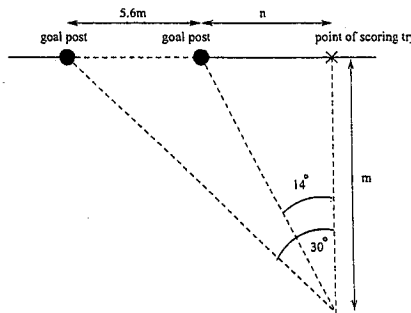


All questions should be submitted by 4pm on Friday May 13th. Assignments can be submitted at your tutorial, or to the MATH1040/7040 assignment boxes (4th floor Priestley Building #67). Make sure that your name, student number, tutorial group and your tutor's name are on each sheet of your answers. You do not need a cover sheet nor do you need to include the question sheet. Solutions will be distributed in class later.

- When launched from a ground-based missile launcher, the flight path of a missile is a parabola. Suppose that a missile is launched from the origin  $(0, 0)$ , reaches a maximum height of 10km, and lands 200km away at the point  $(200, 0)$ . Determine the quadratic equation that describes the missile's flight path.
- Recall that the equation of a circle with centre  $(a, b)$  and radius  $r$  is  $(x - a)^2 + (y - b)^2 = r^2$ . Find the equation of the circle whose centre is somewhere on the  $x$ -axis, and which passes through the points  $(1, 4)$  and  $(0, 3)$ . (Hint: let the centre of the circle be at the point  $(a, 0)$  and let the radius be  $r$ . Then substitute the two points into the equation in order to find values for  $a$  and  $r$ .)
- The Beerwah Barbarians are playing the Sandgate Saracens in the local Rugby Union Grand Final. In the dying seconds of the game the Barbarians' star player, Beautiful Barry, ties the score with a try, crossing the goal-line  $n$  metres to the right of the right-hand goal-post. (There are two goal-posts in Rugby Union: the right-hand and the left-hand goal-posts are 5.6 metres apart.) Isosceles Irwin is going to attempt to kick the potentially game-winning goal for the Barbarians. The goal associated with a try is allowed to be attempted anywhere on a line perpendicular to the goal-line, passing through the point where the try was scored. Isosceles has chosen to attempt the goal from a point  $m$  metres back from the goal-line, such that the angle to the right-hand goal-post is  $14^\circ$  and the angle to the left-hand goal-post is  $30^\circ$ .



- How far to the right of the right-hand goal-post did Barry score the try (that is, find  $n$ )? How far back did Isosceles choose to attempt the goal (that is, find  $m$ )? (Hint: use  $\tan 30^\circ \approx \frac{1}{4}$  and  $\tan 14^\circ \approx \frac{1}{4}$ .)
- Isosceles kicks the ball at an angle of  $26^\circ$ . If the goal-post is within 25 metres, the ball will go over. Does the ball go over? (Hint: Use  $\cos 26^\circ \approx 0.9$ .)

(continued over...)

4. Jim's parents invest \$1000 in a bank account on the day he is born, earning 20% interest per annum, for him to spend when he reaches the age of 30.
- (a) If interest compounds annually, what will be the account balance when he turns 30?  
(Use  $1.2^{30} = 237.38$ .)
  - (b) If interest compounds continuously, what will be the account balance when he turns 30?  
(Use  $e^6 = 403.4$ .)
  - (c) Mary is born on the same day as Jim, but her parents do not start an investment account until her 20th birthday. Assuming her account also earns 20% compounding continuously, how much do they need to invest so that her account balance at age 30 exactly matches Jim's?
  - (d) If Mary's parents can find an account which earns 30% compounding continuously, how much do they need to invest on her 20th birthday so that her account at age 30 exactly matches Jim's?
5. BONUS QUESTION (3 marks) The new ride at Maths World is designed using a quadratic equation. It involves riding a rollercoaster car along the equation  $2x^2 - 4x + c$ . Most mathematicians are thrill seekers so the designers want the ride to just touch the pool of crocodiles over which the ride is built. What value of  $c$  is required to make this possible? Show all working.