ملزمة الوحدة العاشرة Roots and Exponents مع الشرح وتدريبات منهج ريفيل

تم تحميل هذا الملف من موقع المناهج الإماراتية	
موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف العاشر العام ⇦ رياضيات ⇦ الفصل الأول ⇦ ملفات متنوعة ⇦ الملف	
تاريخ إضافة الملف على موقع المناهج: 2025-10-24 13:09:17	
ملفات ا كتب للمعلم ا كتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس	المزيد من مادة رياضيات:
إعداد: مصطفى عبد العزيز	

التواصل الاجتماعي بحسب الصف العاشر العام					
صفحة المناهج الإماراتية على فيسبوك					
المواد على تلغرام	التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات	

المزيد من الملفات بحسب الصف العاشر العام والمادة رياضيات في الفصل الأول	
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وزارة التربيــة والتعــليم

مدرســة الحصــن للتعليم الثانـوي

الفصل الدراسي الأول(2026/2025)

10: G

Mathematics

Unit: 10

Exponents and Roots

1. Multiplication Properties of Exponent
2. Division Properties of Exponents
3. Negative Exponents
4. Rational Exponents
5. Simplifying Radical Expressions
6. Operations With Radical Expression
7. Exponential Equations

أبنائي الطلاب....

العلم هو الوسيلة الوحيدة التي يرتفع بها شأن الانسان إلى مراتب الكرامة والشرف....

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Multiplication Properties of Exponent (10-1)

Objectives:

To find products of monomials.
To find the power of a power.
To find the power of a product.

A monomial is a number, a variable, or a product of a number and one or more variables.

Product of Powers:

To multiply two powers that have the same base, add their exponents
For any real number a and any integers m and p.

$a^m \bullet a^n = a^{m+n}$

$Ex\ \ 2^3 \bullet 2^5 = 2^{3+5} = 2^8$

Simplify each expression.

1. $(3n^4)(4n^7)$

2. $(7xy^2)(2x^4y^3)$

3. $(7n^7)(-7n)$

4. $(11x^6y^6)(xy^9)$

The fastest recorded star in the Milky Way galaxy is US 708, which travels 2,700,000 miles per hour. How far does US 708 travel in 1 year? Write your answer in scientific notation and round to the nearest tenth. (Hint: 1 year = 8760 hours)

أسرع نجم مُسجَّل في مجرة درب التبانة هو النجمUS 708 ، الذي يقطع مسافة 2,700,000 ميل في الساعة. ما المسافة التي يقطعها النجم US 708في سنة واحدة؟ اكتب إجابتك بالصيغة العلمية، ثم قرّبها لأقرب جزء من عشرة. (تلميح: سنة واحدة = 8760 ساعة)

Power of a Power

To find the power of a power, multiply the exponents.
For any real number a and any integers m and p, $(a^m)^p = a^{mp}$

Simplify each expression

1. $(n^5)^3$ =

2. $(x^4)^2$

Power of a Product

To find a power of a product, find the power of each factor and multiply
For any real numbers a and b and any integer m, $(ab)^m = a^m b^m$

Simplify each expression

a. $(3x^5y^2)^5$

b. $(-5ab^4)^2$

c. $(4x^3y^{-2})^3 \bullet (-3a^{-3}b)^6$

d. $(-3b^3c^4)^2$

If the side of each smaller square is x inches, and the side of the whole canvas is **s** inches, then what is the area of the painting in terms of x.

إذا كان ضلع كل مربع أصغر هو x بوصة، وكان ضلع اللوحة بأكملها هو s بوصة، فما هي مساحة اللوحة من حيث x ؟

Homework

Simplify each expression.

1. $(q^2)(2q^4)$

2. $(-2u^2)(6u^6)$

3. $(9w^2x^3)(w^6x^4)$

4. $(y^6z^9)(6y^4z^2)$

5. $(j^5k^7)^4$

6. $[(3^2)^2]^4$

Jeanine is designing an early version of a game and wants to use a cube to stand in for the character, which she will design later. She bases the dimensions of the cube around the height of the character, which she defines as $\frac{1}{8}$x pixels, where x is the height of the total game screen. What is the volume of the cube in terms x?

تصمم "جانين" نسخة مبكرة من لعبة، وتريد استخدام مكعب كبديل عن الشخصية التي ستقوم بتصميمها لاحقًا. وقد حددت أبعاد هذا المكعب بناءً على طول الشخصية، والذي تُعرفه على $\frac{1}{8}$x بكسل، حيث x هو ارتفاع شاشة اللعبة بالكامل.

ما هو حجم هذا المكعب بدلالة x

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Division Properties of Exponents (10-2)

Objectives:

To divide powers with the same base.

To raise a quotient to a power

To divide powers with the same base, subtract the exponents.

