M10 - 4.0 - Exponents Review

Coefficient → $7x^2$ ← Exponent, Base

Rule:	Example:	
$x^a \times x^b = x^{a+b}$	$x^2 \times x^3 = x^{2+3} = x^5$	*Add exponents*
$\frac{x^a}{x^b} = x^{a-b}$	$\frac{x^5}{x^3} = x^{5-3} = x^2$	*Subtract exponents*
$(x^a)^b = x^{a \times b}$	$(x^2)^3 = x^{2\times3} = x^6$	*Multiply exponents (Distribute)*
$(xy)^a = x^a y^a$	$(3x)^2 = 3^2x^2 = 9x^2$	
$\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$	$\left(\frac{x}{y}\right)^2 = \frac{x^2}{y^2}$	

$4^2 \times 4^3 = 4^5 = 1024 = (2^2)^5 = 2^{10}$

$4 = 2^2$

$8 = 2^3$

$81 = 3^4$

Change of Base

$x^{-a} = \frac{1}{x^a}$	$x^{-3} = \frac{1}{x^3}$	$3a^{-2} = \frac{3}{a^2}$; $(2x)^{-3} = \frac{1}{(2x)^3} = \frac{1}{8x^3}$
$\frac{1}{x^{-a}} = x^a$	$\frac{1}{x^{-2}} = x^2$	$3^{-3}a^{-2} = \frac{1}{3^3a^2}$; $\frac{1}{x^2} = x^{-2}$
$\frac{x^{-a}}{y^{-b}} = \frac{y^b}{x^a}$	$\frac{x^{-2}}{y^{-3}} = \frac{y^3}{x^2}$	$\frac{x^{-2}+2}{5} = \frac{\frac{1}{x^2}+2}{5}$; $\frac{x^{-2}+2}{5} \neq \frac{2}{5x^2}$
$\left(\frac{x}{y}\right)^{-a} = \frac{x^{-a}}{y^{-a}} = \frac{y^a}{x^a}$	$\left(\frac{x}{y}\right)^{-2} = \frac{x^{-2}}{y^{-2}} = \frac{y^2}{x^2}$ OR	$\left(\frac{x}{y}\right)^{-2} = \left(\frac{y}{x}\right)^2$; $\left(\frac{x}{y}\right)^{-a} = \left(\frac{y}{x}\right)^a$ Flip it and make the exponent positive

$-x^a = -x^a$	$-x^2 = -x^2$	$x^0 = 1$
$(-x)^a = -x^a$; "a" is odd	$(-x)^3 = -x^3$	$x^1 = x$
$(-x)^a = x^a$; "a" is even	$(-x)^4 = x^4$	$1^x = 1$
		$0^x = 0$; $x \neq 0$

Grade 9

Root Rules

$$x^{\frac{m}{n}} = \sqrt[n]{x^m}$$

Bottom becomes the root

$x^{\frac{2}{3}} = \sqrt[3]{x^2}$; $8^{\frac{2}{3}} = \sqrt[3]{8^2} = 2^2 = 4$; $\sqrt[3]{8} = 2$

Cube Root First

$x^{\frac{1}{2}} = \sqrt[2]{x^1}$; $4^{\frac{1}{2}} = \sqrt[2]{4^1} = 2$

$x \times x = x^2$

$x \times x^2 = x^3$

$\frac{x^3}{x^2} = \frac{x \times x \times x}{x \times x} = x$

$\frac{x^2}{x} = \frac{x \times x}{x} = x$

$\frac{x^3}{x} = \frac{x \times x \times x}{x} = x^2$

$\frac{x}{x} = 1$

$\frac{x}{x^2} = \frac{x}{x \times x} = \frac{1}{x}$

$\frac{x^3}{x^2} = x$

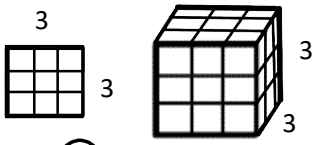
$\frac{x^2}{x} = x$

$\frac{x^3}{x} = x^2$

$\frac{x}{x} = 1$

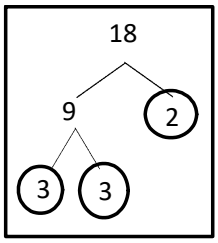
$\frac{x}{x^2} = \frac{1}{x}$

M10 - 4.0 - Radicals Review



$\sqrt[3]{27} = 3$

$\sqrt[2]{9} = 3$



Logic

$3^2 = 3 \times 3 = 9$

$\sqrt{b} \times \sqrt{b} = b$

$\sqrt{3} \times \sqrt{3} = 3$

$\sqrt{3} \times \sqrt{3} = \sqrt{3 \times 3} = \sqrt{9} = \sqrt{3^2} = 3$ ✓

Index → $\sqrt[n]{x}$ ← Radicand

Radical

Simplifying and Expanding Radicals

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

$\sqrt[2]{18} = \sqrt[2]{3 \times 3 \times 2} = \sqrt[2]{3^2 \times 2} = 3\sqrt[2]{2}$ ✓

