4.3 Mixed & Entire Radicals

November-06-13
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Just like fractions, equivalent expressions for any # have the same value

EQUIVALENT FRACTIONS

$\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$

EQUVALENT RADICALS

$\sqrt{16 \cdot 9} = \sqrt{16} \cdot \sqrt{9}$

$= \sqrt{144} = 4 \cdot 3$

$= 12 = 12$

Same for cube roots

$\sqrt[3]{8 \cdot 27} = \sqrt[3]{8} \cdot \sqrt[3]{27}$

$= \sqrt[3]{216} = 2 \cdot 3$

$= 6 = 6$

MULTIPLICATION of RADICALS

$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$

n is a natural # (set of #: 1, 2, 3...)
a and b are real # (rational & irrational)

Mixed Radical

ex. $7\sqrt{3}$

Mixed Fraction

$3\frac{1}{2}$

Entire Radical

ex. $\sqrt{147}$

no # in front of the radical

Ex #1 Express your answer as a mixed radical

(a.) $\sqrt{24} = \sqrt{4 \cdot 6}$

$= \sqrt{4} \cdot \sqrt{6}$

$= \boxed{2\sqrt{6}}$

(b.) $\sqrt[3]{24} = \sqrt[3]{8 \cdot 3}$

$= \sqrt[3]{8} \cdot \sqrt[3]{3}$

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

We can also use prime factorization to simplify a radical

Ex. #2

$\sqrt{80} = \sqrt{8 \cdot 10}$

$= \sqrt{8} \cdot \sqrt{10}$

$= \sqrt{2 \cdot 2 \cdot 2} \cdot \sqrt{5 \cdot 2}$

$= \sqrt{2 \cdot 2 \cdot 2 \cdot 2} \cdot \sqrt{5}$

$= \sqrt{2 \cdot 2} \cdot \sqrt{2 \cdot 2} \cdot \sqrt{5}$

$= 2 \cdot 2 \cdot \sqrt{5} = \boxed{4\sqrt{5}}$

Ex. #3 Simplify each radical

(a.) $\sqrt{63}$

$= \sqrt{9 \cdot 7}$

$= \sqrt{9} \cdot \sqrt{7}$

$= \boxed{3\sqrt{7}}$

(b.) $\sqrt[3]{108}$

$= \sqrt[3]{27 \cdot 4}$

$= \sqrt[3]{27} \cdot \sqrt[3]{4}$

$= \boxed{3\sqrt[3]{4}}$

(c.) $\sqrt[4]{128}$

$= \sqrt[4]{16 \cdot 8}$

$= \sqrt[4]{16} \cdot \sqrt[4]{8}$

$= \boxed{2\sqrt[4]{8}}$

Ex. #4 Write each mixed radical as an entire radical

(a) $7\sqrt{3}$

$= \sqrt{7 \cdot 7} \cdot \sqrt{3}$

$= \sqrt{7 \cdot 7 \cdot 3}$

$= \boxed{\sqrt{147}}$

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

$= \sqrt{2 \cdot 2 \cdot 2} \cdot \sqrt{4}$

$= \sqrt{2 \cdot 2 \cdot 2 \cdot 4}$

$= \sqrt{8 \cdot 4}$

$= \boxed{\sqrt{32}}$

(c) $2\sqrt[5]{3}$

$= \sqrt[5]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2} \cdot \sqrt[5]{3}$

$= \boxed{\sqrt[5]{96}}$

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