

Radical Expressions—Multiplying, Simplifying

FACTS ABOUT YOUNG ANIMALS

1. Work each exercise.
2. Find the code letter for the correct answer.
3. Write the code letter in each blank having that exercise number.

Exercises

Multiply and simplify.

- | | |
|--|--------------------------------------|
| R 1. $\sqrt{5}\sqrt{15} = 5\sqrt{3}$ R | N 11. $\sqrt{7a}\sqrt{7a}$ |
| A 2. $\sqrt{8}\sqrt{3}$ | E 12. $\sqrt{3x^2y}\sqrt{2y}$ |
| G 3. $\sqrt{7}\sqrt{14}$ | J 13. $\sqrt{12ab^2}\sqrt{3ab}$ |
| V 4. $\sqrt{11}\sqrt{11}$ | Q 14. $\sqrt{14x^3y^4}\sqrt{21x}$ |
| O 5. $\sqrt{10}\sqrt{2}$ | L 15. $\sqrt{30a}\sqrt{6ab}$ |
| Y 6. $\sqrt{6}\sqrt{8}$ | R 16. $\sqrt{3}\sqrt{25}$ |
| U 7. $\sqrt{12}\sqrt{8}$ | I 17. $\sqrt{14xy^2}\sqrt{21x^2y}$ |
| T 8. $\sqrt{18}\sqrt{3}$ | B 18. $\sqrt{8ab}\sqrt{8a}$ |
| V 9. $\sqrt{22}\sqrt{\frac{11}{2}}$ | W 19. $\sqrt{12}\sqrt{6}$ |
| P 10. $\sqrt{5a}\sqrt{10b}$ | S 20. $\sqrt{26x^3y^5}\sqrt{13x^2y}$ |

- | | |
|---------------------------------|--------------------|
| E 21. $\sqrt{x^2}\sqrt{6y^2}$ | } give to students |
| H 22. $\sqrt{x-1}\sqrt{2x-2}$ | |
| C 23. $\sqrt{75ab}\sqrt{5a}$ | |
| K 24. $\sqrt{3x-9}\sqrt{6x-18}$ | |

What is the name of a young ...

- kangaroo? JOEY
 $\frac{13}{13} \frac{5}{5} \frac{12}{12} \frac{6}{6}$
- hare? LEVERET
 $\frac{15}{15} \frac{21}{21} \frac{9}{9} \frac{21}{21} \frac{1}{1} \frac{12}{12} \frac{8}{8}$
- salmon? PARR
 $\frac{10}{10} \frac{2}{2} \frac{16}{16} \frac{16}{16}$
- pigeon? SQUAB
 $\frac{20}{20} \frac{14}{14} \frac{7}{7} \frac{2}{2} \frac{18}{18}$
- swan? CYGNET
 $\frac{23}{23} \frac{6}{6} \frac{3}{3} \frac{11}{11} \frac{21}{21} \frac{8}{8}$
- quail? CHEEPER
 $\frac{23}{23} \frac{22}{22} \frac{12}{12} \frac{21}{21} \frac{10}{10} \frac{12}{12} \frac{16}{16}$
- eel? ELVER
 $\frac{12}{12} \frac{15}{15} \frac{4}{4} \frac{21}{21} \frac{16}{16}$
- harp seal? WHITECOAT
 $\frac{19}{19} \frac{22}{22} \frac{17}{17} \frac{8}{8} \frac{12}{12} \frac{23}{23} \frac{5}{5} \frac{2}{2} \frac{8}{8}$
- squirrel? SPOCK
 $\frac{20}{20} \frac{10}{10} \frac{5}{5} \frac{23}{23} \frac{24}{24}$
- beaver? KIT
 $\frac{24}{24} \frac{17}{17} \frac{8}{8}$
- hawk? EYAS
 $\frac{21}{21} \frac{6}{6} \frac{2}{2} \frac{20}{20}$

