

## Adding and Subtracting Polynomials

**Simplify each expression.**

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

$$-3p^3 + 7p^2 - 3$$

2)  $(a^3 - 2a^2) - (3a^2 - 4a^3)$

$$5a^3 - 5a^2$$

3)  $(4 + 2n^3) + (5n^3 + 2)$

$$7n^3 + 6$$

4)  $(4n - 3n^3) - (3n^3 + 4n)$

$$-6n^3$$

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

$$a^2 - 3$$

6)  $(4r^3 + 3r^4) - (r^4 - 5r^3)$

$$2r^4 + 9r^3$$

7)  $(5a + 4) - (5a + 3)$

$$1$$

8)  $(3x^4 - 3x) - (3x - 3x^4)$

$$6x^4 - 6x$$

9)  $(-4k^4 + 14 + 3k^2) + (-3k^4 - 14k^2 - 8)$

$$-7k^4 - 11k^2 + 6$$

10)  $(3 - 6n^5 - 8n^4) - (-6n^4 - 3n - 8n^5)$

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

11)  $(12a^5 - 6a - 10a^3) - (10a - 2a^5 - 14a^4)$

$$14a^5 + 14a^4 - 10a^3 - 16a$$

12)  $(8n - 3n^4 + 10n^2) - (3n^2 + 11n^4 - 7)$

$$-14n^4 + 7n^2 + 8n + 7$$

13)  $(-x^4 + 13x^5 + 6x^3) + (6x^3 + 5x^5 + 7x^4)$

$$18x^5 + 6x^4 + 12x^3$$

14)  $(9r^3 + 5r^2 + 11r) + (-2r^3 + 9r - 8r^2)$

$$7r^3 - 3r^2 + 20r$$

15)  $(13n^2 + 11n - 2n^4) + (-13n^2 - 3n - 6n^4)$

$$-8n^4 + 8n$$

16)  $(-7x^5 + 14 - 2x) + (10x^4 + 7x + 5x^5)$

$$-2x^5 + 10x^4 + 5x + 14$$

17)  $(7 - 13x^3 - 11x) - (2x^3 + 8 - 4x^5)$

$4x^5 - 15x^3 - 11x - 1$

18)  $(13a^2 - 6a^5 - 2a) - (-10a^2 - 11a^5 + 9a)$

$5a^5 + 23a^2 - 11a$

19)  $(3v^5 + 8v^3 - 10v^2) - (-12v^5 + 4v^3 + 14v^2)$

$15v^5 + 4v^3 - 24v^2$

20)  $(8b^3 - 6 + 3b^4) - (b^4 - 7b^3 - 3)$

$2b^4 + 15b^3 - 3$

21)  $(k^4 - 3 - 3k^3) + (-5k^4 + 6k^3 - 8k^5)$

$-8k^5 - 4k^4 + 3k^3 - 3$

22)  $(-10k^2 + 7k + 6k^4) + (-14 - 4k^4 - 14k)$

$2k^4 - 10k^2 - 7k - 14$

23)  $(-7n^2 + 8n - 4) - (-11n + 2 - 14n^2)$

$7n^2 + 19n - 6$

24)  $(14p^4 + 11p^2 - 9p^5) - (-14 + 5p^5 - 11p^2)$

$-14p^5 + 14p^4 + 22p^2 + 14$

25)  $(8k + k^2 - 6) - (-10k + 7 - 2k^2)$

$3k^2 + 18k - 13$

26)  $(-9v^2 - 8u) + (-2uv - 2u^2 + v^2) + (-v^2 + 4uv)$

$-9v^2 + 2uv - 2u^2 - 8u$

27)  $(4x^2 + 7x^3y^2) - (-6x^2 - 7x^3y^2 - 4x) - (10x + 9x^2)$

$14x^3y^2 + x^2 - 6x$

28)  $(-5u^3v^4 + 9u) + (-5u^3v^4 - 8u + 8u^2v^2) + (-8u^4v^2 + 8u^3v^4)$

$-2u^3v^4 - 8u^4v^2 + 8u^2v^2 + u$

29)  $(-9xy^3 - 9x^4y^3) + (3xy^3 + 7y^4 - 8x^4y^4) + (3x^4y^3 + 2xy^3)$

$-8x^4y^4 - 6x^4y^3 + 7y^4 - 4xy^3$

30)  $(y^3 - 7x^4y^4) + (-10x^4y^3 + 6y^3 + 4x^4y^4) - (x^4y^3 + 6x^4y^4)$

$-9x^4y^4 - 11x^4y^3 + 7y^3$

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**Skills Practice**  
**Polynomials**

Determine whether each expression is a polynomial. If it is a polynomial, state the degree of the polynomial.

