ALGEBRA CONCEPTS PA CORE 8 – COURSE 3

STUDENT WORKBOOK

UNIT 1 – THE NUMBER SYSTEM

Before

After

Unit 1	The Number System	PURPLE	GREEN	RED
1.1	Rational Numbers	4.6	2.2, 11.1	1.1
1.2	Powers and Exponents	4.2	5.1, 5.2	1.7
1.3	Multiply and Divide Monomials	4.7, 4.8	5.3	1.7
1.4	Powers of Monomials		5.2	1.8
1.5	Negative Exponents		5.1	1.8
1.6	Scientific Notation	4.9	5.4	1.9
1.7	Compute with Scientific Notation	4.9	5.4	1.9
1.8	Roots		11.1	7.1
1.9	Estimate Roots		11.1	7.1
1.1	Compare Real Numbers	11.1	11.1	1.1, 7.1

STUDY ISLAND TOPICS

Real Numbers
Approximations of Irrational Numbers
Exponential Expressions
Square and Cube Roots
Scientific Notation

Name: _____ Period ____

 Name_____

Adding/Subtracting Integers

Date_____ Period____

Find each sum.

1) $(-12) + 7$

2) $(-10) + (-7)$

3) $(-6) + 12$

4) $8 + 7$

5) $3 + 4$

6) $(-45) + 9$

7) $(-1) + (-46)$

8) $(-30) + 10$

9) $(-34) + 50$

10) $38 + (-5)$

Find each difference.

11) $2 - (-2)$

12) $(-1) - 10$

13) $8 - 7$

14) $(-8) - (-6)$

2

15) $11 - 4$

16) $48 - (-31)$

17) $18 - 41$

18) $(-38) - 30$

19) $(-1) - (-3)$

20) $(-1) - (-40)$

Evaluate each expression.

21) $(-10) - 47$

22) $(-29) - 29$

23) $13 + (-29)$

24) $38 + 22$

25) $(-32) - 44$

26) $(-12) + (-11)$

27) $2 + 15 + 4$

28) $16 + (-13) + 5$

29) $2 - (-9) - 8$

30) $10 + 3 - (-8)$

3

 Name_____

Adding Positive and Negative Numbers

Date_____ Period____

Find each sum.

1) $(-7) + 9$

2) $(-8) + (-1)$

3) $(-1) + 5$

4) $(-6) + 12$

5) $(-8) + (-5)$

6) $11 + (-2)$

7) $49 + (-15)$

8) $(-47) + 30$

9) $49 + (-27)$

10) $(-29) + 9$

11) $43 + (-1)$

12) $10 + (-2) + 1$

13) $(-2) + 11 + 4$

14) $12 + 7 + (-4)$

15) $(-7) + 3 + 9$

16) $(-1) + 11 + 5$

4

17) $2 + 10 + (-10) + 10$

18) $10 + (-11) + 5 + (-5)$

19) $2 + 6 + (-7) + 10$

20) $(-5) + (-8) + (-2) + 1$

21) $(-6.8) + (-1.9)$

22) $2.489 + (-4.3)$

23) $(-4.7) + 5.7$

24) $(-5) + (-7.1)$

25) $(-3.9) + 7.1 + (-7.8)$

26) $(-4.5) + 4.9 + 3.4$

27) $(-2.1) + (-1) + (-7.6)$

28) $0.85 + (-2.4) + 4.5$

29) $\frac{5}{3} + \left(-\frac{7}{5}\right)$

30) $\frac{8}{5} + \left(-\frac{1}{3}\right)$

31) $\left(-\frac{1}{3}\right) + \left(-\frac{3}{5}\right)$

32) $\frac{1}{2} + \left(-\frac{5}{3}\right)$

33) $2 + \left(-\frac{1}{4}\right)$

34) $\left(-\frac{1}{4}\right) + \left(-\frac{3}{2}\right)$

5

 Name_____

Adding/Subtracting Decimals

Date_____ Period____

Find each sum.

1) $5.4 + (-9.7)$

2) $10.8 + (-4.73)$

3) $(-0.5) + 0.3$

4) $(-4.79) + (-0.4)$

5) $3.305 + 1.7$

6) $(-3.6) + 0.43$

7) $(-4.3) + 14.5$

8) $(-7.1) + 3.63$

9) $13.7 + 3.2$

10) $(-10.9) + 6.1$

Find each difference.

11) $2.2 - 7.3$

12) $(-8.1) - (-8.9)$

13) $2.9 - 9.4$

14) $(-3.9) - 8.9$

6

15) $9.8 - 7.1$

16) $(-18.278) - (-6.8)$

17) $17.9 - (-19.4)$

18) $15.5 - 15.5$

19) $1.58 - (-13.6)$

20) $1.81 - 17.17$

Evaluate each expression.

21) $19.4 + 24.2$

22) $(-14.8) - (-9.7)$

23) $(-9.1) + 3.5$

24) $0.96 - 8.5$

25) $9.5 - (-19.3)$

26) $3.4 - (-12.1)$

27) $8.7 + 3.8 + 12.3$

28) $(-13.6) + 12 - (-15.5)$

29) $3.4 - 5 - 10.4$

30) $(-5.6) - (-12.6) + (-6.6)$

Adding and Subtracting Positive and Negative Numbers

Date_____ Period____

Evaluate each expression.

1) $(-2) + 3$

2) $(-14) + (-7)$

3) $3 - (-8)$

4) $(-9) + 14$

5) $(-8) - (-2)$

6) $5 + (-8)$

7) $(-27) - 24$

8) $(-41) + (-40)$

9) $38 - (-17)$

10) $(-44) + (-9)$

11) $(-16) - (-36)$

12) $(-6) - 24$

13) $(-16) - 6 + (-5)$

14) $15 - 13 + 2$

15) $16 - (-13) - (-5)$

16) $(-7) - (-2) - 9$

8

17) $(-11) - (-14) + 7$

18) $7 + (-1) + 12 - 7$

19) $6 + (-7) + (-5) - (-2)$

20) $(-3) + 5 + (-5) + 12$

21) $(-11) - 8 + 1 - (-6)$

22) $10 - (-10) - 7 - 5$

23) $6 - 3.98$

24) $5.8 + (-2.5)$

25) $1.8 - (-3.7)$

26) $7 - 2.8$

27) $(-0.8) + (-7.2) - 5.4$

28) $1.7 - (-0.8) + 4.013$

29) $\left(-\frac{3}{2}\right) + \frac{8}{5}$

30) $\frac{7}{4} - \left(-\frac{1}{2}\right)$

31) $\left(-\frac{1}{5}\right) + \frac{7}{4}$

32) $\frac{2}{5} - \frac{4}{5}$

9

Add/Subtracting Fractions and Mixed Numbers

Date_____ Period____

Evaluate each expression.

