

Algebra 2/Trig
Unit 1 – Powers, Roots, and Radicals
Notes Packet

Simplifying Radicals

1. $\sqrt{25} =$

2. $\sqrt{64} =$

3. $\sqrt{600} =$

Reducing Radicals:

1. “Break down” (a.k.a. factor) the number inside the _____.
2. Determine the desired group amount.
3. Circle all _____ (if any).
4. Write one number from each _____ in front of the _____.
5. If there any “left-overs”, write them _____.

Examples:

1) $\sqrt{600}$

2) $\sqrt[3]{16}$

3) $\sqrt[4]{810x^8y^2z^5}$

4) $\sqrt{72}$

5) $\sqrt[4]{16}$

6) $\sqrt[3]{32}$

7) $\sqrt[2]{60}$

8) $\sqrt[5]{96x^3y^7z^{15}}$

Product Property

$$\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$$

Quotient Property

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

1) $\sqrt{3} \cdot \sqrt{5} =$

2) $\sqrt{10} \cdot \sqrt{14} =$

3) $2\sqrt[3]{7} \cdot \sqrt[3]{14} =$

4) $\sqrt[4]{8} \cdot \sqrt[4]{10} =$

5) $\sqrt{\frac{36}{25}}$

6) $\sqrt{\frac{75}{4}}$

7) $\sqrt{\frac{3}{10}}$

8) $\sqrt{\frac{12}{7}}$

9) $\sqrt[3]{\frac{27}{8}} =$

10) $\sqrt[4]{\frac{32}{5}} =$

11) $\sqrt[3]{\frac{35}{12}}$

12) $\sqrt{\frac{48}{4}}$

Adding/Subtracting Radicals

1) $\sqrt{3} + \sqrt{3} =$

2) $\sqrt{5} + 8\sqrt{5} =$

3) $6\sqrt{7} - 8\sqrt{7} =$

4) $\sqrt{2} + \sqrt{3} =$

5) $2\sqrt[3]{7} + 2\sqrt[3]{7} =$

6) $3\sqrt[4]{8} - \sqrt[4]{8} =$

7) $6\sqrt[3]{5} + 8\sqrt{5} =$

8) $5\sqrt[3]{16} + 7\sqrt[3]{54} =$

Homework: Page 267 #19-47 1st column, Page 411 #34, 38, 42, 46, 50, 52, 54

Complex Examples: Combining Old & New Knowledge

1) $(4 - \sqrt{3})(5 + \sqrt{2}) =$

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

3) $(2 - \sqrt{3})(5 - \sqrt{3}) =$

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

5) $\frac{7 - \sqrt{3}}{5 + \sqrt{2}}$

6) $\frac{8}{4 - \sqrt{3}}$

7) $\frac{9 + \sqrt{11}}{1 - \sqrt{10}}$

8) $\frac{\sqrt{8}}{6 - \sqrt{14}}$

9) $\frac{-6}{12 + \sqrt{5}}$

10) $\frac{4 + \sqrt{5}}{\sqrt{3}}$

11) $\frac{1 - \sqrt{20}}{1 - \sqrt{8}}$

12) $\frac{3 + \sqrt{2}}{4 + \sqrt{2}}$

Simplifying Radicals

1. $\sqrt{225} =$

2. $\sqrt{270} =$

3. $\sqrt[5]{4608} =$

4. $10\sqrt{112} =$

5. $3\sqrt[3]{1200} =$

6. $\sqrt{180} =$

7. $\sqrt[3]{125x^4y^6} =$

8. $\sqrt[5]{100x^4y^{10}} =$

9. $\sqrt[4]{1296} =$

Multiplying Radicals

10. $3\sqrt{20} \cdot \sqrt{10} =$

11. $5\sqrt{4} \cdot \sqrt{4} =$

