# PISCATAWAY TOWNSHIP SCHOOLS 

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# Analytic Geometry 

Content Area: Mathematics<br>Grade Span:<br>Revised by:<br>Presented by:<br>Approval date:

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## COURSE OVERVIEW

## Description

## Goals

| Scope and Sequence |  |  |
| :---: | :---: | :---: |
| Unit | Topic | Length |
| Unit 1 | Fundamental Concepts of Analytic Geometry |  |
| Unit 2 | The Straight Line and the Circle |  |
| Unit 3 | Conics |  |
| Unit 4 | Simplification of Equations |  |
| Unit 5 | Transcendental Functions |  |
| Unit 6 | Polar Coordinates |  |
| Unit 7 |  |  |
| Unit 8 |  |  |
| Unit 9 |  |  |
| Core Text: <br> Suggested Resources: |  |  |

## UNIT 1: Fundamental Concepts of Analytic Geometry

## Summary and Rationale

## Recommended Pacing

## State Standards

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## Instructional Focus

## Unit Enduring Understandings

- There is a relationship between the sides and angles of every triangle.
- Multiple methodologies can be used to solve a problem.


## Unit Essential Questions

- What is the best way to use geometry?
- What is the most effective way to solve a problem? What is the best answer?


## Objectives

## Students will know:

- basic concepts of analytic geometry.
- inclination and slope of a line.
- division of a line segment.
- analytic proofs of geometric theorems.
- relations and functions and their graphs.


## Students will be able to:

- define and apply directed line, direct line segment, directed and undirected distance.
- calculate the distance between two points on a coordinate plane.
- apply the geometric concepts of scalene, isosceles, and equilateral triangles.
- classify triangles by angles through use of the converse of the Pythagorean Theorem.
- prove theorems from geometry by writing analytic proofs.
- determine when a relation also represents a function.
- graph lines, parabolas, absolute value equations, circles, and special hyperbolas.
- determine the equation of a graph that satisfies specific given conditions.
- calculate the slope of a line given two points.
- determine the inclination of a line and the angle of inclination.
- determine if a quadrilateral is a trapezoid and a parallelogram by use of slope.
- determine if a triangle is right through use of slope.
- determine if a parallelogram is a rectangle, rhombus, or square through the use of distance formula and slope.
- find the tangents of the angles of a triangle.
- determine the coordinates of the midpoint of a segment given its endpoints.
- find the coordinates of a point on a segment by applying similar triangles.
- prove various geometric theorems by writing analytic proofs.
- determine when a relation also represents a function.
- graph lines, parabolas, absolute value equations, circles, and special hyperbolas by choosing several points that would lie on each graph.
- given various conditions such as slope, points, distance, and arithmetic relationships determine the equation that meets the various conditions.


## Resources

## Core Text:

## Suggested Resources:

## UNIT 2: The Straight Line and the Circle

## Summary and Rationale

## Recommended Pacing

## State Standards

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## Instructional Focus

## Unit Enduring Understandings

- Multiple methodologies can be used to solve a problem.


## Unit Essential Questions

- What is the most effective way to solve a problem? What is the best answer?


## Objectives

## Students will know:

- lines and first degree equations.
- directed distance from a line to a point.
- circles and families of circles.
- translation of axes.


## Students will be able to:

- determine the equation of a line by applying the slope-intercept, point-slope, or two point formulas.
- determine the equation of a line by applying the alternate form, $A x+B y+C=0$, of the point slope formula
- derive another formula for an equation of a line.
- determine the equations of lines by using only the derived form.
- determine the equation of a line parallel to a given line.
- determine the equation of a line perpendicular to a given line.
- determine the equation of the perpendicular bisector of a line.
- find the equations of the medians of a triangle.
- determine the intersection point of two lines by solving a system of two linear equations in two variables.
- determine the coordinates of the vertices of a triangle by solving systems of linear equations in two variables.
- determine the intersection point of three lines by solving a system of 3 equations in three variables.
- derive the formula for determining the directed distance from a line to a point not on the line.
- determine the directed distance from a line to a point not on the line.
- determine the distance between two parallel lines by applying the directed distance formula.
- determine the equation of the bisector of the acute or obtuse angles formed by two intersecting lines.
- determine the equation of a circle given its center and radius, or other parameters.
- write the equation of a circle in either center-radius, standard, or general form.
- determine the new coordinates of points when the axes are translated to a given point.
- determine the point to which the origin must be translated so the transformed equation will have no first degree terms.


## Resources

## Core Text:

Suggested Resources:

## UNIT 3: Conics

## Summary and Rationale

## Recommended Pacing

## State Standards

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## Instructional Focus

## Unit Enduring Understandings

- Multiple methodologies can be used to solve a problem.


## Unit Essential Questions

- What is the most effective way to solve a problem? What is the best answer?


