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Algebra II - Notes

11-14-13 5-1 Operations with Polynomials

① $3x^0(2x^{-3}y^3)^4(-7x^5y^{-6}) = 3\left(\frac{2y^3}{x^3}\right)^4\left(\frac{-7x^5}{y^6}\right)$

$(3)\frac{(2)y^3\cdot(2)y^3\cdot(2)y^3\cdot(2)y^3}{x^3\cdot x^3\cdot x^3\cdot x^3}\ \frac{(-7)x^5}{y^6} = \frac{-336y^{12}x^5}{x^{12}y^6} =$

$\frac{-336y^{12-6}}{x^{12-5}} = \boxed{\frac{-336y^6}{x^7}}$

② $\left(\frac{5x^3y}{20xy^5}\right)^{-4} = \left(\frac{20xy^5}{5x^3y}\right)^4 = \left(\frac{4y^4}{x^2}\right)^4 =$

$\frac{4y^4\ 4y^4\ 4y^4\ 4y^4}{x^2\ x^2\ x^2\ x^2} = \boxed{\frac{4^4y^{16}}{x^8}}$

③ $\underbrace{3^4\cdot3^5}$ $= 3^9$

Do NOT change the base

Polynomial - any expression that can be written as a combination of terms with variable(s) raised to an integer (whole number) power (non-negative)

exponents → + ~~−~~

Examples: $y = x^3 + 9x^2 + 26x + 24$

$2xyz + x$

$y = \frac{24}{2x^{-3}} + 9x^2 + 6x = 12x^3 + 9x^2 + 6x$

Not polynomials = $y = \frac{1}{x} = y = x^{-1}$

$y = \frac{124}{2x^4} + 9x =$ $\frac{124x^{-4}}{2} + 9x$

$y = \sqrt{x} = y = x^{\frac{1}{2}}$

degree: the power of the term that has the highest exponent in a polynomial

Examples: $y = x^{3} + 9x^2 + 26x + 24$ - 3^{rd} degree

$y = 3x^4 + 2x^{8}$ - 8^{th} degree

$y = 7x^{6} + 5x^4 - 12x^3 + 8x - 41$ - 6^{th} degree

Standard form - polynomial written so that the degrees of the terms decrease from left to right

$$\underbrace{y = 3x^4 + 2x^8}_{\text{Not Standard Form}} \longrightarrow \underbrace{y = 2x^8 + 3x^4}_{\text{Standard Form}}$$

Simplifying polynomials - ± - Do Not Change the exponents

Combine Like Terms

① $(4x^2 - 5x + 6) + (2x^2 + 3x - 1)$

$\boxed{6x^2 - 2x + 5}$

② $(4x^2 - 5x + 6) - (2x^2 + 3x - 1) =$

$4x^2 - 5x + 6 - 2x^2 - 3x + 1$

$\boxed{2x^2 - 8x + 7}$

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a) $4x^2(2x^2-1) = \boxed{8x^4-4x^2} \rightarrow$ 4^{th} degree

b) $3x^3(3x^2-5) = 9x^5-15x^3 \rightarrow$ 5^{th} degree

c) $(4x^2-5x+6)(2x^2-1) =$

$(2x^2-1)(4x^2-5x+6)$

$$\begin{array}{r} 8x^4-10x^3+12x^2 \\ -4x^2+5x-6 \\ \hline \boxed{8x^4-10x^3+8x^2+5x-6} \end{array}$$

d) $(2x^2-3x+1)(3x^2-5) =$

$(3x^2-5)(2x^2-3x+1)$

$$\begin{array}{r} 6x^4-9x^3+3x^2 \\ -10x^2+15x-5 \\ \hline \boxed{6x^4-9x^3-7x^2+15x-5} \end{array}$$

e) $[(5x+1)(2x-1)](x-4) =$

$10x^2-5x+2x-1 = 10x^2-3x-1$

$(x-4)(10x^2-3x-1) =$

$$\begin{array}{r} 10x^3-3x^2-x \\ -40x^2+12x+4 \\ \hline \boxed{10x^3-43x^2+11x+4} \end{array}$$

f) $5x(2x-1)-3x(x-4)+4x(2x-7)$

$10x^2-5x-3x^2+12x+8x^2-28x$

$\boxed{15x^2-21x}$

Algebra II - Notes

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11-14-13 5-2 Dividing Polynomials

Part 1 = Synthetic Division

- Make sure the polynomial is in standard form and all terms are accounted for.
(add a $0x$ or a $0x^2$ for the applicable missing term)

Ex: $4x^5 - 3x^3 + 2x^2 + 5$

$\downarrow$

$4x^5 + 0x^4 - 3x^3 + 2x^2 + 0x + 5$

- Find the root of divisor. Set x to zero and solve.

ex: $x + \cancel{1} = 0$
$-\cancel{1} \quad -1$
$x = -1 \longrightarrow$ used in box

- multiply answer for verification

same as $\div \longrightarrow$ $(x^3 - 8x^2 + 4x - 9)(x-4)^{-1} = x^3 - 8x^2 + 4x - 9) \cdot \frac{1}{x-4}$

Divide

$x \cancel{-} 4 = 0$
$+\cancel{4} \quad +4$
$x = 4 \leftarrow$ goes in box

$$\begin{array}{r|rrrr} 4 & 1 & -8 & 4 & -9 \\ & \downarrow & 4 & -16 & -48 \\ \hline & 1 & -4 & -12 & -57 \end{array}$$

multiply

$\leftarrow$ remainder

$x^2 - 4x - 12 - \frac{57}{x-4} \leftarrow$ divisor

* Last step — divide by # in front of variable

$(6y^3 - 17y^2 + 6y + 8) \div (3y - 4) =$

$3y - 4 = 0$

$+4 \quad +4$

$\frac{\cancel{3}y}{\cancel{3}} = \frac{4}{3}$

$y = 4/3$

$$
\begin{array}{c|cccc}
4/3 & 6 & -17 & 6 & 8 \\
 & \downarrow & 8 & -12 & -8 \\
\hline
 & 6 & -9 & -6 & 0
\end{array}
$$

← remainder

Divide by 3

2   −3   −2   0 ← remainder

$\boxed{2y^2 - 3y - 2}$

verify → $(3y-4)(2y^2-3y-2)$

$$
\begin{array}{r}
6y^3 - 9y^2 - 6y \\
-8y^2 + 12y + 8 \\
\hline
6y^3 - 17y^2 + 6y + 8
\end{array}
$$

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