ALBERT

Name _____ Date _____

Polynomial Identities Worksheet

Algebra 2 · Common Core HSA-APR.C.4

> Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.

Practice

Builds the skill step by step.

1. $(x + 3)^2 = x^2 + kx + 9$. What is k?

2. Use $(a + b)(a - b) = a^2 - b^2$ to find 21×19.

3. Use $(30 + 1)^2$ to find 31^2.

4. $(x - 1)(x^2 + x + 1) = x^3 + k$. What is k?

5. Which equation is an identity?

   A. $(a - b)^2 = a^2 - b^2$

   B. $(a + b)^2 = a^2 + b^2$

   C. $(a - b)^2 = a^2 - 2ab + b^2$

   D. $(a + b)^2 = 2a + 2b$

6. The identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ makes a Pythagorean triple with legs $x^2 - y^2$ and $2xy$ and hypotenuse $x^2 + y^2$. What is the hypotenuse when $x = 2$ and $y = 1$?

7. Using the same triple identity, what is the hypotenuse when $x = 3$ and $y = 2$?

8. Use $(100 - 2)^2$ to find 98^2.

9. $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$. What is the coefficient of a^2b?

10. What does it mean for an equation to be an identity?

    A. It is true for exactly one value.

    B. It is never true.

    C. It has no variables.

    D. It is true for every value of the variables.

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On Level

Grade-level practice.

1. Using legs $x^2 - y^2$ and $2xy$ and hypotenuse $x^2 + y^2$, what are the three sides when $x = 4$ and $y = 1$? List them from least to greatest.

2. Use $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$ to find $7^3 + 3^3$.

3. Prove the identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$.

4. Use $a^2 - b^2 = (a + b)(a - b)$ to find $53^2 - 47^2$.

5. The identity $(n + 1)^2 - n^2 = 2n + 1$ gives the difference of consecutive squares. What is $51^2 - 50^2$?

6. Which identity explains why $4 \times 5 + 5 = 25$?

   A. $n(n + 1) + (n + 1) = (n + 1)^2$

   B. $n(n + 1) = n^2 + 1$

   C. $n + (n + 1) = 2n^2$

   D. $n^2 + n = (n + 1)^2$

7. Using legs $x^2 - y^2$ and $2xy$ and hypotenuse $x^2 + y^2$, what is the hypotenuse when $x = 5$ and $y = 2$?

8. What is the coefficient of x in $(x + 2)^3$?

9. Use $(a + b)(a - b)$ to find 1003×997.

10. $(x + 1)^4 - (x - 1)^4 = ax^3 + bx$. What is a?

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Challenge

Multi-step and word problems that stretch it.

1. The identity $n(n + 1)(n + 2)(n + 3) + 1 = (n^2 + 3n + 1)^2$ shows that a product of four consecutive integers plus 1 is a perfect square. For $n = 5$, what number is squared?

2. Use $a^2 + b^2 = (a + b)^2 - 2ab$. If $a + b = 7$ and $ab = 10$, what is $a^2 + b^2$?

3. $x - y = 3$ and $x + y = 11$. What is $x^2 - y^2$?

4. Using legs $x^2 - y^2$ and $2xy$ and hypotenuse $x^2 + y^2$, what are the three sides when $x = 4$ and $y = 3$? List them from least to greatest.

5. Prove that the difference of the squares of two consecutive odd numbers is a multiple of 8.

6. Which x and y give the triple 9, 40, 41 using $x^2 - y^2$, $2xy$, $x^2 + y^2$?

   A. $x = 9, y = 1$

   B. $x = 5, y = 4$

   C. $x = 4, y = 5$

   D. $x = 6, y = 3$

7. Use $(a + b)^2 - (a - b)^2 = 4ab$ to find $(13 + 7)^2 - (13 - 7)^2$.

8. Use $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$ to find $10^3 - 9^3$.

9. A student claims $(x + 1)^2 = x^2 + 1$ is an identity. Explain why it is not.

10. $x + \frac{1}{x} = 5$. Use $(x + \frac{1}{x})^2 = x^2 + 2 + \frac{1}{x^2}$ to find $x^2 + \frac{1}{x^2}$.