

## Vertical Progression:

8 <sup>th</sup> Grade	<p><b>8.EE.A Work with radicals and integer exponents.</b></p> <ul style="list-style-type: none"> <li>○ <b>8.EE.A.2</b> Use square root and cube root symbols to represent solutions to equations of the form <math>x^2 = p</math> and <math>x^3 = p</math>, where <math>p</math> is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that <math>\sqrt{2}</math> is irrational.</li> </ul> <p><b>8.G.B Understand and apply the Pythagorean Theorem.</b></p> <ul style="list-style-type: none"> <li>○ <b>8.G.B.8</b> Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.</li> </ul>
Algebra 1	<p><b>ELG.MA.HS.A.9 Solve equations and inequalities in one variable</b></p> <ul style="list-style-type: none"> <li>○ <b>A-REI.4</b> Solve quadratic equations in one variable.</li> <li>○ <b>A-REI.4a</b> Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>○ <b>A-REI.4b</b> Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), 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 <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ul>
Geometry	<p><b>ELG.MA.HS.G.11 Translate between the geometric description and the equation for a conic section.</b></p> <ul style="list-style-type: none"> <li>○ <b>G-GPE.1</b> Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.</li> </ul>
Algebra 2	<p><b>ELG.MA.HS.G.11 Translate between the geometric description and the equation for a conic section.</b></p> <ul style="list-style-type: none"> <li>○ <b>G-GPE.2</b> Derive the equation for a parabola given a focus and a directrix.</li> </ul>
	<p><b>ELG.MA.HS.G.11 Translate between the geometric description and the equation for a conic section.</b></p> <ul style="list-style-type: none"> <li>○ <b>G-GPE.3 (+)</b> – Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.</li> </ul>

## Students will demonstrate command of the ELG by:

- Completing the square to find the center and radius of a circle given by an equation
- Using the Pythagorean Theorem to write the equation for a circle given the coordinates of the center and the radius.

## Vocabulary:

- circle
- completing the square
- Pythagorean Theorem
- radius

## Sample Instructional/Assessment Tasks:

### 1) Standard(s): G-GPE.1

Source: <https://www.illustrativemathematics.org/content-standards/HSG/GPE/A/1/tasks/1425>

#### Item Prompt:

This problem examines equations defining different circles in the  $x$ - $y$  plane.

- Use the Pythagorean theorem to find an equation in  $x$  and  $y$  whose solutions are the points on the circle of radius 2 with center  $(1,1)$  and explain why it works.
- Suppose  $r$  is a positive number and  $(a,b)$  a point in the plane. Use the Pythagorean theorem to find an equation in  $x$  and  $y$  whose solutions are the points on the circle of radius  $r$  with center  $(a,b)$  and explain why it works.

#### Solution:

- $(x-1)^2 + (y-1)^2 = 4$
- $(x-a)^2 + (y-b)^2 = r^2$

### 2) Standard(s): G-GPE.1

Source: [http://parcc.pearson.com/resources/practice-tests/math/geometry/eoy/PC194890-001\\_GEOMTB\\_PT.pdf](http://parcc.pearson.com/resources/practice-tests/math/geometry/eoy/PC194890-001_GEOMTB_PT.pdf)

#### Item Prompt:

The equation  $x^2 + y^2 - 4x + 2y = b$  describes a circle.

#### Part A:

Determine the  $y$ -coordinate of the center of the circle.

#### Part B:

The radius of the circle is 7 units. What is the value of  $b$  in the equation?

#### Correct Answers:

Part A: 1

Part B: 44