Algebra 2
150

Properties of Powers

1.	Product of Powers	$(a^m)(a^n) = a^{m+n}$
2.	Power of a Product	$(ab)^p = a^p b^p$
3.	Power of a Power	$(a^m)^n = a^{mn}$
4.	Negative Exponent	$a^{-n} = \frac{1}{a^n}$
5.	Quotient of Powers	$\frac{a^m}{a^n} = a^{m-n}$, $a \approx 0$
6.	Power of a Quotient	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$, $b \neq 0$
7.	Zero Exponent	$a^0 = 1$, $a \approx 0$

Simplifying Products and Quotients

1. $\sqrt{3} \bullet \sqrt{12} = \sqrt{3 \bullet 12} = \sqrt{36} = 6$
2. $\sqrt[3]{5} \bullet \sqrt[3]{25} = \sqrt[3]{5 \bullet 25} = \sqrt[3]{125} = 5$
3. $\sqrt[4]{27} \bullet \sqrt[4]{3} = \sqrt[4]{27 \bullet 3} = \sqrt[4]{81} = 3$
4. $\frac{\sqrt{98}}{\sqrt{2}} = \sqrt{\frac{98}{2}} = \sqrt{7} = 7$
5. $\frac{\sqrt[4]{4}}{\sqrt[4]{1024}} = \sqrt[4]{\frac{4}{1024}} = \sqrt[4]{\frac{1}{256}} = \frac{1}{4}$
6. $\frac{\sqrt[3]{625}}{\sqrt[3]{5}} = \sqrt[3]{\frac{625}{5}} = \sqrt[3]{125} = 5$
7. $\sqrt[3]{135} = \sqrt[3]{27 \bullet 5} = 3\sqrt[3]{5}$
8. $\frac{\sqrt[5]{7}}{\sqrt[5]{8}} = \frac{\sqrt[5]{7}}{\sqrt[5]{8}} \bullet \frac{\sqrt[5]{4}}{\sqrt[5]{4}} = \frac{\sqrt[5]{28}}{\sqrt[5]{32}} = \frac{\sqrt[5]{28}}{2}$

$a\sqrt{b} + c\sqrt{d}$ & $a\sqrt{b} - c\sqrt{d}$ are **conjugates** of each other.
When a denominator is a sum or a difference involving square roots, we multiply both the numerator and the the denominator by the **conjugate** of the denominator.

1. $\frac{1}{5+\sqrt{3}} = \frac{1}{5+\sqrt{3}} \bullet \frac{5-\sqrt{3}}{5-\sqrt{3}} = \frac{5-\sqrt{3}}{5^2-\left(\sqrt{3}\right)^2} = \frac{5-\sqrt{3}}{22}$
2. $\frac{1}{\sqrt{7}-2} = \frac{1}{\sqrt{7}-2} \bullet \frac{\sqrt{7}+2}{\sqrt{7}+2} = \frac{\sqrt{7}+2}{\left(\sqrt{7}\right)^2-2^2} = \frac{\sqrt{7}+2}{3}$

Radical expressions with the same index and radicand are **like radicals**. To add or subtract like radicals, we use the **distributive property** as we normally did with like terms.

1. $\sqrt[4]{10} + 7\sqrt[4]{10} = (1+7)\sqrt[4]{10} = 8\sqrt[4]{10}$
2. $5\left(7^{1/3}\right) + 6\left(7^{1/3}\right) = (5+6)\left(7^{1/3}\right) = 11\left(7^{1/3}\right)$
3. $2\sqrt[6]{17} + 9\sqrt[6]{17} = (2+9)\sqrt[6]{17} = 11\sqrt[6]{17}$
4. $\sqrt[4]{48} - \sqrt[4]{3} = \sqrt[4]{16 \bullet 3} - \sqrt[4]{3} = 2\sqrt[4]{3} - \sqrt[4]{3} = (2-1)\sqrt[4]{3} = \sqrt[4]{3}$
5. $\sqrt[3]{54} - \sqrt[3]{2} = \sqrt[3]{27 \bullet 2} - \sqrt[3]{2} = 3\sqrt[3]{2} - \sqrt[3]{2} = (3-1)\sqrt[3]{2} = 2\sqrt[3]{2}$

Simplify the Following

1. $\sqrt[4]{27} \bullet \sqrt[4]{3} = \sqrt[4]{81} = 3$
2. $2(8^{1/5}) + 10(8^{1/5}) = 12(8^{1/5})$
3. $\dfrac{\sqrt[3]{250}}{\sqrt[3]{2}} = \sqrt[3]{125} = 5$
4. $\sqrt[3]{104} = \sqrt[3]{8 \bullet 13} = 2\sqrt[3]{13}$
5. $\sqrt[5]{\dfrac{3}{4}} = \sqrt[5]{\dfrac{3}{4}} \bullet \sqrt[5]{\dfrac{8}{8}} = \sqrt[5]{\dfrac{24}{32}} = \dfrac{\sqrt[5]{24}}{2}$
6. $4(9^{2/3}) + 8(9^{2/3}) = 12(9^{2/3}) = 12\sqrt[3]{81} = 12\sqrt[3]{27 \bullet 3} = 12 \bullet 3\sqrt[3]{3} = 36\sqrt[3]{3}$

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Simplify the following.

1. $(9^2)^{1/3} =$

2. $(12^2)^{1/4} =$

3. $\dfrac{6}{6^{1/4}} =$

4. $\dfrac{7}{7^{1/3}} =$

5. $\left(\dfrac{9^3}{6^3}\right)^{-1/3} =$

6. $\dfrac{49^{3/8} \bullet 49^{7/8}}{7^{5/4}} =$

7. $\dfrac{11}{9-\sqrt{6}} =$

8. $\dfrac{2}{\sqrt{8}+\sqrt{7}} =$

9. $\sqrt[3]{16} \bullet \sqrt[3]{32} =$

10. $\dfrac{\sqrt[3]{6} \bullet \sqrt[3]{72}}{\sqrt[3]{2}} =$

11. $\dfrac{\sqrt[3]{3} \bullet \sqrt[3]{18}}{\sqrt[6]{2} \bullet \sqrt[6]{2}} =$

12. $5\sqrt{12} - 19\sqrt{3} =$

13. $\sqrt[5]{224} + 3\sqrt[5]{7} =$

14. $5(24^{1/3}) - 4(3^{1/3}) =$