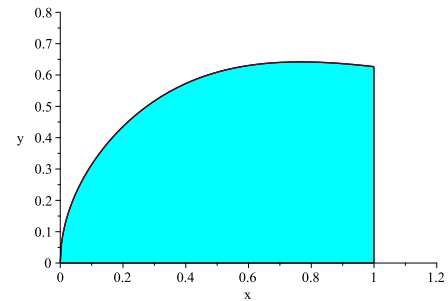


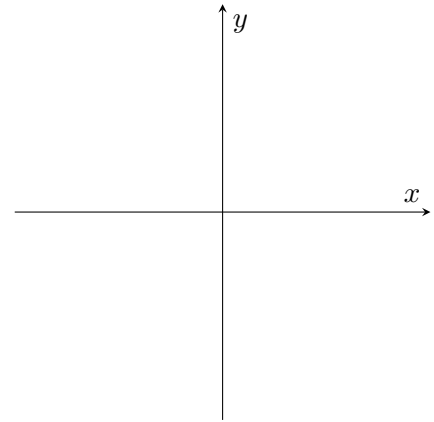
**MATH 101**  
**Assignment 2**

1. (3 marks) Find the exact volume of the solid formed by revolving the region bounded by the curves  $y = \sqrt{\frac{\arctan x}{1+x^2}}$ ,  $y = 0$  and  $x = 1$  (as illustrated) about the  $x$ -axis.



2. (3 marks) Set up, **but do not evaluate**, a definite integral representing the volume of the solid formed by revolving the region of the plane bounded by the curves  $y = e^x$ ,  $x = 0$  and  $y = e$  about the line  $x = 1$  using the **disk/washer** method.

3. (3 marks) Sketch and shade the region in the plane bounded by the curves  $y = \arccos x$ ,  $y = 0$  and  $x = -1$ . Then set up, **but do not evaluate**, a definite integral **with respect to  $y$**  representing the volume of the solid formed by revolving the region about the line  $y = \pi$ .



4. (3 marks) Find the arc length of the curve  $y = \ln(\sec x)$  over the interval  $[0, \pi/3]$ .

5. (3 marks) Derive the formula for the surface area of a sphere of radius  $R$  by revolving the semicircle  $y = \sqrt{R^2 - x^2}$  for  $-R \leq x \leq R$  about the  $x$ -axis.

6. (3 marks) If the work required to stretch a spring 4 feet beyond its natural length is 16 foot-pounds, how much

(a) *force* is needed to stretch it 8 inches beyond its natural length?

(b) *work* is needed to stretch it 8 inches beyond its natural length?

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7. (7 marks) Consider the solid of revolution formed by revolving about the  $y$ -axis the region in the first quadrant bounded by the curve  $y = \sqrt{4 - x}$  and the coordinate axes, where  $x$  and  $y$  are both measured in meters.
- (a) Use the cylindrical shell method to find the volume of the solid.

- (b) Suppose a tank is in the shape of this solid and is sitting flat on the ground. How much work would be required to fill it with beer, weighing  $10,300 \text{ N/m}^3$ , through a hole in the bottom of the tank? Round your answer to the nearest kilojoule (kJ).