when we multiply or divide radicals, you multiply or divide the roots and coefficients (stuff out in front) separately

Ex 1 simplify

a) $-3\sqrt{6x} \cdot 5\sqrt{3x} = -15\sqrt{18x^2} = -15 \cdot 3x\sqrt{2}$

$18 = 2 \cdot 9$, $9 = 3 \cdot 3$

$= \boxed{-45x\sqrt{2}}$

b) $(2\sqrt{3} - 3\sqrt{2})(4\sqrt{3} + \sqrt{2})$

$= 8\sqrt{9}^{=3} + 2\sqrt{6} - 12\sqrt{6} - 3\sqrt{4}^{=2}$

$= 24 - 10\sqrt{6} - 6$

$= 18 - 10\sqrt{6}$

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

c) $\dfrac{\sqrt[2]{x^5}}{\sqrt[3]{x^2}} = \dfrac{x^{\frac{5}{2}}}{x^{2/3}} = x^{\frac{5}{2} - \frac{2}{3}}$

$= x^{\frac{15}{6} - \frac{4}{6}} = x^{\frac{11}{6}} = \sqrt[6]{x^{11}} = \boxed{x\sqrt[6]{x^5}}$

NB: If we have roots with different indices we have to convert to exponential form to simplify

Rationalizing the Denominator

make rational ⇒ fractions NOT roots

"Get rid of roots in the denominator"

Ex 2 Rationalize the denominator

a) $\sqrt{\frac{2}{7}} = \frac{\sqrt{2}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{14}}{\sqrt{49}} = \boxed{\frac{\sqrt{14}}{7}}$

irrational

$\frac{5}{2} \cdot \frac{3}{3} = \frac{15}{6}$

NOT changing value, just denominator

b) $\sqrt[3]{\frac{2}{x}} = \frac{\sqrt[3]{2}}{\sqrt[3]{x}} \cdot \frac{\sqrt[3]{x^2}}{\sqrt[3]{x^2}} = \frac{\sqrt[3]{2x^2}}{\sqrt[3]{x^3}} = \boxed{\frac{\sqrt[3]{2x^2}}{x}}$

not always same, needs to make perfect cube on bottom cube on bottom

c) $$\frac{3}{(2-\sqrt{3})} \cdot \frac{2+\sqrt{3}}{2+\sqrt{3}} = \frac{6+3\sqrt{3}}{4+\cancel{2\sqrt{3}}-\cancel{2\sqrt{3}}-3}$$

$$= 6+3\sqrt{3}$$

$(x+y)(x-y) = x^2-y^2$

Difference of Squares

Conjugate

"The Conjugate of $2-\sqrt{3}$ is $2+\sqrt{3}$"

d) $$\frac{\sqrt{x}-1}{\sqrt{x}+2} \cdot \frac{\sqrt{x}-2}{\sqrt{x}-2} = \frac{x-\sqrt{x}-2\sqrt{x}+2}{x-4}$$

Conjugate of bottom

$$= \boxed{\frac{x-3\sqrt{x}+2}{x-4}}$$