

Using the Factor Theorem to find the Remainder

If the polynomial $f(x)$ is divided by $(ax - b)$ then the remainder is $f\left(\frac{b}{a}\right)$

Example 1: Find the remainder when $f(x) = 4x^4 - 4x^2 + 8x - 1$ is divided by $(2x - 1)$

Using $(ax - b)$ then $a = 2$, $b = 1$ so $f\left(\frac{1}{2}\right)$

$$f(x) = 4x^4 - 4x^2 + 8x - 1$$

$$\begin{aligned} f\left(\frac{1}{2}\right) &= 4 \times \left(\frac{1}{2}\right)^4 - 4 \times \left(\frac{1}{2}\right)^2 + \left(8 \times \frac{1}{2}\right) - 1 \\ &= \frac{4}{16} - \frac{4}{4} + \frac{8}{2} - 1 \\ &= \frac{1}{4} - 1 + 4 - 1 \\ &= 2\frac{1}{4} \end{aligned}$$

\therefore Remainder is $2\frac{1}{4}$

Example 2: Find the remainder if $f(x) = x^3 - 20x + 3$ is divided by $(x - 4)$

Using $(ax - b)$ then $a = 1$, $b = 4$ so $f(4)$

$$f(x) = x^3 - 20x + 3$$

$$\begin{aligned} f(4) &= (4)^3 - (20 \times 4) + 3 \\ &= 64 - 80 + 3 \\ &= -13 \end{aligned}$$

\therefore Remainder is -13