1.  $x^2 + 2x + 2$  **yes; 2**      2.  $\frac{b^2c}{d^4}$  **no**

**Simplify.**

4.  $(g + 5) + (2g + 7)$   
 **$3g + 12$**
6.  $(x^2 - 3x - 3) + (2x^2 + 7x - 2)$   
 **$3x^2 + 4x - 5$**
8.  $(4r^2 - 6r + 2) - (-r^2 + 3r + 5)$   
 **$5r^2 - 9r - 3$**
10.  $(5t - 7) + (2t^2 + 3t + 12)$   
 **$2t^2 + 8t + 5$**
12.  $-5(2c^2 - d^2)$   
 **$-10c^2 + 5d^2$**
14.  $2q(3pq + 4q^4)$   
 **$6pq^2 + 8q^5$**
16.  $m^2n^3(-4m^2n^2 - 2mnp - 7)$   
 **$-4m^4n^5 - 2m^3n^4p - 7m^2n^3$**
18.  $(c + 2)(c + 8)$   
 **$c^2 + 10c + 16$**
20.  $(a - 5)^2$   
 **$a^2 - 10a + 25$**
22.  $(r - 2s)(r + 2s)$   
 **$r^2 - 4s^2$**
24.  $(3 - 2b)(3 + 2b)$   
 **$9 - 4b^2$**
5.  $(5d + 5) - (d + 1)$   
 **$4d + 4$**
7.  $(-2f^2 - 3f - 5) + (-2f^2 - 3f + 8)$   
 **$-4f^2 - 6f + 3$**
9.  $(2x^2 - 3xy) - (3x^2 - 6xy - 4y^2)$   
 **$-x^2 + 3xy + 4y^2$**
11.  $(u - 4) - (6 + 3u^2 - 4u)$   
 **$-3u^2 + 5u - 10$**
13.  $x^2(2x + 9)$   
 **$2x^3 + 9x^2$**
15.  $8w(hk^2 + 10h^3m^4 - 6k^5u^3)$   
 **$8hk^2w + 80h^3m^4w - 48k^5u^3w$**
17.  $-3s^2y(-2s^4y^2 + 3sy^3 + 4)$   
 **$6s^6y^3 - 9s^3y^4 - 12s^2y$**
19.  $(z - 7)(z + 4)$   
 **$z^2 - 3z - 28$**
21.  $(2x - 3)(3x - 5)$   
 **$6x^2 - 19x + 15$**
23.  $(3y + 4)(2y - 3)$   
 **$6y^2 - y - 12$**
25.  $(3w + 1)^2$   
 **$9w^2 + 6w + 1$**

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**Practice (Average)**  
**Polynomials**

Determine whether each expression is a polynomial. If it is a polynomial, state the degree of the polynomial.

1.  $5x^3 + 2xy^4 + 6xy$  **yes; 5**      2.  $-\frac{4}{3}ac - a^5d^3$  **yes; 8**      3.  $\frac{12m^6n^9}{(m-n)^2}$  **no**
4.  $25x^3z - x\sqrt{78}$  **yes; 4**      5.  $6c^{-2} + c - 1$  **no**      6.  $\frac{5}{r} + \frac{6}{s}$  **no**

