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CLASS – 9

MATHS

CHAPTER - 1

Number System

Part – 7

Operations on Real Numbers

Vikas Saini

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OVERVIEW

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1. Number
2. Irrational Number
3. Real Number & Their Decimal Expansions
4. Operations on Real Numbers
5. Laws of Exponents for Real Numbers

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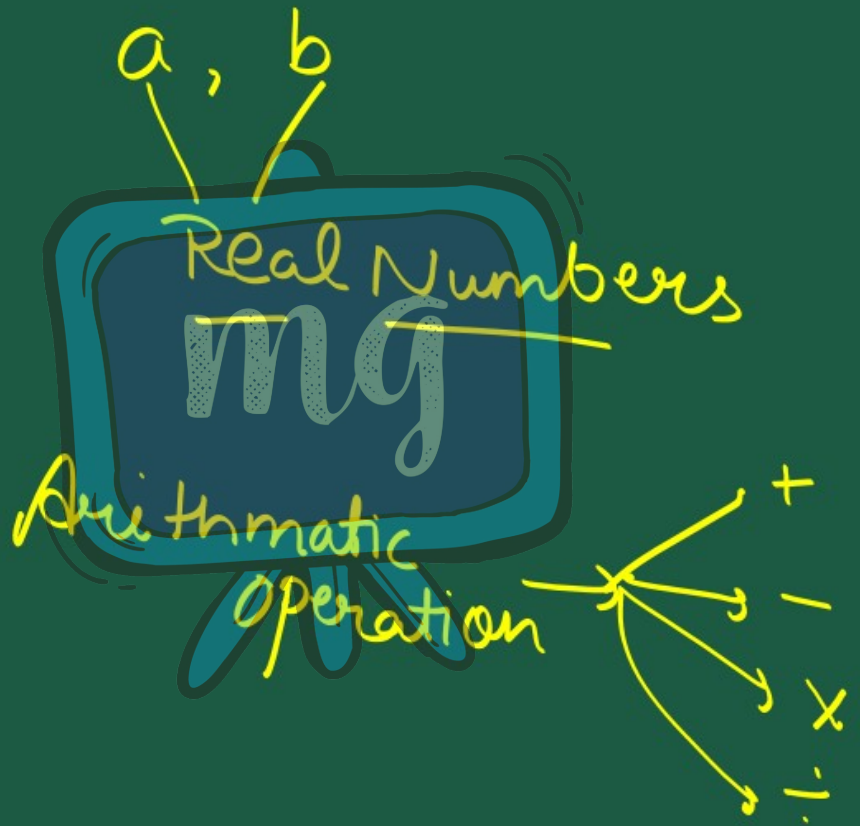

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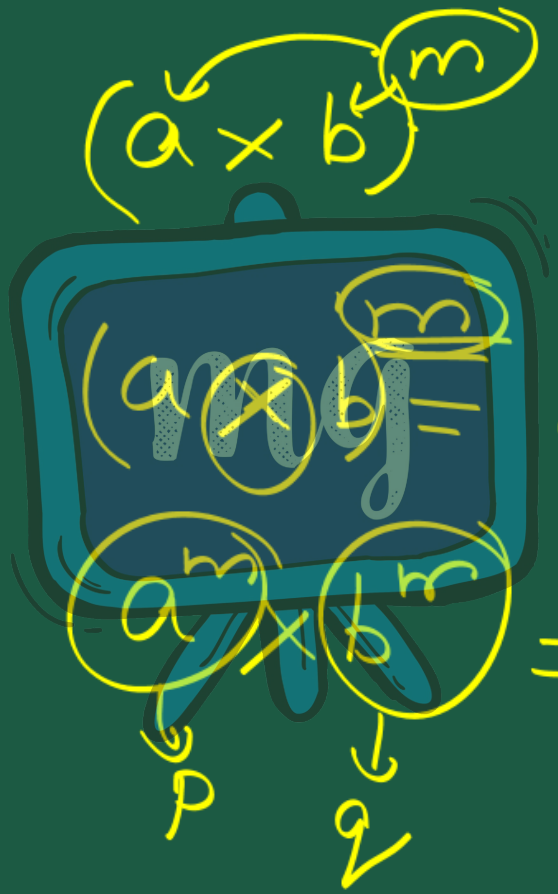

