**INSTRUCTIONS**

**(If this is *not* your *first* group, skip steps 1, 2, & 3)**

1. Get out a blank piece of paper (you may need more than one today), and title it “Steps for Solving Problems Units 1-2”.
2. Write your name in the top corner.
3. Write 3.2 in the bottom corner (this is unit 3, document 2).
4. Draw a line under the last thing you wrote, and then skip a line.
5. Write the name of this group’s topic.
6. Take the solved examples out of the folder, and analyze each step. Work with your group to figure out what is happening in the step.
7. On your paper, for **every** step that these problems take, finish the sentence:

In Step \_\_\_\_ , you must …

1. When you have finished writing your list of steps, write a paragraph as if you were telling a friend how to solve problems like this.
2. If there is a second set of problems, repeat steps 6-8 for those problems.

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**THE TWO RULES**

1. You must work with your group to figure out the steps. Do not move on to the next step until every member of the group knows what happened in the step you are working on.
2. You must stay in your assigned group during each round. You are not allowed to get up to request help from other groups or to offer it. You must rely on your assigned group and yourself to figure out each step.

(You may, with teacher permission, get up if you need to sharpen your pencil, throw out trash, etc.)

To Add or Subtract Polynomials:

|  |  |  |
| --- | --- | --- |
| Problem: | Problem: | Problem: |
| Step 1: | Step 1:  *They’re both so I skip this step.* | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |

|  |  |  |
| --- | --- | --- |
| Problem: | Problem: | Problem: |
| Step 1:  *They’re both so I skip this step.* | Step 1: | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |

*Once you have written out all of the steps for these 6 example problems, do the same for the 6 examples on the next page – To Multiply…*

To Multiply Polynomials:

|  |  |  |
| --- | --- | --- |
| Problem: Determine the product. | Problem: Simplify. | Problem: Multiply. |
| Step 1:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 1:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 1:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |
| Step 2:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 2:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 2:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |
| Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 2:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 2:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |
| Step 4:  *There’s nothing more to simplify*  *in the table, so skip this step.* | Step 4:  *There’s nothing more to simplify*  *in the table, so skip this step.* | Step 4:  *There’s nothing more to simplify*  *in the table, so skip this step.* |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |

|  |  |  |
| --- | --- | --- |
| Problem: Determine the product. | Problem: Simplify. | Problem: |
| Step 1:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 1:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 1:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |
| Step 2:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 2:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 2:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |
| Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |
| Step 4:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 4:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | | Step 4:   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |

To Simplify a Square Root Expression:

|  |  |  |
| --- | --- | --- |
| Problem: | Problem: | Problem: |
| Step 1: | Step 1: | Step 1:  *It’s positive inside the square root,*  *so skip this step.* |
| Step 2:  *It’s a perfect square, so skip this step.* | Step 2: | Step 2: |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |
| Step 5:  *There is not a , so skip this step.* | Step 5:  *There is not a , so skip this step.* | Step 5:  *There is not a , so skip this step.* |
| Step 6:  *There are no like terms to combine,*  *so skip this step.* | Step 6:  *There are no like terms to combine,*  *so skip this step.* | Step 6:  *There are no like terms to combine,*  *so skip this step.* |

|  |  |  |
| --- | --- | --- |
| Problem: | Problem: | Problem: |
| Step 1:  *It’s positive inside the square root,*  *so skip this step.* | Step 1: | Step 1:  *It’s positive inside the square root,*  *so skip this step.* |
| Step 2: | Step 2: | Step 2:  *It’s a perfect square, so skip this step.* |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6:  *There are no like terms to combine,*  *so skip this step.* | Step 6:  *There are no like terms to combine,*  *so skip this step.* | Step 6: |

*Once you have written out all of the steps for these 6 example problems, do the same for the 6 examples on the next page – To Simplify an Exponent of* i*…*

To Simplify an Exponent of :

|  |  |  |
| --- | --- | --- |
| Problem: | Problem: | Problem: |
| Step 1:  *The Remainder is 3* | Step 1:  *The Remainder is 0* | Step 1:  *The Remainder is 2* |
| Step 2: | Step 2: | Step 2: |
| Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | | = | |  | | Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | | = | |  | | Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | | = | |  | |
| Step 4: | Step 4: | Step 4: |

|  |  |  |
| --- | --- | --- |
| Problem: | Problem: | Problem: |
| Step 1:  *The Remainder is 2* | Step 1:  *The Remainder is 1* | Step 1:  *The Remainder is 3* |
| Step 2: | Step 2: | Step 2: |
| Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | | = | |  | | Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | | = | |  | | Step 3:   |  |  |  | | --- | --- | --- | |  |  |  | | = | |  | |
| Step 4: | Step 4: | Step 4: |

