# Factoring the Difference of Two Squares

$$a^2 - 36 = (a + 6)(a - 6)$$
$$3x^2 - 48 = 3(x^2 - 16) = 3(x + 4)(x - 4)$$

Factor, write prime if prime.

1. $x^2 - 1$

2. $x^2 - 9$

3. $x^2 + 4$

4. $x^2 - 25$

5. $9y^2 - 16$

6. $4x^2 - 25$

7. $9x^2 - 1$

8. $a^2 - x^2$

9. $25 - m^2$

10. $x^2 - 16y^2$

11. $25m^2 - n^2$

12. $-x^2 + 16$

13. $36m^2 - 121$

14. $2x^2 - 8$

15. $25 + 4x^2$

16. $4a^2 - 81b^2$

17. $12x^2 - 75$

18. $a^2b - b^3$

19. $-98 + 2x^2$

20. $5x^2 - 45y^2$

21. $9x^4 - 4$

22. $16x^4 - y^2$

Factor, write prime if prime.

1. $x^2 - 1$

$(x+1)(x-1)$

2. $x^2 - 9$

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

3. $x^2 + 4$

prime

4. $x^2 - 25$

$(x+5)(x-5)$

5. $9y^2 - 16$

$(3y+4)(3y-4)$

6. $4x^2 - 25$

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

7. $9x^2 - 1$

$(3x+1)(3x-1)$

8. $a^2 - x^2$

$(a+x)(a-x)$

9. $25 - m^2$

$(5+m)(5-m)$

10. $x^2 - 16y^2$

$(x+4y)(x-4y)$

11. $25m^2 - n^2$

$(5m+n)(5m-n)$

12. $-x^2 + 16$

$(4+x)(4-x)$

13. $36m^2 - 121$

$(6m+11)(6m-11)$

14. $2x^2 - 8$

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

15. $25 + 4x^2$

prime

16. $4a^2 - 81b^2$

$(2a+9b)(2a-9b)$

17. $12x^2 - 75$

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

18. $a^2b - b^3$

$b(a+b)(a-b)$

19. $-98 + 2x^2$

$2(x+7)(x-7)$

20. $5x^2 - 45y^2$

$5(x+3y)(x-3y)$

21. $9x^4 - 4$

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

22. $16x^4 - y^2$

$(4x^2+y)(4x^2-y)$

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## Factoring Perfect Square Trinomials

$$x^2 - 14x + 49 = (x - 7)^2$$

Factor, write prime if prime.

1. $x^2 + 8x + 16$

2. $x^2 - 16x + 64$

3. $y^2 + 12y + 36$

4. $a^2 - 10a + 25$

5. $16y^2 + 8y + 1$

6. $9x^2 - 6x + 1$

7. $25x^2 + 10x + 1$

8. $n^2 - 14n + 49$

9. $81x^2 - 90x + 25$

10. $4y^2 - 20y + 25$

11. $25a^2 + 60a + 36$

12. $16 + 40x + 25x^2$

13. $16x^2 + 24x + 9$

14. $49x^2 - 14x + 1$

15. $9y^2 - 30y + 25$

16. $n^2 + 2n + 4$

17. $b^2 + 2b + 1$

18. $36x^2 + 84x + 49$

19. $81 - 18x + x^2$

20. $4 - 12y + 9y^2$

Factor, write prime if prime.

1. $x^2 + 8x + 16$
$(x+4)^2$

2. $x^2 - 16x + 64$
$(x-8)^2$

3. $y^2 + 12y + 36$
$(y+6)^2$

4. $a^2 - 10a + 25$
$(a-5)^2$

5. $16y^2 + 8y + 1$
$(4y+1)^2$

6. $9x^2 - 6x + 1$
$(3x-1)^2$

7. $25x^2 + 10x + 1$
$(5x+1)^2$

8. $n^2 - 14n + 49$
$(n-7)^2$

9. $81x^2 - 90x + 25$
$(9x-5)^2$

10. $4y^2 - 20y + 25$
$(2y-5)^2$

11. $25a^2 + 60a + 36$
$(5a+6)^2$

12. $16 + 40x + 25x^2$
$(4+5x)^2$

13. $16x^2 + 24x + 9$
$(4x+3)^2$

14. $49x^2 - 14x + 1$
$(7x-1)^2$

15. $9y^2 - 30y + 25$
$(3y-5)^2$

16. $n^2 + 2n + 4$
prime

17. $b^2 + 2b + 1$
$(b+1)^2$

18. $36x^2 + 84x + 49$
$(6x+7)^2$

19. $81 - 18x + x^2$
$(x-9)^2$

20. $4 - 12y + 9y^2$
$(3y-2)^2$

## Extra: Factoring by Grouping

$$6ax - 2b - 3a + 4bx = 6ax - 3a + 4bx - 2b$$
$$= 3a(2x - 1) + 2b(2x - 1)$$
$$= (2x - 1)(3a + 2b)$$

