

Operations on Real Numbers

Example 13: Check whether a. $5\sqrt{2}$ b. $\frac{5}{\sqrt{2}}$ c. $21 + \sqrt{3}$ d. $\pi + 3$ are irrational numbers or not?

Note: If q is rational and s is irrational then $q + s$, $q - s$, $q \cdot s$ and $\frac{q}{s}$ are irrational numbers

Example 14: Subtract $5\sqrt{3} + 7\sqrt{5}$ from $3\sqrt{5} - 7\sqrt{3}$.

Example 15: Multiply $6\sqrt{3}$ and $13\sqrt{3}$.

Identities related to square roots:

If p and q are two positive real numbers

$$1. \sqrt{pq} = \sqrt{p}\sqrt{q}$$

$$2. \sqrt{\frac{p}{q}} = \frac{\sqrt{p}}{\sqrt{q}}$$

$$3. (\sqrt{p} + \sqrt{q})(\sqrt{p} - \sqrt{q}) = p - q$$

$$4. (p + \sqrt{q})(p - \sqrt{q}) = p^2 - q$$

$$5. (\sqrt{p} + \sqrt{q})(\sqrt{r} + \sqrt{s}) = \sqrt{pr} + \sqrt{ps} + \sqrt{qr} + \sqrt{qs}$$

$$6. (\sqrt{p} + \sqrt{q})^2 = p + 2\sqrt{pq} + q$$

Example 16: Simplify the following expressions:

$$1. \text{ Simplify } (3 + \sqrt{3})(2 + \sqrt{2})$$

2. $(\sqrt{5} + \sqrt{2})^2$

Example 17: Find the square root of $5 + 2\sqrt{6}$