

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Notes: Polynomial Operations

Do Now: Simplify each expression.

1)  $3r^2 - 9r + 12r^2 - 15 + 7r$

$$15r^2 - 2r - 15$$

2)  $(5y^2 + (-7) + 2y) + (9y - 2 + y^2)$

$$5y^2 - 7 + 2y + 9y - 2 + y^2$$

$$6y^2 + 11y - 9$$

3)  $(5y^2 + (-7) + 2y) - (9y - 2 + y^2)$

$$5y^2 - 7 + 2y - 9y + 2 - y^2$$

$$4y^2 - 7y - 5$$

## Vocab Breakdown

**Standard Form:** the degree of each term decreases from left to right

**Example:**

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

**Ex:** When simplifying an expression, Jeremy found the difference to be  $5x^3 - 8 + 11x^5 + 15x$ . He then stated that the leading coefficient of this polynomial was 5. Do you agree with Jeremy? Explain your reasoning.

$$11x^5 + 5x^3 + 15x - 8$$

I disagree with Jeremy because the expression must be put in standard form before you find the lead coefficient, which is 11.



## Multiplying

$$\begin{array}{l} \overbrace{4x(5x+6)} \\ 4x(5x) + 4x(6) \\ \hline 20x^2 + 24x \end{array}$$

$$\begin{array}{l} 2x(6x^4 - x^3 + 5) \\ 6x^4(2x) - x^3(2x) + 5(2x) \\ \hline 12x^5 - 2x^4 + 10x \end{array}$$

$$\begin{array}{l} \overbrace{(7-2x)(10+3x)} \\ 7(10) + 3x(7) - 2x(10) - 2x(3x) \\ 70 + 21x - 20x - 6x^2 \\ \hline -6x^2 + x + 70 \end{array}$$

$$\begin{array}{l} \overbrace{(x-9)(x+4)} \\ x^2 + 4x - 9x - 36 \\ \hline x^2 - 5x - 36 \end{array}$$

$$\begin{array}{l} 3cd(c^2 + cd - 4d^2) \\ 3c^3d + 3c^2d^2 - 12cd^3 \\ \hline 3c^3d + 3c^2d^2 - 12cd^3 \end{array}$$

$$\begin{array}{l} (4x-3)^2 \\ (4x-3)(4x-3) \\ 16x^2 - 12x - 12x + 9 \\ \hline 16x^2 - 24x + 9 \end{array}$$

$$\begin{array}{l} \overbrace{(2x^2 - x + 12)(5x + 3)} \\ 5x(2x^2) + 3(2x^2) + 5x(-x) + 3(-x) + 5x(12) + 3(12) \\ 10x^3 + 6x^2 - 5x^2 - 3x + 60x + 36 \\ \hline 10x^3 + x^2 + 57x + 36 \end{array}$$

Dividing

$$\frac{8c^2 - 12d^2}{4}$$
$$\frac{8c^2}{4} - \frac{12d^2}{4}$$
$$2c^2 - 3d^2$$

$$\frac{16t^5 - 8t^4}{4t^2}$$
$$\frac{16t^5}{4t^2} - \frac{8t^4}{4t^2}$$
$$4t^3 - 2t^2$$

$$\frac{3ab^2 - 4a^2b}{ab}$$
$$\frac{3ab^2}{ab} - \frac{4a^2b}{ab}$$
$$3b - 4a$$

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### Classwork: Polynomial Operations

Completely simplify each expression.

1)  $\frac{4x^3+18x^2+9x}{2}$

$$2x^3 + 9x^2 + 4.5x$$

2)  $7(y-8) + 10y - 5$

$$7y - 56 + 10y - 5$$
$$17y - 61$$

3)  $-4b(5b^2 - 1)$

$$-20b^3 + 4b$$

4)  $x^2(7.5x^9 - 1.2x^3 + x)$

$$7.5x^{11} - 1.2x^5 + x^3$$

5)  $\frac{63b^4 - 21b}{7b}$

$$\frac{63b^4}{7b} - \frac{21b}{7b}$$
$$9b^3 - 3$$

6)  $\frac{18m^7 - 9m + 3}{-1}$

$$-18m^7 + 9m - 3$$

7)  $-8 + x(7y - x) + 9xy$

$$-8 + 7xy - x^2 + 9xy$$
$$-x^2 + 16xy - 8$$

8)  $-5m^2n^2(-2m^3 - mn + 10n^3)$

$$10m^5n^2 + 35m^3n^3 - 50m^2n^5$$

9)  $\frac{7(4x-8)+9x^2-7x}{2}$

$$\frac{28x - 56 + 9x^2 - 7x}{2}$$
$$\frac{9x^2 + 21x - 56}{2}$$
$$4.5x^2 + 10.5x - 28$$

10)  $(2x-3)(2x-3) = 4x^2 - 12x + 9$

When  $(2x - 3)^2$  is subtracted from  $5x^2$ , the result is

- (1)  $x^2 - 12x - 9$        (3)  $x^2 + 12x - 9$   
 (2)  $x^2 - 12x + 9$        (4)  $x^2 + 12x + 9$

$$5x^2 - (4x^2 - 12x + 9)$$

$$5x^2 - 4x^2 + 12x - 9$$

$$x^2 + 12x - 9$$

11)

If  $y = 3x^3 + x^2 - 5$  and  $z = x^2 - 12$ , which polynomial is equivalent to  $2(y + z)$ ?