Prime Factorization

OR

$\sqrt[3]{24} = \sqrt[3]{2 \times 2 \times 2 \times 3} = 2\sqrt[3]{3}$ ✓

$\sqrt[n]{a^m a^* b} = a^{\frac{m}{n}}\sqrt[n]{a^* b}$ *remainder

$\sqrt[2]{2^3} = 2\sqrt[2]{2} = 2.83$ ✓

$\sqrt[3]{2^8} = 2^2\sqrt[3]{2^2} = 4\sqrt[3]{4} = 6.35$ ✓

$\sqrt[2]{18} = \sqrt[2]{9} \times \sqrt[2]{2} = 3\sqrt[2]{2} = 4.24$ ✓

Perfect Squares: 1,4,9,16,25,36,49…

$\sqrt[3]{24} = \sqrt[3]{8} \times \sqrt[3]{3} = 2\sqrt[3]{3} = 2.88$ ✓

Perfect Cubes: 1,8,27,64,125,216,343 …

Divide by Perfect Squares/Cubes

$\frac{18}{4} = 4.5$

$\frac{18}{9} = 2$

$\frac{24}{8} = 3$

Can't square root a negative $\sqrt{-4} = DNE$

Can't even root a negative $\sqrt[4]{-3} = DNE$

Can cube root a negative $\sqrt[3]{-27} = -3$

Can odd root a negative $\sqrt[5]{-32} = -2$

You may Not put a Negative into a Square/Even Root

You may put a Negative into a Cube/Odd Root

$\sqrt{x} \neq -5$ A Square Root Can't Equal a Negative

No Solution A Even Root Can't Equal a Negative

Square rooting both sides

$x^2 = 4$

$\sqrt{x^2} = \pm\sqrt{4}$

$x = \pm 2$

Plus or Minus

$(+2)^2 = +4 \quad (-2)^2 = +4$ ✓

Fraction Root Laws

$\sqrt[a]{x^1} = x^{\frac{1}{a}}$

$\sqrt[2]{x^1} = x^{\frac{1}{2}}$

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

$2.24 = 2.24$ ✓

$x^{\frac{m}{n}} = \sqrt[n]{x^m}$

$x^{\frac{2}{3}} = \sqrt[3]{x^2}$

$8^{\frac{2}{3}} = \sqrt[3]{8^2}$

$4 = 4$ ✓

$x^{\frac{m}{n}} = \sqrt[n]{x^m}$

Root first, Exponent second!

$8^{\frac{2}{3}} = \sqrt[3]{8^2} = 2^2 = 4$ ✓

Multiplying/Dividing Radicals: *Can only Multiply/Divide if it has the Same Root Index. (Or Fractions*)*

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

$\sqrt{5} \times \sqrt{3} = \sqrt{5 \times 3} = \sqrt{15} = 3.87$ ✓

$a\sqrt{b} \times c\sqrt{d} = a \times c\sqrt{b \times d}$

$3\sqrt{5} \times 2\sqrt{7} = 3 \times 2\sqrt{5 \times 7} = 6\sqrt{35} = 35.50$ ✓

$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{7}{2}} = \frac{\sqrt{7}}{\sqrt{2}} = 1.87$ ✓

$\frac{a}{b}\sqrt{\frac{c}{d}} = \frac{20\sqrt{6}}{5\sqrt{3}} = \frac{20}{5}\sqrt{\frac{6}{3}} = 4\sqrt{2} = 5.66$ ✓

Combine Roots/Separate Roots

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

$2\sqrt{3} = 2 \times \sqrt{3}$

$a = a\sqrt{1}$

$2 = 2\sqrt{1}$

$\sqrt{b} = 1\sqrt{b}$

$\sqrt{5} = 1\sqrt{5}$

$\sqrt[2]{5} \times \sqrt[3]{5} = 5^{\frac{1}{2}} \times 5^{\frac{1}{3}} = 5^{\frac{5}{6}} \quad \frac{1}{2} + \frac{1}{3} = \frac{5}{6}$