## Outcome 5A Multiplying Polynomials Review

CO\#5A: Students will demonstrate understanding of multiplication of monomials, binomials and trinomials, concretely, pictorially and symbolically.

| Beginning | Approaching | Proficient | Mastery |
| :--- | :--- | :--- | :--- |
| I need help/I | I am consistent with multiplying monomials |  |  |
| am |  |  |  |
| inconsistent | I am consistent <br> process of how to multiply binomials by <br> binomials, but I make consistent mistakes, <br> maybe with signs | I am able to multiply all types of polynomials <br> with multiplying <br> binomials by <br> binomials | accurately. I am able to perform error analysis <br> on multiplication of polynomials. I am able to <br> show multiplication pictorially, concretely and <br> symbolically. |

## Level 2

## Example 1: Expand and simplify:

a) $3\left(4 a^{2}+5 a-7\right)$

Distribute the 3 to each term (this

means MULTIPLY each term by 3)

$$
12 a^{2}+15 a-21
$$

b) $-5\left(2 m^{2} n^{2}+5 m-3 n+7 m n\right)$

Distribute the -5 to each term (this

means MULTIPLY each term by -5 ).
When you multiply by a negative every sign will change.
$-10 m^{2} n^{2}-25 m+15 n-35 m n$

1. Expand and simplify
a) $6\left(3 x^{2}+2 x-5\right)$
b) $8\left(5 y^{2}-2 y+7\right)$
c) $-3\left(3 a^{2} b^{2}-2 a b+3 a+4 b-5\right)$
c) $\quad-10(x+2 y-5)$

## Example 2: Expand and Simplify:

a) $5 x\left(3 x^{2}-6 x+2\right)$

Distribute (multiply) the 5 x to each

term in the bracket. When you
multiply same bases, you add
their exponents. ie. $x\left(x^{2}\right)=x^{1+2}=x^{3}$
$15 x^{3}-30 x^{2}+10 x$
b) $-6 x^{2} y z^{3}\left(-2 x y^{3} z+4 x^{3} y-5 y^{2} z^{5}\right)$

Distribute (multiply) the $-6 x^{2} y z^{3}$

$$
\overbrace{-6 x^{2} y z^{3}\left(-2 x y^{3} z+4 x^{3} y-5 y^{2} z^{5}\right)}
$$

to each term in the bracket. When
you multiply the same variables,
you add their exponents.

$$
12 x^{2+1} y^{1+3} z^{3+1}-24 x^{2+3} y^{1+1} z^{3}+30 x^{2} y^{1+2} z^{3+5}
$$

$12 x^{3} y^{4} z^{4}-24 x^{5} y^{2} z^{3}+30 x^{2} y^{3} z^{8}$
2. Expand and simplify
a) $2 m\left(-5 m^{2}+3 m-5\right)$
b) $8 y\left(2 y^{2}+3 y-5\right)$
c) $-4 a c(2 a+5 c-3)$
d) $\quad-3 m n(3 m+5 n-1)$
e) $-2 m^{4} n^{3} p^{2}\left(-4 m^{3} p^{2}-2 n^{6} p+m^{2} n^{7}\right)$
f) $\quad-3 a^{2} c^{6} d^{3}\left(-2 a d^{2}-4 c^{2} d^{3}+2 a^{3} b^{4}\right)$

## Level 3

Example 3 Expand and simplify
You can use double distribution to expand a binomial x binomial (if you know another correct strategy feel free to use it) Double distribution means EACH term from the first binomial is multiplied to EACH term in the second binomial. So 'a' will multiply to 'a' and ' 3 ' and ' 4 ' will multiply to 'a' and '3'.

(1) $a \times a=a^{2}$
(2) $\mathrm{a} \times 3=3 \mathrm{a}$
(3) $4 \times a=4 a$
(4) $4 \times 3=12$

$$
a^{2}+3 a+4 a+12 \quad \text { Now collect any like terms }
$$

$$
a^{2}+7 a+12
$$

$(x+5)(x+2)$
Another strategy would be to set up a table
Since it is a binomial $x$ binomial we need to make a $2 \times 2$ table
Place each term of one binomial as headings across the top and each term of the other binomial as headings along the side.


