

# Polynomial Division (unit 3 Day 5)

quotient

$$232 \frac{7}{15} \leftarrow \text{remainder}$$

(ex)

$$\begin{array}{r}
 15 \overline{) 3487} \\
 \underline{- 30} \phantom{0} \\
 48 \phantom{0} \\
 \underline{- 45} \phantom{0} \\
 37 \phantom{0} \\
 \underline{- 30} \\
 7
 \end{array}$$

divisor

dividend

(ex)

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

\* Since we got a remainder that's not 0,

then  $x+1$  is not a factor of  $x^2+3x+5$

\*  $x+1=0$   
 $x=-1$  is not an  $x$ -int for  $y=x^2+3x+5$

(ex)

$$\begin{array}{r}
 x^3 + 2x^2 - x + \frac{1}{2x-1} \\
 \hline
 2x-1 \overline{) 2x^4 + 3x^3 - 4x^2 + x + 1} \\
 \underline{-(2x^4 - x^3)} \phantom{0} \\
 4x^3 - 4x^2 \phantom{0} \\
 \underline{-(4x^3 - 2x^2)} \phantom{0} \\
 -2x^2 + x \phantom{0} \\
 \underline{-(2x^2 + x)} \\
 0 + 1
 \end{array}$$

ⓔx  $x^3 - 3x^2 - 10 \div x - 1$  ⓔr

$$\frac{x^3 - 3x^2 - 10}{x - 1}$$

Synthetic Division

$$\begin{array}{r|rrrr} 1 & 1 & -3 & 0 & -10 \\ & \downarrow & & & \\ & 1 & -2 & -2 & -12 \end{array}$$

\* always replace missing term with "0"

\* must be in standard form!

=  $x^2 - 2x - 2 - \frac{12}{x-1}$

\* go down 1 degree for answer

ⓔx  $2x^4 + 3x^3 - 4x^2 + x + 1 \div 2x - 1$

$$\begin{array}{r|rrrrr} \frac{1}{2} & 2 & 3 & -4 & 1 & 1 \\ & \downarrow & & & & \\ & 2 & 4 & -2 & 0 & 1 \end{array}$$

↑ greater than 1

divide by 2:

$$\begin{array}{r} 1 & 2 & -1 & 0 & 1 \end{array}$$

remainder stays the same

=  $x^3 + 2x^2 - x + \frac{1}{2x-1}$

• Remainder Thm: when we divide a polynomial  $f(x)$  by  $x-c$ , then the remainder equals  $f(c)$ .

(ex)  $x^2 + 3x + 5 \div x + 1$

Find the remainder

$$f(-1) = (-1)^2 + 3(-1) + 5$$
$$1 - 3 + 5 = \textcircled{3} \leftarrow \text{remainder}$$