Mathematics in Education and Industry

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Teaching Projectiles

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A number of teaching ideas and approaches that will enhance the teaching and learning of the topic of projectiles will be presented and discussed.

Introduction

Activities for you to try…

- Skateboard
- Projectiles card sort
- Stomp rocket
- Megawoosh

Megawoosh

http://www.microsoft.com/germany/aktionen/mach-es-machbar/en-us/default.aspx

Examples

- Golf: http://www.bbc.co.uk/sport/0/golf/17653711
- Basketball: http://www.wnba.com/video/wnba/2013/04/11/dawnstaleycareerhighlighsmov-2441641
- Cricket: http://www.iplt20.com/videos/media/id/3cb8d321bc604ce0821704d77d8c8464/m43-srh-vs-mi-super-sixes

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Examples

- Angry Birds: http://www.angrybirds.com/

Stomp Rocket

Challenge: To fire the rocket so that it lands in the target zone

Equipment:

- Stomp rocket
- Blu-Tac
- Table for recording results
- Tape measure (optional)
- Target e.g. a bucket
- Protractor
- Timer/Stop clock (optional)

Task: To find the angle of projection required to land the rocket on the target.

Instructions and Hints:

- Fire the stomp rocket towards the target.
- By placing different amounts of Blu-Tac under the base of the Stomp Rocket vary the angle of projection until the rocket hits the target.

Note: The firing arm of the rocket is fixed in position giving an initial angle of projection of $30°$.

- Below is a simple table that might help you to keep a record of your findings:

Angle of projection	Too far?	Not far enough?

Questions to consider:

- What angle enabled you to hit the target? Is this the only possible angle you could have used?
- What angle caused you to be furthest from the target?
- What did you need to (i) keep the same (ii) vary in order to successfully complete the challenge?
- Can you work out the velocity that you fired the rocket at from the information you have or can find out from the activity?
- What is the longest time that you can keep the rocket in the air for? What angle of projection did you use?

Skateboard Instructions

Equipment:

- Skateboard
- Masking Tape
- Ball

Task: To explore the motion of a ball released by a moving person.

Overview:

A person will travel along on the skateboard carrying the ball. When they pass over the masking tape marker they will release the ball and others will see where it lands.

Instructions:

1. Stick a piece of masking tape on the floor to serve as the point at which the ball will be released.
2. Each member of the group takes a piece of masking tape and writes their name on it and sticks it at the point where they think the ball will first hit the floor after being released.
3. A volunteer needs to be pushed (or propel themselves) on the skateboard at a constant speed.
4. When the skateboard passes over the marker they must release the ball by dropping it.
5. Other members of the group can identify where the ball first hit the floor and mark this point. This can process can be repeated a couple of times to check the accuracy of the experiment.
6. Discuss who made the best guess and find out why people chose the point they did.

Questions:

- Does the point where the ball lands change as the speed increases or decreases?
- Draw a diagram showing the path of the ball. Why does this happen?
- What are the limitations of the experiment?

Note: An alternative approach if no skateboard is available could be for a person to run along the corridor and drop the ball as they run past the marker.

Projectiles Card Sort

Equipment:

- Cards for sorting
- A3 version of projectile path

Task: To annotate the path of a projectile diagram using the cards.

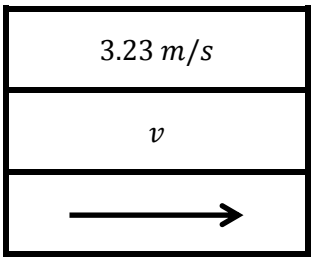
Instructions:

There are three types of card:

(i) Arrows to indicate vectors

(ii) Letters to indicate quantities such as velocity, displacement, etc

(iii) Numerical values to to indicate quantities such as velocity, displacement



Place the cards in the correct positions on the diagram to indicate the velocity, displacement, acceleration and time of the projectile at the relevant points of its journey.

Megawoosh

Equipment:

- Video clip:
  http://www.microsoft.com/germany/aktionen/mach-es-machbar/en-us/default.aspx
- Handout of images from video

Task: To decide whether the 'Megawoosh' is possible.

Instructions:

Bruno Kammerl claimed that he travelled 35.2 metres before landing in the target zone. Is this possible?

Watch the video clip and then model the scenario using the diagrams on the handout.

Decide whether you think Megawoosh is (a) possible (b) real, justifying your answers.

$20 \cos 35°$	$20 \sin 35°$	$9.8\ m/s^2$
$0.75\ s$	$20\ m/s$	$9.8\ m/s^2$
$2.34\ s$	$6.71\ m$	$9.8\ m/s^2$
$1.17\ s$	$38.35\ m$	$9.8\ m/s^2$
0	$24.57\ m$	$9.8\ m/s^2$
$6.18\ m$	$12.29\ m$	$4.12\ m/s$
$16.89\ m/s$	$14.1°$	$16.70\ m/s$
$11.15°$	$5.85\ m$	$16.38\ m/s$
$16.38\ m/s$	$16.38\ m/s$	$16.38\ m/s$
$19.18\ m$	$35°$	$1.5\ s$
0	0	0
0	0	0
θ	θ	θ
θ	θ	s
v	v	v
v	v	v
v	v	v
v	v	v
v	v	v

a	a	a
a	a	a
a	a	a
a	t	t
t	t	t
s	s	s
s	s	s
s	s	s
→	→	→
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