12. $\sqrt[3]{125x^4y^6} \cdot \sqrt[3]{4x^2y^5} =$

13. $\sqrt[4]{x^2} \cdot \sqrt[4]{x^2} =$

14. $\sqrt[3]{10} \cdot \sqrt[3]{32} =$

15. $\sqrt[5]{18} \cdot \sqrt[5]{27} =$

Dividing Radicals

16. $\sqrt{\frac{18}{49}} =$

17. $\sqrt{\frac{80}{64}} =$

18. $\sqrt{\frac{175}{54}} =$

19. $\sqrt{\frac{10}{3}} =$

20. $\sqrt{\frac{5}{10}} =$

21. $\sqrt[3]{\frac{54}{125}} =$

22. $\sqrt[4]{\frac{5}{8}} =$

23. $\sqrt[5]{\frac{1}{27}} =$

24. $\sqrt[3]{\frac{27}{8}} =$

25. $\sqrt[4]{\frac{6x^7}{y^4}} =$

26. $\sqrt[3]{\frac{25x^4}{y^2}} =$

27. $\sqrt[5]{\frac{3y^2}{x^4}} =$

Adding and Subtracting Radicals

28. $10\sqrt{3} + 5\sqrt{3} =$

29. $4\sqrt{6} - 11\sqrt{6} =$

30. $\sqrt{3} + \sqrt{3} =$

31. $\sqrt{4} + \sqrt{5} =$

32. $\sqrt[3]{2} + 3\sqrt[3]{2} =$

33. $2\sqrt[4]{5} + 6\sqrt[4]{5} =$

34. $\sqrt[5]{2} - 7\sqrt[3]{2} =$

35. $\sqrt[4]{x^2} + 3\sqrt[4]{x^2} =$

36. $\sqrt[5]{3x} - 2\sqrt[5]{x} =$

Complex Numbers (Multiplying and Dividing)

37. $(5 + \sqrt{2})(4 - \sqrt{6}) =$

38. $(7 - \sqrt{3})(1 - 2\sqrt{5}) =$

39. $(3 + \sqrt{5})(9 - \sqrt{5}) =$

40. $\frac{4}{5 + \sqrt{3}} =$

41. $\frac{1 - \sqrt{2}}{3 - \sqrt{5}} =$

42. $\frac{8 + \sqrt{3}}{5 + \sqrt{6}} =$

Review:

$$\sqrt{4} = \underline{\quad} \quad \text{because } \underline{\quad} * \underline{\quad} = 4$$

$$\sqrt{9} = \underline{\quad} \quad \text{because } \underline{\quad} * \underline{\quad} = 9$$

$$\sqrt{-9} = \underline{\quad}$$

Imaginary Numbers

Imaginary number = _____ Symbol = _____

Ex: $\sqrt{-5} =$

Ex: $\sqrt{-49} =$

Ex: $\sqrt{-12} =$

$i =$

$i^2 =$

Complex Numbers

Complex numbers = combine imaginary and real numbers

Ex: $5 + 3i$

Adding and Subtracting*Add the corresponding numbers and imaginary coefficients****Examples:***

1. $(3 + 4i) + (5 - 3i) =$

2. $(2 + 3i) - (4 - 2i) =$

3. $(2 - 4i) - (-2 + 3i) =$

Practice:

4. $(5 + 6i) + (4 - 2i) =$

5. $(3 + 8i) - (12 - 10i) =$

6. $(1 - 11i) - (-4 + 9i) =$

Multiplication

****When multiplying it is important to remember the powers of i ****

Examples:

1. $5i(-2 + i) =$

2. $(7 - 4i)(-1 + 2i) =$

3. $(6 + 3i)(6 - 3i) =$

Practice:

4. $6i(-10 + 3i) =$

5. $(11 - 2i)(-5 + 7i) =$

6. $(5 + 4i)(8 - 10i) =$

Division

In order to divide you need to multiply the numerator or denominator by the conjugate of the denominator.