$c^m = d$

$= P \times Q = d$

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$$(a \times b)^m = a^m \times b^m$$

$$(2^2 \times 9^2) = (18)^2 = 324$$

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

$$= 4 \times 81 = 324$$

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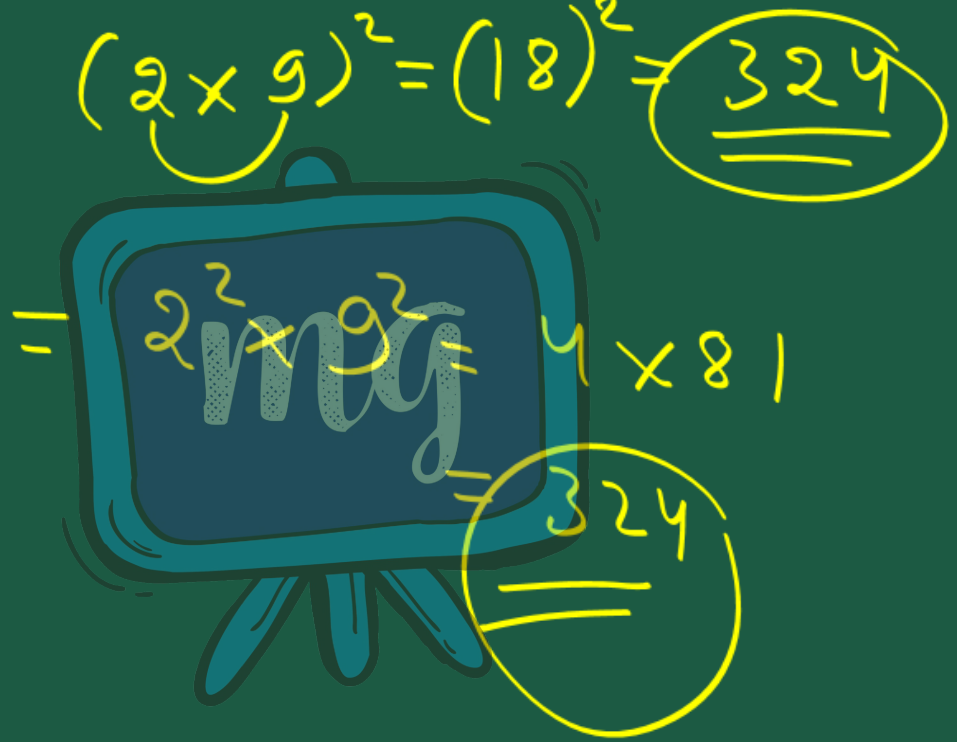