To Factor a Quadratic:

|  |  |  |
| --- | --- | --- |
| Problem: | Problem: | Problem: |
| Step 1:  *, so it is not necessary to divide every term, so skip this step.* | Step 1: | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3:  multiply to , & add to | Step 3:  multiply to , and add to | Step 3:  multiply to , and add to |
| Step 4:  *, so skip this step.* | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |

|  |  |  |
| --- | --- | --- |
| Problem: | Problem: | Problem: |
| Step 1:  *It isn’t possible to divide every term by anything, so skip this step.* | Step 1: | Step 1:  *It isn’t possible to divide every term by anything, so skip this step.* |
| Step 2: | Step 2: | Step 2: |
| Step 3:  multiply to , and add to | Step 3:  multiply to , & add to | Step 3:  multiply to , and add to |
| Step 4: | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |

*Once you have written out all of the steps for these 6 example problems, do the same for the 3 examples on the next page – To Find Roots…*

To Find Roots of a Quadratic in Factored Form:

|  |  |  |
| --- | --- | --- |
| Problem:  Find the roots of the quadratic below. | Problem:  Determine the zeros. | Problem:  Determine the roots of the equation. |
| Step 1: | Step 1: | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3:  *There is no number multiplied to x, so skip this step.* | Step 3: | Step 3: |

To Find Roots of a Quadratic in Standard Form, using the Quadratic Formula:

|  |  |  |
| --- | --- | --- |
| Problem:  Calculate the roots of the quadratic equation, if possible. Verify your solution. | Problem:  Use the quadratic formula to find the zeros. | Problem:  A ball on an unknown planet is tossed upward. Its height can be modeled by the quadratic function  .  How long will it take for the ball to reach the ground after it has been tossed? |
| Step 1: | Step 1: | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6:  *It’s a perfect square, so skip this step.* | Step 6: | Step 6:  *It’s a perfect square, so skip this step.* |
| Step 7: | Step 7: | Step 7: |
| Step 8: | Step 8: | Step 8: |
| Step 9: | Step 9:  *There are no like terms to combine,*  *so skip this step.* | Step 9: |
| Step 10: | Step 10: | Step 10:  *Since a ball cannot land 2 seconds in the past, it took to land.* |

*Continued on next page.*

To Find Roots of a Quadratic in Standard Form, using the Quadratic Formula:

(Continued)

|  |  |  |
| --- | --- | --- |
| Problem:  Calculate the roots of the quadratic equation, if possible. Verify your solution. | Problem:  Use the quadratic formula to find the zeros. | Problem:  A ball on an unknown planet is tossed upward. Its height can be modeled by the quadratic function  .  How long will it take for the ball to reach the ground after it has been tossed? |
| Step 1: | Step 1: | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6:  *It’s a perfect square, so skip this step.* | Step 6: |
| Step 7:  *The square root cannot be simplified,*  *so skip this step.* | Step 7: | Step 7: |
| Step 8: | Step 8: | Step 8: |
| Step 9:  *There are no like terms to combine,  so skip this step.* | Step 9: | Step 9:  *There are no like terms to combine,  so skip this step.* |
| Step 10:  *The 3 terms do not have anything in common to divide, so skip this step.* | Step 10: | Step 10:  *Since a ball cannot land at an imaginary time, the ball will be at ground level.* |

To Find Roots of a Quadratic in Vertex Form

(Solving Perfect Square Binomials):

|  |  |  |
| --- | --- | --- |
| Problem:  Find the value of . | Problem:  Determine the roots. | Problem:  Determine the zeros. |
| Step 1: | Step 1: | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3:  , *so skip this step.* | Step 3: | Step 3:  , *so skip this step.* |
| Step 4: | Step 4: | Step 4: |
| Step 5:  *It’s a perfect square, so skip this step.* | Step 5:  *It’s a perfect square, so skip this step.* | Step 5: |
| Step 6: | Step 6: | Step 6: |
| Step 7: | Step 7: | Step 7: |
| Step 8: | Step 8: | Step 8: |
| Step 9: | Step 9: | Step 9:  *There are no like terms to combine,  so skip this step.* |

|  |  |  |
| --- | --- | --- |
| Problem:  Solve the quadratic. | Problem:  Calculate the zeros. | Problem:  Find the value of . |
| Step 1:  *It is equal to a number, not f(x) or y,*  *so skip this step.* | Step 1:  *It is equal to a number, not f(x) or y,*  *so skip this step.* | Step 1:  *It is equal to a number, not f(x) or y,*  *so skip this step.* |
| Step 2:  *There is not a number added behind the square, so skip this step.* | Step 2:  *There is not a number added behind the square, so skip this step.* | Step 2:  *There is not a number added behind the square, so skip this step.* |
| Step 3: | Step 3:  , *so skip this step.* | Step 3:  , so skip this step. |
| Step 4: | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |
| Step 7: | Step 7: | Step 7: |
| Step 8: | Step 8: | Step 8: |
| Step 9:  *There are no like terms to combine,  so skip this step.* | Step 9:  *There are no like terms to combine,  so skip this step.* | Step 9:  *There are no like terms to combine,  so skip this step.* |

