**Proving the Quadratic Formula**

1. Study this solution to a quadratic equation by completing the square. Fill in the blanks below.

Here is the equation: $3x^{2}+15x+7=0$

**Step 1:** Divide by 3 on both sides. $x^{2}+5x+\frac{7}{3}=0$

**Step 2:** Complete the square by adding $\\_\\_\\_\\_\\_\\_\\_\\_\\_$ on both sides. $x^{2}+5x+\frac{25}{4}+\frac{7}{3}=\frac{25}{4}$

**Step 3:** Write the first three terms as a binomial square. $(x+\frac{5}{2})^{2}+\frac{7}{3}=\frac{25}{4}$

**Step 4:** Subtract \_\_\_\_\_\_\_\_\_\_\_ on both sides. $(x+\frac{5}{2})^{2}=\frac{25}{4}-\frac{7}{3}$

**Step 5:** Find a common denominator on the right side. $(x+\frac{5}{2})^{2}=\frac{3∙25}{4∙3}-\frac{4∙7}{4∙3}$

**Step 6:** Multiply the numerator and denominator on the right

 side by 3 to make the denominator a perfect square. $(x+\frac{5}{2})^{2}=\frac{3^{2}∙25}{4∙3∙3}-\frac{4∙3∙7}{4∙3∙3}$

 **Step 7:** Put both terms on the right over the common $(x+\frac{5}{2})^{2}=\frac{9∙25-4∙3∙7}{4∙3∙3}$

 denominator to obtain a single fraction.

 **Step 8:** Take square roots on both sides. $x+\frac{15}{2∙3}=\pm \frac{\sqrt{15^{2}-4∙3∙7}}{2∙3}$

 **Step 9:** Subtract\_\_\_\_\_\_\_ on both sides. $x=-\frac{15}{2∙3}\pm \frac{\sqrt{15^{2}-4∙3∙7}}{2∙3}$

1. Explain these details.
2. In Step 2 what quantity is added on both sides?
3. In Step 4 what quantity is subtracted on both sides?
4. In Step 6 why is $4∙3∙3$ a perfect square?
5. What happened to $\frac{5}{2}$ going from Step 7 to Step 8?
6. In Step 9 what quantity is subtracted on both sides?
7. In the original equation $3x^{2}+15x+7=0$ identify the value of each parameter:

 *a* = \_\_\_\_\_\_\_\_ *b* = \_\_\_\_\_\_\_\_ *c* = \_\_\_\_\_\_\_\_

1. Substitute for *a, b,* and *c* in Step 9 of the solution. This should give you the quadratic formula.

 *x* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Simplify the result in Step 9, leaving the values of *x* with radicals in the solutions.
2. Find decimal approximations to the solutions in Step 9.
3. Use Step 3 of the solution to find the vertex of the function $y=3x^{2}+15x+7.$
4. Graph the function $y=3x^{2}+15x+7$. Use the graph to find the vertex and estimate the *x*-intercepts. Check these values with those found in question 6 and question 7.
5. Use the same nine steps to derive the general quadratic formula using the parameters *a, b,* and *c,* rather than the specific values given in question 1.