1) $\frac{5}{4} - \frac{3}{4}$

2) $\frac{3}{2} - \frac{1}{2}$

3) $\frac{2}{5} + \frac{4}{5}$

4) $\frac{1}{3} - \frac{1}{3}$

5) $6 - \frac{1}{6}$

6) $\frac{1}{2} - \frac{1}{2}$

7) $\frac{1}{5} + \frac{1}{5}$

8) $\frac{7}{6} - \frac{5}{6}$

9) $\left(-\frac{4}{5}\right) - \frac{7}{8}$

10) $\frac{1}{3} - \left(-\frac{5}{3}\right)$

11) $\left(-\frac{1}{3}\right) + \frac{3}{8}$

12) $\left(-\frac{10}{7}\right) + \frac{1}{6}$

13) $\frac{9}{5} + \left(-\frac{4}{3}\right)$

14) $2 - \frac{13}{8}$

10

15) $\frac{9}{5} - \frac{5}{8}$

16) $\left(-\frac{4}{3}\right) - \left(-\frac{3}{2}\right)$

17) $(-1) + \left(-2\frac{2}{5}\right)$

18) $\left(-3\frac{3}{5}\right) - 4\frac{2}{5}$

19) $3\frac{6}{7} + \left(-1\frac{1}{7}\right)$

20) $1\frac{2}{7} + \left(-3\frac{4}{7}\right)$

21) $2\frac{1}{3} + \left(-1\frac{2}{3}\right)$

22) $\left(-1\frac{3}{4}\right) + \left(-3\frac{3}{4}\right)$

23) $\left(-1\frac{7}{8}\right) + \left(-3\frac{1}{2}\right)$

24) $\left(-2\frac{7}{8}\right) + \left(-1\frac{1}{2}\right)$

25) $\left(-2\frac{5}{6}\right) - \left(-1\frac{1}{4}\right)$

26) $\left(-3\frac{5}{8}\right) - 4\frac{2}{5}$

27) $1\frac{2}{5} - \left(-3\frac{3}{4}\right)$

28) $2\frac{4}{5} - \frac{5}{8}$

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Multiplying and Dividing Positives and Negatives

Date_____ Period____

Find each quotient.

1) $\frac{10}{5}$

2) $\frac{-24}{12}$

3) $\frac{-20}{-2}$

4) $\frac{-300}{-20}$

5) $\frac{65}{5}$

6) $\frac{-66}{-6}$

7) $\frac{75}{-15}$

8) $\frac{-56}{-14}$

9) $\frac{102}{-17}$

10) $\frac{-72}{-4}$

11) $153 \div 17$

12) $12 \div -3$

13) $48 \div 6$

14) $-120 \div -20$

15) $306 \div 18$

16) $-65 \div 13$

12

17) $-85 \div -17$

18) $128 \div -16$

19) $-180 \div 15$

20) $234 \div -13$

Find each product.

21) -11×9

22) -7×-12

23) -8×-11

24) -6×4

25) -3×-11

26) -5×-9

27) 9×-7

28) -9×-3

29) 12×-12

30) 11×-6

31) $6 \times -5 \times 3$

32) $6 \times -1 \times 2$

33) $8 \times -6 \times -3$

34) $-3 \times 6 \times -6$

35) $(3)(3)(-1)(3)$

36) $(-3)(3)(-3)(-3)$

13

Fractions, Decimals, and Percents

Date_____ Period____

Write each as a decimal. Round to the thousandths place.

1) 90%

2) 30%

3) 115.9%

4) 9%

5) 7%

6) 65%

7) 0.3%

8) 445%

Write each as a percent. Round to the nearest tenth of a percent.

9) 0.452

10) 0.006

11) 0.002

12) 0.05

13) 4.78

14) 0.1

15) 3.63

16) 0.03

Write each as a fraction.

17) 25%

18) 70%

19) 93%

20) 58%

21) 50%

22) $66.\overline{6}\%$

23) 20%

24) 80%

25) 71%

26) 30%

Write each as a percent. Use repeating decimals when necessary.

27) $\frac{1}{2}$

28) $\frac{1}{8}$

29) $\frac{2}{3}$

30) $\frac{1}{100}$

31) $2\frac{1}{10}$

32) $\frac{3}{8}$

33) $\frac{1}{10}$

34) $\frac{87}{100}$

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Lesson 1.1 Skills Practice

OBJECTIVE:
KEY NOTES:

Rational Numbers

Write each fraction or mixed number as a decimal.

1. $\frac{1}{10}$

2. $\frac{1}{8}$

3. $-\frac{3}{4}$

4. $-\frac{4}{5}$

5. $\frac{21}{50}$

6. $-3\frac{9}{20}$

7. $4\frac{9}{25}$

8. $\frac{7}{9}$

9. $-1\frac{1}{6}$

10. $-2\frac{4}{25}$

11. $\frac{5}{33}$

12. $7\frac{3}{11}$

Write each decimal as a fraction or mixed number in simplest form.

13. 0.9

14. 0.7

15. 0.84

16. -0.92

17. -1.12

18. -5.05

19. -2.35

20. 8.85

21. $-0.\overline{1}$

22. $4.\overline{8}$

23. $6.\overline{7}$

24. $-8.\overline{4}$

Lesson 1.1 Problem-Solving Practice

Rational Numbers

1. ASTRONOMY The pull of gravity on the surface of Mars is 0.38 that of Earth. Write 0.38 as a fraction in simplest form.	**2. ENERGY** Nuclear power provided 78% of the energy used in France in 2005. Write 0.78 as a fraction in simplest form.
3. WEIGHTS AND MEASURES One pint is About $\frac{5}{9}$ liter. Write $\frac{5}{9}$ liter as a decimal.	**4. WEIGHTS AND MEASURES** One inch is 25.4 millimeters. Write 25.4 millimeters as a mixed number in simplest form.
5. EDUCATION A local middle school has 47 computers and 174 students. What is the number of students per computer at the school? Write your answer as both a mixed number in simplest form and a decimal rounded to the nearest tenth.	**6. BASEBALL** In the 2008 season, the Florida Marlins won 84 out of 162 games. What was the ratio of wins to total games? Write your answer as both a fraction in simplest form and a decimal rounded to the nearest thousandth.
7. COLLEGES AND UNIVERSITIES Recently, a small college had an enrollment of 1,342 students and a total of 215 faculty. What was the student-faculty ratio for this college? Write your answer as both a mixed number in simplest form and a decimal rounded to the nearest hundredth.	**8. BASKETBALL** In the 2007–2008 season, Dwayne Wade made 439 field goals out of 937 attempts. What was Dwayne Wade's ratio of successful field goals to attempts? Write your answer as both a fraction in simplest form and a decimal rounded to the nearest thousandth.