## Objectives

## Students will know:

- the parabola.
- ellipses and hyperbolas.


## Students will be able to:

- write the general formula for a quadratic equation.
- know how conics, both degenerate and non-degenerate, are created.
- know the difference between a degenerate and non-degenerate conic.
- know the names of the degenerate and non-degenerate conics.
- determine the coordinates of the vertex and focus, length of the latus rectum, coordinates of the endpoints of the latus rectum and the equation of the directrix of a parabola.
- determine the equation of a parabola in standard form that satisfies various given conditions.
- sketch the curves of parabolas.
- determine the coordinates of the center and foci, the endpoints and lengths of the major and minor axes, length of each latus rectum, and coordinates of the endpoints of each latus rectum of an ellipse.
- determine the equation of an ellipse in standard form by completing the squares
- determine the equation of an ellipse that satisfies the given conditions
- sketch the curves of ellipses.
- determine if the transverse and conjugate axes are either horizontal or vertical, the coordinates of the center, vertices, and foci, the endpoints and lengths of the latus rectums, the equations of the asymptotes given the equation of a hyperbola.
- determine the equation of a hyperbola in standard form by completing the square.
- determine the equation of a hyperbola that satisfies given conditions.
- sketch the curves of hyperbolas.


## Resources

## Core Text:

Suggested Resources:

## UNIT 4: Simplification of Equations

## Summary and Rationale

## Recommended Pacing

## State Standards

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## Instructional Focus

## Unit Enduring Understandings

- Multiple methodologies can be used to solve a problem.


## Unit Essential Questions

- What is the most effective way to solve a problem? What is the best answer?


## Objectives

## Students will know:

- simplification by translation and rotation of axes along with identification of conics.


## Students will be able to:

- determine the equation if the origin is translated to a given point.
- determine the point to which the origin must be translated in order that the translated equation will have no first degree term.
- determine the new equation when the axes are rotated through the given angle.
- apply the double and half angle trigonometric identities to find the value of the angle.
- determine the angle of rotation such that the transformed equation will have no x-y term.
- reduce a given equation to one of the special reduced forms by rotation and translation of axes.
- draw the graphs of each type of equation.
- classify the equation of a non-degenerate conic by applying the discriminant.
- determine whether an equation represents a non-degenerate conic, a degenerate conic, or has no graph.
- determine the type of conic if it is a non-degenerate conic or the nature if it is a degenerate conic.


## Resources

## Core Text:

Suggested Resources:

## UNIT 5: Polynomial Graphs

## Summary and Rationale

## Recommended Pacing

## State Standards

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Instructional Focus
Unit Enduring Understandings

- Multiple methodologies can be used to solve a problem.


## Unit Essential Questions

- What is the most effective way to solve a problem? What is the best answer?


## Objectives

## Students will know:

- algebraic curves.


## Students will be able to:

- determine the graphs of an equation by establishing its x-intercept, then by testing a value in the regions created by the x-intercept.
- determine the solution of inequalities by testing a value in each region created by the zeroes.
- determine the graph of rational or irrational equations by finding any vertical, horizontal, slant asymptotes, or regions where values are imaginary numbers, then creating a table of appropriate values.


## Resources

## Core Text:

Suggested Resources:

## UNIT 6: Transcendental Functions

## Summary and Rationale

## Recommended Pacing

## State Standards

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## Instructional Focus

## Unit Enduring Understandings

- Multiple methodologies can be used to solve a problem.


## Unit Essential Questions

- What is the most effective way to solve a problem? What is the best answer?


## Objectives

## Students will know:

- trigonometric, logarithmic, and exponential functions.


## Students will be able to:

- determine the graph of the sine, cosine, and tangent functions
- determine the radian measure of an angle given in degrees
- determine the amplitude, period, vertical shift, and phase shift given a trigonometric function
- determine the graph of an exponential equation
- change the equation of an exponential equation into a logarithmic equation
- change the equation of a logarithmic equation into an exponential equation
- solve exponential, logarithmic, and natural log equations.


## Resources

## Core Text:

Suggested Resources:

## UNIT 7: Polar Coordinates

## Summary and Rationale

## Recommended Pacing

## State Standards

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## Instructional Focus

## Unit Enduring Understandings

- Multiple methodologies can be used to solve a problem.


## Unit Essential Questions

- What is the most effective way to solve a problem? What is the best answer?


## Objectives

## Students will know:

- polar and rectangular systems.


## Students will be able to:

- plot polar coordinates on a polar coordinate system.
- write a polar coordinate 3 different ways.
- convert polar coordinates into rectangular coordinates.
- convert rectangular coordinates into polar coordinates.
- transform a polar equation into a rectangular coordinate form.
- transform a rectangular coordinate equation into polar form.
- write complex number numbers in polar form.
- graph polar coordinate equations.
- solve trigonometric equations.


## Resources

## Core Text:

Suggested Resources:

