Master ☺

6-2 Dividing Polynomials

Divide a Polynomial by a Monomial: *Just divide each term by the denominator and simplify.*

1. $\dfrac{5a^2b - 15ab^3 + 10a^3b^4}{5ab}$

$\dfrac{5a^2b}{5ab} - \dfrac{15ab^3}{5ab} + \dfrac{10a^3b^4}{5ab}$

$a - 3b^2 + 2a^2b^3$

2. $\dfrac{24mn^6 - 40m^2n^3}{4m^2n^3}$

$\dfrac{24mn^6}{4m^2n^3} \quad \dfrac{-40m^2n^3}{4m^2n^3}$

$\dfrac{6n^3}{m} - 10$

Divide Polynomials using Long Division

3. $(x^2 + 3x - 18) \div (x - 3)$

$$\begin{array}{r} x+6 \\ x-3 \overline{)\, x^2+3x-18} \\ -(x^2-3x) \\ \hline 6x-18 \\ -(6x-18) \\ \hline 0 \end{array}$$

$x+6$

4. $(4x^2 - 9) \div (2x + 3)$

$$\begin{array}{r} 2x-3 \\ 2x+3 \overline{)\, 4x^2+0x-9} \\ -(4x^2+6x) \\ \hline -6x-9 \\ -(-6x-9) \\ \hline 0 \end{array}$$

$2x-3$

5. $(m^2 - 3m - 7) \div (m + 2)$

$$\begin{array}{r} m-5 \\ m+2 \overline{)\, m^2-3m-7} \\ -(m^2+2m) \\ \hline -5m-7 \\ -(-5m-10) \\ \hline 3 \end{array}$$

$m - 5$ r. 3 = $m - 5 + \dfrac{3}{m+2}$

6. $(2x^2 + x - 3) \div (x - 1)$

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

$2x+3$

7. $(t^3 - 6t^2 + 1)(t + 2)^{-1}$ i.e. $(t^3 - 6t^2 + 1) \div (t + 2)$

$$\begin{array}{r} t^2-8t+16 \\ t+2 \overline{)\, t^3-6t^2+0t+1} \\ -(t^3+2t^2) \\ \hline -8t^2+0t \\ -(-8t^2-16t) \\ \hline 16t+1 \\ -(16t+32) \\ \hline -31 \end{array}$$

$t^2 - 8t + 16 - \dfrac{31}{t+2}$

8. $(6x^3 + 5x^2 + 9) \div (2x + 3)$

$$\begin{array}{r} 3x^2-2x+3 \\ 2x+3 \overline{)\, 6x^3+5x^2+0x+9} \\ -(6x^3+9x^2) \\ \hline -4x^2+0x \\ -(-4x^2-6x) \\ \hline 6x+9 \\ -(6x+9) \\ \hline 0 \end{array}$$

$3x^2 - 2x + 3$

Divide Polynomials Using Synthetic Division

Example: $(2x^3 - 7x^2 - 8x + 16) \div (x - 4)$

A. Put in descending order (if it is not already).

B. If there are any missing terms, write them as $0x^{(power)}$

C. Write the coefficients of each term in a row and write the value of r 2nd polynomial (x - r), to the left of the 1st polynomial. *You can find it by setting the factor equal to zero and solving for x.*

4 | 2 -7 -8 16

D. Leave one row blank and draw a horizontal line.

4 | 2 -7 -8 16

_____

E. Drop 1st coefficient below line.

4 | 2 -7 -8 16

↓

2

F. Multiply *r* times the 1st coefficient and place result in the blank row under 2nd coefficient.

4 | 2 -7 -8 16

8

2

G. Add.

4 | 2 -7 -8 16

8

2 1

H. Continue multiplying and adding until all coefficients have been used.

4 | 2 -7 -8 16

8 4 -16

2 1 -4 | 0

I. Write the result in descending powers of the variable beginning with a power one less than the dividend.

$2x^2 + x - 4$

**Never use synthetic division if your divisor has a leading coefficient greater than 1!*

Examples:

9. $(2x^3 - 7x^2 - x - 12) \div (x - 4)$

4 | 2 -7 -1 -12

↓ 8 4 12

2 1 3 | 0

$2x^2 + x + 3$

10. $(x^3 - 2x + 12) \div (x + 3)$

-3 | 1 0 -2 12

↓ -3 9 -21

1 -3 7 | -9

$x^2 - 3x + 7 - \frac{9}{x+3}$

11. $(3x^4 + 2x^3 - 5) \div (x + 4)$

-4 | 3 2 0 0 -5

↓ -12 40 -160 640

3 -10 40 -160 | 635

$3x^3 - 10x^2 + 40x - 160 + \frac{635}{x+4}$

12. $(6x^4 - 40x^3 + 40x^2 + 80x + 100) \div (x - 5)$

5 | 6 -40 40 80 100

↓ 30 -50 -50 150

6 -10 -10 30 | 250

$6x^3 - 10x^2 - 10x + 30 + \frac{250}{x-5}$