

Vertical Progression:

<p>7th Grade</p>	<p>7.EE.B Solve real-life and mathematical problems using numerical and algebraic expressions and equations.</p> <ul style="list-style-type: none"> ○ 7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations to solve problems by reasoning about the quantities. ○ 7.EE.B.4.a Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution. ○ 7.EE.B.4.b Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.
<p>8th Grade</p>	<p>8.EE.C Analyze and solve linear equations and pairs of simultaneous linear equations.</p> <ul style="list-style-type: none"> ○ 8.EE.C.7 Solve linear equations in one variable ○ 8.EE.C.7.a Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers.) ○ 8.EE.C.7.b Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
<p>Algebra 1</p>	<p>ELG.MA.HS.A.9: Solve equations and inequalities in one variable</p> <ul style="list-style-type: none"> ○ A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. ○ A-REI.4 Solve quadratic equations in one variable. ○ A-REI.4.a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. ○ A-REI.4.b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. [Note: Algebra 1 students are only required to recognize that complex roots are not real numbers.]
<p>Algebra 2</p>	<p>ELG.MA.HS.A.9: Solve equations and inequalities in one variable.</p> <ul style="list-style-type: none"> ○ A-REI.4 Solve quadratic equations in one variable. ○ A-REI.4.b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

Students will demonstrate command of the ELG by:

- Solving linear equations and inequalities with one variable including equations with coefficients represented by letter.
- Solving quadratic equations by a variety of methods (inspection, square roots, factoring, completing the square, quadratic formula)
- Completing the square to transform a quadratic equation into vertex form.
- Deriving the quadratic formula from the vertex form of a quadratic equation.

Vocabulary:

- Completing the square
- Linear equation
- Linear inequality
- Quadratic equation
- Quadratic formula
- Square root

Sample Instructional/Assessment Tasks:

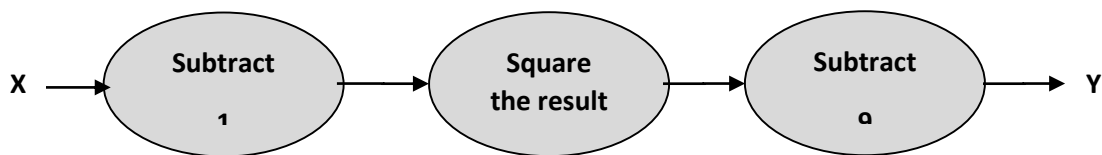
1) Standard(s): A-REI.4, F-IF.4, F-IF.7, F-IF.8

Source: Inside Mathematics

[http://www.insidemathematics.org/assets/common-core-math-tasks/quadratic%20\(2009\).pdf](http://www.insidemathematics.org/assets/common-core-math-tasks/quadratic%20(2009).pdf)

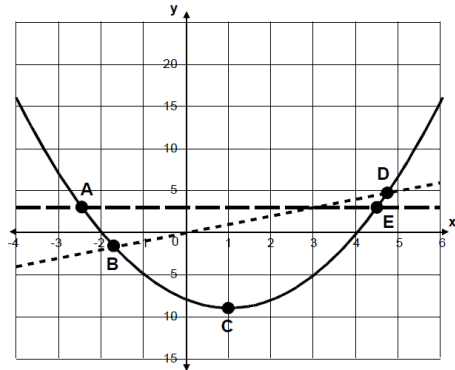
Item Prompt:

This is a quadratic number machine.



- Show that, if x is 5, y is 7.
 - What is y if x is 0?
 - Use algebra to show that, for this machine, $y = x^2 - 2x - 8$.
- The diagram on the next page shows the graph of the machine's quadratic function $y = x^2 - 2x - 8$ and the graphs of $y = 3$ and $y = x$.
 - Which point on the diagram shows the minimum value of y ?
 - Which point(s) on the diagram show(s) the solution(s) to the equation $3 = x^2 - 2x - 8$?

3. a. Use the graph to solve the equation $x^2 - 2x - 8 = 0$. Mark the solutions on the graph.
 b. Use algebra to solve the same equation.



Correct Answers:

1. a. $5 \rightarrow 4 \rightarrow 16 \rightarrow 7$
 b. -8
 c.
$$y = (x - 1)^2 - 9$$
$$= x^2 - 2x + 1 - 9$$
$$= x^2 - 2x - 8$$
2. a. C
 b. A and E
 c. B and D
3. a. -2, 4
 b. Answers may vary

Note: More explanation of correct answers and examples of student work can be found via the link.

2) Standard(s): A-REI.B.3

Source: Jonathan Mattes-Ritz

Item Prompt: Solving Formulas

Solve each formula (equation) for the indicated variable.

- 1) Solve the Kinetic Energy formula for mass (m)

$$KE = \frac{1}{2}mv^2$$

- 2) Solve the Fahrenheit - Celsius conversion formula for Fahrenheit (F)

$$C = \frac{5}{9}(F - 32)$$

- 3) Solve the volume of a sphere formula for the radius (r)

$$V = \frac{1}{3}\pi r^3$$

- 4) Solve the volume of a cone formula for the height (h)

$$V = \frac{1}{3}h\pi r^2$$

- 5) Solve the distance formula for the second y coordinate (y_2)

$$D = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Correct Answers:

1) $m = \frac{2KE}{v^2}$

2) $F = \frac{9}{5}C + 32$

3) $r = \sqrt[3]{\frac{3V}{4\pi}}$

4) $h = \frac{3V}{\pi r^2}$

5) $y_2 = y_1 - \sqrt{D^2 - (x_1 - x_2)^2}$