**Simplify.**

7.  $(3n^2 + 1) + (8n^2 - 8)$   
 **$11n^2 - 7$**
9.  $(-6n - 13n^2) + (-3n + 9n^2)$   
 **$-9n - 4n^2$**
11.  $(5m^3 - 2mp - 6p^2) - (-3m^2 + 5mp + p^2)$   
 **$8m^3 - 7mp - 7p^2$**
13.  $(5t - 7) + (2t^2 + 3t + 12)$   
 **$2t^2 + 8t + 5$**
15.  $-9(y^2 - 7w)$   
 **$-9y^2 + 63w$**
17.  $-6a^2w(a^3w - aw^4)$   
 **$-6a^5w^2 + 6a^3w^5$**
19.  $2x^2(x^2 + xy - 2y^2)$   
 **$2x^4 + 2x^3y - 4x^2y^2$**
21.  $(v^2 - 6)(v^2 + 4)$   
 **$v^4 - 2v^2 - 24$**
23.  $(y - 8)^2$   
 **$y^2 - 16y + 64$**
25.  $(5x + 4w)(5x - 4w)$   
 **$25x^2 - 16w^2$**
27.  $(w + 2s)(w^2 - 2ws + 4s^2)$   
 **$w^3 + 8s^3$**
8.  $(6w - 11w^2) - (4 + 7w^2)$   
 **$-18w^2 + 6w - 4$**
10.  $(8x^2 - 3x) - (4x^2 + 5x - 3)$   
 **$4x^2 - 8x + 3$**
12.  $(2x^2 - xy + y^2) + (-3x^2 + 4xy + 3y^2)$   
 **$-x^2 + 3xy + 4y^2$**
14.  $(u - 4) - (6 + 3u^2 - 4u)$   
 **$-3u^2 + 5u - 10$**
16.  $-9r^4y^2(-3r^7 + 2r^3y^4 - 8r^{10})$   
 **$27r^5y^9 - 18r^7y^6 + 72r^{14}y^2$**
18.  $5a^2w^3(a^2w^6 - 3a^4w^2 + 9aw^6)$   
 **$5a^4w^9 - 15a^6w^5 + 45a^3w^9$**
20.  $-\frac{3}{5}ab^3d^2(-5ab^2d^5 - 5ab)$   
 **$3a^2b^5d^7 + 3a^2b^4d^2$**
22.  $(7a + 9y)(2a - y)$   
 **$14a^2 + 11ay - 9y^2$**
24.  $(x^2 + 5y)^2$   
 **$x^4 + 10x^2y + 25y^2$**
26.  $(2n^4 - 3)(2n^4 + 3)$   
 **$4n^8 - 9$**
28.  $(x + y)(x^2 - 3xy + 2y^2)$   
 **$x^3 - 2x^2y - xy^2 + 2y^3$**

29. **BANKING** Terry invests \$1500 in two mutual funds. The first year, one fund grows 3.8% and the other grows 6%. Write a polynomial to represent the amount Terry's \$1500 grows to in that year if  $x$  represents the amount he invested in the fund with the lesser growth rate.  **$-0.022x + 1590$**

30. **GEOMETRY** The area of the base of a rectangular box measures  $2x^2 + 4x - 3$  square units. The height of the box measures  $x$  units. Find a polynomial expression for the volume of the box.  **$2x^3 + 4x^2 - 3x$  units<sup>3</sup>**

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### 5-3 Skills Practice

#### Dividing Polynomials

Simplify.

- $\frac{10c + 6}{2} \cdot 5c + 3$
- $\frac{12x + 20}{4} \cdot 3x + 5$
- $\frac{15y^3 + 6y^2 + 3y}{3y} \cdot 5y^2 + 2y + 1$
- $\frac{12x^2 - 4x - 8}{4x} \cdot 3x - 1 - \frac{x}{x}$
- $(15q^6 + 5q^2)(5q^4)^{-1}$   
 $3q^2 + \frac{1}{q}$
- $(6j^2k - 9jk^2) \div 3jk$   
 $2j - 3k$
- $(n^2 + 7n + 10) \div (n + 5)$   
 $n + 2$
- $(2s^2 + 13s + 15) \div (s + 5)$   
 $2s + 3$
- $(4g^2 - 9) \div (2g + 3)$   
 $2g - 3$
- $\frac{y^2 + 5y - 12}{u - 3} \cdot \frac{u + 8 + \frac{12}{u-3}}{u-3}$
- $(3v^2 - 7v - 10)(v - 4)^{-1}$   
 $3v + 5 + \frac{10}{v-4}$
- $\frac{y^3 - y^2 - 6}{y + 2} \cdot \frac{y^2 - 3y + 6 - \frac{18}{y+2}}{y^2 - 3y + 6 - \frac{18}{y+2}}$
- $(4p^3 - 3p^2 + 2p) \div (p - 1)$   
 $4p^2 + p + 3 + \frac{3}{p-1}$
28. **GEOMETRY** The area of a rectangle is  $x^3 + 8x^2 + 13x - 12$  square units. The width of the rectangle is  $x + 4$  units. What is the length of the rectangle?  $x^2 + 4x - 3$  units