Code Letter	Simplified Answer
A	$2\sqrt{6}$
B	$8a\sqrt{b}$
C	$5a\sqrt{15b}$
D	$6ab\sqrt{5}$
E	$xy\sqrt{6}$
F	$3\sqrt{5}$
G	$7\sqrt{2}$
H	$(x-1)\sqrt{2}$
I	$7xy\sqrt{6xy}$
J	$6ab\sqrt{b}$
K	$3(x-3)\sqrt{2}$
L	$6a\sqrt{5b}$
M	$13x^2y\sqrt{2xy}$
N	$7a$
O	$2\sqrt{5}$
P	$5\sqrt{2ab}$
Q	$7x^2y^2\sqrt{6}$
R	$5\sqrt{3}$
S	$13x^2y^3\sqrt{2x}$
T	$3\sqrt{6}$
U	$4\sqrt{6}$
V	11
W	$6\sqrt{2}$
Y	$4\sqrt{3}$

Radical Expressions—Simplifying Fractional Radicands, Approximating Square Roots of Fractions

HIDDEN MESSAGE

1. Work each exercise.
2. Shade in the block that contains the answer.
3. Read the message in the unshaded blocks.

Exercises

Simplify.

1. $\sqrt{\frac{16}{25}} = \frac{4}{5}$
2. $\sqrt{\frac{49}{36}}$
3. $\sqrt{\frac{100}{81}}$
4. $\sqrt{\frac{1}{9}}$
5. $-\sqrt{\frac{4}{81}}$
6. $-\sqrt{\frac{1}{100}}$
7. $\sqrt{\frac{8}{9}}$
8. $\sqrt{\frac{8}{18}}$
9. $\sqrt{\frac{288}{50}}$

10. $\sqrt{\frac{25}{x^2}}$
11. $-\sqrt{\frac{36}{a^2}}$
12. $-\sqrt{\frac{50}{2}}$
13. $\sqrt{\frac{a^2b^2}{c^2}}$
14. $\sqrt{\frac{9a^2c}{b^2}}$
15. $\sqrt{\frac{250}{490}}$
16. $\sqrt{\frac{x^2}{900}}$
17. $\sqrt{\frac{x^2y^2}{16}}$
18. $\sqrt{\frac{1690}{2250}}$

19. $\sqrt{\frac{4x^2}{9y^2}}$
20. $\sqrt{\frac{w^2}{100a^2}}$
21. $\sqrt{\frac{3}{5}}$
22. $\sqrt{\frac{2}{3}}$
23. $\sqrt{\frac{1}{18}}$
24. $\sqrt{\frac{1}{5}}$
25. $\sqrt{\frac{3}{x}}$
26. $\sqrt{\frac{x}{y}}$

Approximate to three places.

27. $\sqrt{\frac{1}{3}}$
28. $\sqrt{\frac{1}{2}}$
29. $\sqrt{\frac{2}{5}}$
30. $\sqrt{1\frac{1}{3}}$
31. $\sqrt{3\frac{2}{3}}$

give to students

¹⁴ W $\frac{3a}{b}\sqrt{c}$	²² R $\frac{1}{3}\sqrt{6}$	S $\frac{2}{3}\sqrt{6}$	⁹ S $\frac{12}{5}$	¹⁵ L $\frac{xy}{4}$	⁶ Y $-\frac{1}{10}$	¹¹ O $-\frac{6}{a}$	⁴ H $\frac{1}{3}$
⁵ I $-\frac{2}{9}$	²⁸ O 0.707	P 1.153	U 0.576	P $\frac{1}{y}\sqrt{x^2y}$	¹² T -5	I $\frac{1}{x}\sqrt{3}$	L $\frac{a}{b}\sqrt{c}$
⁷ S $\frac{2}{3}\sqrt{2}$	¹³ P $\frac{ab}{c}$	²⁴ U $\frac{1}{5}\sqrt{5}$	P $\frac{4}{5}$	P 0.717	¹⁹ I $\frac{2x}{3y}$	²³ L $\frac{1}{6}\sqrt{2}$	²⁷ O 0.577
¹⁶ E $\frac{x}{30}$	³⁰ W 1.155	¹⁰ P $\frac{5}{x}$	²⁵ E $\frac{1}{x}\sqrt{3x}$	¹⁵ H $\frac{5}{7}$	E 1.913	²⁶ Y $\frac{1}{y}\sqrt{xy}$	¹⁸ W $\frac{13}{15}$
³¹ S 1.915	³ U $\frac{10}{9}$	²¹ T $\frac{1}{5}\sqrt{15}$	⁸ N $\frac{2}{3}$	²⁰ E $\frac{w}{10a}$	² R $\frac{7}{6}$	R 0.639	²⁹ S 0.632

Radical Expressions—Adding, Subtracting

DOT-TO-DOT PUZZLE

1. Work each exercise.
2. Find the dot by each answer and connect the dots in order.

Exercises

Add or subtract.