Lesson 1.2 Skills Practice

OBJECTIVE:
KEY NOTES:

Powers and Exponents

Write each expression using exponents.

1. 2 • 2 • 2 • 2

2. 9 • 9

3. 7 • 7 • 5 • 5 • 5 • 5

4. $\frac{3}{8} \bullet \frac{3}{8} \bullet \frac{3}{8}$

5. $c \bullet \frac{1}{4} \bullet c \bullet \frac{1}{4} \bullet \frac{1}{4}$

6. s • 6 • s • s • 6 • 6 • s

7. 8 • x • 2 • 2 • 2 • x • 8

8. a • (–4) • b • a • b • (–4) • (–4)

9. $\frac{1}{3} \bullet n \bullet 4 \bullet n \bullet \frac{1}{3} \bullet n \bullet 4 \bullet 4$

10. 9 • 9 • x • w • x • y • w • 9 • y

Evaluate each expression.

11. 4^3

12. 2^5

13. $(-8)^3$

14. $\left(\frac{3}{5}\right)^4$

15. $2^8 - 3^2$

16. $2^3 \bullet 5^2$

17. $3^4 - (-4)^2$

18. $6 + 2^6$

19. $(-3)^3 \div 3^2$

ALGEBRA Evaluate each expression if g = 2 and h = –3.

20. g^4

21. $(g + h)^3$

22. $h^4 - h^3$

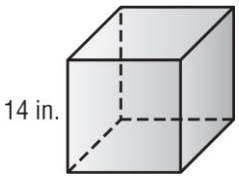
23. $g^3 + h^2$

24. $(g - h)^2 + h^2$

25. $h^4 - (h - g)^3$

Lesson 1.2 Problem-Solving Practice

Powers and Exponents

1. GEOMETRY The volume of a cube can be found by raising the side length to the third power. What is the volume of the cube below?  	**2. SPORTS** In the first round of a local tennis tournament, there are 2^5 matches. Find the number of matches.
3. PALM TREES There are about $2^3 \cdot 3 \cdot 5^3$ species of palm trees in the whole world. About how many species is this?	**4. NATURE** A forest fire affected about $3^4 \cdot 10^4$ acres of land. About how many acres did the fire affect?
5. BIOLOGY A scientist estimates that after a certain amount of time, there would be $2^5 \cdot 3^3 \cdot 10^5$ bacteria in a Petri dish. About how many bacteria is this?	**6. ACTIVISM** A total of $5^4 \cdot 7^3$ people have signed a petition. How many people signed the petition?
7. MEASUREMENT There are 10^6 millimeters in one kilometer. The distance from Dana's house to her uncle's house is 4^4 kilometers. What is this distance in millimeters?	**8. DOGS** Dedra's dog weighs $5 \cdot 2^4$ pounds. What is the weight of Dedra's dog?

 Name_____

Exponents and Multiplication

Date_____ Period____

Simplify. Your answer should contain only positive exponents.

1) $4^2 \cdot 4^2$

2) $4 \cdot 4^2$

3) $3^2 \cdot 3^2$

4) $2 \cdot 2^2 \cdot 2^2$

5) $2n^4 \cdot 5n^4$

6) $6r \cdot 5r^2$

7) $2n^4 \cdot 6n^4$

8) $6k^2 \cdot k$

9) $5b^2 \cdot 8b$

10) $4x^2 \cdot 3x$

11) $6x \cdot 2x^2$

12) $6x \cdot 6x^3$

13) $7v^3 \cdot 10u^3v^5 \cdot 8uv^3$

14) $9xy^2 \cdot 9x^5y^2$

15) $6m^3n^3 \cdot 8m^2n^3$

16) $6x^2 \cdot 6x^3y^4$

17) $7u^2v^5 \cdot 9uv^3$

18) $uv \cdot 4uv^5$

19) $10xy^3 \cdot 8x^5y^3$

20) $3u^4v^5 \cdot 7u^2v^3$

21) $(2x^2)^2$

22) $(p^4)^4$

23) $(k^3)^4$

24) $(7k)^2$

25) $(x^2)^3$

26) $(2b^2)^4$

21

OBJECTIVE:
KEY NOTES:

Lesson 1.3 Skills Practice

Multiply and Divide Monomials

Simplify. Express using exponents.

1. $5^9 \bullet 5^3$ **2.** $3^8 \bullet 3$ **3.** $c \bullet c^6$ **4.** $m^5 \bullet m^2$

5. $3x \bullet 4x^4$ **6.** $(2h^7)(7h)$ **7.** $-5d^6(8d^6)$ **8.** $(6k^5)(-k^4)$

9. $(-w)(-10w^3)$ **10.** $-7z^4(-3z^8)$ **11.** $bc^3(b^2c)$ **12.** $3a^4 \bullet 6a^2$

13. $3m^3n^2(8mn^3)$ **14.** $7t^5(-6t^5)$ **15.** $(3ab^2)(a^2c^5)$ **16.** $(9p^4)(-8p^2)$

17. $\frac{2^9}{2^3}$ **18.** $\frac{3^8}{3^4}$ **19.** $\frac{5^9}{5^2}$ **20.** $\frac{8^7}{8}$

21. $\frac{b^{12}}{b^5}$ **22.** $\frac{12n^5}{4n^2}$ **23.** $\frac{14m^3}{7m^2}$ **24.** $\frac{9r^8}{3r^4}$

25. $\frac{24t^9}{6t^3}$ **26.** $\frac{18y^6}{2y}$ **27.** $\frac{a^4c^6}{a^2c}$ **28.** $\frac{5^{10}}{5^2}$

Simplify.

