Math 115

Fall 2017

Lecture 16

$\sqrt{xy}$

Ch. 4

Exponential Rules:

1) $x^n = \underbrace{x \cdot x \cdot x \cdot x \cdots x}_{n \text{ times}}$

2) $x^1 = x$

3) $x^0 = 1$; $x \neq 0$

4) $x^m \cdot x^n = x^{m+n}$

5) $(x^m)^n = x^{m \cdot n}$

6) $(xy)^n = x^n y^n$

7) $\dfrac{x^m}{x^n} = x^{m-n}$

8) $\left(\dfrac{x}{y}\right)^n = \dfrac{x^n}{y^n}$

9) $x^{-n} = \dfrac{1}{x^n}$

10) $\dfrac{x^{-n}}{y^{-m}} = \dfrac{y^m}{x^n}$

11) $\left(\dfrac{x}{y}\right)^{-n} = \left(\dfrac{y}{x}\right)^n$

Simplify:

$5^1 - 10^0 = 5 - 1 = \boxed{4}$

$\left(\frac{-3}{4}\right)^0 - \left(\frac{1}{2}\right)^{-1} = 1 - \left(\frac{2}{1}\right)^1 = 1 - 2^1$

$= 1 - 2 = \boxed{-1}$

Expand: $(-3x^2)^4 = \underbrace{(-3x^2)\cdot(-3x^2)\cdot(-3x^2)\cdot(-3x^2)}_{4 \text{ times}}$

write using exponent:

$\frac{4}{x}\cdot\frac{4}{x}\cdot\frac{4}{x}\cdot\frac{4}{x}\cdot\frac{4}{x} = \left(\frac{4}{x}\right)^5$

Simplify:

1) $x^8 \cdot x^{10} = x^{8+10}$

$= \boxed{x^{18}}$

2) $(x^8)^{10} = x^{8\cdot 10}$

$= \boxed{x^{80}}$

3) $(x^7)^3 \cdot x^9$

$= x^{7\cdot 3} \cdot x^9$

$= x^{21} \cdot x^9 = \boxed{x^{30}}$

4) $(x^{10})^2 \cdot (x^5)^4$

$= x^{20} \cdot x^{20}$

$= \boxed{x^{40}}$

5) $(-5x^6)^3 = (-5)^3(x^6)^3$

$= \boxed{-125x^{18}}$

6) $(2x^8y^3)^4$

$= 2^4(x^8)^4(y^3)^4$

$= \boxed{16x^{32}y^{12}}$

7) $\dfrac{x^{12}}{x^3} = x^{12-3}$

$= \boxed{x^9}$

8) $\dfrac{(x^6)^4}{(x^3)^5}$

$= \dfrac{x^{24}}{x^{15}}$

$= x^{24-15} = \boxed{x^9}$

Simplify (No negative exponent)

1) $x^{-4} = \boxed{\dfrac{1}{x^4}}$

2) $3^{-1} = \dfrac{1}{3^1} = \boxed{\dfrac{1}{3}}$

3) $(x^{-2})^5 = x^{-10}$

$= \boxed{\dfrac{1}{x^{10}}}$

4) $(x^{-3})^{-4} \cdot x^{-13}$

$= x^{12} \cdot x^{-13}$

$= x^{-1} = \dfrac{1}{x^1} = \boxed{\dfrac{1}{x}}$

Simplify

1) $\left(\frac{3x}{y^4}\right)^2$

$= \frac{3^2 x^2}{(y^4)^2} = \boxed{\frac{9x^2}{y^8}}$

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

$= \frac{2^3 (y^5)^3}{(x^3)^3}$

$= \boxed{\frac{8y^{15}}{x^9}}$

Simplify

$\frac{-\cancel{24}^{\,3} x^{12} y^{18}}{\cancel{16}_{\,2} x^{10} y^8} = -\frac{3x^2 y^{10}}{2}$

$x^{12-10} = x^2$

$y^{18-8} = y^{10}$

Reduce by 8

$= \boxed{-\frac{3}{2} x^2 y^{10}}$

Simplify

$\frac{-50x^{12} y^{-6}}{15 x^{-8} y^{10}} = \frac{-\cancel{50}^{\,10} x^{12} x^8}{\cancel{15}_{\,3} y^{10} y^6} = \boxed{\frac{-10x^{20}}{3y^{16}}}$

Monomial: # Variables^whole #

$5x^2$, $-12x^3y^4$, $\frac{2}{3}x^6y^3z$

Coefficient

Degrees

$2017x^8$ Coef. 2017, Deg. 8

$-100x^2y^8$ Coef. = -100, Deg. 2+8=10

A monomial without any variable is called constant. Constant has degree 0.