To Determine the Vertex in Vertex Form:

|  |  |  |
| --- | --- | --- |
| Problem:  Determine the vertex of the quadratic. Is it an absolute maximum or minimum? | Problem:  Find the vertex. Is it an absolute maximum or minimum? | Problem:  A ball on an unknown planet is tossed upward. Its height can be modeled by the quadratic function  . Find the maximum height the ball will reach. |
| Step 1:  It’s , so the graph faces up—the vertex is on the bottom. | Step 1:  It’s , so the graph faces up—the vertex is on the bottom. | Step 1:  It’s , so the graph faces down—the vertex is on the top. |
| Step 2:   |  | | --- | | The vertex is an **absolute minimum**, because the turning point is the lowest point on a positive  (upward) quadratic function. | | Step 2:   |  | | --- | | The vertex is an **absolute minimum**, because the turning point is the lowest point on a positive  (upward) quadratic function. | | Step 2:  The vertex is an **absolute** **maximum**, because the turning point is the highest point on a negative (downward) quadratic function. |
| Step 3:  Vertex is: | Step 3:  Vertex is: . | Step 3:  Vertex is:. |
| Step 4:  *The problem does not ask for the maximum value, so skip this step.* | Step 4:  *The problem does not ask for the maximum value, so skip this step.* | Step 4:  The maximum height the ball will reach   |  |  | | --- | --- | | is | 99 feet. | |

|  |  |  |
| --- | --- | --- |
| Problem:  Determine the vertex of the quadratic. Is it an absolute maximum or minimum? | Problem:  Determine the absolute minimum or maximum. | Problem:  A ball is tossed upward. Its height can be modeled by the quadratic function  . Find the maximum height the ball will reach. |
| Step 1:  It’s , so the graph faces down—the vertex is on the top. | Step 1:  It’s , so the graph faces up—the vertex is on the bottom. | Step 1:  It’s , so the graph faces down—the vertex is on the top. |
| Step 2:   |  | | --- | | The vertex is an **absolute** **maximum**, because the turning point is the highest point on a negative (downward) quadratic function. | | Step 2:  The vertex is an **absolute minimum**, because the turning point is the lowest point on a positive (upward)  quadratic function. | Step 2:  The vertex is an **absolute** **maximum**, because the turning point is the highest point on a negative (downward) quadratic function. |
| Step 3:  Vertex is: | Step 3:  Vertex is:. | Step 3:  Vertex is: |
| Step 4:  *The problem does not ask for the maximum value, so skip this step.* | Step 4:  The minimum value is . | Step 4:  The maximum height the ball will reach   |  |  | | --- | --- | | is | 8 feet. | |

*Once you have written out all of the steps for these 6 example problems, do the same for the 6 examples on the next page – To Determine Vertex…Standard Form*

To Determine the Vertex in Standard Form:

|  |  |  |
| --- | --- | --- |
| Problem:  Determine the vertex of the quadratic. Is it an absolute maximum or minimum? | Problem:  Find the vertex. Is it an absolute maximum or minimum? | Problem:  A ball on an unknown planet is tossed upward. Its height can be modeled by the quadratic function  . Find the maximum height the ball will reach. |
| Step 1:  It’s , so the graph faces up—the vertex is on the bottom. | Step 1:  It’s , so the graph faces up—the vertex is on the bottom. | Step 1:  It’s , so the graph faces down—the vertex is on the top. |
| Step 2:   |  | | --- | | The vertex is an **absolute minimum**, because the turning point is the lowest point on a positive  (upward) quadratic function. | | Step 2:   |  | | --- | | The vertex is an **absolute minimum**, because the turning point is the lowest point on a positive  (upward) quadratic function. | | Step 2:  The vertex is an **absolute** **maximum**, because the turning point is the highest point on a negative (downward) quadratic function. |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |
| Step 7: | Step 7: | Step 7: |
| Step 8: | Step 8: | Step 8: |
| Step 9: | Step 9: | Step 9: |
| Step 10: | Step 10: | Step 10: |
| Step 11:  The Vertex is | Step 11:  The Vertex is | Step 11:  The Vertex is |
| Step 12:  *The problem does not ask for the maximum value, so skip this step.* | Step 12:  *The problem does not ask for the maximum value, so skip this step.* | Step 12:  The maximum height the ball will reach   |  |  | | --- | --- | | is | 99 feet. | |