1. $2\sqrt{3} + 3\sqrt{3} = 5\sqrt{3}$
2. $8\sqrt{5} - 2\sqrt{5}$
3. $\sqrt{x} + \sqrt{x}$
4. $3\sqrt{3} - \sqrt{27}$
5. $7\sqrt{2} - 6\sqrt{2}$
6. $3\sqrt{x} + 6\sqrt{x}$
7. $4\sqrt{a} + \sqrt{a}$
8. $11\sqrt{a} - 4\sqrt{a}$
9. $13\sqrt{x} - 9\sqrt{x}$
10. $3\sqrt{8} + 3\sqrt{2}$
11. $5\sqrt{12} - 3\sqrt{3}$
12. $\sqrt{125} - \sqrt{20}$
13. $\sqrt{75} - \sqrt{12}$
14. $\sqrt{8} + \sqrt{50}$
15. $\sqrt{300} - \sqrt{12}$

16. $\sqrt{98} - \sqrt{2}$
17. $3\sqrt{8} + \sqrt{18} - \sqrt{32}$
18. $2\sqrt{27} + \sqrt{12} - \sqrt{48}$
19. $\sqrt{72x^2} + \sqrt{18x^2}$
20. $\sqrt{100x^3} - \sqrt{49x^3}$
21. $\sqrt{8x^3} + \sqrt{50x^3}$

$3\sqrt{3x+3}$
 $2\sqrt{2x-2}$

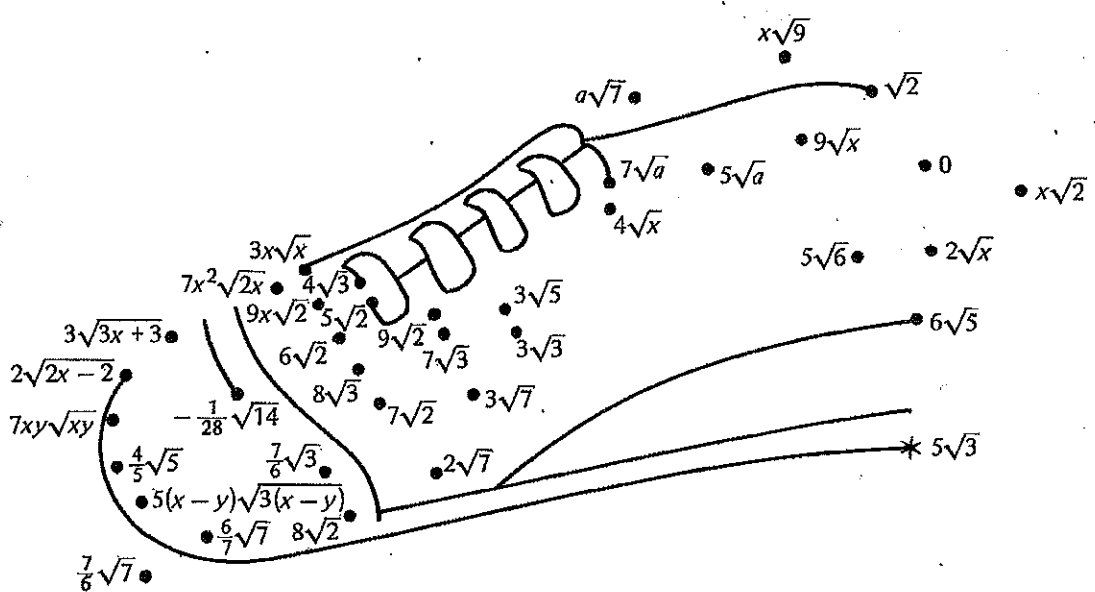
22. $\sqrt{12x+12} + \sqrt{3x+3}$
23. $\sqrt{18x-18} - \sqrt{2x-2}$
24. $5x\sqrt{xy^3} + 2y\sqrt{x^3y}$
25. $\sqrt{5} - \sqrt{\frac{1}{5}}$

