

VIII. Calculating limits:

i) * Plug-in* limits:

↳ We don't have problems* in plugging the number in the limit (applying the value directly to the limit).

* Examples:

$$\textcircled{1} \lim_{x \rightarrow 1} (4x^2 + 5x + 1) = 10$$

$$\textcircled{2} \lim_{x \rightarrow 2} \frac{4x - 3}{2x - 1} = \frac{5}{3}$$

* Mathematical inconsistencies.

ii) * Factoring* limits:

↳ We have problems (mathematical inconsistencies) in just applying the value directly to the limit.

* Examples:

$$\textcircled{1} \lim_{x \rightarrow 1} \frac{x^3 - 1}{x - 1} = \lim_{x \rightarrow 1} \frac{(x-1)(x^2 + x + 1)}{x-1} = 3$$

$$\textcircled{2} \lim_{x \rightarrow 2} \frac{x^2 - 3x + 2}{x - 2} = \lim_{x \rightarrow 2} \frac{(x-2)(x-1)}{x-2} = 1$$

* Factorisation techniques:

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

$$\bullet a^2 \pm 2ab + b^2 = (a \pm b)^2 = (a+b)(a+b) \text{ or } (a-b)(a-b)$$

$$\bullet a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$$

• Extracting roots from polynomials: $a(x-x_1)(x-x_2) \dots$