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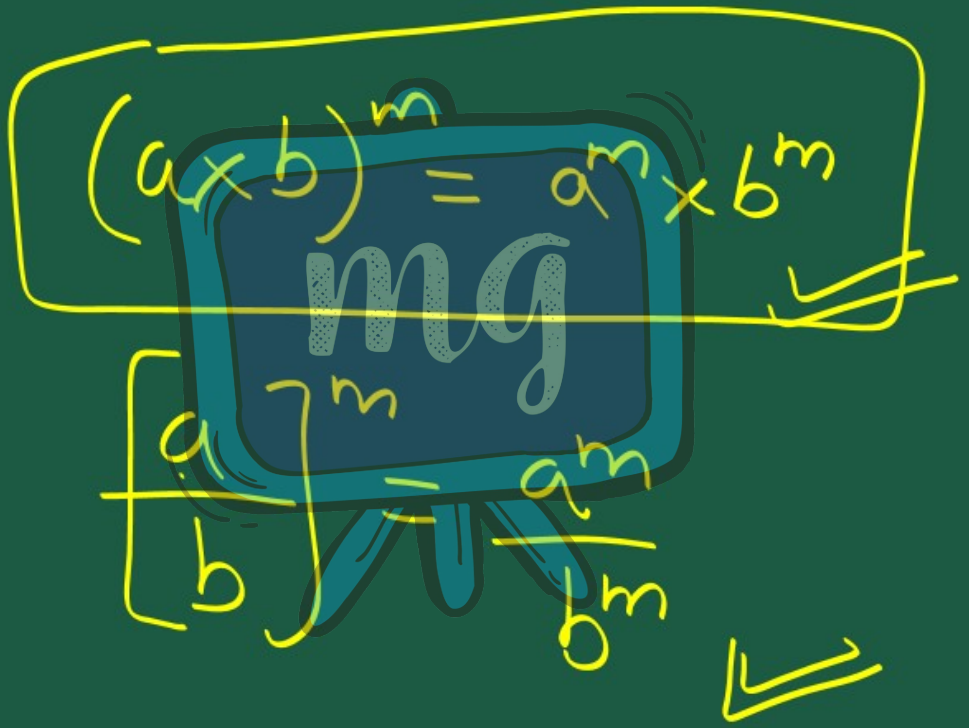

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$$\left(\frac{3.6}{4}\right)^2 = (9)^2 = 81$$

$$= \frac{mg}{y^2} \quad \frac{36}{4} \times \frac{36}{4} = 81$$

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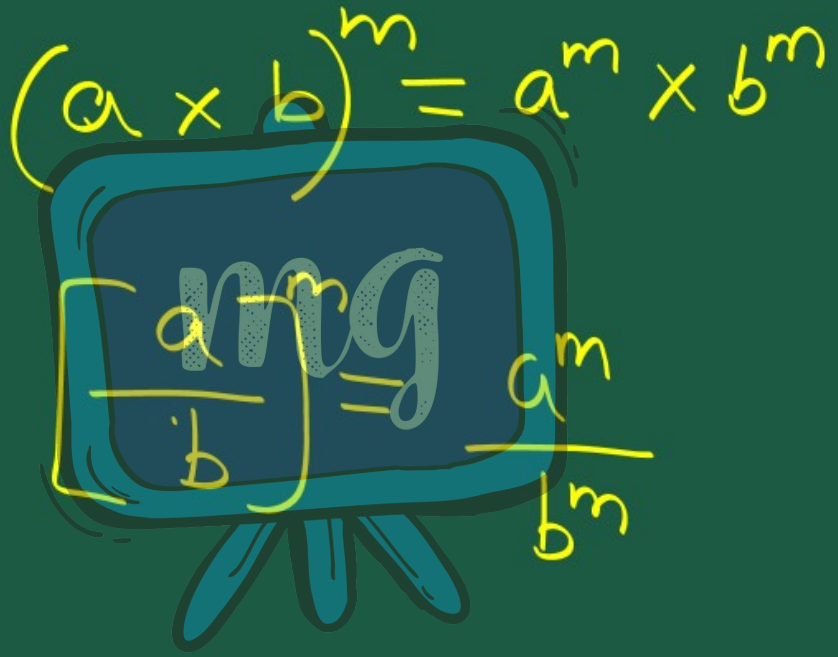

