

**Terms you should know:**

$$\begin{array}{r} \text{Quotient} \\ \text{Divisor} \overline{) \text{Dividend}} \end{array}$$

**Example using long division:**

$$\begin{array}{r} 25 \\ 21 \overline{) 540} \\ \underline{42} \\ 120 \\ \underline{105} \end{array}$$

15 The remainder is 15, the quotient is 25

**Example of long division of polynomials:**

$$\frac{2x^3 - 2x^2 - 4x - 6}{x - 4}$$

$$\begin{array}{r} 2x^2 + 6x + 20 + \frac{74}{x-4} \\ x-4 \overline{) 2x^3 - 2x^2 - 4x - 6} \\ \underline{-(2x^3 - 8x^2)} \\ 6x^2 - 4x \\ \underline{-(6x^2 - 24x)} \\ 20x - 6 \\ \underline{-(20x - 80)} \\ 74 \end{array}$$

This is your remainder.

**Recall:** Dividend = Quotient \* Divisor + Remainder

**Example 1:**

- a. Use long division to find the quotient and remainder if any.

$$\begin{array}{r}
 \underline{2x^4 - 8x^2 + 3x - 5} \\
 \begin{array}{r}
 x-5 \overline{) 2x^4 + 0x^3 - 8x^2 + 3x - 5} \\
 \underline{-(2x^4 - 10x^3)} \\
 10x^3 - 8x^2 \\
 \underline{-(10x^3 - 50x^2)} \\
 42x^2 + 3x \\
 \underline{-(42x^2 - 210x)} \\
 213x - 5 \\
 \underline{-(213x - 1065)} \\
 1060 \text{ Remainder}
 \end{array}
 \end{array}$$

quotient:  $2x^3 + 10x^2 + 42x + 213$   
 Remainder: 1060

- b. Use Synthetic Division on the same problem.

$$\begin{array}{r}
 \underline{2x^4 - 8x^2 + 3x - 5} \\
 x-5
 \end{array}$$

$x-5=0$   
 $x=5$

5	2	0	-8	3	-5
	↓				
		10	50	210	1065
		2	10	42	213
					1060

quotient:  $2x^3 + 10x^2 + 42x + 213$   
 remainder: 1060

**Example 2:**

a. Divide the following:

$$\frac{6x^3 + 9x^2 + 22x + 2}{3x^2 - 2}$$

quotient:  $2x + 3$   
 remainder:  $26x + 8$

$$\begin{array}{r}
 2x + 3 \\
 \hline
 3x^2 - 2 \overline{) 6x^3 + 9x^2 + 22x + 2} \\
 \underline{-(6x^3 \phantom{+ 9x^2} - 4x)} \phantom{+ 2} \\
 9x^2 + 26x \phantom{+ 2} \\
 \underline{-(9x^2 \phantom{+ 26x} - 6)} \phantom{+ 2} \\
 26x + 8
 \end{array}$$

b. Divide the following:

$$\frac{2x^3 + 13x^2 + 28x + 21}{x^2 + 3x + 1}$$

$$\begin{array}{r}
 2x + 7 \\
 \hline
 x^2 + 3x + 1 \overline{) 2x^3 + 13x^2 + 28x + 21} \\
 \underline{-(2x^3 + 6x^2 + 2x)} \phantom{+ 21} \\
 7x^2 + 26x + 21 \\
 \underline{-(7x^2 + 21x + 7)} \phantom{+ 21} \\
 5x + 14
 \end{array}$$

quotient:  $2x + 7$   
 remainder:  $5x + 14$