$5(x-y)\sqrt{3(x-y)}$

26. $\sqrt{27(x-y)^3} + \sqrt{12(x-y)^3}$
27. $\sqrt{7} - \sqrt{\frac{1}{7}}$
28. $3\sqrt{2} + 10\sqrt{\frac{1}{2}}$
29. $\sqrt{\frac{3}{4}} + \sqrt{\frac{4}{3}}$
30. $\sqrt{\frac{7}{8}} - \sqrt{\frac{8}{7}}$

give to students

give to students



Radical Expressions—Dividing, Rationalizing Denominators

FACTS ABOUT NOBEL PRIZES

1. Work each exercise.
2. Find the code letter for the correct answer.
3. Write the code letter in each blank having that exercise number.

Exercises

Divide and simplify.

I 1. $\frac{\sqrt{30}}{\sqrt{5}} = \sqrt{6}$ I

B 2. $\frac{\sqrt{14}}{\sqrt{2}}$

U 3. $\frac{\sqrt{98}}{\sqrt{2}}$

N 4. $\frac{\sqrt{243}}{\sqrt{3}}$

A 5. $\frac{\sqrt{180}}{\sqrt{5}}$

K 6. $\frac{\sqrt{21}}{\sqrt{7}}$

R 7. $\frac{\sqrt{2}}{\sqrt{32}}$

D 8. $\frac{\sqrt{5}}{\sqrt{125}}$

O 9. $\frac{\sqrt{72}}{\sqrt{50}}$

E 10. $\frac{\sqrt{18x}}{\sqrt{2x}}$

P 11. $\frac{\sqrt{75x^5}}{\sqrt{3x}}$

A 12. $\frac{\sqrt{144x^3}}{\sqrt{4x^3}}$

C 13. $\frac{\sqrt{12x^3}}{\sqrt{4xy}}$

N 14. $\frac{\sqrt{162A}}{\sqrt{2A}}$

F 15. $\frac{4\sqrt{x}}{3\sqrt{10x}}$

W 16. $\frac{\sqrt{\frac{2}{3}}}{\sqrt{\frac{5}{6}}}$

T 17. $\frac{\sqrt{\frac{3}{4}}}{\sqrt{\frac{4}{3}}}$

G 18. $\frac{\sqrt{175x^3}}{\sqrt{7x}}$

H 19. $\frac{\sqrt{\frac{1}{8}}}{\sqrt{8}}$

I 20. $\frac{\sqrt{3}}{\sqrt{\frac{1}{2}}}$

Y 21. $\frac{\sqrt{2}}{\sqrt{7}}$

M 22. $\frac{\sqrt{2}}{\sqrt{3}}$

L 23. $\frac{6}{\sqrt{3}}$

V 24. $\frac{\sqrt{x}}{\sqrt{y}}$

J 25. $\frac{2}{7}\sqrt{\frac{49}{196}}$

S 26. $\frac{2\sqrt{150}}{15\sqrt{2}}$

Code Letter	Simplified Answer
A	6
B	$\frac{\sqrt{7}}{x\sqrt{3y}}$
C	$\frac{1}{y}$
D	$\frac{1}{5}$
E	3
F	$\frac{2}{15}\sqrt{10}$
G	5x
H	$\frac{1}{8}$
I	$\sqrt{6}$
J	$\frac{1}{7}$
K	$\sqrt{3}$
L	$2\sqrt{3}$
M	$\frac{1}{3}\sqrt{6}$
N	9
O	$\frac{6}{5}$
P	$5x^2$
R	$\frac{1}{4}$
S	$\frac{2}{3}\sqrt{3}$
T	$\frac{3}{4}$
U	7
V	$\frac{\sqrt{xy}}{y}$
W	$\frac{2}{5}\sqrt{5}$
Y	$\frac{1}{7}\sqrt{14}$

Who won the Nobel Prize . . .

in Physics in 1971? D E N N I S G A B O R (British)
 8 10 4 14 1 26 18 5 2 9 7

in Peace in 1975? A N D R E I S A K H A R O V (Russian)
 5 14 8 7 10 1 26 5 6 19 5 7 9 24

in Literature in 1954? E R N E S T H E M I N G W A Y (American)
 10 7 14 10 26 17 19 10 22 20 14 18 16 12 21

in Chemistry in 1954? L I N S P A U L I N G (American)
 23 20 4 3 26 11 5 3 23 1 14 18

in Medicine—Physiology in 1962? F R A N C I S C R I C K (British)
 15 7 5 4 13 20 26 13 7 1 13 6
J A M E S W A T S O N (American)
 25 12 22 10 26 16 5 17 26 9 4
M A U R L C E W I L K E N S (British)
 22 5 3 7 20 13 10 16 1 23 6 20 4 26

Quadratic Equations—Solving Equations of the Type $(x + k)^2 = d$

HIDDEN MESSAGE

1. Work each exercise.
2. Find both solutions on the diagram.
3. Shade in both regions that contain those answers.
4. Read the message in the unshaded regions.

