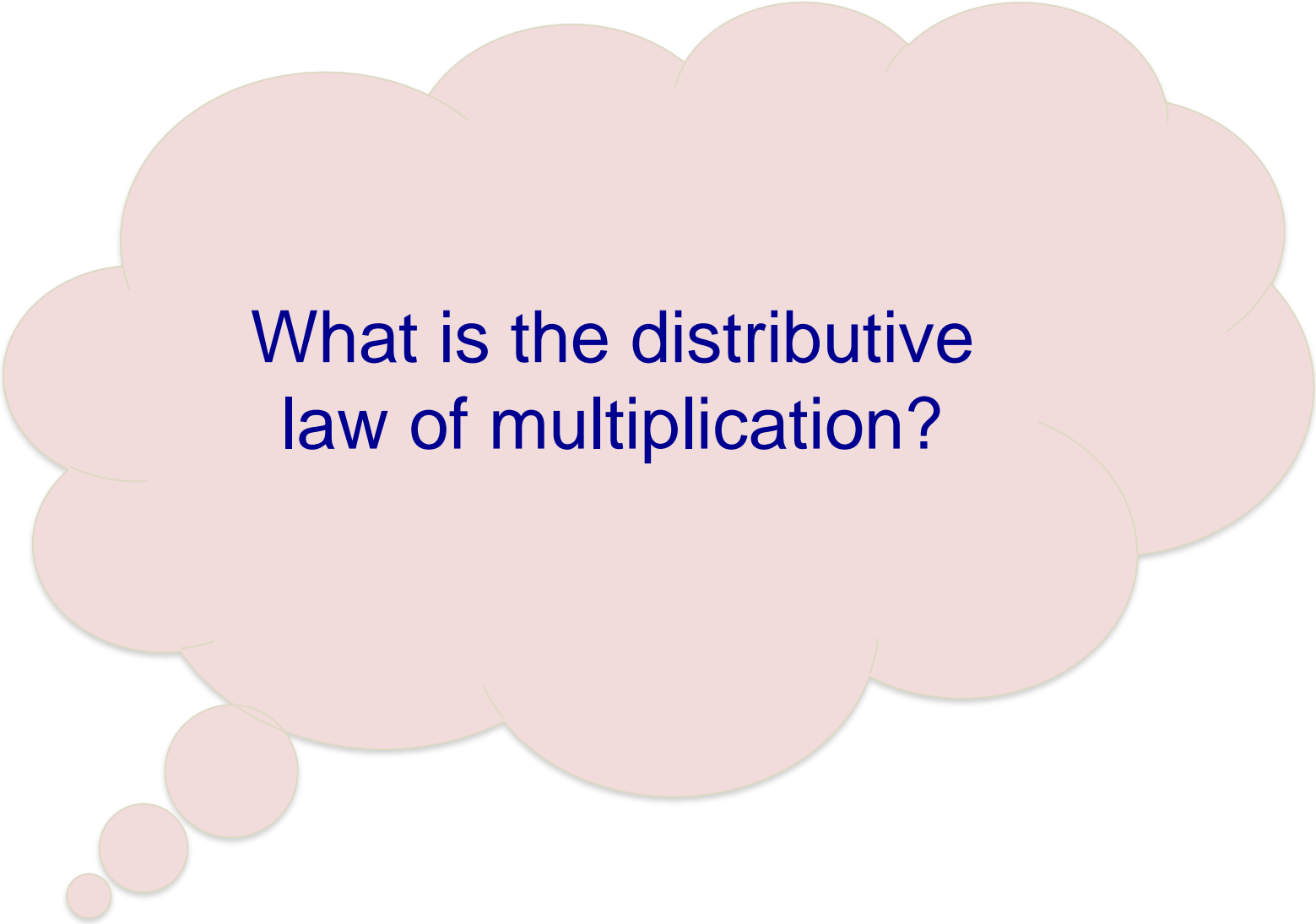


# Multiplication of Polynomials

## ◆ Multiplication of Polynomials





What is the distributive law of multiplication?

# Multiplication of Polynomials

Multiplication of polynomials can be performed by applying the **distributive law of multiplication**:

$$k(x + y) = kx + ky \quad \text{or} \quad (x + y)k = xk + yk$$

$kx + ky$  and  $xk + yk$  are the **expansions** of  $k(x + y)$  and  $(x + y)k$  respectively.



# Multiplication of Polynomials



Expand each of the following expressions.

$$\begin{aligned} \text{(a)} \quad & 2(3a + 5b) \\ & = 2(3a) + 2(5b) \\ & = \underline{6a + 10b} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & -a(4a - 3) \\ & = -a(4a) + (-a)(-3) \\ & = \underline{-4a^2 + 3a} \end{aligned}$$

# Multiplication of Polynomials



When we expand the product of two binomials  $(p + q)(x + y)$ , we can also use the distributive law of multiplication to do so.

$$\begin{aligned} & (p + q)(x + y) \\ &= p(x + y) + q(x + y) \\ &= px + py + qx + qy \end{aligned}$$

Consider  $x + y$  as a single term to expand the product.

# Multiplication of Polynomials

Expand each of the following expressions.



$$\begin{aligned} \text{(a)} \quad & (a + 4)(3 - a) \\ &= a(3) + a(-a) + 4(3) + 4(-a) \\ &= 3a - a^2 + 12 - 4a \\ &= \underline{\underline{-a^2 - a + 12}} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & (b - a)(6a + 5b) \\ &= b(6a) + b(5b) + (-a)(6a) + (-a)(5b) \\ &= 6ab + 5b^2 - 6a^2 - 5ab \\ &= \underline{\underline{-6a^2 + ab + 5b^2}} \end{aligned}$$

# Multiplication of Polynomials

We can also perform multiplication of polynomials in columns.



e.g. Expand  $(b^2 - 2)(b + 5)$ .

$$\begin{array}{r} \begin{array}{cccc} b^2 & + & 0b & - & 2 \\ \times) & & & & \\ \hline & b^3 & + & 0b^2 & - & 2b \\ +) & & 5b^2 & + & 0b & - & 10 \\ \hline \underline{\underline{b^3 + 5b^2 - 2b - 10}} \end{array} \end{array}$$

The diagram shows the multiplication process with arrows indicating the distribution of terms. A purple arrow points from  $b^2$  to  $b$ , and another purple arrow points from  $b^2$  to  $5$ . A red arrow points from  $0b$  to  $b$ , and another red arrow points from  $0b$  to  $5$ . A red arrow points from  $-2$  to  $b$ , and another red arrow points from  $-2$  to  $5$ .

Arrange the terms in descending powers of  $b$  and add '+0b' for the missing term.

# Multiplication of Polynomials



Expand  $(3b + 1)(4b - 5)$  and present the steps in columns.

$$\begin{array}{r} \phantom{\times)} \phantom{12b^2} + 4b \\ \times) \phantom{12b^2} + 4b - 5 \\ \hline 12b^2 + 4b \\ +) \phantom{12b^2} - 15b - 5 \\ \hline \underline{\underline{12b^2 - 11b - 5}} \end{array}$$



# Multiplication of Polynomials

Expand  $(8 - b^2)(2b + 9)$  and present the steps in columns.



$$\begin{array}{r} \phantom{\times)} \phantom{-} \phantom{b^2} + \phantom{0b} + 8 \\ \times) \phantom{-} \phantom{b^2} + \phantom{0b} + 9 \\ \hline -2b^3 + 0b^2 + 16b \\ +) \phantom{-} - 9b^2 + 0b + 72 \\ \hline \underline{\underline{-2b^3 - 9b^2 + 16b + 72}} \end{array}$$