## Spotlight Project: Projectile Motion

**Project Overview**

<table>
<thead>
<tr>
<th>Name of Project:</th>
<th>Projectile motion</th>
<th>Duration:</th>
<th>2 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject/Course:</td>
<td>Math (Algebra 1/Trigonometry)</td>
<td>Grade Level:</td>
<td>11</td>
</tr>
<tr>
<td>Other Subject Areas to Be Included:</td>
<td>Physics</td>
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### Project Idea

**Summary of the challenge, investigation, scenario, problem, or issue:**

Students work in teams to design and construct a ballistic device that launches an object in a flight path that follows a parabola. They use low cost materials (PVC pipe, plywood, rubber bands, etc.) to build the device, which must be capable of repeated firings. Students use knowledge of quadratic functions in order to hit a target. Each team conducts multiple tests and use the data they record to redesign their device if needed. Students make an oral presentation using PowerPoint slides to summarize their findings.

### Driving Question

How can we build a device to launch a projectile, and calculate its motion in order to hit a target?

### Content and Skills Standards to be addressed:

Students will be able to:

- Use two-dimensional equations of motion for projectile motion to calculate initial velocity, time in the air, horizontal distance and maximum height.
- Use trigonometry to resolve two-dimensional vectors into its vertical and horizontal components.
- Graph quadratic equation and find x-intercepts, y-intercepts and vertex.
- Apply factoring, quadratic formula and graphing calculator to find x-intercepts of a quadratic graph.

**CA Content Standards:** Algebra 1: 8.0, 10.0; Trigonometry: 12.0, 19.0; Physics: 11.0, 12.0

### 21st Century Skills

<table>
<thead>
<tr>
<th>Skill</th>
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<tbody>
<tr>
<td>Collaboration</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>Presentation</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Other: Critical and Creative Thinking; Problem Solving</td>
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### Culminating Products & Performances

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<tbody>
<tr>
<td>Individual:</td>
<td></td>
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</table>

### Presentation Audience:

- Class
- School
- Community
- Experts
- Web
- Other:____________________
### Project Overview

**Entry Event** to launch inquiry and engage students:

Activity: Paper wad tossing contest (try to hit wastebasket, tossing over students of varying heights) and discussion of parabolas

Video: Scenes from last year's project (final tests of projectile launch devices)

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Formative Assessments (During Project)</th>
<th>Summative Assessments (End of Project)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quizzes/Tests</td>
<td>Written Product(s), with rubric:</td>
</tr>
<tr>
<td></td>
<td>Journal/Learning Log</td>
<td>Other Product(s) or Performance(s), with rubric:</td>
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<tr>
<td></td>
<td>Preliminary Plans/Outlines/Prototypes</td>
<td>Oral Presentation, with rubric</td>
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<td>Rough Drafts</td>
<td>Multiple Choice/Short Answer Test</td>
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<td></td>
<td>Online Tests/Exams</td>
<td>Essay Test</td>
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<tr>
<td>Formative Assessments</td>
<td>Practice Presentations</td>
<td>Peer Evaluation</td>
</tr>
<tr>
<td>Summative Assessments</td>
<td>Notes</td>
<td>Self-Evaluation</td>
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<tr>
<td>Other:</td>
<td>Concept Maps</td>
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<tr>
<td>Other:</td>
<td>Checklists</td>
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<tr>
<td>Other:</td>
<td>Other:</td>
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**Resources Needed**

- **On-site people, facilities:** large open area for constructing and firing ballistic devices; other teachers and aides as available to help with construction

- **Equipment:** measuring tape, LCD projector

- **Materials:** low cost materials (PVC pipe, plywood, rubber bands, etc.) which may be provided or that students may collect

- **Community resources:** none

**Reflection Methods**

- **(check all that will be used)**
  - Journal/Learning Log
  - Whole-Class Discussion
  - Survey
  - Focus Group
  - Fishbowl Discussion
  - Other:
## Spotlight Project Sample: American Archetypes

<table>
<thead>
<tr>
<th><strong>Project Teaching and Learning Guide</strong></th>
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<tbody>
<tr>
<td><strong>Project:</strong> American Archetypes</td>
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<tr>
<td>Knowledge and Skills Needed by Students to successfully complete culminating products and performances, and do well on summative assessments</td>
</tr>
<tr>
<td>Business communication</td>
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<tr>
<td>Online research skills</td>
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<tr>
<td>PowerPoint and Excel</td>
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<tr>
<td>Marketing tools and techniques</td>
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<tr>
<td>Presentation skills</td>
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<tr>
<td>Report writing</td>
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<tr>
<td>U.S. history content knowledge</td>
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### Project Calendar

**Project: Design and Attract**  
**Start Date: Feb. 2**

<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
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#### Project Week One

- **Monday:**
  - Grabber: Memo from Middleburg University
  - Know/Need to Know list
  - Project Teams Announced
  - Discussion of expectations for team work
  - First team meeting: roles, contract, initial task list

- **Tuesday:**
  - Explanation of Project Details, Procedures
  - Explanation of rubrics for major products
  - Review samples of professional products in relation to rubric
  - Team meeting: task list
  - Daily team assessment

- **Wednesday:**
  - Design Software review (taught prior to project)
  - Lesson: Design theory
  - Team work time: continue assessment of client needs; begin brainstorming ideas for materials
  - Homework: Reading on assessing client needs
  - Daily team assessment

- **Thursday:**
  - Lesson: Assessing client needs
  - Team work time: begin assessment of client needs
  - Homework: complete client needs assessment (due Mon.)
  - Daily team assessment

- **Friday:**
  - Checkpoint: Quiz on Design Theory
  - Team work time: begin design of materials
  - Review/Revise Know/Need to Know list
  - Daily team assessment; meeting with team leaders

#### Project Week Two

- **Monday:**
  - Checkpoint: Collect "Client Needs Assessment"
  - Team work time: Continue designing materials
  - Homework: notes on initial ideas due tomorrow
  - Daily team assessment

- **Tuesday:**
  - Checkpoint: Collect notes on initial ideas for materials
  - Checkpoint: Teams meet with others to critique work in progress
  - Team work time: discuss feedback from critique
  - Daily team assessment

- **Wednesday:**
  - Lesson: Typography review
  - Team work time: Continue creating materials
  - Review/revise Know/Need to Know list
  - Daily team assessment

- **Thursday:**
  - Lesson: Lecture on typography
  - Checkpoint: Quiz on typography
  - Explanation of rubric for presentation of products
  - Team work time: Continue creating materials
  - Daily team assessment; meeting with team leaders

- **Friday:**
  - Checkpoint: Teams meet with others to critique work in progress
  - Team work time: Continue creating materials, planning presentation
  - Daily team assessment
  - Homework: Continue creating materials

#### Project Week Three

- **Monday:**
  - Team work time: Finish creating materials, planning presentation
  - Checkpoint: Submit materials for teacher review
  - Final review/revision of Know/Need to Know list
  - Daily team assessment

- **Tuesday:**
  - Team work time: Prepare and practice presentation of materials
  - Daily team assessment

- **Wednesday:**
  - Team work time: Prepare and practice presentation of materials
  - Daily team assessment

- **Thursday:**
  - Self and Peer Assessment
  - Project Debrief and celebration

- **Friday:**
  - Presentation Day