LESSON MAKER PRO

Identity Power Moves

Expand, compare, and build number relationships.

HIGH SCHOOL · HSA-APR.C.4

CCSS.Math.Content.HSA-APR.C.4 "Prove polynomial identities and use them to describe numerical relationships. …"

NAME _____ DATE _____

MATCHING FOR EVERY X

When you multiply polynomial expressions, expand each product and combine like terms. If both sides simplify to the same expression for every value of x, the equation is a polynomial identity. You can substitute a number for x in an identity to create a true numerical relationship.

WORKED EXAMPLE

Prove that $(x + 7)^2 = x^2 + 14x + 49$.

1. Rewrite the square as $(x + 7)(x + 7)$.
2. Distribute: $x^2 + 7x + 7x + 49$.
3. Combine like terms: $x^2 + 14x + 49$.

Answer: $(x + 7)^2 = x^2 + 14x + 49$, so the equation is an identity.

PRACTICE 6 problems

1 Expand and simplify: $(x - 4)(x - 4)$.

ANSWER _____

2 Factor $x^2 + 10x + 25$ as a squared binomial.

ANSWER _____

3 Simplify $(x + 3)(x - 3)$. Then state the identity.

ANSWER _____

4 Find the missing number: $(x + 6)^2 = x^2 + 12x + ___$.

ANSWER _____

5 Use $(x^2 - 1)^2 + (2x)^2 = (x^2 + 1)^2$. Substitute $x = 4$ and write the Pythagorean triple in increasing order.

ANSWER _____

6 Is $(x + 2)(x + 9) = x^2 + 11x + 18$ an identity? Expand the left side to justify your answer.

ANSWER _____

APPLY IT Show your work

1 While filming a soccer highlight, a student walks 9 m along one sideline and then 40 m straight toward the field. The two paths are perpendicular. Use a numerical relationship to show the direct distance from the starting point.

WORK SPACE

ANSWER _____

2 A coding club makes a right-triangle sprite using the identity $(x^2 - 1)^2 + (2x)^2 = (x^2 + 1)^2$. For $x = 5$, what are the two leg lengths and the hypotenuse length in pixels?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Prove that $(x^2 + 4)^2 = (x^2 - 4)^2 + (4x)^2$ by expanding both sides. Then substitute $x = 3$ and use the identity to write a Pythagorean triple in increasing order.

WORK SPACE AND ANSWER

ANSWER KEY

Identity Power Moves

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Expand and simplify: $(x - 4)(x - 4)$.	**$x^2 - 8x + 16$**
2	Factor $x^2 + 10x + 25$ as a squared binomial.	**$(x + 5)^2$**
3	Simplify $(x + 3)(x - 3)$. Then state the identity.	**$x^2 - 9$; $(x + 3)(x - 3) = x^2 - 9$**
4	Find the missing number: $(x + 6)^2 = x^2 + 12x +$ ___.	**36**
5	Use $(x^2 - 1)^2 + (2x)^2 = (x^2 + 1)^2$. Substitute $x = 4$ and write the Pythagorean triple in increasing order.	**(8, 15, 17)**
6	Is $(x + 2)(x + 9) = x^2 + 11x + 18$ an identity? Expand the left side to justify your answer.	**Yes. $(x + 2)(x + 9) = x^2 + 11x + 18$, which matches the right side.**

PART 2 · APPLY IT

1. **41 m, because $9^2 + 40^2 = 41^2$.** Square the two perpendicular distances and add them: 81 + 1600 = 1681. Since 1681 = 41^2, the direct distance is 41 m.
2. **The leg lengths are 10 pixels and 24 pixels, and the hypotenuse is 26 pixels.** Substitute 5: $x^2 - 1 = 24$, $2x = 10$, and $x^2 + 1 = 26$. Thus $24^2 + 10^2 = 26^2$.

CHALLENGE

Left side: $x^4 + 8x^2 + 16$. Right side: $x^4 - 8x^2 + 16 + 16x^2 = x^4 + 8x^2 + 16$. For $x = 3$, $5^2 + 12^2 = 13^2$, so the triple is (5, 12, 13).

Accept equivalent expanded or factored forms when algebraically identical. In Practice 5 and the challenge, require all three lengths in increasing order: (8, 15, 17) and (5, 12, 13). For tasks asking only for the two legs and hypotenuse, accept either leg order when the hypotenuse is clearly identified.