29. $\frac{4^8 \bullet 5^3 \bullet 7^6}{4^6 \bullet 5^2 \bullet 7^5}$.

30. $\frac{(-2)^9 \bullet (-3)^7 \bullet 4^3}{(-2)^5 \bullet (-3)^5 \bullet 4^1}$.

31. $\frac{3^{10} \bullet (-6)^5}{3^7 \bullet (-6)^2}$.

32. $\frac{9^8 \bullet 10^{12}}{9^6 \bullet 10^6}$.

Lesson 1.3 Problem-Solving Practice

Multiply and Divide Monomials

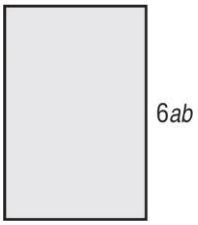
1. SOUND Decibels are units to measure sound. Ordinary conversation is rated at about 60 decibels (or a relative loudness of 10^6). Thunder is rated at about 120 decibels (or a relative loudness of 10^{12}). How many times greater is the relative loudness of thunder than the relative loudness of ordinary conversation?

2. GEOMETRY Express the area of a square with sides of length $5ab$ as a monomial.

3. COMPUTERS The byte is the fundamental unit of computer processing. The byte is based on powers of 2, as shown in the table. How many times greater is a gigabyte than a megabyte?

Memory Term	Number of Bytes
byte	2^0 or 1
kilobyte	2^{10}
megabyte	2^{20}
gigabyte	2^{30}

4. GEOMETRY The area of the rectangle in the figure is $24a^2b^3$ square units. Find the width of the rectangle.



5. BOOKS A publisher sells 10^6 copies of a new book. Each book has 10^2 pages. How many pages total are there in all of the books sold? Write the answer using exponents.

6. RABBITS Randall has 2^3 pairs of rabbits on his farm. Each pair of rabbits can be expected to produce 2^5baby rabbits in a year. How many baby rabbits will there be on Randall's farm each year? Write the answer using exponents.

OBJECTIVE:
KEY NOTES:

Lesson 1.4 Skills Practice

Powers of Monomials

Simplify.

1. $(7^2)^3$ **2.** $(3^2)^6$ **3.** $(8^3)^2$ **4.** $(9^4)^2$

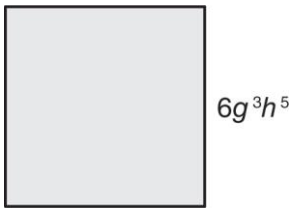
5. $(d^7)^6$ **6.** $(m^5)^5$ **7.** $(h^6)^3$ **8.** $(z^7)^3$

9. $[(4^3)^2]^2$ **10.** $(-5a^2b^7)^7$ **11.** $(2m^5g^{11})^6$ **12.** $[(2^3)^3]^2$

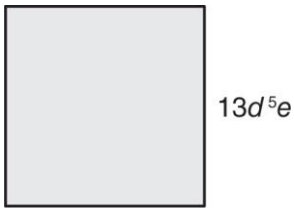
13. $(7a^5b^6)^4$ **14.** $(7m^3n^{11})^5$ **15.** $(-3w^3z^8)^5$ **16.** $(-7r^4s^{10})^4$

GEOMETRY Express the area of each square below as a monomial.

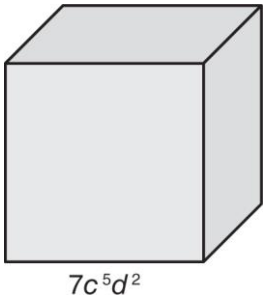
17.

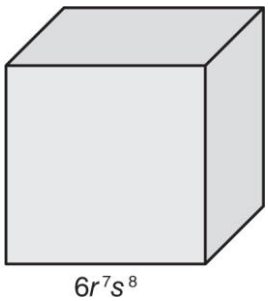


18.



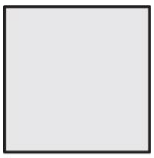
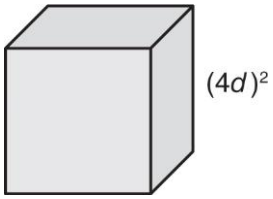
GEOMETRY Express the volume of each cube below as a monomial.





Lesson 1.4 Problem-Solving Practice

Powers of Monomials

1. DEBATE Charmaine and Aaron are having a debate. Charmaine thinks the answer to their math homework is $(4^2)^4$, but Aaron says the answer is $(4^4)^2$. Explain how both Charmaine and Aaron can be correct.	**2. LAND** Kate was given a square plot of land in which to build. If one side of the plot was $(3a)^3$ feet long, express the area of her plot as a monomial.  $(3a)^3$
3. CRAFTS Numa loves beads and wants to know which amount would be more, a thousand beads or $(6^2)^3$ beads?	**4. TEST** The teacher marked Silvano's problem wrong on his test. $(4^5)^4 = 4^9$ Explain what he did wrong and give the correct answer.
5. WOOD Dmitry calculated that he needs $6s^2$ square inches of wood for each crate he makes. Simplify the expression when *s* is replaced by t^4.	**6. VOLUME** Express the volume of the following cube as a monomial.  $(4d)^2$

Exponents and Division

Date_____ Period____

Simplify. Your answer should contain only positive exponents.

1) $\frac{5^4}{5}$

2) $\frac{3}{3^3}$

3) $\frac{2^2}{2^3}$

4) $\frac{2^4}{2^2}$

5) $\frac{3r^3}{2r}$

6) $\frac{7k^2}{4k^3}$

7) $\frac{10p^4}{6p}$

8) $\frac{3b}{10b^3}$

9) $\frac{8m^3}{10m^3}$

10) $\frac{7n^3}{2n^5}$

11) $\frac{2n^2}{n}$

12) $\frac{8x^3}{10x^5}$

13) $\frac{12x^3}{9y^8}$

14) $\frac{14x^4y^7}{6x^5y^4}$

15) $\frac{11u^4}{17u^7v^9}$

16) $\frac{4y^4}{14yx^8}$

17) $\frac{12yx^4}{10yx^8}$

18) $\frac{18x^8y^8}{10x^3}$

19) $\frac{5n^8}{20n^8}$

20) $\frac{16yx^4}{9x^8y^2}$

27

OBJECTIVE:
KEY NOTES:

Lesson 1.5 Skills Practice

Negative Exponents

Write each expression using a positive exponent.

