3.2 <u>Remainder</u> <u>Theorem</u> Day 2 ①

If $f(x)$ is divided by $x-k$, then the remainder is equal to $f(k)$.

$\boxed{\text{Ex } 2}$ $f(x) = -x^4 + 3x^2 - 4x - 5.$

Use Remainder Theorem to find $f(\overset{k}{-3})$.

$$\frac{-x^4+3x^2-4x-5}{\underset{x+3}{x - -3}} \rightarrow \begin{array}{r|rrrrr} -3 & -1 & 0 & 3 & -4 & -5 \\ & & 3 & -9 & 18 & -42 \\ \hline & -1 & 3 & -6 & 14 & -47 \end{array}$$

Remainder

$$\boxed{f(-3) = -47}$$

Check! $f(-3) = -(-3)^4 + 3(-3)^2 - 4(-3) - 5 = -47$ ✓

#37

A <u>zero</u> of a polynomial function $f(x)$ is a number k such that $f(k) = 0$.

Zero = x-intercept = root

Ex: $f(x) = x^2 - 5x + 6$ ← Use Quad. Form. / Factor

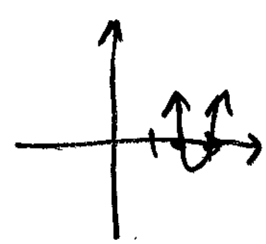
Set $f(x) = 0 = x^2 - 5x + 6$

$0 = (x-3)(x-2)$

$$\begin{array}{c|c} 6 & -5 \\ (-3)(-2) & \end{array}$$

$$\begin{array}{rr} x-3=0 \\ +3 \quad +3 \\ \hline \boxed{x=3} \end{array} \qquad \begin{array}{rr} x-2=0 \\ +2 \quad +2 \\ \hline \boxed{x=2} \end{array}$$

← x-intercepts zeros



$\boxed{\text{Ex 3}}$ Deciding Whether a Number is a Zero (x-intercept)

Decide whether a number k is a zero of $f(x)$

(a) $f(x) = x^3 - 4x^2 + 9x - 6;\ k = 1$

$$\begin{array}{r|rrrr} 1 & 1 & -4 & 9 & -6 \\ & & 1 & -3 & 6 \\ \hline & 1 & -3 & 6 & 0 \end{array} \leftarrow \text{Remainder}$$

$f(1) = 0 \rightarrow$ $\boxed{\text{1 is an x-intercept / Zero}}$

(b) $f(x) = x^4 + x^2 - 3x + 1;\ k = -1$

$$\begin{array}{r|rrrrr} -1 & 1 & 0 & 1 & -3 & 1 \\ & & -1 & 1 & -2 & 5 \\ \hline & 1 & -1 & 2 & -5 & 6 \end{array} \leftarrow \text{Remainder}$$

$f(-1) = 6$: -1 is <u>NOT</u> an x-intercept / zero

49