Year 9 algebra worksheet

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Name: _____ Date: _____

Question 1

Write an algebraic expression for each of the following.

(a) 7 more than the product of 3 and x

(b) the sum of a and b, divided by 4

(c) half of the square of m

Answer: _____

Question 2

Simplify:

(a) 4ab - 7ab + 2ab

(b) $3x^2 + 5x - x^2 - 8x$

Answer: _____

Question 3

Expand and simplify:

(a) -2x(3x - 5)

(b) 4(2a - 3) - 5(a - 2)

Answer: _____

Question 4

Expand and simplify (x + 5)(x - 3).

Answer: _____

Question 5

Expand $(x + 7)^2$.

Answer: _____

Question 6

Factorise fully:

(a) 15x - 25 (b) 12ab + 18a (c) $-4m^2 - 10m$

Answer: _____

Question 7

Factorise $x^2 - x - 12$.

Answer: _____

Question 8

Evaluate $3a^2 - 2b$ when $a = -2$ and $b = 5$.

Answer: _____

Question 9

Simplify:

(a) $-3m \times 4mn$

(b) $18x^2y \div (6xy)$

Answer: _____

Question 10

Rectangle A measures $3x$ cm by $(x + 2)$ cm. Rectangle B measures x cm by $(2x - 5)$ cm, where $x > 2.5$.

(a) Write an expanded expression for the area of each rectangle.

(b) Find a simplified expression for the total area of the two rectangles.

(c) Find a simplified expression for how much larger the area of A is than the area of B.

(d) Use your answer to (b) to find the total area when $x = 4$.

Answer: _____

Year 9 algebra: answers and worked solutions

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Question 1

Key idea: Translate each phrase in order: "product" means multiply, "sum" means add, and "square" means raise to the power 2.

1. (a) The product of 3 and x is 3x; 7 more than this is 3x + 7 2. (b) The sum of a and b is a + b; divided by 4 gives (a + b)/(4) 3. (c) The square of m is m^2; half of it is $(m^2)/(2)$

Answer: (a) 3x + 7 (b) (a + b)/(4) (c) $(m^2)/(2)$

Question 2

Key idea: Only like terms (same pronumerals with the same powers) can be added or subtracted.

1. (a) 4 - 7 + 2 = -1, so 4ab - 7ab + 2ab = -ab 2. (b) x^2 terms: $3x^2 - x^2 = 2x^2$; x terms: 5x - 8x = -3x, giving $2x^2 - 3x$

Answer: (a) -ab (b) $2x^2 - 3x$

Question 3

Key idea: Multiply every term inside the brackets by the term outside, taking care with negative signs, then collect like terms.

1. (a) $-2x \times 3x = -6x^2$ and $-2x \times (-5) = 10x$, so $-6x^2 + 10x$ 2. (b) 4(2a - 3) = 8a - 12 and -5(a - 2) = -5a + 10 3. (b) 8a - 12 - 5a + 10 = 3a - 2

Answer: (a) $-6x^2 + 10x$ (b) 3a - 2

Question 4

Key idea: Use the distributive law (FOIL) to multiply every term in the first bracket by every term in the second bracket, then collect like terms.

1. Multiply the First terms: $x \times x = x^2$ 2. Multiply the Outer terms: $x \times (-3) = -3x$ 3. Multiply the Inner terms: $5 \times x = 5x$ 4. Multiply the Last terms: $5 \times (-3) = -15$ 5. Collect like terms: $x^2 - 3x + 5x - 15 = x^2 + 2x - 15$

Answer: $x^2 + 2x - 15$

Question 5

Key idea: $(a + b)^2 = a^2 + 2ab + b^2$.

1. $x^2 + 2 \times x \times 7 + 7^2$ 2. $= x^2 + 14x + 49$

Answer: $x^2 + 14x + 49$

Question 6

Key idea: Take out the highest common factor (HCF) of the numbers and the pronumerals. If the first term is negative, take out a negative factor.

1. (a) HCF = 5: $15x - 25 = 5(3x - 5)$ 2. (b) HCF = 6a: $12ab + 18a = 6a(2b + 3)$ 3. (c) HCF = -2m: $-4m^2 - 10m = -2m(2m + 5)$

Answer: (a) $5(3x - 5)$ (b) $6a(2b + 3)$ (c) $-2m(2m + 5)$

Question 7

Key idea: Find two integers that multiply to the constant term and add to the coefficient of x. Write the expression as a product of two binomial factors.

1. Find two numbers that multiply to -12 and add to -1. 2. Test factor pairs of -12: $3 \times (-4) = -12$ and $3 + (-4) = -1$. ✓ 3. Write the factorised form: $(x + 3)(x - 4)$ 4. Check by expanding: $(x + 3)(x - 4) = x^2 - 4x + 3x - 12 = x^2 - x - 12$ ✓

Answer: $(x + 3)(x - 4)$

Question 8

Key idea: Substitute each value in brackets, then follow the order of operations (powers first).

1. $3(-2)^2 - 2(5) = 3 \times 4 - 10$ 2. $= 12 - 10 = 2$

Answer: 2

Question 9

Key idea: Multiply or divide the numbers first, then the pronumerals. $m \times m = m^2$, and a pronumeral divided by itself is 1.

1. (a) $-3 \times 4 = -12$ and $m \times m \times n = m^2n$, so $-12m^2n$ 2. (b) $(18x^2y)/(6xy) = 18/6 \times (x^2)/(x) \times y/y = 3 \times x \times 1 = 3x$

Answer: (a) $-12m^2n$ (b) $3x$

Question 10

Key idea: Area of a rectangle = length × width. Expand each product, then add or subtract like terms.

1. (a) A: $3x(x + 2) = 3x^2 + 6x$; B: $x(2x - 5) = 2x^2 - 5x$ 2. (b) $(3x^2 + 6x) + (2x^2 - 5x) = 5x^2 + x$ 3. (c) $(3x^2 + 6x) - (2x^2 - 5x) = 3x^2 + 6x - 2x^2 + 5x = x^2 + 11x$ 4. (d) $5(4)^2 + 4 = 80 + 4 = 84$ (check: $A = 12 \times 6 = 72$, $B = 4 \times 3 = 12$, total 84)

Answer: (a) A: $(3x^2 + 6x)$ cm²; B: $(2x^2 - 5x)$ cm² (b) $(5x^2 + x)$ cm² (c) $(x^2 + 11x)$ cm² (d) 84 cm²