For any nonzero number a, and any integers m and p

$$\frac{a^m}{a^p} = a^{m-p}$$

Example $\frac{2^5}{2^3} = 2^{5-3} = 2^2 = 4$

Simplify

$\frac{b^5c^7}{b^2c}$. Assume that the denominator does not equal zero.

Power of a Quotient

To find the power of a quotient, find the power of the numerator and the power of the denominator.

For any real numbers a and b ≠ 0, and any integer m.

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}.$$

Simplify

$\left(\frac{5a^2}{6}\right)^3$

$\left(\frac{4m^2n^2p^2}{3mp}\right)^4$

Simplify each expression. Assume that no denominator equals zero.

$\frac{m^4p^2}{m^2p}$

$\frac{p^{12}t^3r}{p^2tr}$

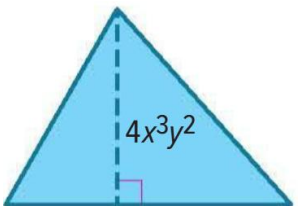
$\frac{c^4d^4f^3}{c^2d^4f^3}$

$\left(\frac{3xy^4}{5z^2}\right)^2$

$\frac{-16x^7y^2}{-6xy^5}$

$\left(\frac{6j^5}{7m^6n^3}\right)^2$

The area of the triangle shown is $6x^5y^3$. Find the base of triangle.



The area of the rectangle in the figure is $32xy^3$ square units. Find the width of the rectangle.

INVESTMENTS A poor investment is expected to decrease in value by 5% every year.

a. If the initial value of the investment was $100, what does it mean for it to decrease in value by 5% in the first year?

b. Erik claims that rather than multiplying by 0.05 and subtracting, we can simply multiply the investment by 0.95. Is he correct? Explain.

c. Write an expression that represents the value of the investment after t years if the initial value was n

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Negative Exponents (10-3)

Objectives:

- Simplify expressions containing zero and negative exponents.
- Simplify expressions containing negative exponents.

Zero Exponent Property

Any nonzero number raised to zero power is equal to 1.

$a^0 = 1, a \neq 0$

Examples: $30^0 = 1$ ، $\left(\frac{8}{3}\right)^0 = 1$

Simplify each expression. Assume that no denominator equals zero.

$\left(\frac{-8m^2np^8}{9k^2mn^4}\right)^0 = 1$

$\frac{a^4b^0}{a^2} = \frac{a^4}{a^2} \bullet b^0 = a^2 \bullet 1 = a^2$

Select the simplified form of $\frac{56g^2hj^{11}}{8g^0h^0j^0}$. Assume that the denominator does not equal zero

A. $7g^2hj^{11}$

B. $7gj^{10}$

C. $7ghj^{10}$

D. $7g^2hj^{10}$

Negative Exponent Property

For any nonzero number a and any integer n, $a^{-n} = \frac{1}{a^n}$

Examples:

$3^{-5} = \frac{1}{3^5} = \frac{1}{243}$ ، $\frac{1}{m^{-2}} = m^2$

An expression is considered simplified when:

- it contains only positive exponents.
- each base appears exactly once.
- there are no powers of powers.
- all fractions are in simplest form.

Simplify (Assume that the denominator does not equal zero.)

$\frac{a^3 b^{-4}}{c^{-2}}$ =

$\frac{42r^{-2}t^{-6}u^3}{14r^2u^{-3}}$

$\frac{35h^0j^{-5}k^{-2}}{14h^2m^5}$.

$\frac{-10m^{-1}y^0r}{-14m^{-7}y^{-3}r^{-4}}$

The order of magnitude of a quantity is the number rounded to the nearest power of 10.

Examples: 105,000,000 $= 1.05 \cdot 10^8 \approx 10^8$

$0.0012 = 1.2 \cdot 10^{-3} \approx 10^{-3}$

Activity $6258 = 6.258 \cdot 10^3 \approx 10^4$

Consider a dust mite that measures 10 millimeters in length and a gecko that measures 10 centimeters long. How many orders of magnitude as long as the mite is the gecko?

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Rational Exponents (10-4)

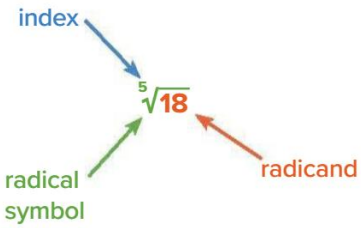
Objectives: Rewrite expressions involving nth roots and rational exponents.
Rewrite expressions involving powers of nth roots and rational exponents

Exponents that are expressed as a fraction are called rational exponents.

Powers of One Half

For any nonnegative real number b, $b^{\frac{1}{2}} = \sqrt{b}$

Example: $64^{\frac{1}{2}} = \sqrt{64}$ =8



n^{th} Roots

For any real numbers a and b and any positive integer n.

