ALBERT

Name _____ Date _____

Completing the Square for Maximum and Minimum Worksheet

Algebra 1 · Common Core HSA-SSE.B.3b

> Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

Practice

Builds the skill step by step.

1. What is the minimum value of $f(x) = (x - 3)^2 + 5$?

2. What is the minimum value of $f(x) = (x + 2)^2 - 7$?

3. What is the maximum value of $f(x) = -(x - 1)^2 + 4$?

4. At what value of x does $f(x) = (x - 3)^2 + 5$ reach its minimum?

5. Rewrite $f(x) = x^2 + 6x + 11$ as $(x + 3)^2 + k$. What is the minimum value?

6. What number completes the square: $x^2 + 8x + ?$

7. What number completes the square: $x^2 - 10x + ?$

8. Complete the square: $x^2 + 4x + 1 = (x + 2)^2 + k$. What is the minimum value of $f(x) = x^2 + 4x + 1$?

9. $f(x) = a(x - h)^2 + k$ with $a > 0$. What does k tell you?

   A. the slope

   B. the minimum value of f

   C. the maximum value of f

   D. a zero of f

10. Complete the square to find the minimum value of $f(x) = x^2 - 6x + 11$.

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On Level

Grade-level practice.

1. Complete the square to find the minimum value of $f(x) = x^2 + 10x + 30$.

2. Complete the square to find the minimum value of $f(x) = x^2 - 2x - 8$.

3. Complete the square to find the vertex of $f(x) = x^2 + 6x + 4$.

4. Complete the square to find the maximum value of $f(x) = -x^2 + 4x + 1$.

5. Complete the square to find the minimum value of $f(x) = 2x^2 + 8x + 3$.

6. A store's profit is $P = -x^2 + 40x - 300$ dollars when it sells x items. What is the maximum profit?

7. For $P = -x^2 + 40x - 300$, how many items give the maximum profit?

8. What number completes the square: $x^2 + 3x + ?$

9. Explain how completing the square shows the minimum value of $f(x) = x^2 - 8x + 20$.

10. Complete the square to find the minimum value of $f(x) = x^2 - 5x + 7$.

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Challenge

Multi-step and word problems that stretch it.

1. A ball's height is $h = -16t^2 + 32t + 6$ feet. What is its maximum height?

2. Complete the square to find the minimum value of $f(x) = 3x^2 - 12x + 7$.

3. A rectangle has a perimeter of 40. Its area is $A = x(20 - x)$. What is the largest possible area?

4. Complete the square to find the maximum value of $f(x) = -2x^2 + 12x - 10$.

5. $f(x) = x^2 + bx + 10$ has its minimum value of 1 at $x = 3$. What is b?

6. Which form shows the minimum value of the function directly?

   A. $x^2 - 8x + 7$

   B. $(x - 1)(x - 7)$

   C. $x^2 - 8x$

   D. $(x - 4)^2 - 9$

7. Complete the square to find the minimum value of $f(x) = x^2 + 2x + 5$.

8. Revenue is $R = -5p^2 + 100p$ dollars at price p. What is the maximum revenue?

9. Complete the square to find the minimum value of $f(x) = 2x^2 - 6x + 1$.

10. Explain why $f(x) = (x - 3)^2 + 5$ never equals 2.