1. 4^{-5} **2.** 5^{-7} **3.** m^{-9} **4.** s^{-6}

5. f^{-3} **6.** $(-2)^{-6}$ **7.** $(-4)^{-3}$ **8.** w^{-12}

Evaluate each expression.

9. $(-5)^{-5}$ **10.** 3^{-2} **11.** 8^{-3} **12.** $(-9)^{-4}$

Write each fraction as an expression using a negative exponent.

13. $\frac{1}{12^3}$ **14.** $\frac{1}{81}$ **15.** $\frac{1}{t^6}$ **16.** $\frac{1}{8^8}$

Simplify. Express using positive exponents.

17. $2^{-6} \bullet 2^3$ **18.** $s^{-5} \bullet s^7$ **19.** $\frac{m^8}{m^{-4}}$ **20.** $\frac{10^8}{10^9}$

21. $y^{-3} \bullet y^3$ **22.** $s^{-5} \bullet s^7$ **23.** $\frac{x^6}{x^{-3}}$ **24.** $\frac{6^{-4}}{6^8}$

25. $\frac{3^5}{3^{-3}}$ **26.** $\frac{e^{-3}}{e^{-2}}$ **27.** $\frac{n^{-6}}{n^4}$ **28.** $\frac{j^{-2}}{j^{-2}}$

Lesson 1.5 Problem-Solving Practice

Negative Exponents

1. MOTHS A Polyphemus Moth caterpillar weighs about $\frac{1}{64^2}$ times less when it first becomes a larva than it does when it is fully grown. Write this number using a negative exponent.

2. WEIGHT The length of one common termite is about 30^{-2}meters. Write this number using a positive exponent.

3. MONEY The school system spent 3^8 dollars on fuel for buses and school vehicles per week last year. This year, they spent 3^{10} dollars per week. How many times more did they spend per week this year than last year?

4. MEASUREMENT The table converts the size of each measurement to kilograms. Write each number using a positive exponent.

Amount	Amount in Kilograms
1 centigram	10^{-5}
1 decigram	10^{-4}
1 dekagram	10^{-2}

5. SCIENCE Electrons are smaller than 10^{-18} meters. Write this number using a positive exponent.

6. MONEY A bank loans a new business 6^7 dollars to get started. If the business pays back 6^5 dollars per year, how many years will it take to pay off the loan? Write your answer using a positive exponent.

Properties of Exponents

Date_____ Period____

Simplify. Your answer should contain only positive exponents.

1) $2m^2 \cdot 2m^3$

2) $m^4 \cdot 2m^{-3}$

3) $4r^{-3} \cdot 2r^2$

4) $4n^4 \cdot 2n^{-3}$

5) $2k^4 \cdot 4k$

6) $2x^3y^{-3} \cdot 2x^{-1}y^3$

7) $2y^2 \cdot 3x$

8) $4v^3 \cdot vu^2$

9) $4a^3b^2 \cdot 3a^{-4}b^{-3}$

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

11) $(x^2)^0$

12) $(2x^2)^{-4}$

13) $(4r^0)^4$

14) $(4a^3)^2$

15) $(3k^4)^4$

16) $(4xy)^{-1}$

17) $(2b^4)^{-1}$

18) $(x^2y^{-1})^2$

19) $(2x^4y^{-3})^{-1}$

20) $(3m)^{-2}$

21) $\frac{r^2}{2r^3}$

22) $\frac{x^{-1}}{4x^4}$

23) $\frac{3n^4}{3n^3}$

24) $\frac{m^4}{2m^4}$

25) $\frac{3m^{-4}}{m^3}$

26) $\frac{2x^4y^{-4}z^{-3}}{3x^2y^{-3}z^4}$

27) $\frac{4x^0y^{-2}z^3}{4x}$

28) $\frac{2h^3j^{-3}k^4}{3jk}$

29) $\frac{4m^4n^3p^3}{3m^2n^2p^4}$

30) $\frac{3x^3y^{-1}z^{-1}}{x^{-4}y^0z^0}$

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 Name_____

Simplifying Rational Expressions

Date_____ Period____

Simplify each expression.

1) $-\frac{36x^3}{42x^2}$

2) $\frac{16r^2}{16r^3}$

3) $\frac{16p^2}{28p}$

4) $\frac{32n^2}{24n}$

5) $-\frac{70n^2}{28n}$

6) $\frac{15n}{30n^3}$

7) $\frac{2r-4}{r-2}$

8) $\frac{45}{10a-10}$

9) $\frac{x-4}{3x^2-12x}$

10) $\frac{15a-3}{24}$

11) $\frac{v-5}{v^2-10v+25}$

12) $\frac{x+6}{x^2+5x-6}$

13) $\dfrac{27}{27x + 18}$

14) $\dfrac{v^2 - 7v - 30}{v^2 - 5v - 24}$

15) $\dfrac{x^2 + 8x + 12}{x^2 + 3x - 18}$

16) $\dfrac{x^2 - 11x + 18}{x^2 + 2x - 8}$

17) $\dfrac{b^2 + 3b - 28}{b^2 - 49}$

18) $\dfrac{v^2 - 3v - 40}{v^2 - 11v + 24}$

19) $\dfrac{4n - 4}{6n - 20}$

20) $\dfrac{v^2 - 5v - 14}{v^2 + 4v + 4}$

21) $\dfrac{6v^3 + 42v^2}{2v^2 + 26v + 84}$

22) $\dfrac{x^3 - x^2 - 42x}{2x^2 - 20x + 42}$

23) $\dfrac{2v^2 + 10v - 48}{8v + 64}$

24) $\dfrac{9x^2 + 81x}{x^3 + 8x^2 - 9x}$

25) $\dfrac{x^2 + 2x - 80}{2x^3 - 24x^2 + 64x}$

26) $\dfrac{3r^2 - 39r + 90}{r^2 - 3r - 70}$

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Lesson 1.6 Skills Practice

OBJECTIVE:
KEY NOTES:

Scientific Notation

Write each number in standard form.

1. 6.7×10^{1}

2. 6.1×10^{4}

3. 1.6×10^{3}

4. 3.46×10^{2}

5. 2.91×10^{5}

6. 8.651×10^{7}

7. 3.35×10^{-1}

8. 7.3×10^{-6}

9. 1.49×10^{-7}

10. 4.0027×10^{-4}

11. 5.2277×10^{-3}

12. 8.50284×10^{-2}

Write each number in scientific notation.

