

Factoring Polynomials: practice solutions, Grade 9 – download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Finding the GCF



Coefficients: GCF of 12 and 18 is 6. Variable a : smallest exponent is 1. Variable b : smallest exponent is 1.

The GCF is $6ab$. Check: $12a^2b = 6ab \cdot 2a$ and $18ab^3 = 6ab \cdot 3b^2$.

2 Factoring out a GCF



a) GCF 5: $5(3x + 5)$.

b) GCF $4y$: $4y(2y - 3)$.

c) GCF $3m^2$: $3m^2(3m + 2)$.

3 Easy trinomials



a) Product 10, sum 7: 2 and 5, so $(x + 2)(x + 5)$.

b) Product 21, sum 10: 3 and 7, so $(x + 3)(x + 7)$.

c) Product 24, sum 11: 3 and 8, so $(x + 3)(x + 8)$.

4 Trinomials with negative terms



- a) Product -12 , sum -1 : -4 and 3 , so $(x - 4)(x + 3)$.
- b) Product -15 , sum 2 : 5 and -3 , so $(x + 5)(x - 3)$.
- c) Product 14 , sum -9 : -2 and -7 , so $(x - 2)(x - 7)$.

5 Differences of squares



- a) $x^2 - 9^2 = (x - 9)(x + 9)$.
- b) $(2y)^2 - 5^2 = (2y - 5)(2y + 5)$.
- c) $10^2 - n^2 = (10 - n)(10 + n)$.

6 Reading factored equations



- a) $x - 4 = 0$ or $x + 9 = 0$: $x = 4$ or $x = -9$.
- b) $x = 0$ or $2x - 7 = 0$: $x = 0$ or $x = \frac{7}{2}$.
- c) $3x + 6 = 0$ gives $x = -2$; $x - 1 = 0$ gives $x = 1$.

7 True or false?



- a) False. $(x + 4)(x - 4) = x^2 - 16$, not $x^2 + 16$; a sum of squares does not factor this way.
- b) True. $3(2x + 3) = 6x + 9$.
- c) True. $(x + 5)^2 = x^2 + 10x + 25$.

8 Factor completely



The GCF is $6x$: $12x^3 - 18x^2 + 30x = 6x(2x^2 - 3x + 5)$.

The trinomial $2x^2 - 3x + 5$ has $ac = 10$ and no pair of integers with product 10 and sum -3 , so it is prime. The complete factorization is $6x(2x^2 - 3x + 5)$.

9 Grouping practice



a) $x^2(x + 5) + 2(x + 5) = (x + 5)(x^2 + 2)$.

b) $3a(b + 2) - 4(b + 2) = (b + 2)(3a - 4)$. Expanding: $3ab - 4b + 6a - 8$, which matches.

10 Larger constants



a) Product -54 , sum -3 : -9 and 6 , so $(x - 9)(x + 6)$.

b) Product -56 , sum 1 : 8 and -7 , so $(x + 8)(x - 7)$.

11 The ac method



a) $ac = 6$, sum 7 : 6 and 1 . $2x^2 + 6x + x + 3 = 2x(x + 3) + (x + 3) = (x + 3)(2x + 1)$.

b) $ac = 30$, sum -17 : -15 and -2 .

$$5x^2 - 15x - 2x + 6 = 5x(x - 3) - 2(x - 3) = (x - 3)(5x - 2).$$

12 GCF and squares together



a) $(3x)^2 - 7^2 = (3x - 7)(3x + 7)$.

b) Factor out 2 first: $2(25x^2 - 1) = 2(5x - 1)(5x + 1)$.

13 Perfect square trinomials



- a) $x^2 - 2 \cdot 6x + 6^2 = (x - 6)^2$.
- b) Middle term: $2 \cdot 7x \cdot 2 = 28x$, so $(7x + 2)^2$.
- c) Middle term: $2 \cdot 3y \cdot 4 = 24y$, so $(3y - 4)^2$.

14 First equations



- a) $(x - 3)(x - 5) = 0$, so $x = 3$ or $x = 5$.
- b) Move 28: $x^2 + 3x - 28 = 0$, so $(x + 7)(x - 4) = 0$ and $x = -7$ or $x = 4$. Check $x = 4$: $16 + 12 = 28$. Check $x = -7$: $49 - 21 = 28$.

15 Reading a graph



- a) The graph crosses the x-axis at $x = -2$ and $x = 4$.
- b) Product -8 , sum -2 : -4 and 2 , so $x^2 - 2x - 8 = (x - 4)(x + 2)$, which is zero at $x = 4$ and $x = -2$.
- c) At $x = 0$, $y = -8$; this equals the constant term.

16 Garden dimensions



- a) Product 14, sum 9: 2 and 7, so area = $(x + 2)(x + 7)$. The dimensions are $x + 2$ m and $x + 7$ m.
- b) For $x = 3$: width 5 m, length 10 m. Check the area: $5 \cdot 10 = 50$ and $9 + 27 + 14 = 50$. Perimeter = $2(5 + 10) = 30$ m (about 98.4 ft).

17 A trinomial equation

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$ac = -12$, sum 1: 4 and -3 .

$$6x^2 + 4x - 3x - 2 = 2x(3x + 2) - (3x + 2) = (3x + 2)(2x - 1).$$

Then $x = -\frac{2}{3}$ or $x = \frac{1}{2}$.

18 Squares and common factors

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a) $4x^2 - 25 = 0$, $(2x - 5)(2x + 5) = 0$, so $x = \pm \frac{5}{2}$.

b) $3x^2 - 12x = 0$, $3x(x - 4) = 0$, so $x = 0$ or $x = 4$. Dividing by x would have lost $x = 0$.

19 Consecutive integers

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Let the integers be n and $n + 1$. Then $n(n + 1) = 156$, so $n^2 + n - 156 = 0$.

Product -156 , sum 1: 13 and -12 . $(n + 13)(n - 12) = 0$, so $n = -13$ or $n = 12$.

Only $n = 12$ is positive. The integers are 12 and 13, and $12 \cdot 13 = 156$.

20 A launched ball

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Set $-16t^2 + 64t + 80 = 0$. Factor out -16 : $-16(t^2 - 4t - 5) = 0$, so

$$-16(t - 5)(t + 1) = 0.$$

Thus $t = 5$ or $t = -1$. A negative time makes no sense here, so the ball lands after 5 seconds. Check: $-16 \cdot 25 + 64 \cdot 5 + 80 = -400 + 320 + 80 = 0$.

21 Find the error



The zero product property works only when the product equals 0, not 14.

Expand and set to zero: $x^2 + x - 6 = 14$, so $x^2 + x - 20 = 0$, $(x + 5)(x - 4) = 0$.

Hence $x = -5$ or $x = 4$.

Check: $x = 4$: $2 \cdot 7 = 14$. $x = -5$: $(-7)(-2) = 14$.

22 Which values of k?



We need integers p and q with $pq = 12$; then $k = p + q$.

Pairs: (1, 12), (2, 6), (3, 4) give sums 13, 8, 7. Pairs (-1, -12), (-2, -6), (-3, -4) give sums -13, -8, -7.

So $k \in \{-13, -8, -7, 7, 8, 13\}$.



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