*Continued on next page.*

To Determine the Vertex in Standard Form:

(Continued)

|  |  |  |
| --- | --- | --- |
| Problem:  Determine the vertex of the quadratic. Is it an absolute maximum or minimum? | Problem:  Determine the absolute minimum or maximum. | Problem:  A ball is tossed upward. Its height can be modeled by the quadratic function  . Find the maximum height the ball will reach. |
| Step 1:  It’s , so the graph faces down—the vertex is on the top. | Step 1:  It’s , so the graph faces up—the vertex is on the bottom. | Step 1:  It’s , so the graph faces down—the vertex is on the top. |
| Step 2:   |  | | --- | | The vertex is an **absolute** **maximum**, because the turning point is the highest point on a negative (downward) quadratic function. | | Step 2:   |  | | --- | | The vertex is an **absolute minimum**, because the turning point is the lowest point on a positive  (upward) quadratic function. | | Step 2:  The vertex is an **absolute** **maximum**, because the turning point is the highest point on a negative (downward) quadratic function. |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |
| Step 7: | Step 7: | Step 7: |
| Step 8: | Step 8: | Step 8: |
| Step 9: | Step 9:  , *so skip this step.* | Step 9: |
| Step 10: | Step 10: | Step 10: |
| Step 11: | Step 11: | Step 11: |
| Step 12:  The Vertex is | Step 12:  The Vertex is | Step 12:  The Vertex is. |
| Step 13:  *The problem does not ask for the maximum value, so skip this step.* | Step 13:  The minimum value is . | Step 13:  The maximum height the ball will reach   |  |  | | --- | --- | | is | 8 feet. | |

To Solve Systems Involving Quadratic Equations (Cont’d on Next Page):

|  |  |  |
| --- | --- | --- |
| Problem:  Solve the system of equations over the set of real numbers. | Problem:  Solve the system. | Problem:  Determine the point(s) of intersection. |
| Step 1: | Step 1: | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4: | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |
| Step 7: | Step 7: | Step 7: |
| Step 8: | Step 8: | Step 8: |
| Step 9:  *It’s a perfect square, so skip this step.* | Step 9: | Step 9:  *It’s a perfect square, so skip this step.* |
| Step 10: | Step 10:  *x is an imaginary number, so skip*  *all remaining steps. There will be* | Step 10: |
| Step 11: | Step 11: | Step 11: |
| Step 12: | Step 12: | Step 12: |
| Step 13: | Step 13: | Step 13: |
| Step 14:  seems easier, so: | Step 14: | Step 14:  seems easier, so: |
| Step 15: | Step 15: | Step 15: |
| Step 16: | Step 16: | Step 16: |
| Step 17:  The solutions are | Step 17: | Step 17:  The solutions are |
| Step 18: *(Check the solutions)*  🗸  🗸 | Step 18: | Step 18: *(Check the solutions)*  ✓  🗸 |

To Solve Systems Involving Quadratic Equations (Continued):

|  |  |  |
| --- | --- | --- |
| Problem:  Solve the system of equations over the set of real numbers. | Problem:  Solve the system. | Problem:  Solve the system of equations over the set of real numbers. |
| Step 1: | Step 1: | Step 1: |
| Step 2: | Step 2: | Step 2: |
| Step 3: | Step 3: | Step 3: |
| Step 4: | Step 4:  *The result is not quadratic, so skip the quadratic formula steps.*  \*\*\* DIFFERENT PROCESS to find *x* \*\*\* | Step 4: |
| Step 5: | Step 5: | Step 5: |
| Step 6: | Step 6: | Step 6: |
| Step 7: | Step 7:  *Skip to Step 14 to find* y*.* | Step 7: |
| Step 8: | Step 8: | Step 8: |
| Step 9:  *It’s a perfect square, so skip this step.* | Step 9: | Step 9:  *It’s a perfect square, so skip this step.* |
| Step 10: | Step 10: | Step 10: |
| Step 11: | Step 11: | Step 11: |
| Step 12: | Step 12: | Step 12: |
| Step 13: | Step 13: | Step 13: |
| Step 14: , so: | Step 14: \*\*\*SAME PROCESS to find y\*\*\*  *Neither seem easy, so:* | Step 14: , so: |
| Step 15: | Step 15: | Step 15: |
| Step 16: | Step 16: | Step 16: |
| Step 17: | Step 17: | Step 17: |
| Step 18: *(Check the solution)*  🗸 | Step 18: *(Check the solution)*    🗸 | Step 18: *(Check the solutions)*    🗸  🗸 |