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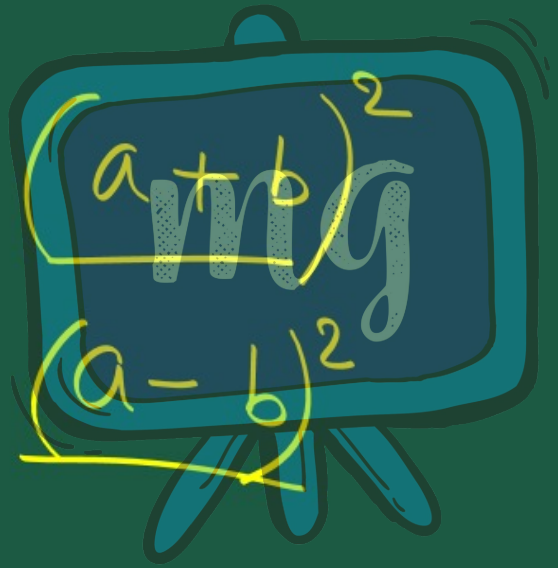
a , b



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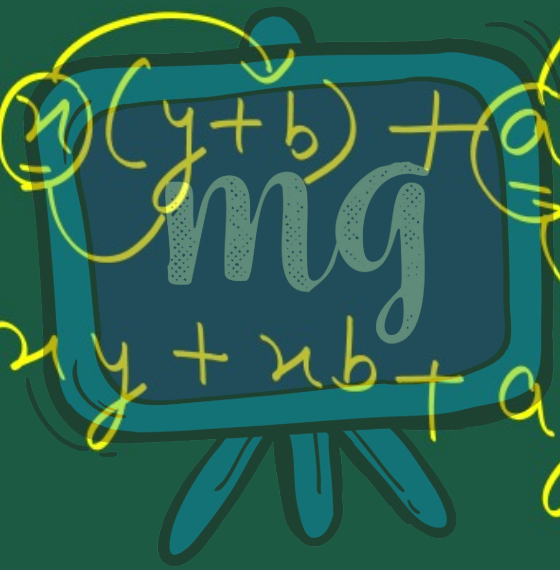
$$= (x + a)(y + b)$$

$$= x(y + b) + a(y + b)$$

$$= xy + xb + ay + ab$$



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$a, b \in$ Real Numbers

$(a+b)^2$

a^2+b^2

$(2+3)^2 = (5)^2 = 25$

$= 2^2+3^2$

$= 4+9 = 13$

$13 \neq 25$

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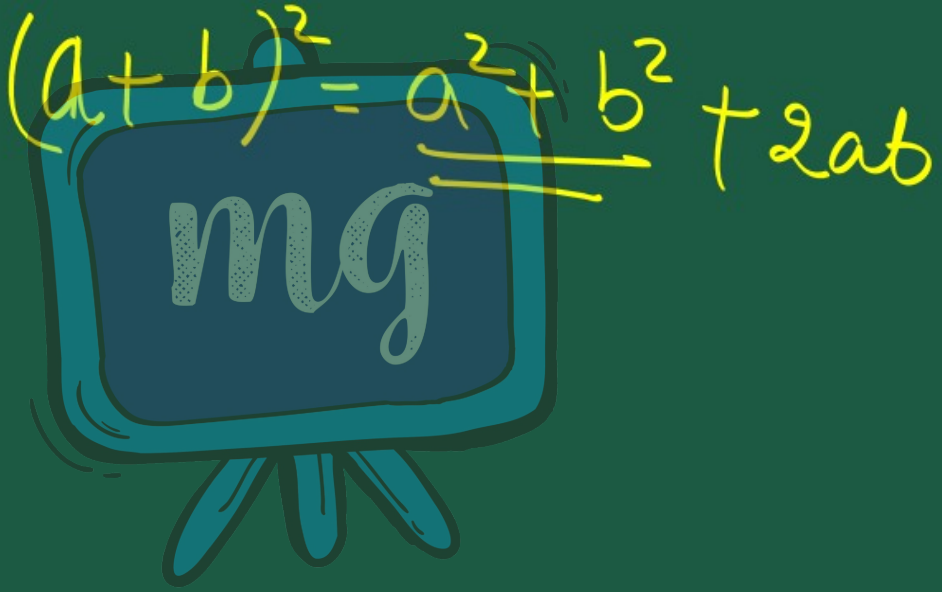

