Notes:

[11.5] Square Roots of Variable Expressions

① $\sqrt{13}^2 = \boxed{13}$ ② $\sqrt{17 \cdot 17} = \boxed{17}$

③ $\sqrt{x^2} = \boxed{x}$ ④ $\sqrt{x^4} = \boxed{x^2}$

⑤ $\sqrt{x^6} = \boxed{x^3}$ $\boxed{\sqrt{x} = x^{\frac{1}{2}}}$

⑥ $\sqrt{x^3} = \sqrt{x^2 \cdot x} = \boxed{x\sqrt{x}}$

⑦ $\sqrt{x^5} = \sqrt{x^4 \cdot x} = \boxed{x^2\sqrt{x}}$

⑧ $\sqrt{x^{32}} = \boxed{x^{16}}$ $x^{16} \cdot x^{16} = x^{32}$

⑨ $\sqrt{x^{15}} = \sqrt{x^{14} \cdot x} = \boxed{x^7\sqrt{x}}$

⑩ $\sqrt{45x^{11}} = \sqrt{9 \cdot 5 \cdot x^{10} \cdot x} = \boxed{3x^5\sqrt{5x}}$

⑪ $\pm\sqrt{60x^7y^4} = \pm\sqrt{4 \cdot 15 \cdot x^6 \cdot x \cdot y^4} = \boxed{\pm 2x^3y^2\sqrt{15x}}$

⑫ $\sqrt{\dfrac{x^5}{16y^2}} = \sqrt{\dfrac{x^4 \cdot x}{16y^2}} = \boxed{\dfrac{x^2\sqrt{x}}{4y}}$

Homework:

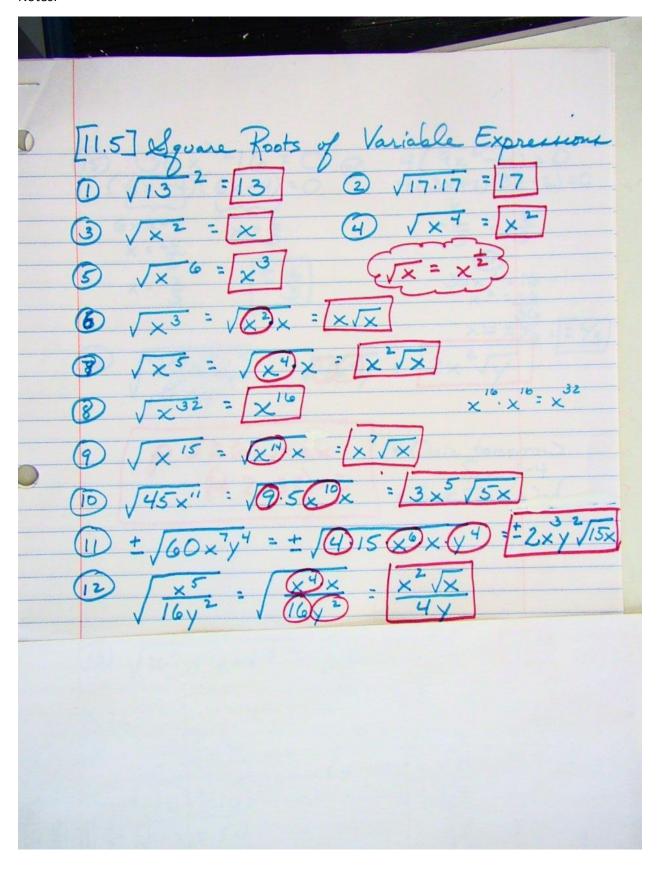NAME _____ — _____   DATE _____

Square Roots of Variable Expressions

Objective: To find square roots of variable expressions and to use them to solve equations and problems.

Property

Property of Square Roots of Equal Numbers For any real numbers r and s:
$r^2 = s^2$ if and only if $r = s$ or $r = -s$.

CAUTION When you are finding the principal square root of a variable expression, you must be careful to use absolute value signs when needed to ensure that your answer is positive. For example, $\sqrt{x^2} = |x|$, not x.

Example 1 Simplify: a. $\sqrt{144x^2}$ b. $\sqrt{25n^8}$ c. $\sqrt{12a^3}$

Solution a. $\sqrt{144x^2} = \sqrt{144} \cdot \sqrt{x^2}$
$= 12|x|$

b. $\sqrt{25n^8} = \sqrt{25} \cdot \sqrt{n^8}$
$= \sqrt{25} \cdot \sqrt{(n^4)^2}$
$= 5n^4$ (n^4 is always nonnegative)

c. $\sqrt{12a^3} = \sqrt{4 \cdot 3 \cdot a^2 \cdot a}$
$= \sqrt{4} \cdot \sqrt{a^2} \cdot \sqrt{3} \cdot \sqrt{a}$
$= 2|a|\sqrt{3a}$

Simplify.

1. $\sqrt{81x^2}$

2. $\sqrt{121x^2}$

3. $\sqrt{20x^2}$

4. $\sqrt{45x^4}$

5. $-\sqrt{25x^2}$

6. $-\sqrt{16c^4}$

7. $-\sqrt{64d^8}$

8. $-\sqrt{98n^6}$

9. $\sqrt{225y^4}$

10. $\sqrt{400a^6b^4}$

11. $\sqrt{81m^{12}}$

12. $\sqrt{441n^6}$

13. $\pm\sqrt{75x^2y^3}$

14. $\pm\sqrt{60x^6y^4}$

15. $-\sqrt{121x^2y^2}$

16. $-\sqrt{900a^4b^6}$

17. $\pm\sqrt{\dfrac{81x^8}{100}}$

18. $\pm\sqrt{\dfrac{121}{225x^{10}}}$

19. $\sqrt{\dfrac{x^4y^8}{9z^2}}$

20. $\sqrt{\dfrac{32m^3n^2}{2mn^2}}$

21. $\sqrt{\dfrac{16x^{18}}{3600y^{20}}}$

22. $\sqrt{\dfrac{256x^{40}}{25}}$

23. $\sqrt{2.25x^4}$

24. $-\sqrt{2.56k^2}$