85 → Monomial → constant → Deg. = 0

Monomial	Coef.	Degree
$25x^6$	25	6
$-32xy$	-32	$1+1=2$
$123xy^2z^3$	123	$1+2+3=6$
100	Constant	0

Binomial: + or − of two monomials

$4x^2 + 10$, $-3x - 8$, $x^4y^2 - x^2y^4$

$\frac{2}{3}x - \frac{3}{5}y$, $x^2y^3z^5 + xyz$

Deg. is the highest degree of the monomials.

Coef. of that monomial is called the leading Coef.

$3x^{10} - 20x^2$ Deg. $= 10$

L.C. $= 3$

$4x^3y^7 - 12x^8y^5 \Rightarrow$ Deg. $= 13$

D = 10   D = 13   L.C. = −12

C = 4   C = −12

Monomial	D	C
$4x^3y^7$	10	4
$-12x^8y^5$	13	−12

D = 13

L.C. = −12

Find D & C of each monomial, then give D & L.C. of the binomial

$24x^6y^3 \quad -400xy$

D=9

L.C. 24

Mon.	D	C
$24x^6y^3$	9	24
$-400xy$	2	-400

Trinomial: + or − of three monomials

$x^2 - 5x + 7 \Rightarrow D=2$, L.C.=1, constant=7

$4x^3 + 12x^2 - 100x \Rightarrow D=3$, L.C.=4, NO constant

$x^6y^5 \quad -15x^3y^7 \quad + xy$

Deg. 11

L.C. = 1

Monomials	D	C
x^6y^5	11	1
$-15x^3y^7$	10	-15
xy	2	1

Monomial, binomial, trinomial are special Polynomials.

Polynomial: + or − of monomials

$7x^4 - 12x^3 + 25x^2 - 45$

D=4, L.C.=7, Const.=−45

$12x^4y^2 - 10x^6y^3 + \frac{2}{3}x^8y^5 + xy + 1$

D=6 D=9 D=13 D=2 D=0

$\boxed{D=13, \ L.C.=\frac{2}{3}, \ \text{Constant}=1}$

Simplify

$(4x^5)(12x^3) = \underbrace{4 \cdot 12} \cdot x^5 \cdot x^3$

$= 48x^8$

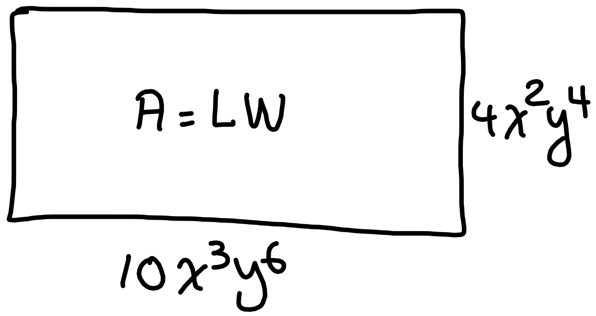
Monomial
D=8
C=48

$\dfrac{-60x^{12}y^8}{5x^3y^7} = -12x^9y^1 = -12x^9y$

Monomial
D=9+1=10, C=−12

find the area

$A = LW$



$= (10x^3y^6)(4x^2y^4)$

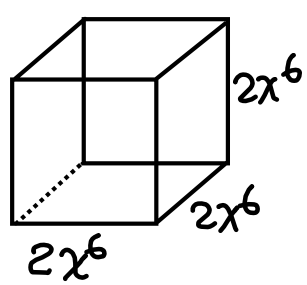
$= 10 \cdot 4 x^3 x^2 y^6 y^4$

$= \boxed{40x^5y^{10}}$

Monomial

$D = 15$, Coef. 40

find the volume



$V = S^3$

$V = (2x^6)^3$

$= 2^3 (x^6)^3$

$= \boxed{8x^{18}}$

Monomial

$D = 18$

$C = 8$

Recall $a(b+c) = ab + ac$

Distributive Prop.