If $a^n = b$, then a is the n^{th} root of b.

$\Rightarrow a^n = b$, then $a = \sqrt[n]{b}$

Example $3^4 = 81$, 3 is the fourth root of 81; $\sqrt[4]{81}$ =3.

Rational Exponents

For any nonnegative real number b and any positive n.

$b^{\frac{1}{n}} = \sqrt[n]{b}$.

$32^{\frac{1}{5}} = \sqrt[5]{32} = \sqrt[5]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$ or 2

Write each expression in radical or exponential form.

a. $10^{\frac{1}{n}}$ =

b. $\sqrt{7k^2}$ =

c. $\sqrt{16P}$ =

d. $34^{\frac{1}{2}}$ =

e. $8\sqrt{P}$ =

f. $(3P)^{\frac{1}{2}}$ =

Evaluate each expression.

$\sqrt[5]{243} = \sqrt[5]{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3} = 3$

$\sqrt[4]{625} = \sqrt[4]{5 \cdot 5 \cdot 5 \cdot 5} = 5$

a. $\sqrt[4]{4096}$ =

b. $\sqrt[5]{16807}$

Evaluate each expression.

$4096^{\frac{1}{6}}$

$\left(\frac{81}{256}\right)^{\frac{1}{4}}$

$100{,}000^{\frac{1}{5}}$

Powers of nth Roots

For any real number b and any integers m and $n > 1$, $b^{\frac{m}{n}} = (\sqrt[n]{b})^m$ or $\sqrt[n]{b^m}$.
$216^{\frac{4}{3}} = (\sqrt[3]{216})^4 = 6^4$ or 1296
$32^{\frac{2}{5}} = \sqrt[5]{32^2} = \sqrt[5]{1024} = \sqrt[5]{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}$ or 4

Note:

The exponent can be simplified before it is evaluated.

Example:

$$4^{\frac{15}{5}} = 4^3$$
$$= 4 \cdot 4 \cdot 4$$
$$= 64$$

Evaluate each expression.

a. $729^{\frac{5}{6}}$

$$729^{\frac{5}{6}} = (\sqrt[6]{729})^5$$
$$= (\sqrt[6]{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3})^5$$
$$= (\sqrt[6]{3^6})^5$$
$$= 3^5 \text{ or } 243$$

b. $\left(\frac{36}{49}\right)^{\frac{3}{2}}$

$$\left(\frac{36}{49}\right)^{\frac{3}{2}} = \frac{36^{\frac{3}{2}}}{49^{\frac{3}{2}}}$$
$$= \frac{(\sqrt{36})^3}{(\sqrt{49})^3}$$
$$= \frac{6^3}{7^3}$$
$$= \frac{216}{343}$$

Evaluate each expression

- $49^{\frac{3}{2}}$
- $243^{\frac{3}{5}}$
- $\left(\frac{1}{81}\right)^{\frac{1}{4}}$
- $\left(\frac{3125}{32}\right)^{\frac{1}{5}}$
- $729^{\frac{5}{6}}$
- $256^{\frac{3}{8}}$
- $\left(\frac{8}{125}\right)^{\frac{4}{3}}$
- $49^{\frac{5}{2}}$
- $(3^2)^{\frac{-3}{2}}$
- $\left(81^{\frac{1}{4}}\right)^{-2}$
- $K^{\frac{-1}{2}}$
- $\left(d^{\frac{4}{3}}\right)^{0}$

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Simplifying Radical Expressions (10-5)

Objectives:

To simplify square roots.

To simplify cube root.

Vocabulary: radical expression -square root- perfect square
principal square root- cube root -perfect cube.

$\sqrt{25} = 5$

Product Property of Square Roots

$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ if $a \geq 0$ and $b > 0$

$\sqrt{\frac{100}{4}} = \sqrt{25} = 5$ or $\sqrt{\frac{100}{4}} = \frac{\sqrt{100}}{\sqrt{4}} = \frac{10}{2} = 5$

Quotient Property of Square Roots

$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ if $a \geq 0$ and $b > 0$

$\sqrt{\frac{100}{4}} = \sqrt{25} = 5$ or $\sqrt{\frac{100}{4}} = \frac{\sqrt{100}}{\sqrt{4}} = \frac{10}{2} = 5$

Simplify:

$\sqrt{72}$ =

$\sqrt{5} \cdot \sqrt{48}$ =

$\sqrt{\frac{24}{72}}$ =

$\sqrt{525x^4y^5Z^5}$ =

$\sqrt{147x^3y^4z^5}$ =

Product Property of Radicals

$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ if $a \geq 0$ and $b \geq 0$

