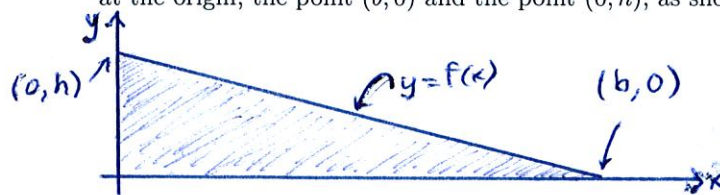


EE106 – Engineering Mathematics I

Problem Set 7

Due in tutorial on Thursday, 27 November 2014

1. Find the area under the curve $f(x) = 1 + 2x^2 - 3x^4$ between -1 and 1 .
2. Consider a right triangle of base length b and height h whose vertices are at the origin, the point $(b, 0)$ and the point $(0, h)$, as shown below.



The function describing the hypotenuse is

$$f(x) = h - \frac{hx}{b}$$

Use this to show that the triangle's area is $bh/2$.

3. The integral of $f(x) = \csc(x)$ is $F(x) = -\ln(\csc(x) + \cot(x)) + C$, where C is an arbitrary constant. Prove this by showing that $F'(x) = f(x)$.
4. We know that

$$\int \frac{dx}{1+x^2} = \arctan(x)$$

Use this, and the fact that the first four terms in the Taylor series for $1/(1+x^2)$ are $1 - x^2 + x^4 - x^6 + \dots$ to show that the first four terms in the Taylor series for $\arctan(x)$ are

$$\arctan(x) = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots$$