$2(x+3) = 2x + 6$

$-3(4x-5) = -12x + 15$

$5(2x^2 - 3x + 1) = 10x^2 - 15x + 5$

$4x(3x-2) = 4x \cdot 3x - 4x \cdot 2$

$= \boxed{12x^2 - 8x}$

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

$= 3x^2 \cdot 4x^2 - 3x^2 \cdot 5x + 3x^2 \cdot 6$

$= 12x^4 - 15x^3 + 18x^2$

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

$= 4x^3 \cdot 5x^2 - 4x^3 \cdot 4x + 4x^3 \cdot 1$

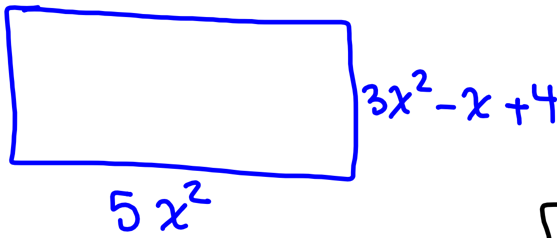
$= 20x^5 - 16x^4 + 4x^3$

Trinomial

D=5

L.C.=20

Find the area



$A = LW$

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

$= 5x^2 \cdot 3x^2 - 5x^2 \cdot x + 5x^2 \cdot 4$

$\boxed{A = 15x^4 - 5x^3 + 20x^2}$

Trinomial

$D = 4$, L.C. $= 15$

No constant.

FOIL Method

- F → First ones
- O → outside ones
- I → Inside ones
- L → Last ones

Multiply $(x + 5)(x + 2) =$

$x^2 + 2x + 5x + 10 =$

$\boxed{x^2 + 7x + 10}$

Trinomial

$D = 2$

L.C. $= 1$

Constant $= 10$

Multiply by using FOIL method:

$(2x+4)(3x-5)$

$= 2x \cdot 3x - 2x \cdot 5 + 4 \cdot 3x - 4 \cdot 5$

$= 6x^2 - 10x + 12x - 20$

$= \boxed{6x^2 + 2x - 20}$

Trinomial

D=2

L.C.=6

Constant =-20

Multiply

$(5x-3)(4x-5)$

$= 5x \cdot 4x - 5x \cdot 5 - 3 \cdot 4x + 3 \cdot 5$

$= 20x^2 - 25x - 12x + 15$

$= \boxed{20x^2 - 37x + 15}$

D=2, L.C.=20

Const. 15

Trinomial

Multiply

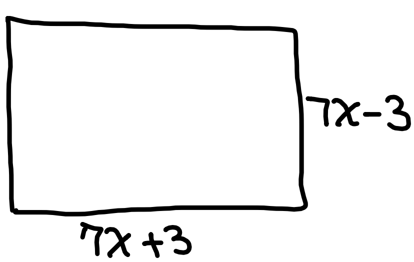
$$\underbrace{(5x+6)(5x-6)}_{\text{Conjugates}}$$

$$= 5x\cdot 5x - 5x\cdot 6 + 6\cdot 5x - 6\cdot 6$$

$$= 25x^2 \cancel{-30x} \cancel{+30x} - 36$$

$$= \boxed{25x^2 - 36}$$

find the area



$A = LW$

$$= \underbrace{(7x+3)(7x-3)}_{\text{Conjugates}}$$

$$= 49x^2 \cancel{-21x} \cancel{+21x} - 9$$

$$= 49x^2 - 9$$

Use FOIL method to multiply

$$(x^1+3)(x^2-3x+9)$$

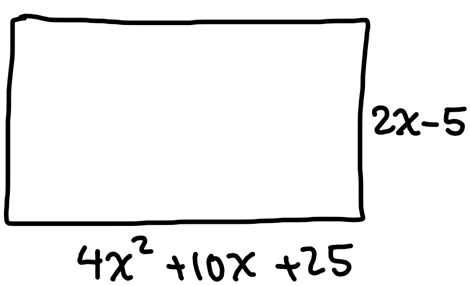
$$= x^3 \cancel{-3x^2} \cancel{+9x} \cancel{+3x^2} \cancel{-9x} +27$$

$$= \boxed{x^3+27}$$

binomial D=3 L.C. 1

Const 27

find the area



$A = LW$

$$A = (2x-5)(4x^2+10x+25)$$

$$= 8x^3 \cancel{+20x^2} \cancel{+50x}$$
$$\cancel{-20x^2} \cancel{-50x} -125$$

$$= \boxed{8x^3 - 125}$$

Binomial

D=3, L.C. 8

Const -125