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$$(a+b)^2 = (a+b)(a+b)$$

$$= a(a+b) + b(a+b)$$

$$= a^2 + ab + ab + b^2$$

$$= a^2 + 2ab + b^2$$

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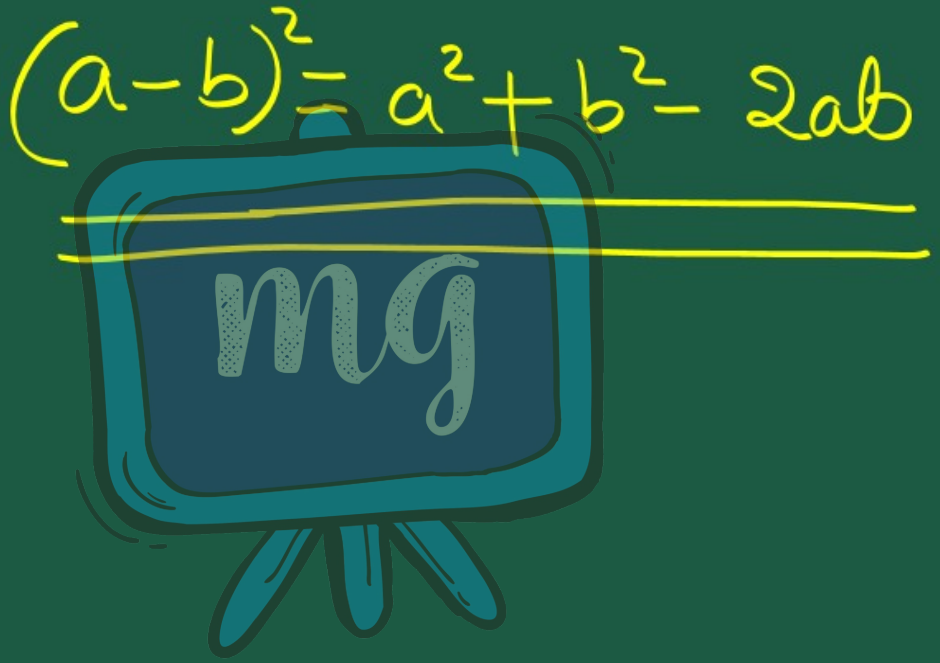

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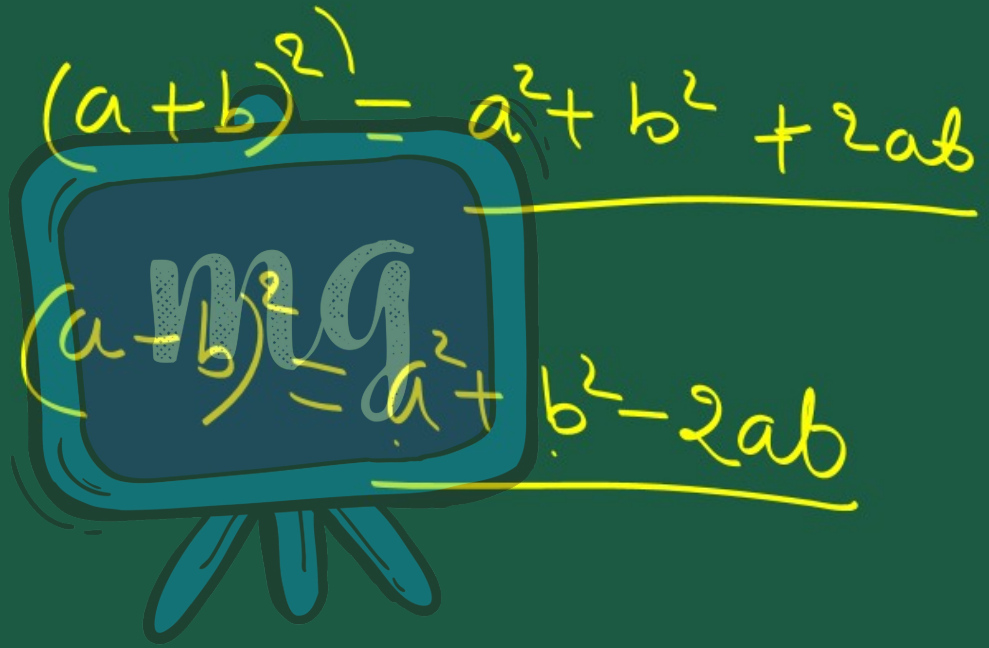