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### 5-3 Practice (Average)

#### Dividing Polynomials

Simplify.

- $\frac{15r^{10} - 5r^8 + 40r^2}{5r^4} \cdot 3r^6 - r^4 + \frac{8}{r^2}$
- $\frac{6k^2m - 12k^3m^2 + 9m^3}{2km^2} \cdot 3k - 6k^2 + \frac{9m}{2k}$
- $(-30x^3y + 12x^2y^2 - 18xy^3) \div (-6x^2y)$   
 $5x - 2y + 3$
- $(4a^3 - 8a^2 + a^2)(4a)^{-1}$   
 $a^2 - 2a + \frac{1}{4}$
- $\frac{f^2 + 7f + 10}{f + 2} \cdot f + 5$
- $(a^3 - 6a) \div (a - 4) \cdot a^2 + 4a + 16$
- $\frac{2x^3 + 6x + 152}{x + 4} \cdot 2x^2 - 8x + 38$
- $(3w^3 - 2w + 2 - \frac{3}{w+3}) \div (w + 3)$   
 $3w^2 - 2w + 2 - \frac{3}{w+3}$
- $(x^4 - 3x^3 - 11x^2 + 3x + 10) \div (x - 5)$   
 $x^3 + 2x^2 - x - 2$
- $(x^4 - 3x^3 + 5x - 6)(x + 2)^{-1}$   
 $x^3 - 5x^2 + 10x - 15 + \frac{24}{x+2}$
- $\frac{4x^2 - 2x + 6}{2x - 3} \cdot \frac{12}{2x + 2} + \frac{2x - 3}{2x + 2}$
- $(2r^3 + 5r^2 - 2r - 15) \div (2r - 3)$   
 $r^2 + 4r + 5$
- $\frac{4p^4 - 17p^3 + 14p - 3}{2p - 3} \cdot 2p^3 + 3p^2 - 4p + 1$
- $(6y^4 + 15y^3 - 28y - 6) \div (y + 2)$   
 $6y^3 + 3y^2 - 6y - 16 + \frac{26}{y+2}$
- $(3m^5 + m - 1) \div (m + 1)$   
 $3m^4 - 3m^3 + 3m^2 - 3m + 4 - \frac{5}{m+1}$
- $(6y^2 - 5y - 15)(2y + 3)^{-1}$   
 $3y - 7 + \frac{2y + 3}{6}$
- $\frac{6x^2 - x - 7}{3x + 1} \cdot 2x - 1 - \frac{6}{3x + 1}$
- $(6y^3 + 5y^2 - 2y + 1) \div (3t + 1)$   
 $2t^2 + t - 1 + \frac{3t + 1}{2}$
- $\frac{2h^4 - h^3 + h^2 + h - 3}{h^2 - 1} \cdot 2h^2 - h + 3$
25. **GEOMETRY** The area of a rectangle is  $2x^2 - 11x + 15$  square feet. The length of the rectangle is  $2x - 5$  feet. What is the width of the rectangle?  $x - 3$  ft
26. **GEOMETRY** The area of a triangle is  $15x^4 + 3x^3 + 4x^2 - x - 3$  square meters. The length of the base of the triangle is  $6x^2 - 2$  meters. What is the height of the triangle?  
 $5x^2 + x + 3$  m

Lesson 5-3