Examples:

1. $\frac{5+3i}{1-2i}$

2. $\frac{4-2i}{3-3i}$

Practice:

3. $\frac{5}{2+i} =$

4. $\frac{3+i}{3-i} =$

5. $\frac{-5-3i}{4i} =$

6. $\frac{10-i}{2+i}$

Rational Exponent Form:

Rules: $\sqrt{a} = a^{1/2}$ $\sqrt[3]{a} = a^{1/3}$ $\sqrt[4]{a} = a^{1/4}$ $\sqrt[5]{a} = a^{1/5}$

So.... $(\sqrt[3]{a})^4 =$ $(\sqrt[2]{a})^5 =$ $a^{4/5} =$

1) $27^{2/3} =$ 2) $16^{3/4} =$ 3) $343^{-1/3} =$

4) $64^{1/2} =$ 5) $32^{2/5} =$ 6) $8^{-5/3} =$

Rewrite the expression using rational exponent form.

7. $\sqrt[3]{11} =$ 8. $(\sqrt[9]{16})^5 =$ 9. $(\sqrt[3]{6})^3 =$ 10. $(\sqrt{5})^3 =$

Rewrite the expression using radical notation, then simplify.

11. $-(49^{1/2}) =$ 12. $3125^{2/5} =$

13. $(-125)^{1/3} =$ 14. $9^{-3/2} =$

15. $\sqrt[4]{256} =$ 16. $(\sqrt[5]{32})^3 =$ 17. $(\sqrt[3]{27})^2 =$

18. $(\sqrt[3]{125})^4 =$ 19. $(\sqrt[5]{243})^2 =$ 20. $(\sqrt[4]{16})^6 =$

Classwork: p. 404 #14 – 22 even (simplify 18,20,22), #29-40 all

Algebra 2 / Trig – 7.2 Properties of Rational Exponents

Review	New: Rational Exponents
$4^3 \cdot 4^5$	$4^{1/3} \cdot 4^{2/5}$
$(5^2)^7$	$(5^{1/3})^{5/4}$
$(2x)^3$	$(2x)^{2/3}$
3^{-6}	$3^{-1/4}$
$\frac{8^5}{8^2}$	$\frac{8^{6/5}}{8^{2/5}}$
$\left(\frac{2}{5}\right)^3$	$\left(\frac{2}{5}\right)^{1/4}$

Use the properties of rational exponents to simplify the following problems.

1. $\left(\frac{5}{5^{2/3}}\right)^3 =$

2. $\left(\frac{27}{8}\right)^{1/3} =$

3. $3^{1/2} \cdot 3^{1/2} =$

4. $\left(3^{1/4} \cdot 4^{2/5}\right)^4 =$

5. $\frac{250^{1/2}}{10^{1/2}} =$

6. $\left(\frac{54^{1/3}}{2^{1/3}}\right)^4 =$

Multiplying and Dividing

Review	New: Rational Exponents
$\sqrt{6} \cdot \sqrt{3}$	$\sqrt[3]{12} \cdot \sqrt[3]{6}$
$\sqrt{\frac{10}{9}}$	$\sqrt[3]{\frac{5}{8}}$
$\sqrt{\frac{6}{5}}$	$\sqrt[4]{\frac{2}{27}}$

$$7. \sqrt[3]{10} \cdot \sqrt[3]{32} =$$

$$8. \sqrt[5]{18} \cdot \sqrt[5]{27} =$$

$$9. \sqrt[3]{\frac{54}{125}} =$$

$$10. \sqrt[4]{\frac{5}{8}} =$$

$$11. \sqrt[5]{\frac{1}{27}} =$$

$$12. \sqrt[3]{\frac{27}{8}} =$$

Adding and Subtracting

Review	New: Rational Exponents
$\sqrt{6} + \sqrt{3}$	$\sqrt[4]{6} + \sqrt[3]{6}$ or $\sqrt[5]{2} + \sqrt[5]{7}$
$4\sqrt{5} - \sqrt{5}$	$\sqrt[3]{5} - 7\sqrt[3]{5}$