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(5) $(a+b)\times(a-b)$

$b \times a = ba = ab$

$= a(a-b) + b(a-b)$

$= a^2 - ab + ab - b^2$

$= a^2 - b^2$

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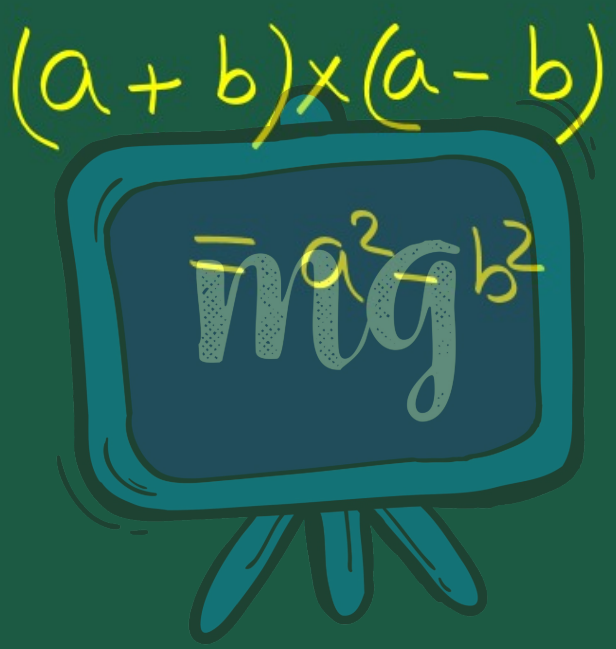

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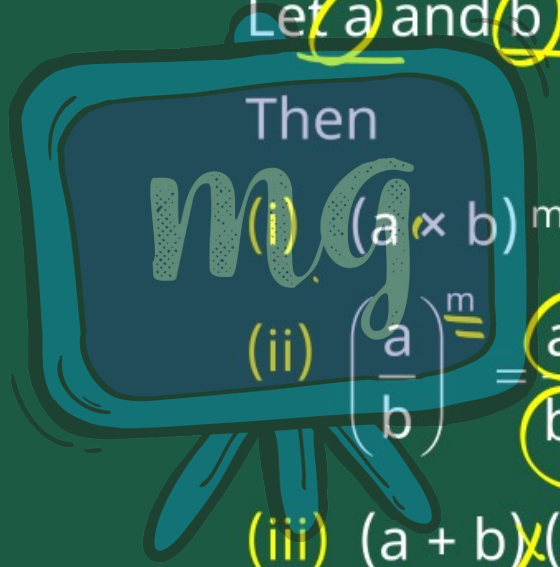
IDENTITIES

Let a and b be positive real numbers.

Then



(i) $(a \times b)^m = a^m \times b^m$

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

(iii) $(a + b)(a - b) = a^2 - b^2$

(iv) $(a + b)^2 = a^2 + b^2 + 2ab$

(v) $(a - b)^2 = a^2 + b^2 - 2ab$

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Identities

Let a and b be positive real numbers.

