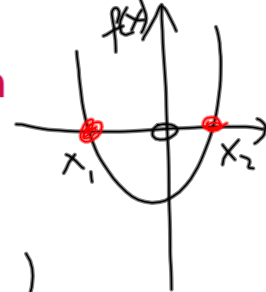


chapter **2** Algebra 2

Section 2.9 The factor theorem



FUNCTION

$$f(x) = x^2 + 3x + 2$$

FACTORS $(x + 2)(x + 1)$

Roots $\Rightarrow x = -2, x = -1$
Sols

$$f(-2) = (-2)^2 + 3(-2) + 2 = 0$$

PROJECT MATHS
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The Factor Theorem:

If $f(k) = 0$, then $(x - k)$ is a factor.

Conversely, if $(x - k)$ is a factor, then $f(k) = 0$.

Also, if $(ax - k)$ is a factor, then $f(\frac{k}{a}) = 0$.

Example 1

Show that $(2x - 3)$ is a factor of $2x^3 - 5x^2 + 5x - 3$.

Sub in
Solu $f(k) = 0$

$$\begin{aligned} 2x - 3 &= 0 \\ 2x &= 3 \\ x &= \frac{3}{2} \end{aligned}$$

$$\begin{aligned} f\left(\frac{3}{2}\right) &= 2\left(\frac{3}{2}\right)^3 - 5\left(\frac{3}{2}\right)^2 + 5\left(\frac{3}{2}\right) - 3 \\ &= 0 \end{aligned}$$

Divide

$$\begin{array}{r} x^2 - x + 1 \\ 2x - 3 \overline{) 2x^3 - 5x^2 + 5x - 3} \\ \underline{2x^3 + 3x^2} \\ -2x^2 + 5x \\ \underline{-2x^2 + 3x} \\ 2x - 3 \\ \underline{2x - 3} \\ 0 \end{array}$$

Example 2

If $(x - 2)$ and $(x + 1)$ are both factors of $ax^3 + 3x^2 - 9x + b$, find the values a and b .

$$f(2) = 0 \Rightarrow a(2)^3 + 3(2)^2 - 9(2) + b = 0$$
$$8a + b = 6$$

$$f(-1) = 0 \Rightarrow a(-1)^3 + 3(-1)^2 - 9(-1) + b = 0$$
$$-a + b = -12$$

$$\begin{array}{r} 8a + b = 6 \\ + 9 - b = 12 \\ \hline 9a = 18 \\ a = 2 \end{array}$$

$$-(2) + b = -12$$
$$b = 10$$