$$13. \sqrt[3]{2} + 3\sqrt[3]{2} =$$

$$14. 2\sqrt[4]{5} + 6\sqrt[4]{5} =$$

$$15. \sqrt[5]{2} - 7\sqrt[5]{2} =$$

Problems with Variables

Simplifying, Multiplying and Dividing

$$16. \sqrt[3]{125x^4y^6}$$

$$17. \sqrt[4]{\frac{6x^7}{y^4}}$$

$$18. \sqrt[3]{\frac{25x^4}{y^2}}$$

$$19. x^{1/3} \cdot x^{2/5}$$

$$20. \frac{y^{1/3}}{y^{2/5}}$$

$$21. \sqrt[5]{100x^4y^{10}}$$

$$22. \sqrt[3]{125x^4y^6} \cdot \sqrt[3]{4x^2y^5}$$

$$23. \sqrt[4]{x^2} \cdot \sqrt[4]{x^2}$$

$$24. \sqrt[5]{\frac{3y^2}{x^4}}$$

Adding and Subtracting

$$25. \sqrt[4]{x^2} + 3\sqrt[4]{x^2}$$

$$26. \sqrt[5]{3x} - 2\sqrt[5]{x}$$

$$27. y^{2/3} + 4y^{2/3}$$

Simplify the expression. Leave in rational exponent form.

1. $6^{1/2} \cdot 6^{5/3} =$

2. $\left(4^{1/3}\right)^5 =$

3. $\frac{1}{3^{-3/4}} =$

4. $\left(\frac{5^3}{10^4}\right)^{1/2} =$

5. $\left(2^{3/4} \cdot 3^{1/3}\right)^9 =$

6. $\frac{7^{9/7}}{7^{5/7}} =$

Simplify the radical expression.

7. $3\sqrt{5} + \sqrt{5} =$

8. $5^4\sqrt{3} - 3^4\sqrt{3} =$

9. $\sqrt{8} + 5\sqrt{2} =$

10. $\sqrt[3]{\frac{27}{64}} =$

11. $\frac{6}{\sqrt[3]{4}} =$

12. $\frac{5y}{\sqrt[4]{27}} =$

13. $\frac{4x}{\sqrt[4]{x^2}} =$

Simplify the expression. Write the answer in rational exponent form.

14. $\sqrt{64} \cdot \sqrt[3]{64} =$

15. $\sqrt[4]{6} \cdot \sqrt[4]{6} =$

16. $\frac{\sqrt{7}}{\sqrt[5]{7}} =$

Simplify the expressions.

Write the answer in radical notation.

17. $x^{1/3} \cdot x^{1/5} =$

18. $\sqrt[5]{32x^5} =$

19. $\sqrt[3]{\frac{x^{15}}{y^3}} =$

20. $\sqrt{49x^5} =$

21. $\left(y \cdot y^{1/4}\right)^{4/3} =$

22. $\left(\sqrt[4]{x^3} \cdot \sqrt[4]{x^5}\right)^2 =$

Write the following in rational **exponent** notation.

1) $\sqrt[3]{12}$

2) $(\sqrt[4]{15})^3$

3) $(\sqrt[3]{2})^{11}$

4) $\sqrt{11}$

Write the following using **radical** notation.

5) $15^{1/3}$

6) $10^{3/2}$

7) $5^{2/5}$

8) $9^{4/7}$

Simplify the following.

9) $\sqrt[3]{1000}$

10) $\sqrt[4]{3750}$

11) $\sqrt[5]{972}$

12) $(\sqrt[6]{64})^8$

13) $(\sqrt[4]{0})^3$

14) $125^{2/3}$

15) $1^{1/3}$

16) $25^{-3/2}$

17) $16^{-1/2}$

Simplify the expression. Leave in rational exponent form.