Then

(i) $\sqrt{ab} = (ab)^{\frac{1}{2}}$

$\sqrt{a} = a^{\frac{1}{2}}$

$\therefore (ab)^{\frac{1}{2}} = a^{\frac{1}{2}} \times b^{\frac{1}{2}}$

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

$(\sqrt{b}) = b^{\frac{1}{2}}$

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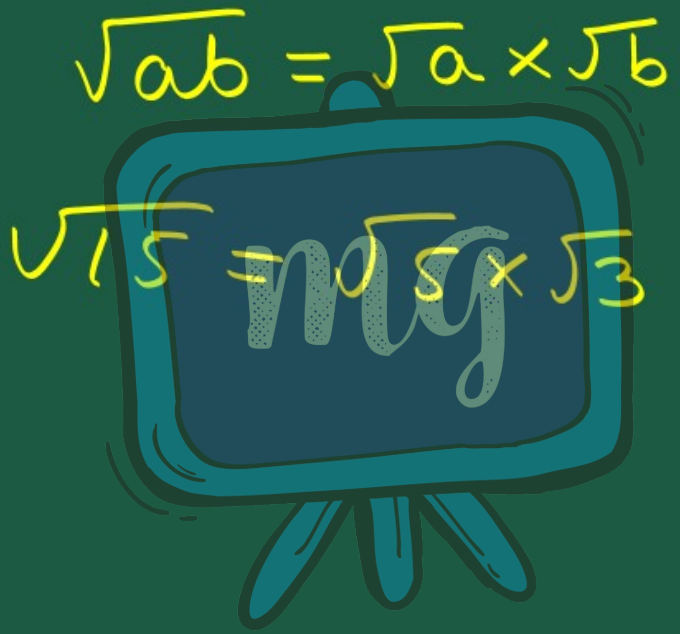

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(ii) $\sqrt{\frac{a}{b}} =$

$\left(\frac{a}{b}\right)^{\frac{1}{2}} = \frac{a^{\frac{1}{2}}}{b^{\frac{1}{2}}} = \frac{\sqrt{a}}{\sqrt{b}}$

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

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(iii) $(\sqrt{a}+\sqrt{b})(\sqrt{a}-\sqrt{b}) =$

$(a+b)(a-b) = a^2 - b^2$

$= (\sqrt{a})^2 - (\sqrt{b})^2$

$= a - b$

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(iv) $(a+\sqrt{b})(a-\sqrt{b}) = a^2-b$

$(a+b)(a-b) = a^2-b^2$

$= (a)^2 - (b)^2$

$= a^2 - b$

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(v) $(\sqrt{a}+\sqrt{b})(\sqrt{c}+\sqrt{d}) =$

$= (\sqrt{a}+\sqrt{b}) \times (\sqrt{c}+\sqrt{d})$

$= \sqrt{a}(\sqrt{c}+\sqrt{d}) + \sqrt{b}(\sqrt{c}+\sqrt{d})$

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

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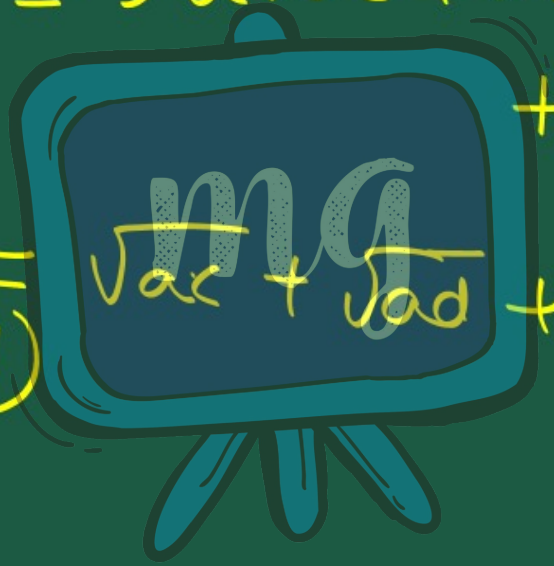
$$(\sqrt{a}+\sqrt{b})\times(\sqrt{c}+\sqrt{d}) = \sqrt{ac}+\sqrt{ad}+\sqrt{bc}+\sqrt{bd}$$