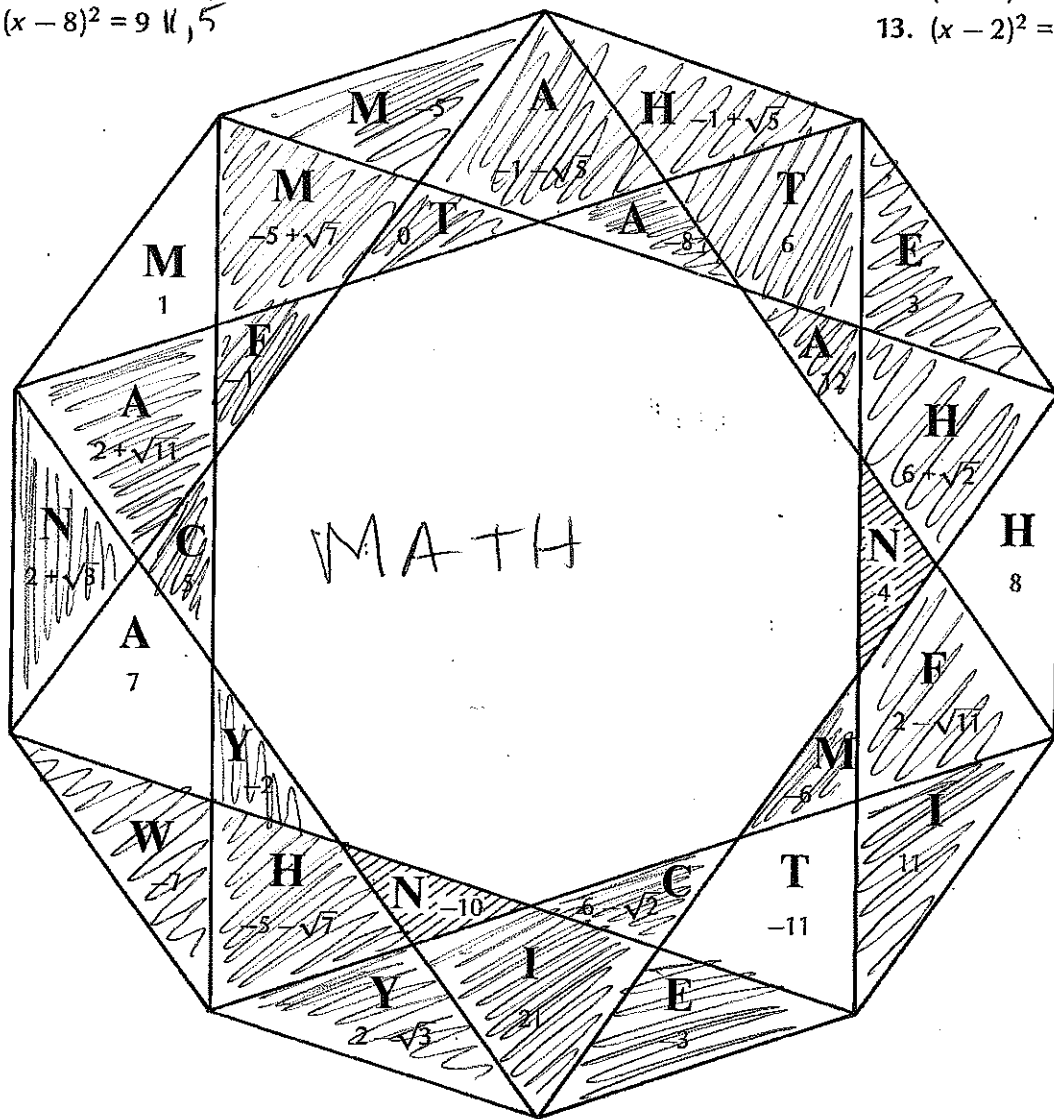
Exercises

Solve.

