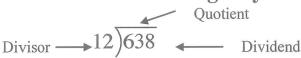
Sec. 11.2B Synthetic and Long Division

Dividing Polynomials Using Long Division



Remainder – what is left over To Divide:

- 1. Divide the leading term by the leading term of the divisor. Enter the result over the radical sign.
- 2. Multiply the divisor by the result and enter below the dividend.
- 3. Subtract and bring down the remaining terms.
- 4. Repeat the first 3 steps until finished.

Ex: a.
$$4x^3 - 3x^2 + x + 1$$
 divided by $x + 2$

$$\begin{array}{c} x + 2x - 3x + x + 1 \text{ divided by } x + 2 \\ \hline x + 2 \left[\frac{4x^2 - 11x + 23}{4x^3 - 3x^2 + x + 1} - \frac{4x^3 - 3x^2 + x + 1}{-4x^3 + 8x^2} \right] \\ \hline - \frac{-11x^2 - 22x}{23x + 1} \\ \hline - \frac{23x + 46}{-45} \end{array}$$

$$4x^{2}-11x+23+\frac{-45}{x+2}$$

b.
$$-2+3x^3-x^2+x$$
 divided by x^2+2

$$\begin{array}{r}
3x - 1 \\
x^{2} + 2 \overline{\smash)3x^{3} - x^{2} + x - 2} \\
-3x^{3} + 6x \\
-x^{2} - 5x - 2 \\
-x^{2} - 5x
\end{array}$$

$$3X-1+\frac{-5X}{X^2+2}$$

c.
$$4x-3x^2+x^5-5x^4+6$$
 divided by $2+x^2$

$$\begin{array}{r}
x^3-5x^2-2x+7 \\
x^2+2 & x^5-5x^4-3x^2+4x+6 \\
-x^5 & +2x^3
\end{array}$$

$$\begin{array}{r}
-5x^4-2x^3-3x^2+4x+6 \\
--5x^4-2x^3-3x^2+4x+6 \\
--5x^4-2x^3+7x^2+4x+6 \\
-2x^3+7x^2+8x+6 \\
-7x^2+8x+6 \\
-7x^2+8x-8
\end{array}$$

$$x^{3} = 5x^{2} - 2x + 7 + \frac{8x - 8}{x^{2} + 2}$$

Dividing Polynomials Using Synthetic Division

To Divide:

- 1. Write the dividend in descending powers of x. Copy the coefficients, remembering to insert 0 for any missing powers of x.
- 2. Insert the usual division symbol. If the divisor is x #, enter the # to the left of the division symbol. If it is x + #, enter -#.
- 3. Bring the first number down to the answer row.
- 4. Multiply the first entry by the divisor and place in row 2, 1 column to the right.
- 5. Add the last entry in row 2 to the entry above it in row 1 and enter in the answer in row 3.
- 6. Continue until finished.
- 7. The final entry in row 3 is your remainder. The other entries are the coefficients of x starting with the exponent whose degree is 1 less than you started with.

Ex: Divide $-4x^3 + 2x^2 - x + 1$ by x + 2.

Ex: Divide $x^6 - 16x^4 + x^2 - 16$ by x + 4

Ex: Show that g(x) = x + 3 is a factor of $f(x) = -4x^3 + 5x^2 + 8$.

Ex: If you know that x = -7 is one zero, use synthetic division and factoring to find the other zeros of the function $x^3 + 4x^2 - 21x$.

Homework: pg. 1028 #1, 3, 5, 12, 13, 15, 23, 31, 32, 33, 34, 39, 41, 42, 43, 44