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



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(vi) $\left(\sqrt{a}+\sqrt{b}\right)^2 =$

$(a+b)^2 = a^2+b^2+2ab$

$= (\sqrt{a})^2 + (\sqrt{b})^2 + 2\times\sqrt{a}\times\sqrt{b}$

$= a + b + 2\sqrt{ab}$

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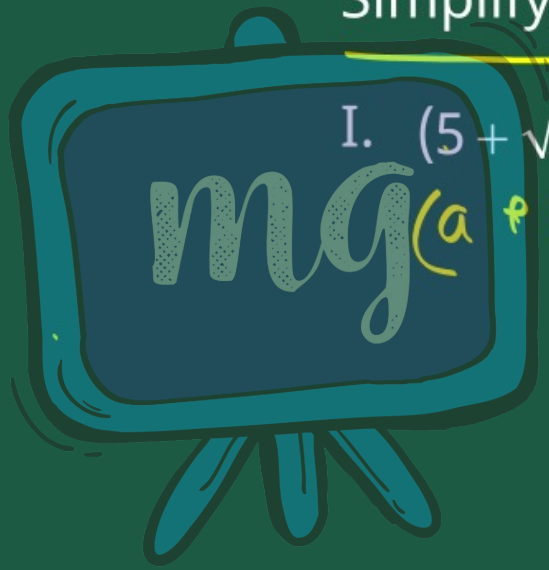
Example 15 :

Simplify the following expressions:



I. $(5+\sqrt{7})(2+\sqrt{5})$

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$y \times 2 = (2y)$

$(5+\sqrt{7}) \times (2+\sqrt{5})$

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

$5 \times y$

$= 5y$

$= 5(2+\sqrt{5}) + \sqrt{7}(2+\sqrt{5})$

$= 10 + 5\sqrt{5} + \sqrt{7} \times 2 + \sqrt{7} \times \sqrt{5}$

$= 10 + 5\sqrt{5} + 2\sqrt{7} + \sqrt{35}$

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II. $(5+\sqrt{5})(5-\sqrt{5})$

$(a+b)(a-b)$

$= a^2 - b^2$

$= (5)^2 - (\sqrt{5})^2$

$= 25 - 5$

$= 20$

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III. $(\sqrt{3}+\sqrt{7})^2$

$(a+b)^2 = a^2+b^2+2ab$



$= (\sqrt{3})^2+(\sqrt{7})^2+2\times\sqrt{3}*\sqrt{7}$

$= 3+7+2\sqrt{21}$

$= 10+2\sqrt{21}$

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IV. $(\sqrt{11}+\sqrt{7})(\sqrt{11}-\sqrt{7}) = 4$

$(a+b)(a-b)$

$= a^2 - b^2$



$= (\sqrt{11})^2 - (\sqrt{7})^2$

$= 11 - 7$

$= 4$

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LEARNING OUTCOMES

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Square Identities related to Square Roots

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ASSESSMENT

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1 By simplifying $(\sqrt{3}+\sqrt{2})\times(\sqrt{3}-\sqrt{2})$ we get .....

A $5+4\sqrt{6}$

B $5+2\sqrt{6}$

C 5

D 1

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ASSESSMENT



2 By simplifying $(\sqrt{7}+\sqrt{6})^2-2\sqrt{42}$ we get .....

$(a+b)^2 = a^2+b^2+2ab$

$(\sqrt{7})^2+(\sqrt{6})^2+2\sqrt{7}\times\sqrt{6}$

$= 7+6+2\sqrt{42}$

$= 13+2\sqrt{42}-2\sqrt{42}$

A $5+4\sqrt{6}$

B 0

C 13

D 1