

*Difference of Perfect Squares*—Factor into the product of two binomials (or trinomials).

1. a)  $x^2 - 49$                       b)  $4b^2 - 121$                       c)  $9m^2 - 64$                       d)  $81f^2 - 16$   
e)  $25y^2 - 144$                       f)  $49x^2 - 36$                       g)  $16 - 81y^2$                       h)  $169 - 16t^2$   
i)  $100m^2 - 49$                       j)  $64b^2 - 1$                       k)  $121a^2 - 400$                       l)  $b^4 - 25$   
m)  $25p^4 - 81$                       n)  $144m^6 - 49$                       o)  $36 - 121y^{10}$                       p)  $1 - 25q^{16}$
2. a)  $4s^2 - 9t^2$                       b)  $16x^2 - 49y^2$                       c)  $81a^2 - 64b^2$                       d)  $p^2 - 36t^2$   
e)  $121c^2 - 100d^2$                       f)  $25m^2 - 169n^2$                       g)  $4e^2 - 225f^2$                       h)  $16m^2 - 81n^2$   
i)  $64x^2 - 225y^2$                       j)  $49a^4 - 121b^4$                       k)  $(x - y)^2 - z^2$                       l)  $(2a + b)^2 - 81$

*Three Factors*—Factor as the product of a monomial and two binomials.

3. a)  $2x^2 + 12x + 10$                       b)  $5a^2 - 10a - 40$                       c)  $10n^2 + 10n - 20$   
d)  $4a^2 - 16a - 20$                       e)  $3x^2 + 15x + 18$                       f)  $7a^2 - 35a + 42$   
g)  $x^3 - 2x^2 - 3x$                       h)  $a^3 - 8a^2 - 9a$                       i)  $2y^3 + 14y^2 + 20y$   
j)  $3x^3 + 6x^2 - 24x$                       k)  $10n^5 + 50n^4 + 60n^3$                       l)  $3x^5 - 9x^3 - 84x$
4. a)  $8m^2 - 72$                       b)  $6x^2 - 150$                       c)  $20x^2 - 5y^2$   
d)  $18b^2 - 128$                       e)  $12a^2 - 75$                       f)  $18p^2 - 98$   
g)  $144y^2 - 81z^2$                       h)  $36b^{12} - 100c^2$                       i)  $(5m - 2)^2 - (3m - 4)^2$   
j)  $63a^2b - 28b$                       k)  $75s^2t^2 - 27t^2$                       l)  $2x^3 - 18x$   
m)  $2a^4 - 242a^2$                       n)  $x^8 - 25x^6$                       o)  $a^3b^3 - 49ab^5$

*Factor mixture*—Factor fully.

5. a)  $\frac{1}{4}x^2 - \frac{4}{9}$                       b)  $\frac{1}{9} - \frac{1}{16}x^2$                       c)  $\frac{4}{25}x^2 - \frac{9}{64}y^2$   
d)  $x^4 - 1$                       e)  $a^4 - 16$                       f)  $16c^4 - 1$   
g)  $x^4 - 13x^2 + 36$                       h)  $a^4 - 17a^2 + 16$                       i)  $y^4 - 72y^2 + 1296$

1. Factor:

- |                            |                              |                            |
|----------------------------|------------------------------|----------------------------|
| a) $ax + ay + bx + by$     | b) $3b + 3c + ab + ac$       | c) $x^3 + 3x^2 - x - 3$    |
| d) $4x^3 + 8x^2 - x - 2$   | e) $x^2 - x - xy + y$        | f) $xy - 2y + 3x - 6$      |
| g) $a^3 - 11a^2 + 5a - 55$ | h) $10x^4 + 20x^3 + 9x + 18$ | i) $3ax + 12a - 5bx - 20b$ |
| j) $kx - 2ky - rx + 2ry$   | k) $x^2 - xy + xz - yz$      | l) $yz - xy + y^2 - xz$    |

