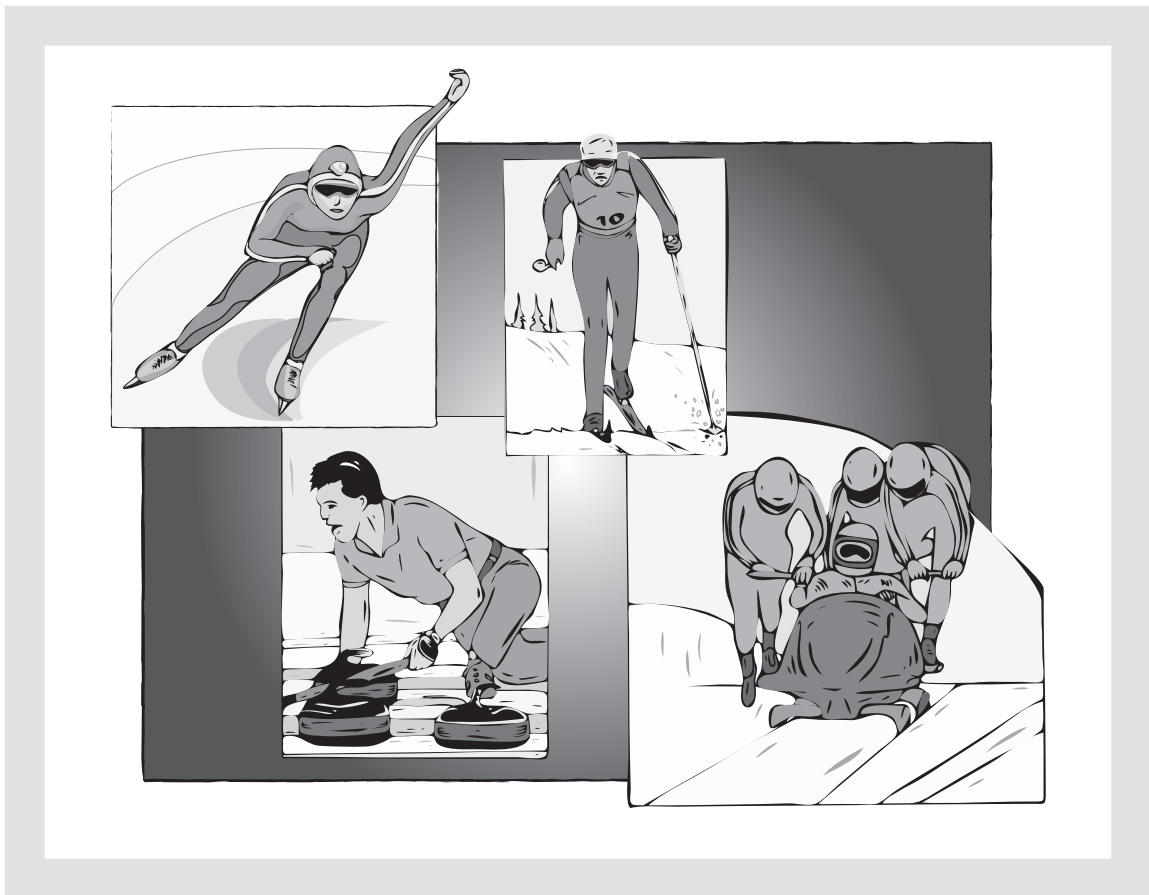


Pure Mathematics 30

**Teacher Notes:
Winter Sports Competitions**



September 2009

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Pure Mathematics 30

Winter Sports Competitions—Teacher Notes

Introduction

This project explores two winter sports—speed skating and curling. It allows students to use mathematics learned in the following units: Transformation of Functions, Trigonometry, Conics, Permutations and Combinations, and Statistics. It is designed to be completed in three to five hours of student time. The use of this project is optional; however, if you do choose to use it, you may include it as a part of your assessment. Sample solutions for the project questions can be found on the Alberta Education extranet at <https://phoenix.edc.gov.ab.ca>. A hard copy will be mailed to your school in August 2009. The general scoring guide for the project is the same as the one issued in September 2000.

The first written-response question, which is worth 10%, on the Pure Mathematics 30 January 2010 Diploma Examination will relate to this project. Students who do not complete the project but who have completed the course will have the knowledge to answer the written-response question; however, students who do complete this project will gain experience with the related mathematical skills.