- (1)  $6x^3 + 4x^2 - 34$        (3)  $6x^3 + 3x^2 - 22$   
 (2)  $6x^3 + 3x^2 - 17$        (4)  $6x^3 + 2x^2 - 17$

$$2(3x^3 + x^2 - 5 + x^2 - 12)$$

$$2(3x^3 + 2x^2 - 17)$$

$$6x^3 + 4x^2 - 34$$

12)

Mrs. Allard asked her students to identify which of the polynomials below are in standard form and explain why.

- I.  $15x^4 - 6x + 3x^2 - 1$   
 II.  $12x^3 + 8x + 4$   
 III.  $2x^5 + 8x^2 + 10x$

Which student's response is correct?

- (1) Tyler said I and II because the coefficients are decreasing.  
 (2) Susan said only II because all the numbers are decreasing.  
 (3) Fred said II and III because the exponents are decreasing.  
 (4) Alyssa said II and III because they each have three terms.

13) If  $A = 5x^2 - 3x + 1$ ,  $B = -3x - 4 + x^2$  and  $C = 9 - 4x^3 + 0.5x$ , find  $A - B + C$ .

$$(5x^2 - 3x + 1) - (-3x - 4 + x^2) + (9 - 4x^3 + 0.5x)$$

$$5x^2 - 3x + 1 + 3x + 4 - x^2 + 9 - 4x^3 + 0.5x$$

$$-4x^3 + 4x^2 + 0.5x + 10$$

14)

The expression  $3(x^2 - 1) - (x^2 - 7x + 10)$  is equivalent to

- (1)  $2x^2 - 7x + 7$                       (3)  $2x^2 - 7x + 9$   
(2)  $2x^2 + 7x - 13$                     (4)  $2x^2 + 7x - 11$

(2)

$$3x^2 - 3 - x^2 + 7x - 10$$
$$2x^2 + 7x - 13$$

15)

Which trinomial is equivalent to  $3(x - 2)^2 - 2(x - 1)$ ?

- (1)  $3x^2 - 2x - 10$                       (3)  $3x^2 - 14x + 10$   
(2)  $3x^2 - 2x - 14$                       (4)  $3x^2 - 14x + 14$

(4)

$$3(x-2)(x-2) - 2(x-1)$$
$$3(x^2 - 4x + 4) - 2(x-1)$$
$$3x^2 - 12x + 12 - 2x + 2$$
$$3x^2 - 14x + 14$$

16)

A company produces  $x$  units of a product per month, where  $C(x)$  represents the total cost and  $R(x)$  represents the total revenue for the month. The functions are modeled by  $C(x) = 300x + 250$  and  $R(x) = -0.5x^2 + 800x - 100$ . The profit is the difference between revenue and cost where  $P(x) = R(x) - C(x)$ . What is the total profit,  $P(x)$ , for the month?

- (1)  $P(x) = -0.5x^2 + 500x - 150$   
 (2)  $P(x) = -0.5x^2 + 500x - 350$   
(3)  $P(x) = -0.5x^2 - 500x + 350$   
(4)  $P(x) = -0.5x^2 + 500x + 350$

$$R(x) - C(x)$$
$$(-0.5x^2 + 800x - 100) - (300x + 250)$$
$$-0.5x^2 + 800x - 100 - 300x - 250$$
$$-0.5x^2 + 500x - 350$$

17)

If the difference  $(3x^2 - 2x + 5) - (x^2 + 3x - 2)$  is multiplied by  $\frac{1}{2}x^2$ , what is the result, written in standard form?

$$\begin{aligned}
 & 3x^2 - 2x + 5 + x^2 - 3x + 2 \\
 & (4x^2 - 5x + 7) \cdot \frac{1}{2}x^2 \\
 & \boxed{2x^4 - 2.5x^3 + 3.5x^2}
 \end{aligned}$$

18)

A manufacturing company has developed a cost model,  $C(x) = 0.15x^3 + 0.01x^2 + 2x + 120$ , where  $x$  is the number of items sold, in thousands. The sales price can be modeled by  $S(x) = 30 - 0.01x$ . Therefore, revenue is modeled by  $R(x) = x \cdot S(x)$ .

The company's profit,  $P(x) = R(x) - C(x)$ , could be modeled by

- (1)  $0.15x^3 + 0.02x^2 - 28x + 120$
- (2)  $-0.15x^3 - 0.02x^2 + 28x - 120$
- (3)  $-0.15x^3 + 0.01x^2 - 2.01x - 120$
- (4)  $-0.15x^3 + 32x + 120$

$$\begin{aligned}
 R(x) &= x \cdot S(x) \\
 &= x(30 - 0.01x) \\
 &= 30x - 0.01x^2
 \end{aligned}$$

$$\begin{aligned}
 & R(x) - C(x) \\
 & (30x - 0.01x^2) - (0.15x^3 + 0.01x^2 + 2x + 120) \\
 & 30x - 0.01x^2 - 0.15x^3 - 0.01x^2 - 2x - 120 \\
 & -0.15x^3 - 0.02x^2 + 28x - 120
 \end{aligned}$$