$\sqrt[3]{8 \cdot 64} = \sqrt[3]{512}$ or 8; $\sqrt[3]{8 \cdot 64} = \sqrt[3]{8} \cdot \sqrt[3]{64} = 2 \cdot 4$ or 8

Simplify

$\sqrt[3]{343}$ =

$\sqrt[3]{135}$ =

$\sqrt[3]{2} \cdot \sqrt[3]{36}$ =

$\sqrt[3]{\frac{168}{375}}$ =

$\sqrt[3]{\frac{15x^2y^3z^4}{81x^5}}$ =

Simplify each expression

$\sqrt{2} \cdot \sqrt{10}$

$\sqrt{5} \cdot \sqrt{60}$

$\sqrt{16b^4}$

$\sqrt{40x^4y^8}$

$\sqrt[3]{\frac{640a^3b^8}{5ab^4}}$

$\sqrt[3]{\frac{192x^7}{1029x^{10}}}$

$\sqrt[3]{10yz^5} \cdot \sqrt[3]{4y^3}$

$\sqrt[3]{16} \cdot \sqrt[3]{20}$

$\sqrt[3]{54x^2y^8} \cdot \sqrt[3]{5x^5y^4}$

$\sqrt[3]{\frac{162}{3}}$

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Operations With Radical Expression (10-6)

Objectives

To add and subtract radical expressions.
To multiply radical expression

Simplify

$5a + 3a$ =

$5\sqrt{a} + 3\sqrt{a}$ =

$4\sqrt{5} + 3\sqrt{7} - 2\sqrt{5} + 7\sqrt{7}$ =

$3\sqrt{75} - 6\sqrt{48} - \sqrt{27}$ =

Simplify $17\sqrt{19} - 14\sqrt{6} + 11\sqrt{6} - 3\sqrt{19}$.

A. 0

B. $14\sqrt{19} - 3\sqrt{6}$

C. $11\sqrt{25}$

D. $28\sqrt{19} - 17\sqrt{6}$

Simplify

$-11\sqrt{50} + 2\sqrt{32} - 18\sqrt{8}$ =

A. $99\sqrt{2}$

B. $-83\sqrt{2}$

C. $-27\sqrt{2}$

D. $-11\sqrt{50} - 14\sqrt{8}$

Kate is decorating a rectangular pavilion for a party and wants to string lights along the edge of the roof. Two of the sides have a length of $13\sqrt{5}$ feet, and the other two sides have a length of $6\sqrt{45}$ feet. How many feet of lights will Kate need to decorate the entire pavilion?

Multiply Radical Expressions

Simplify

$5\sqrt{3} \bullet 4\sqrt{6} =$

$3\sqrt{10}\left(-9\sqrt{6}\right) =$

$4\sqrt{7}\left(2\sqrt{8}+3\sqrt{7}\right) =$

$-4\sqrt{6}(7\sqrt{12}-4\sqrt{8}).$

$\left(6\sqrt{2}+2\sqrt{3}\right)\left(\sqrt{10}-4\sqrt{7}\right) =$

$\frac{1}{2}\sqrt{8}-\sqrt{\frac{2}{9}}+9\sqrt{2} =$

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Exponential Equations (10-7)

Objectives

To solve exponential equations.

Power Property of Equality

For any real number $b > 0$ and $b \neq 1$, $b^x = b^y$ if and only if $x = y$.

Activity

If $4^x = 4^5$ then $x =$ ---

If $5^n = 5^{\frac{2}{5}}$ then n = ---

Solve $5^x = 625$.

$5^x = 625$	Original equation
$5^x = 5^4$	Rewrite 625 as 5^4.
$x = 4$	Simplify.

Solve $2^x = 512$.

Solve

$27^{x-1} = 3$

$3^x = 6561$

Homework

Solve

$16^x = 4$

$4^{x-1} = 1024$

$3^{x-3} = 234$

$4^{2x+1} = 1024$

in the 1950s, scientists proposed a space station that could house a crew of approximately 80 people. The station could produce artificial gravity by rotating at a speed of $W = \sqrt{gr}$, where g is 32 feet per second squared, and r is the radius of the station. If the station design required a rotating speed of approximately 64 feet per second to simulate gravity on Earth, what would the radius need to be?

في خمسينيات القرن الماضي، اقترح العلماء إنشاء محطة فضائية تتسع لطاقم من حوالي 80 شخصًا. يمكن للمحطة توليد جاذبية اصطناعية من خلال الدوران بسرعة $W = \sqrt{gr}$ ، حيث g = 32 قدمًا في الثانية المربعة، و r = نصف قطر المحطة. إذا تطلب تصميم المحطة سرعة دوران تقارب 64 قدمًا في الثانية لمحاكاة الجاذبية على الأرض، فما هو نصف القطر المطلوب؟