2. Factor – it may be necessary to rearrange terms and extract common factors:

- |                               |                               |                                    |
|-------------------------------|-------------------------------|------------------------------------|
| a) $a^4 + 10a^3 + 2a^2 + 20a$ | b) $30x^4 + 60x^3 + 27x + 54$ | c) $b^5 - 6b^4 - 4b^3 + 24b^2$     |
| d) $x^2y^2 + 3x^2 + 6 + 2y^2$ | e) $fhx + fhy + ghx + ghy$    | f) $a^2 + xy - ax - ay$            |
| g) $1 + bx + x + b$           | h) $6ab - d^2 - 3bd + 2ad$    | i) $8a^2x - 12aby - 12a^2y + 8abx$ |
| j) $2cx - 4dy + 2cy - 4dx$    |                               |                                    |

3. Factor:

- |   |  |
|---|--|
| a) $x^7 + 3x^6 + 5x^5 + 2x^2 + 6x + 10$                   | b) $3x^9 - 12x^3 - 2x^8 + 8x^2 - 5x^6 + 20$                      |
| c) $x^8 + 3x^7 + 2x^6 - x^5 - 3x^4 - 2x^3 - x^2 - 3x - 2$ | d) $6x^{12} - 18x^9 + 18x^8 - 54x^5 - 36x^3 + 108$               |
| e) $x^4 + 2x^3y + x^2y^2 - x^2y^2 - 2xy^3 - y^4$          | f) $2x^{16} - 8x^{14} + 6x^{12} - 4x^7 + 16x^5 - 12x^3$          |
| g) $4x^{12} - 12x^7 + 8x^2 - x^{10} + 3x^5 - 2$           | h) $8x^{13} + 12x^{12} + 16x^9 + 24x^8 + 6x^5 + 9x^4 + 12x + 18$ |

4. Factor:

- |                      |                        |                          |
|----------------------|------------------------|--------------------------|
| a) $(x-1)^2 + x - 1$ | b) $(x+1)^2 + 3x + 3$  | c) $(a+2)^2 - 2a^2 - 4a$ |
| d) $(x-y)^2 - x + y$ | e) $(ab-1)^2 - ab + 1$ | f) $(x-a)^4 + (x-a)^5$   |

**Answers:**

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|---------------------------------|-----------------------------------|-------------------------|------------------------|
| 1. a) $(x+y)(a+b)$              | b) $(a+3)(b+c)$                   | c) $(x+3)(x+1)(x-1)$    | d) $(x+2)(2x-1)(2x+1)$ |
| e) $(x-y)(x-1)$                 | f) $(x-2)(y+3)$                   | g) $(a-11)(a^2+5)$      | h) $(x+2)(10x^3+9)$    |
| i) $(x+4)(3a-5b)$               | j) $(k-r)(x-2y)$                  | k) $(x-y)(x+z)$         | l) $(y-x)(y+z)$        |
| 2. a) $a(a+10)(a^2+2)$          | b) $3(x+2)(10x^3+9)$              | c) $b^2(b-6)(b-2)(b+2)$ | d) $(x^2+2)(y^2+3)$    |
| e) $h(f+g)(x+y)$                | f) $(a-x)(a-y)$                   | g) $(b+1)(x+1)$         | h) $(2a-d)(3b+d)$      |
| i) $4a(a+b)(2x-3y)$             | j) $2(c-2d)(x+y)$                 |                         |                        |
| 3. a) $(x^5+2)(x^2+3x+5)$       | b) $(x^3+2)(x^3-2)(3x^3-2x^2-5)$  |                         |                        |
| c) $(x+1)(x+2)(x^6-x^3-1)$      | d) $6(x^3-3)(x^9+3x^5-6)$         |                         |                        |
| e) $(x-y)(x+y)^3$               | f) $2x^3(x^9-2)(x^2-3)(x-1)(x+1)$ |                         |                        |
| g) $(2x+1)(2x-1)(x^5-2)(x^5-1)$ | h) $(4x^8+3)(x^4+2)(2x+3)$        |                         |                        |
| 4. a) $x(x-1)$                  | b) $(x+1)(x+4)$                   | c) $(2-a)(a+2)$         | d) $(x-y)(x-y-1)$      |
| e) $(ab-1)(ab-2)$               | f) $(x-a)^4(1+x-a)$               |                         |                        |