18) $4^{1/2} \cdot 4^{5/3}$

19) $(5^{1/3})^6$

20) $\frac{1}{5^{-2/3}}$

Simplify the expression. Leave in rational exponent form.

21) $\left(\frac{6^4}{2^4}\right)^{1/2}$

22) $(5^{3/4} \cdot 6^{1/2})^8$

23) $\frac{30^{10/8}}{30^{3/8}}$

Simplify answer may be left in radical or rational form.

24) $\sqrt{36} \cdot \sqrt[6]{36}$

25) $\sqrt[4]{6} \cdot \sqrt[4]{8}$

26) $\frac{2}{\sqrt[5]{9}}$

Combine like radical terms.

27) $\sqrt{6} + 3\sqrt{6}$

28) $4\sqrt[3]{2} - 2\sqrt[3]{2}$

29) $\sqrt[3]{16} + 4\sqrt[3]{2}$

30) $5\sqrt[3]{x} + 2\sqrt[3]{x}$

31) $y^{2/5} + 4y^{2/5}$

32) $\sqrt[3]{b} - 2\sqrt[4]{b}$

Simplify the expressions.

33) $x^{1/3} \cdot x^{1/5}$

34) $\sqrt[3]{512x^{10}b^4}$

35) $\sqrt[3]{\frac{x^{15}}{y^3}}$

36) $\sqrt{49x^5}$

37) $(y \cdot y^{1/4})^{4/3}$

38) $(\sqrt[4]{x^3} \cdot \sqrt[4]{x^5})^2$

39) $\sqrt[5]{\frac{9x^6}{y^4}}$

40) $\sqrt[4]{81x^6y^5}$

Imaginary Number Review

41) $\sqrt{-25} =$

42) $\sqrt{-40} =$

43) $\sqrt[3]{-8} =$

44) $(3+i)(4-5i) =$

45) $(3+2i) - (5-i) =$

46) $3i(2-7i) =$

47) $\frac{3-i}{2+5i} =$

48) $\frac{3+2i}{5i} =$

49) $\frac{6}{2-i} =$

1) $\sqrt{44}$

2) $\sqrt{6} \cdot 4\sqrt{30}$

3) $\sqrt{\frac{32}{25}}$

4) $\sqrt{\frac{7}{3}}$

5) $3\sqrt{3} - 4\sqrt{3}$

6) $2\sqrt{6} - \sqrt{5}$

7) $(4 - 3i) - (1 + 2i)$

8) $(5 + \sqrt{3})(1 - \sqrt{2})$

9) $(1 - 4i)(5 - 3i)$

10) $\frac{1 - \sqrt{5}}{2 - \sqrt{3}}$

11) $\frac{2 - 5i}{1 + 4i}$

Rewrite in **rational** form

12) $(\sqrt[3]{6})^5$

Rewrite in **radical** form.

13) $10^{1/2}$

Simplify Completely. (No Decimal Answers)

14) $\sqrt[5]{64}$

15) $(\sqrt[4]{81})^5$

Simplify Completely. (No Decimal Answers)

16) $9^{-3/2}$

17) $2^{1/2} \cdot 2^{1/3}$

18) $(5^{1/5})^4$

19) $\frac{1}{6^{-2/5}}$

20) $\left(\frac{10^6}{2^6}\right)^{1/2}$

21) $(5^{3/8} \cdot 6^{1/2})^4$

22) $\frac{14^{6/5}}{14^{2/5}}$

23) $\sqrt[3]{6} \cdot \sqrt[3]{9}$

24) $\frac{5}{\sqrt[4]{9}}$

25) $\sqrt[3]{2} - 4\sqrt[3]{2}$

26) $2x^{3/5} + 5x^{3/5}$

27) $x^{1/3} \cdot x^{2/5}$

28) $\sqrt[3]{144x^9b^5}$

29) $\sqrt[3]{\frac{x^{12}}{y^6}}$

30) $(y \cdot y^{2/3})^{1/6}$