13. 34

14. 273

15. 79,700

16. 6,590

17. 4,733,800

18. 2,204,000,000

19. 0.00916

20. 0.29

21. 0.00000571

22. 0.0008331

23. 0.0121

24. 0.00000018

Lesson 1.6 Problem-Solving Practice

Scientific Notation

1. MEASUREMENT There are about 25.4 millimeters in one inch. Write this number in scientific notation.	**2. POPULATION** In the year 2000, the population of Rahway, New Jersey, was 26,500. Write this number in scientific notation.
3. MEASUREMENT One nanometer is 1.0×10^{-5} meter. Write this number in standard notation.	**4. PHYSICS** The speed of light is about 1.86×10^{5} miles per second. Write this number in standard notation.
5. COMPUTERS A CD can store about 650,000,000 bytes of data. Write this number in scientific notation.	**6. SPACE** The diameter of the Sun is about 1.39×10^{9} meters. Write this number in standard notation.
7. BIOLOGY The diameter of a certain virus is 0.000000028 meter. Write this number in scientific notation.	**8. MASS** The mass of planet Earth is about 5.98×10^{24} kilograms. Write this number in standard notation.

 Name_____

Writing in Scientific Notation

Date_____ Period____

Write each number in scientific notation.

1) 0.000006

2) 5400000

3) 60

4) 0.009

5) 6.7

6) 0.0000002

7) 2000000

8) 71×10^{3}

9) 48900

10) 0.0000009

11) 0.63×10^{1}

12) 33×10^{-3}

13) 0.000216

14) 0.0042

15) 0.15×10^{-2}

16) 4.8

Write each number in standard notation.

17) 0.9×10^{-1}

18) 2×10^{-1}

19) 2×10^{5}

20) 804×10^{2}

21) 2.66×10^{4}

22) 1.5×10^{-2}

23) 7.75×10^{-1}

24) 8.3×10^{7}

25) 9.5×10^{7}

26) 1.71×10^{7}

27) 0.9×10^{-3}

28) 38×10^{2}

29) 7.5×10^{-5}

30) 4×10^{0}

31) 8.4×10^{5}

32) 4×10^{-5}

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Lesson 1.7 Skills Practice

Compute with Scientific Notation

OBJECTIVE:
KEY NOTES:

1. $(5.8 \times 10^5)(6.4 \times 10^2)$

2. $(3.92 \times 10^6)(2.2 \times 10^4)$

3. $\dfrac{2.952 \times 10^6}{3.6 \times 10^3}$

4. $\dfrac{2.052 \times 10^7}{5.4 \times 10^4}$

5. $(6.9 \times 10^7) + (2.12 \times 10^5)$

6. $(1.78 \times 10^4) + (5.35 \times 10^3)$

7. $(8.4 \times 10^7) - (6.3 \times 10^6)$

8. $(9.62 \times 10^5) - (2.58 \times 10^3)$

9. $\dfrac{6.256 \times 10^8}{6.8 \times 10^4}$

10. $\dfrac{2.888 \times 10^5}{7.22 \times 10^2}$

11. $(3.68 \times 10^3)(2.4 \times 10^6)$

12. $(7.2 \times 10^7)(1.82 \times 10^2)$

13. $(6.78 \times 10^4) - (4.13 \times 10^2)$

14. $\dfrac{3.024 \times 10^6}{4.8 \times 10^2}$

15. $(5.9 \times 10^8) + (2.6 \times 10^6)$

16. $(3.45 \times 10^7)(1.68 \times 10^4)$

17. $(8.33 \times 10^3) + (4.1 \times 10^5)$

18. $(6.82 \times 10^5) - (3.11 \times 10^4)$

Lesson 1.7 Problem-Solving Practice

Compute with Scientific Notation

1. OCEAN Humpback whales are known to weigh as much as 8×10^4 pounds. The tiny krill they eat weigh only 2.1875×10^{-3} pounds. How many times greater than krill are humpback whales?

2. MEASUREMENT One inch is equal to 1.5782×10^{-5} miles. One centimeter is equal to 6.2137×10^{-6} miles. How many miles greater is one inch than one centimeter?

3. MONUMENT The Statue of Liberty is about 1.5108×10^2 feet tall from the base to the torch. The pedestal is 1.54×10^2 feet tall. How tall is the Statue of Liberty from the foundation of the pedestal to the top of the torch?

4. FUNDRAISER The table shows the amount of money raised by each region for cancer awareness. How much money did the North and South raise together?

Region	Amount Raised ($)
East	1.46×10^4
North	2.38×10^4
South	6.75×10^3
West	8.65×10^3

5. TURKEYS When the National Wild Turkey Federation was formed in 1973, there were only about 1.3×10^6 wild turkeys in North America. Now there are over 7×10^6 wild turkeys in North America. About how many more turkeys are there now than there were in 1973?

6. MONEY A bank starts the day with 2.93×10^4 dollars in the vault. At the end of the day, the bank has 3.5×10^5 dollars in the vault. How much more money is in the vault at the end of the day than there was in the morning?

Scientific Notation

Date_____ Period____

Write each number in scientific notation.

1) 0.000000786

2) 3940

3) 4.7

4) 1260000

5) 0.06

6) 175

Write each number in standard notation.

7) 6.17×10^{3}

8) 7×10^{4}

9) 7.31×10^{6}

10) 5.4×10^{-8}

11) 6.7×10^{-3}

12) 9.59×10^{2}

Write each number in scientific notation.

13) 0.2×10^{6}

14) 30×10^{-8}

15) 88.4×10^{3}

16) 28.8×10^{-9}

Simplify. Write each answer in scientific notation.

17) $(5.4 \times 10^{-1})(7 \times 10^{0})$

18) $(5 \times 10^{3})(3.5 \times 10^{-1})$

19) $(6 \times 10^{6})(4 \times 10^{-1})$

20) $(4.11 \times 10^{5})(8.65 \times 10^{-5})$

21) $(7.68 \times 10^{2})(9 \times 10^{6})$

22) $(8.31 \times 10^{-3})(6.6 \times 10^{-6})$

 Name_____

Operations With Scientific Notation

Date_____ Period____

Simplify. Write each answer in scientific notation.

