

Honors Algebra 2  
4.5 Completing the Square

1. Factor the following perfect square trinomials.

$f(x) = x^2 + 18x + 81$ $f(x) = (x+9)^2$	$f(x) = x^2 - 16 + 64$ $f(x) = (x-8)^2$	$f(x) = x^2 + \frac{3}{4}x + \frac{9}{64}$ $f(x) = (x + \frac{3}{8})^2$
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2. Find the value of  $c$  that makes each expression a perfect square trinomial. Then write the expression as the square of the binomial.

$x^2 + 14x + c$ $c = 49$	$a^2 + 12a + c$ $c = 36$	$m^2 + 11m + c$ $c = (\frac{11}{2})^2$ $= \frac{121}{4}$ $= 30.25$
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3. Solve the following use the square root property:

$x^2 + 6x + 9 = 36$ $(x+3)^2 = 36$ $x+3 = \pm\sqrt{36}$ $x = -3 \pm 6$ $x = -3+6 \text{ and } x = -3-6$ $x = 3 \qquad x = -9$ <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-top: 5px;"><math>x = -9, 3</math></div>	$x^2 - 10x + 25 = 27$ $(x-5)^2 = 27$ $x-5 = \pm\sqrt{27}$ <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-top: 5px;"><math>x = 5 \pm \sqrt{27}</math></div>	$x^2 - 12x + 36 = 25$ $(x-6)^2 = 25$ $x-6 = \pm\sqrt{25}$ $x = 6 \pm \sqrt{25}$ $x = 6 \pm 5$ $x = 6+5 \text{ and } x = 6-5$ <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-top: 5px;"><math>x = 11, 1</math></div>
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#### Steps to Complete the Square for $ax^2 + bx + c = 0$

1. The coefficient of the quadratic term must be 1. Divide each side by   a  .
2. Isolate the constant term.
3. Create a perfect square trinomial. (Finding c above).
4. Balance the equation. Add    $(\frac{b}{2})^2$    to both sides of the equation.
5. Write the left side as a binomial squared.
6. Take the square root of each side.
7. Solve for x.

4. Solve each of the following by completing the square.

$x^2 - 14x + 19 = 0$ $x^2 - 14x = -19$ $c = (-14/2)^2 = 49$ $x^2 - 14x + 49 = -19 + 49$ $(x-7)^2 = 30$ $x-7 = \pm\sqrt{30}$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <math>x = 7 \pm \sqrt{30}</math> </div>	$v^2 + 18 = 9v$ $v^2 - 9v + 18 = 0$ $v^2 - 9v = -18$ $v^2 - 9v + 8\frac{1}{4} = -18 + 8\frac{1}{4}$ $(v - 9/2)^2 = -7\frac{3}{4} + 8\frac{1}{4}$ $v - 9/2 = \pm\sqrt{9/4}$ $v = \frac{9}{2} \pm \frac{3}{2}$ $v = \frac{12}{2}, \frac{6}{2}$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <math>v = 6, 3</math> </div>
$3a^2 + a - 2 = 0$ $a^2 + \frac{1}{3}a - \frac{2}{3} = 0$ $c = (\frac{1}{3}/2)^2$ $a^2 + \frac{1}{3}a = \frac{2}{3}$ $c = (\frac{1}{6})^2$ $a^2 + \frac{1}{3}a + \frac{1}{36} = \frac{2}{3} + \frac{1}{36}$ $c = \frac{1}{36}$ $(a + \frac{1}{6})^2 = \frac{24}{36} + \frac{1}{36}$ $a + \frac{1}{6} = \pm\sqrt{\frac{25}{36}}$ $a = -\frac{1}{6} \pm \frac{5}{6}$ $a = \frac{4}{6}, -\frac{6}{6}$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <math>a = \frac{2}{3}, -1</math> </div>	$2d^2 - 10d + 5 = 0$ $d^2 - 5d + \frac{5}{2} = 0$ $d^2 - 5d = -\frac{5}{2}$ $d^2 - 5d + (\frac{5}{2})^2 = -\frac{5}{2} + (\frac{5}{2})^2$ $(d - \frac{5}{2})^2 = -\frac{5}{2} + \frac{25}{4}$ $d - \frac{5}{2} = \pm\sqrt{-\frac{10}{4} + \frac{25}{4}}$ $d = \frac{5}{2} \pm \sqrt{\frac{15}{4}}$ $d = \frac{5}{2} \pm \frac{\sqrt{15}}{2}$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <math>d = \frac{5 \pm \sqrt{15}}{2}</math> </div>

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$x^2 + 10x - 11 = 0$ $x^2 + 10x = 11$ $x^2 + 10x + \left(\frac{10}{2}\right)^2 = 11 + \left(\frac{10}{2}\right)^2$ $\left(x + \frac{10}{2}\right)^2 = 11 + \frac{100}{4}$ $\left(x + \frac{10}{2}\right)^2 = \frac{44}{4} + \frac{100}{4}$ $x + \frac{10}{2} = \pm \sqrt{\frac{144}{4}}$ $x = -\frac{10}{2} \pm \frac{12}{2}$ $x = \frac{2}{2}, -\frac{22}{2} \quad \boxed{x = 1, -11}$	$2x^2 - 7x + 5 = 0$ $x^2 - \frac{7}{2}x + \frac{5}{2} = 0$ $x^2 - \frac{7}{2}x = -\frac{5}{2}$ $x^2 - \frac{7}{2}x + \left(\frac{7}{4}\right)^2 = -\frac{5}{2} + \left(\frac{7}{4}\right)^2$ $\left(x - \frac{7}{4}\right)^2 = -\frac{5}{2} + \frac{49}{16}$ $x - \frac{7}{4} = \pm \sqrt{-\frac{40}{16} + \frac{49}{16}}$ $x - \frac{7}{4} = \pm \sqrt{\frac{9}{16}}$ $x = \frac{7}{4} \pm \frac{3}{4}$ $x = \frac{10}{4}, \frac{4}{4} \quad \boxed{x = \frac{5}{2}, 1}$
$x^2 + 8x + 22 = 0$ $x^2 + 8x = -22$ $x^2 + 8x + 16 = -22 + 16$ $(x + 4)^2 = -6$ $x + 4 = \pm \sqrt{-6}$ $\boxed{x = -4 \pm i\sqrt{6}}$	$x^2 = 10x - 24$ $x^2 - 10x = -24$ $x^2 - 10x + 25 = -24 + 25$ $(x - 5)^2 = 1$ $x - 5 = \pm 1$ $x = 5 \pm 1$ $\boxed{x = 4, 6}$