1. $(x + 3)^2 = 49$ 4, -10
2. $(x + 2)^2 = 25$ 3, -7
3. $(x + 4)^2 = 1$ -3, -5
4. $(x - 6)^2 = 36$ 12, 0
5. $(x - 8)^2 = 9$ 11, 5

6. $(x - 10)^2 = 121$ 21, -1
7. $(x - 2)^2 = 16$ 6, -2
8. $(x + 7)^2 = 1$ -6, -8

9. $(x + 5)^2 = 7$ $-5 \pm \sqrt{7}$
10. $(x - 2)^2 = 3$ $2 \pm \sqrt{3}$
11. $(x + 1)^2 = 5$ $-1 \pm \sqrt{5}$
12. $(x - 6)^2 = 2$ $6 \pm \sqrt{2}$
13. $(x - 2)^2 = 11$ $2 \pm \sqrt{11}$



Quadratic Equations—Solving Equations of the Type $ax^2 = k, a \neq 0$

SECRET MESSAGE

1. Work each exercise.
2. Find the code letter for the correct answer.
3. Write the code letter in each blank having that exercise number.

Exercises

Solve.

- | | |
|---|--|
| <p>1. $x^2 = 9$ $x = 3, -3$ E
 R 2. $x^2 = 81$
 L 3. $x^2 = 64$
 I 4. $x^2 = 100$
 F 5. $x^2 = 121$
 H 6. $x^2 = 169$
 T 7. $x^2 = 5$
 O 8. $x^2 = 3$
 V 9. $3x^2 = 21$
 D 10. $2x^2 = 20$
 I 11. $3x^2 = 300$
 G 12. $5x^2 = 40$
 C 13. $9x^2 - 25 = 0$
 E 14. $4x^2 - 36 = 0$
 U 15. $4x^2 = 48$
 Y 16. $5x^2 - 75 = 0$
 R 17. $2x^2 - 162 = 0$
 E 18. $5x^2 - 45 = 0$
 T 19. $3x^2 - 15 = 0$
 R 20. $x^2 - 15 = 66$
 F 21. $7x^2 - 63 = 0$
 R 22. $x^2 - 11 = 70$</p> | <p>C 23. $18x^2 - 50 = 0$
 S 24. $7x^2 - 25 = 0$
 U 25. $3x^2 - 36 = 0$
 S 26. $14x^2 - 50 = 0$
 G 27. $7x^2 - 56 = 0$
 A 28. $4y^2 - 5 = 39$
 E 29. $8x^2 - 21 = 51$
 M 30. $6x^2 - 6 = 0$
 A 31. $2x^2 + 18 = 40$
 H 32. $x^2 - 75 = 94$
 T 33. $4x^2 - 20 = 0$</p> |
|---|--|

Code Letter	Answers
A	$\sqrt{11}, -\sqrt{11}$
B	$\sqrt{2}, -\sqrt{2}$
C	$\frac{5}{3}, -\frac{5}{3}$
D	$\sqrt{10}, -\sqrt{10}$
E	3, -3
F	11, -11
G	$2\sqrt{2}, -2\sqrt{2}$
H	13, -13
I	10, -10
K	$\frac{\sqrt{7}}{5}, -\frac{\sqrt{7}}{5}$
L	8, -8
M	1, -1
N	15, -15
O	$\sqrt{3}, -\sqrt{3}$
P	7, -7
R	9, -9
S	$\frac{5\sqrt{7}}{7}, -\frac{5\sqrt{7}}{7}$
T	$\sqrt{5}, -\sqrt{5}$
U	$2\sqrt{3}, -2\sqrt{3}$
V	$\sqrt{7}, -\sqrt{7}$
W	$5\sqrt{3}, -5\sqrt{3}$
Y	$\sqrt{15}, -\sqrt{15}$

You'll get a charge out of this!

G I V E Y O U R S E L F
 12 11 9 1 16 8 15 17 24 14 3 5

C R E D I T U S E
 13 20 18 10 4 19 25 26 14

M A T H T E R C H A R G E
 30 28 33 32 7 29 22 23 6 31 2 27 21