You can then collect any like terms in the table and write your answer as an expression.


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

3. Expand and simplify
a) $(a+2)(a+5)$
b) $\quad(x+1)(x+5)$
d) $(m+3)(m+2)$

## Example 4 Expand and simplify when there are negative values.

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

You can use either strategy as before, you just need to remember the multiplication rules of signs:
$(+)(+)=+$
$(-)(-)=+$
$(+)(-)=-$
$(-)(+)=-$

## Double Distribution <br>  <br> $x^{2}-2 x+3 x-6$ <br> $x^{2}+x-6$

Table


$$
x^{2}+x-6
$$

4. Expand and simplify
a) $(a+5)(a-3)$
b) $(m-6)(m+2)$
c) $(x+4)(x-7)$
d) $(a-5)(a-2)$
e) $(m-1)(m-3)$
e) $(y-2)(y+5)$

Example 5 Expand and simplify when the first term is not just a variable.
(2a-5)(7a-3)
You can still use either strategy.
Double Distribution
$\overbrace{(2 a-5)(7 a-3)}$
$14 a^{2}-6 a-35 a+15$
$14 a^{2}-41 a+15$

$14 a^{2}-41 a+15$
5. Expand and simplify
a) $(3 m+2)(2 m+5)$
b) $(2 x-4)(3 x+2)$
c) $(4 y-3)(y+2)$
d) $(7 a+3)(2 a-1)$
e) $(5+6 x)(1-x)$
f) $(1-3 x)(1-2 x)$

## Level 4

Example 6 Multiplying a polynomial by a polynomial with any amount of terms
$(x-2)\left(2 x^{2}-3 x+4\right)$
This time, if you are using the distribution, you can continue to "double" distribute; the ' $x$ ' in the binomial will multiply to every term in the trinomial and the ' -2 ' in the binomial will multiply to every term in the trinomial.
If you are using the table, you will need a $2 \times 3$ table because there are 2 terms in one factor and 3 terms in the second.

Distribution

$2 x^{3}-3 x^{2}+4 x-4 x^{2}+6 x-8$
$2 x^{3}-7 x^{2}+10 x-8$

Table


$$
2 x^{3}-7 x^{2}+10 x-8
$$

6. Expand and Simplify
a) $(x+1)\left(3 x^{2}+6 x-7\right)$
b) $(2 m-3)\left(4 m^{2}+2 m-1\right)$
c) $(2 x+y)(3 x+3 y-4)$
d) $(m-2 n)(3 m-4 n+2)$
$(3 x+1)(2 x-4)-(5 x-2)(x-3)$
There is more than one way to organize these types of problems! In this one we will multiply the first two binomials together and the second two binomials before we consider subtracting. Use the strategy for binomial multiplication that makes the most sense to you (double distribution or table)
$(3 x+1)(2 x-4)$
$(5 x-2)(x-3)$
$6 x^{2}-12 x+2 x-4$
$5 x^{2}-15 x-2 x+6$
$6 x^{2}-10 x-4$
$5 x^{2}-17 x+6$

Now subtract $\quad\left(6 x^{2}-10 x-4\right)-\left(5 x^{2}-17 x+6\right)$
When subtracting you can add the opposite or distribute the negative through the second bracket. Either way ALL signs in the second bracket will change and then you collect like terms.

$$
\begin{aligned}
& \left(6 x^{2}-10 x-4\right)-\left(5 x^{2}-17 x+6\right) \\
& 6 x^{2}-10 x-4-5 x^{2}+17 x-6 \\
& x^{2}+7 x-10
\end{aligned}
$$

7. Expand and Simplify
a) $(2 x-3)(x+5)-(4 x+3)(2 x+1)$
b) $\quad(3 c-5)(2 c+1)-(c+2)(3 c-5)$