1. $x^2 + 2x + xy + 2y$

2. $3a^2 - 2b - 6a + ab$

3. $t^3 - t^2 + \underline{t - 1}$
   Hint: $t - 1 = 1(t - 1)$

4. $10 + 2t - 5s - st$

5. $\frac{2}{3}bc - \frac{14}{3}b + c - 7$

6. $4u^2 + v + 2uv + 2u$

7. $ad + 3a - d^2 - 3d$

8. $n^2 + 2n + 3mn + 6m$

9. $2ax^2 + bx^2 - 2ay^2 - by^2$

10. $yz^2 - y^3 + z^3 - y^2z$

11. $y^3 - y^2 - 4y + 4$

12. $x^2a + x^2b - 16a - 16b$

13. $x^3 + x^2 - x - 1$

14. $a^3 - a^2 - 8a + 8$

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# Answers

1. $x^2 + 2x + xy + 2y$

$$(x+2)(x+y)$$

2. $3a^2 - 2b - 6a + ab$

$$(a+2)(3a+b)$$

3. $t^3 - t^2 + \underline{t - 1}$

Hint: $t - 1 = 1(t - 1)$

$$(t-1)(t^2+1)$$

4. $10 + 2t - 5s - st$

$$(2-s)(t+5)$$

5. $\frac{2}{3}bc - \frac{14}{3}b + c - 7$

$$(c-7)\left(\frac{2}{3}b+1\right)$$

5. $4u^2 + v + 2uv + 2u$

$$(2u+1)(2u+v)$$

7. $ad + 3a - d^2 - 3d$

$$(a-d)(d+3)$$

8. $n^2 + 2n + 3mn + 6m$

$$(n+3m)(n+2)$$

9. $2ax^2 + bx^2 - 2ay^2 - by^2$

$$(x-y)(x+y)(2a+b)$$

10. $yz^2 - y^3 + z^3 - y^2z$

$$(z-y)(z+y)^2$$

11. $y^3 - y^2 - 4y + 4$

$$(y+2)(y-2)(y-1)$$

12. $x^2a + x^2b - 16a - 16b$

$$(x+4)(x-4)(a+b)$$

13. $x^3 + x^2 - x - 1$

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

14. $a^3 - a^2 - 8a + 8$

$$(a-1)(a^2-8)$$

## Factoring: Putting It All Together

$$5x^2 + 20x - 60 = 5(x^2 + 4x - 12) = 5(x + 6)(x - 2)$$

Factor completely, write prime if prime.

1. $2x^2 - 8$

2. $2x^2 + 8x + 6$

3. $3n^2 + 9n - 30$

4. $6x^2 - 26x - 20$

5. $2x^2 + 12x - 80$

6. $5t^2 + 15t + 10$

7. $8n^2 - 18$

8. $14x^2 + 7x - 21$

9. $4x^2 + 16x + 16$

10. $18x + 12x^2 + 2x^3$

11. $2x - 2xy^2$

12. $3t^3 - 27t$

13. $24a^2 - 30a + 9$

14. $10x^2 + 15x - 10$

15. $3x^2 - 42x + 147$

16. $4x^4 - 4x^2$

# Answers

## Factoring: Putting It All Together

$$5x^2 + 20x - 60 = 5(x^2 + 4x - 12) = 5(x + 6)(x - 2)$$

Factor completely, write prime if prime.

1. $2x^2 - 8$

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

2. $2x^2 + 8x + 6$

   $2(x+3)(x+1)$

3. $3n^2 + 9n - 30$

   $3(n+5)(n-2)$

4. $6x^2 - 26x - 20$

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

5. $2x^2 + 12x - 80$

   $2(x+10)(x-4)$

6. $5t^2 + 15t + 10$

   $5(t+1)(t+2)$

7. $8n^2 - 18$

   $2(2n+3)(2n-3)$

8. $14x^2 + 7x - 21$

   $7(2x+3)(x-1)$

9. $4x^2 + 16x + 16$

   $4(x+2)^2$

10. $18x + 12x^2 + 2x^3$

    $2x(x+3)^2$

11. $2x - 2xy^2$

    $2x(1+y)(1-y)$

12. $3t^3 - 27t$

    $3t(t+3)(t-3)$

13. $24a^2 - 30a + 9$

    $3(2a-1)(4a-3)$

14. $10x^2 + 15x - 10$

    $5(2x-1)(x+2)$

15. $3x^2 - 42x + 147$

    $3(x-7)^2$

16. $4x^4 - 4x^2$

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

## Solving Equations Using Factoring

1. Rewrite equation in standard form (one member equals 0).
2. Factor completely.
3. Set each factor equal to 0; then solve.
4. Check results in original equation.

$$x^2 - 7x + 12 = 0$$
$$(x - 4)(x - 3) = 0$$
$$x - 4 = 0 \text{ or } x - 3 = 0$$
$$x = 4 \qquad x = 3$$
$$x = 3, 4$$

$$v^3 = 10v - 3v^2$$
$$v^3 + 3v^2 - 10v = 0$$
$$v(v^2 + 3v - 10) = 0$$
$$v(v + 5)(v - 2) = 0$$
$$v = 0 \text{ or } v + 5 = 0 \text{ or } v - 2 = 0$$
$$v = -5 \qquad v = 2$$
$$v = -5, 0, 2$$

1. $x^2 - 5x - 6 = 0$

2. $v^3 - 4v = 0$

3. $n^2 - 16n = 0$

4. $x^2 + 9 = 10x$

5. $6x^2 = 16x - 8$

6. $s^2 = 56s - s^3$

7. $3y^2 + 2y - 1 = 0$

8. $u^3 = 14u^2 + 32u$

9. $23p = 5p^2 + 24$

10. $x^2 - 3x - 10 = 0$

11. $y^2 = 49$

12. $y^2 = -7y - 10$

13. $x^2 = 8x$

14. $3x^2 - 2 = x^2 + 6$

15. $4y^2 = -4y - 1$

16. $5x^2 - 2x - 3 = 0$