Equations and Inequalities

Solve Radical Inequalities A **radical inequality** is an inequality that has a variable in a radicand. Use the following steps to solve radical inequalities.

Step 1	If the index of the root is even, identify the values of the variable for which the radicand is nonnegative.
Step 2	Solve the inequality algebraically.
Step 3	Test values to check your solution.

Example **Solve $5 - \sqrt{20x + 4} \geq -3$.**

Since the radicand of a square root must be greater than or equal to zero, first solve

$20x + 4 \geq 0$.

$20x + 4 \geq 0$

$20x \geq -4$

$x \geq -\frac{1}{5}$

Now solve $5 - \sqrt{20x + 4} \geq -3$.

$5 - \sqrt{20x + 4} \geq -3$	Original inequality
$\sqrt{20x + 4} \leq 8$	Isolate the radical.
$20x + 4 \leq 64$	Eliminate the radical by squaring each side.
$20x \leq 60$	Subtract 4 from each side.
$x \leq 3$	Divide each side by 20.

It appears that $-\frac{1}{5} \leq x \leq 3$ is the solution. Test some values.

$x = -1$	$x = 0$	$x = 4$
$\sqrt{20(-1) + 4}$ is not a real number, so the inequality is not satisfied.	$5 - \sqrt{20(0) + 4} = 3$, so the inequality is satisfied.	$5 - \sqrt{20(4) + 4} \approx -4.2$, so the inequality is not satisfied

Therefore the solution $-\frac{1}{5} \leq x \leq 3$ checks.

Exercises

Solve each inequality.

1. $\sqrt{c - 2} + 4 \geq 7$

2. $3\sqrt{2x - 1} + 6 < 15$

3. $\sqrt{10x + 9} - 2 > 5$

4. $5\sqrt[3]{x + 2} - 8 < 2$

5. $8 - \sqrt{3x + 4} \geq 3$

6. $\sqrt{2x + 8} - 4 > 2$

7. $9 - \sqrt{6x + 3} \geq 6$

8. $\frac{20}{\sqrt{3x + 1}} < 4$

9. $2\sqrt{5x - 6} - 1 < 5$

10. $\sqrt{2x + 12} + 4 \geq 12$

11. $\sqrt{2d + 1} + \sqrt{d} \leq 5$

12. $4\sqrt{b + 3} - \sqrt{b - 2} \geq 10$

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5-9 Skills Practice

Complex Numbers

Simplify.

1. $\sqrt{-36}$

2. $\sqrt{-196}$

3. $\sqrt{-81x^6}$

4. $\sqrt{-23} \cdot \sqrt{-46}$

5. $(3i)(-2i)(5i)$

6. i^{11}

7. i^{65}

8. $(7 - 8i) + (-12 - 4i)$

9. $(-3 + 5i) + (18 - 7i)$

10. $(10 - 4i) - (7 + 3i)$

11. $(2 + i)(2 + 3i)$

12. $(2 + i)(3 - 5i)$

13. $(7 - 6i)(2 - 3i)$

14. $(3 + 4i)(3 - 4i)$

15. $\frac{8 - 6i}{3i}$

16. $\frac{3i}{4 + 2i}$

Solve each equation.

17. $3x^2 + 3 = 0$

18. $5x^2 + 125 = 0$

19. $4x^2 + 20 = 0$

20. $-x^2 - 16 = 0$

21. $x^2 + 18 = 0$

22. $8x^2 + 96 = 0$

Find the values of m and n that make each equation true.

23. $20 - 12i = 5m + 4ni$

24. $m - 16i = 3 - 2ni$

25. $(4 + m) + 2ni = 9 + 14i$

26. $(3 - n) + (7m - 14)i = 1 + 7i$

Lesson 5-9

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5-9 Practice

Complex Numbers

Simplify.

1. $\sqrt{-49}$
2. $6\sqrt{-12}$
3. $\sqrt{-121s^8}$
4. $\sqrt{-36a^3b^4}$
5. $\sqrt{-8} \cdot \sqrt{-32}$
6. $\sqrt{-15} \cdot \sqrt{-25}$
7. $(-3i)(4i)(-5i)$
8. $(7i)^2(6i)$
9. i^{42}
10. i^{55}
11. i^{89}
12. $(5 - 2i) + (-13 - 8i)$
13. $(7 - 6i) + (9 + 11i)$
14. $(-12 + 48i) + (15 + 21i)$
15. $(10 + 15i) - (48 - 30i)$
16. $(28 - 4i) - (10 - 30i)$
17. $(6 - 4i)(6 + 4i)$
18. $(8 - 11i)(8 - 11i)$
19. $(4 + 3i)(2 - 5i)$
20. $(7 + 2i)(9 - 6i)$
21. $\frac{6 + 5i}{-2i}$
22. $\frac{2}{7 - 8i}$
23. $\frac{3 - i}{2 - i}$
24. $\frac{2 - 4i}{1 + 3i}$

Solve each equation.

25. $5n^2 + 35 = 0$
26. $2m^2 + 10 = 0$
27. $4m^2 + 76 = 0$
28. $-2m^2 - 6 = 0$
29. $-5m^2 - 65 = 0$
30. $\frac{3}{4}x^2 + 12 = 0$

Find the values of m and n that make each equation true.

31. $15 - 28i = 3m + 4ni$
32. $(6 - m) + 3ni = -12 + 27i$
33. $(3m + 4) + (3 - n)i = 16 - 3i$
34. $(7 + n) + (4m - 10)i = 3 - 6i$

35. **ELECTRICITY** The impedance in one part of a series circuit is $1 + 3j$ ohms and the impedance in another part of the circuit is $7 - 5j$ ohms. Add these complex numbers to find the total impedance in the circuit.

36. **ELECTRICITY** Using the formula $E = IZ$, find the voltage E in a circuit when the current I is $3 - j$ amps and the impedance Z is $3 + 2j$ ohms.