Factor Theorem Examples

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

Factor: $f(x) = x^3 - 10x^2 + 19x + 30$ if $(x - 6)$ is a factor. → put a 6 outside

$$\begin{array}{c|cccc} 6 & 1 & -10 & 19 & 30 \\ & \downarrow & 6 & -24 & -30 \\ \hline & 1 & -4 & -5 & 0 \end{array}$$

$$f(x) = (x-6)(x^2-4x-5)$$

$$= (x-6)(x-5)(x+1)$$

Solve: $0 = x^3 + 6x^2 + 5x - 12$ if $(x + 4)$ is a factor. → put -4 outside

$$\begin{array}{c|cccc} -4 & 1 & 6 & 5 & -12 \\ & \downarrow & -4 & -8 & 12 \\ \hline & 1 & 2 & -3 & 0 \end{array}$$

$$0 = (x+4)(x^2+2x-3)$$

$$0 = (x+4)(x+3)(x-1)$$

$x+4=0$ $\quad$ $x+3=0$ $\quad$ $x-1=0$

$x=-4$ $\quad$ $x=-3$ $\quad$ $x=1$

Find all the zeros: $f(x) = x^3 - 2x^2 - 21x - 18$ if -3 is a zero. → put -3 outside

$(x+3)$ is a factor

$$\begin{array}{c|cccc} -3 & 1 & -2 & -21 & -18 \\ & \downarrow & -3 & 15 & 18 \\ \hline & 1 & -5 & -6 & 0 \end{array}$$

$$0 = (x+3)(x^2-5x-6)$$

$$0 = (x+3)(x-6)(x+1)$$

$x+3=0$ $\quad$ $x-6=0$ $\quad$ $x+1=0$

$x=-3$ $\quad$ $x=6$ $\quad$ $x=-1$