Specific Notes

Teachers may want to

- discuss terminology related to the speed skating and curling
- discuss the meaning of the term *centre of mass*
- remind students that the sine and cosine functions used to model real-life situations have to be used with radian measure in order for the units to be consistent
- inform students that the question regarding the calculation of the area of an ellipse is for enrichment only; it is **not** part of the *Pure Mathematics 30 Program of Studies*
- remind students that explanations of unfamiliar sports terms and other information are available on the websites provided at the end of the student project

Program of Studies

The project relates to mathematics learned in the following units of Pure Mathematics 30.

Transformations of Functions

- Specific Outcomes**
- 1.1: Describe how various translations of functions affect graphs and their related equations:
- $y = f(x - h)$
 - $y - k = f(x)$
- [C, T, V]
- 1.2: Describe how various stretches of functions (compressions and expansions) affect graphs and their related equations:
- $y = af(x)$
 - $y = f(kx)$
- [C, T, V]
- 1.3: Describe how reflections of functions in both axes and in the line $y = x$ affect graphs and their related equations:
- $y = f(-x)$
 - $y = -f(x)$
 - $y = f^{-1}(x)$
- [C, T, V]
- 1.5: Describe and perform single transformations and combinations of transformations on functions and relations. [C, T, V]

Trigonometry

- Specific Outcomes**
- 3.8: Draw (using technology), sketch, and analyze the graphs of sine, cosine, and tangent functions for:
- amplitude, if defined
 - period
 - domain and range
 - asymptotes, if any
 - behaviour under transformations
- [CN, T, V]
- 3.10: Use sine and cosine functions to model and solve problems. [PS, R, V]

Conic Sections

- Specific Outcomes**
- 4.2: Classify conic sections according to a given equation in general or standard (completed square) form (vertical or horizontal axis of symmetry only). [CN, T, V]
 - 4.3: Convert a given equation of a conic section from general form to standard form and vice versa. [R, T]

Permutations and Combinations

- Specific Outcomes**
- 5.1: Use the fundamental counting principle to determine the number of different ways to perform multistep operations. [PS, R]
 - 5.2: Determine the number of linear permutations of n objects taken r at a time, and use this to solve problems. [PS, R, V]
 - 5.7: Solve probability problems using either permutations and combinations or the fundamental counting principle. [E, PS, R]

Statistics

- Specific Outcomes**
- 6.1: Find the population standard deviation of a data set, using technology. [CN, E, T, V]
 - 6.3: Use z -scores to solve problems related to the normal distribution. [PS, R, T, V]

ICT Program of Studies

C.1—Students will access, use, and communicate information from a variety of technologies.

Specific Outcome 4.1: Plan and perform complex searches, using more than one electronic source.

C.6—Students will use technology to investigate and/or solve problems.

Specific Outcomes 4.1: Investigate and solve problems of prediction, calculation, and inference.

4.2 Investigate and solve problems of organization and manipulation of information.

F.1—Students will demonstrate an understanding of the nature of technology.

Specific Outcome 4.2: Solve mathematical and scientific problems by selecting appropriate technology to perform calculations and experiments.

F.2—Students will understand the role of technology as it applies to self, work, and society.

Specific Outcome 4.7: Use current, reliable information sources from around the world.

P.2—Students will organize and manipulate data.

Specific Outcome 4.1: Manipulate and present data through the selection of appropriate tools, such as scientific instrumentation, calculators, databases and/or spreadsheets.

Mathematical Processes

Communication	Explain the transformations for the two graphs of the speed skater as well as the parts of the curling rinks.
Connections	Assess the effectiveness of the icemakers in maintaining ideal ice temperatures, and propose factors that influence the ice temperature.
Estimation and Mental Mathematics	Evaluate the reasonableness of calculator solutions.
Problem Solving	Apply permutations and the fundamental counting principle to arrangements of varying difficulty in order to determine probabilities.
Reasoning	Select an appropriate method to determine the number of arrangements for more-complex situations.
Technology	Analyze probabilities in the context of normally distributed variables using a calculator or spreadsheet.
Visualization	Relate the graphical data for the speed skater to the movement involved in skating.