1) $(1.08 \times 10^{-3})(9.3 \times 10^{-3})$

2) $(2 \times 10^{-4})(8.1 \times 10^{-1})$

3) $(2.32 \times 10^{-6})(4 \times 10^{-5})$

4) $(3.48 \times 10^{3})(9.8 \times 10^{4})$

5) $(7.1 \times 10^{-5})(6.7 \times 10^{-6})$

6) $(6 \times 10^{3})(9.91 \times 10^{0})$

7) $\dfrac{7.1 \times 10^{6}}{8.2 \times 10^{1}}$

8) $\dfrac{5.4 \times 10^{-1}}{3.4 \times 10^{1}}$

9) $\dfrac{4 \times 10^{4}}{3.63 \times 10^{-4}}$

10) $\dfrac{9 \times 10^{-5}}{9.24 \times 10^{-6}}$

11) $\dfrac{8.42 \times 10^{3}}{5 \times 10^{2}}$

12) $\dfrac{8.9 \times 10^{6}}{8.4 \times 10^{6}}$

13) $(8.9 \times 10^{5})^{4}$

14) $(4 \times 10^{-5})^{-6}$

15) $(6 \times 10^{-5})^3$

16) $(6.3 \times 10^{2})^{-6}$

17) $(5.21 \times 10^{-5})^2$

18) $(2.4 \times 10^{-5})^4$

19) $\frac{3 \times 10^{-2}}{8 \times 10^{-1}}$

20) $\frac{4.1 \times 10^{4}}{1.28 \times 10^{-5}}$

21) $\frac{1.91 \times 10^{3}}{5 \times 10^{-4}}$

22) $\frac{1.62 \times 10^{-6}}{5.3 \times 10^{6}}$

23) $\frac{3.59 \times 10^{-2}}{2.22 \times 10^{1}}$

24) $(8.8 \times 10^{-5})^{-5}$

25) $\frac{6 \times 10^{-3}}{8.08 \times 10^{-2}}$

26) $(3.5 \times 10^{-2})(9 \times 10^{4})$

27) $(8.8 \times 10^{2})(2.25 \times 10^{-2})$

28) $\frac{1.18 \times 10^{-4}}{3 \times 10^{0}}$

OBJECTIVE:
KEY NOTES:

Lesson 1.8 Skills Practice

Roots

Find each square root or cube root.

1. $\sqrt{16}$

2. $-\sqrt{9}$

3. $\sqrt{36}$

4. $\sqrt[3]{2{,}744}$

5. $\sqrt[3]{1{,}331}$

6. $\sqrt[3]{729}$

7. $-\sqrt{0.04}$

8. $\sqrt{-289}$

9. $\pm\sqrt{0.81}$

10. $-\sqrt{400}$

11. $\sqrt{\frac{16}{49}}$

12. $\sqrt{\frac{49}{100}}$

ALGEBRA Solve each equation. Check your solution(s).

13. $s^2 = 81$

14. $t^2 = 36$

15. $x^2 = 49$

16. $256 = z^2$

17. $900 = y^2$

18. $1024 = h^2$

19. $c^2 = \frac{49}{64}$

20. $a^2 = \frac{25}{121}$

21. $\frac{1}{100} = d^2$

22. $\frac{144}{169} = r^2$

Find each cube root.

23. $\sqrt[3]{64}$

24. $\sqrt[3]{-512}$

Lesson 1.8 Problem-Solving Practice

Roots

1. PLANNING Rosy wants a large picture window put in the living room of her new house. The window is to be square with an area of 49 square feet. How long should each side of the window be?	**2. GEOMETRY** If the area of a square is 81 square meters, how many meters long is each side?
3. ART A miniature portrait of George Washington is square and has an area of 169 square centimeters. How long is each side of the portrait?	**4. BAKING** Cody is baking a square cake for his friend's wedding. When served to the guests, the cake will be cut into square pieces 1 inch on a side. The cake should be large enough so that each of the 121 guests gets one piece. How long should he make each side of the cake?
5. ART Cara has 196 marbles that she is using to make a square formation. How many marbles should be in each row?	**6. GARDENING** Tate is planning to put a square garden with an area of 289 square feet in his back yard. What will be the length of each side of the garden?
7. HOME IMPROVEMENT Basil has 324 square paving stones that he plans to use to construct a square patio. How many paving stones will make up the width of the patio?	**8. GEOMETRY** If the volume of a cube is 12,167 cubic inches, what is the length of a side of the square?

Square Roots

Date_____ Period____

Find each square root.

1) $\sqrt{64}$

2) $\sqrt{36}$

3) $\sqrt{49}$

4) $\sqrt{0}$

5) $\sqrt{25}$

6) $\sqrt{1}$

7) $\sqrt{9}$

8) $\sqrt{4}$

Find each square root. Round to the nearest whole number.

9) $-\sqrt{200}$

10) $\sqrt{144}$

11) $-\sqrt{80}$

12) $-\sqrt{34}$

13) $-\sqrt{127}$

14) $\sqrt{1}$

15) $-\sqrt{36}$

16) $-\sqrt{148}$

Find each square root.

17) $-\sqrt{\frac{1}{4}}$

18) $\sqrt{\frac{81}{121}}$

19) $\sqrt{\frac{49}{196}}$

20) $\sqrt{\frac{81}{49}}$

21) $-\sqrt{\frac{25}{196}}$

22) $-\sqrt{\frac{196}{225}}$

Lesson 1.9 Skills Practice

OBJECTIVE:
KEY NOTES:

Estimate Roots

Estimate to the nearest integer.

