MATH 1710 Problem Workshop 6

1. Show that $\dfrac{d}{dx}\cot^{-1}x = -\dfrac{1}{1+x^2}$ using implicit differentiation.

2. Calculate the following

   (a) $\dfrac{d}{dx}\sin^{-1}(\sqrt{x})$ when $x = 0.64$.

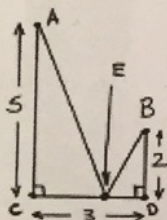   (b) $\dfrac{d}{dx}\left(\tan^{-1}x\right)^3$ when $x = \sqrt{3}$.

3. (a) Assuming y is defined as a function of x given by the equation

   $$2y\cot^{-1}x = \pi(1+xy).$$

   Find an equation of the tangent line to the curve when $x = 1$.

   (b) Find the equation of the normal line at the same point.

4. Find the position of the point E on the line segment CD in the following figure in order that the angle AEB is as large as possible.

5. A fisherman, sitting in a stationary boat F observes two other boats travelling on the lake in which he is fishing. Boat A is travelling due east at a constant speed of 50 kilometres per hour along a straight line 1 metre north of the fisherman. Boat B is travelling due north at a constant speed of 40 kilometres per hour along a line two kilometres east of the fisherman. If θ denotes the angle between the two lines of sight of the fisherman, find the rate at which θ is changing at the instant when boat A is $\sqrt{10}$ kilometres from the fisherman and boat B is $2\sqrt{2}$ kilometres from the fisherman.