1. $\sqrt{5}$

2. $\sqrt{18}$

3. $\sqrt{10}$

4. $\sqrt{34}$

5. $\sqrt{53}$

6. $\sqrt{80}$

7. $\sqrt[3]{510}$

8. $\sqrt[3]{999}$

9. $\sqrt[3]{119}$

10. $\sqrt{77}$

11. $\sqrt{171}$

12. $\sqrt{230}$

13. $\sqrt{147}$

14. $\sqrt{194}$

15. $\sqrt{290\frac{3}{7}}$

16. $\sqrt{440}$

17. $\sqrt{578}$

18. $\sqrt{730}$

19. $\sqrt[3]{780}$

20. $\sqrt[3]{1{,}370}$

21. $\sqrt[3]{947}$

22. $\sqrt{17.8}$

23. $\sqrt{11.5}$

24. $\sqrt{37.7}$

25. $\sqrt{23.8}$

26. $\sqrt{59.4}$

27. $\sqrt{97.3}$

28. $\sqrt[3]{32.5}$

29. $\sqrt[3]{211.7}$

30. $\sqrt{692.9}$

Lesson 1.9 Problem-Solving Practice

Estimate Roots

1. GEOMETRY If the area of a square is 29 square inches, estimate the length of each side of the square to the nearest whole number.	**2. DECORATING** Miki has a square rug in her living room that has an area of 19 square yards. Estimate the length of a side of the rug to the nearest whole number.
3. GARDENING Ruby is planning to put a square garden with an area of 200 square feet in her back yard. Estimate the length of each side of the garden to the nearest whole number.	**4. ALGEBRA** Estimate the solution of $c^2 = 40$ to the nearest integer.
5. ALGEBRA Estimate the solution of $x^2 = 138.2$ to the nearest integer.	**6. ARITHMETIC** The **geometric mean** of two numbers a and b can be found by evaluating $\sqrt{a \cdot b}$ Estimate the geometric mean of 5 and 10 to the nearest whole number.
7. GEOMETRY The radius r of a certain circle is given by $r = \sqrt{71}$. Estimate the radius of the circle to the nearest foot.	**8. GEOMETRY** In a triangle whose base and height are equal, the base b is given by the formula $b = \sqrt{2A}$, where A is the area of the triangle. Estimate to the nearest whole number the base of this triangle if the area is 17 square meters.

 Name_____

Simplifying Radical Expressions

Date_____ Period____

Simplify.

1) $\sqrt{125n}$

2) $\sqrt{216v}$

3) $\sqrt{512k^2}$

4) $\sqrt{512m^3}$

5) $\sqrt{216k^4}$

6) $\sqrt{100v^3}$

7) $\sqrt{80p^3}$

8) $\sqrt{45p^2}$

9) $\sqrt{147m^3n^3}$

10) $\sqrt{200m^4n}$

11) $\sqrt{75x^2y}$

12) $\sqrt{64m^3n^3}$

13) $\sqrt{16u^4v^3}$

14) $\sqrt{28x^3y^3}$

15) $\sqrt{36x^2y^3}$

16) $\sqrt{384x^4y^3}$

17) $7\sqrt{96m^3}$

18) $6\sqrt{72x^2}$

19) $-6\sqrt{150r}$

20) $5\sqrt{80a^2}$

21) $2\sqrt{125v}$

22) $-8\sqrt{24k^3}$

23) $-4\sqrt{192x}$

24) $2\sqrt{8p^2q^3r}$

25) $-4\sqrt{216x^2y^2z}$

26) $-3\sqrt{24a^4b^2c^3}$

27) $3\sqrt{16x^4y^4z}$

28) $-2\sqrt{48a^3b^4c^2}$

29) $6\sqrt{75mp^2q^3}$

30) $4\sqrt{36x^2y^3z^4}$

OBJECTIVE:
KEY NOTES:

Lesson 1.10 Skills Practice

Compare Real Numbers

Name all sets of numbers to which each real number belongs.

1. 12

2. -15

3. $1\frac{1}{2}$

4. 3.18

5. $\frac{8}{4}$

6. $9.\overline{3}$

7. $-2\frac{7}{9}$

8. $\sqrt{25}$

9. $\sqrt{3}$

10. $-\sqrt{64}$

11. $-\sqrt{12}$

12. $\sqrt{13}$

Replace each ○ with <, >, or = to make a true statement.

13. $1.7 \bigcirc \sqrt{3}$

14. $\sqrt{6} \bigcirc 2\frac{1}{2}$

15. $4\frac{2}{5} \bigcirc \sqrt{19}$

16. $4.\overline{8} \bigcirc \sqrt{24}$

17. $6\frac{1}{6} \bigcirc \sqrt{38}$

18. $\sqrt{55} \bigcirc 7.4\overline{2}$

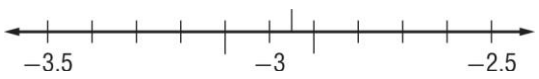
19. $2.1 \bigcirc \sqrt{4.41}$

20. $2.\overline{7} \bigcirc \sqrt{7.7}$

Order each set of numbers from least to greatest. Verify your answer by graphing on a number line.

21. $1.84, \sqrt{5}, \frac{5}{2}, 2.3, \sqrt{3}$

22. $-3.01, -2.95, -2.9, -3.1, -3.5$



Lesson 1.10 Problem-Solving Practice

Compare Real Numbers

1. GEOMETRY If the area of a square is 33 square inches, which is greater: the length of a side of the square to the nearest tenth of an inch or $\sqrt{40}$?	**2. GARDENING** Hal has a square garden in his back yard with an area of 210 square feet. Which is greater: the length of a side of the garden to the nearest tenth of a foot or $15\frac{1}{2}$?
3. ALGEBRA Which is greater: the solution of $a^2 = 21$ to the nearest tenth or $4\frac{1}{2}$?	**4. ALGEBRA** Which is greater: the solution of $b^2 = 67.5$ to the nearest tenth or $8\frac{1}{3}$?
5. ARITHMETIC The *geometric mean* of two numbers *a* and *b* can be found by evaluating $\sqrt{ab}$. Which is greater: the geometric mean of 4 and 11 to the nearest tenth or $6\frac{4}{5}$?	**6. ELECTRICITY** In a certain electrical circuit, the voltage *V* across a 20 ohm resistor is given by the formula $V = \sqrt{20P}$, where *P* is the power dissipated in the resistor, in watts. Which is greater: the voltage when $P = 4$ or $\sqrt{90}$?
7. GEOMETRY The length *s* of a side of a cube is related to the surface area *A* of the cube by the formula $s = \sqrt{\frac{A}{6}}$. Which is greater: the surface area when $A = 27$ or $2\frac{1}{2}$?	**8. PETS** Alicia and Didia are comparing the weights of their pet dogs. Alicia reports that her dog weighs $11\frac{1}{5}$ pounds, while Didia says that her dog weighs $\sqrt{125}$ pounds. Whose dog weighs more?

Sets of Real Numbers

Date_____ Period____

Name the set or sets to which each number belongs.

1) -15

2) 11

3) $\sqrt{30}$

4) $\frac{17}{3}$

5) 6

6) 0

7) -13

8) 3

9) $\frac{10}{11}$

10) 14

11) -13

12) π

13) $\frac{475}{325}$

14) $\sqrt{77}$

15) $\frac{6}{7}$

16) $\sqrt{0}$

17) $-\sqrt{196}$

18) -1

19) $\frac{-16}{-2}$

20) $\frac{135}{-3}$