# COMP1003 Maths Worksheet 3

Don’t worry, if you can’t do all of the tasks below. They are just for exercise. You will see (some but perhaps not all) solutions in the Labs or a podcast. The assessment tasks are all easier.

1. Compute the roots of f(x) = x2 -4x + 4

Use formula from lectures for roots of quadratic equations.

Or use (x-a)2 = x2 -2ax –a2 this implies a=2 and therefore x2 -4x + 4 = (x-2)2

The latter can only be 0 for x=2 and the root counts two-fold (because of the square exponent of the term x-2

1. Compute the derivatives of all orders of f(x) from task 1

F’(x) = 2x -4

F’’(x) = 2

F’’’=0 and so are all higher order derivatives

1. Compute the integral of f(x) from -1 to 2

The indefinite integral is x3/2 -2x2 + 4x because dxn/dx = nxn-1

Theintegration runs from -1 to 2 ie the integral is

[ x3/2 -2x2 + 4x ]-12 = ( 23/2 -2 22 + 4 2 ) – ( (-1)3/2 -2(-1)2 + 4 (-1) )

= .. you do the rest ..

1. Multiply the polynomial x2 -4x -4 by 1+x

(x2 -4x -4)\*(1+x) = (x2 -4x -4)\*1+ (x2 -4x -4)\*x = … left to you …

1. What are the roots/zero crossings of the polynomial from task 4?

The function is (x-2)2(x+1) according to parts 1 and 4.

This is zero of x=-1 or x=2. The latter root counts twice because of the squre exponent at t he corresponding term in the equation.

1. log10( 1000 ) = ? 3 because 10\*10\*10 = 1000
2. ld (1024 ) = ? 10 because 2\*2\*2… \*2 = 1024 (10 twos)
3. exp( 0 ) = ? 1 a0 = 1 for any a by definition
4. exp( 1 ) = ? e because a1=a for all a by definition and the base of the exp() function is e = 2.714….
5. exp( exp (0) ) = ? = exp( 1 ) = e according to part 8 and 9
6. ln(e0) = ? 0 because ln and exp are inverse functions
7. Compute the maxima and minima of the funcion in task 1 (if any).

F’(x) = 0 : 2x-4 = 0 -> x = 2

F’’(2) = 2 > 0 -> the extremum at x=2 is a minimum

1. Compute the derivative of f(x) = x3 + cos( x3 ) + 1

F’(x) = 3x2 - 3x2 sin( x3 ) Why ? which rules have been applied?

1. Prove that



Assume a < c < b and use Riemann sums for the integrals; there is a minor complication at location c, where two rectangle may overlap and part of the area will be counted twice. However, for vanishing stepsize (or increasingly finer resolution), this contribution vanishes, too, and can be ignored.

Discuss case where a < c < b does not hold by noting that flipping integral boundaries inverts the integral’s value.

1. Compute the integral of exp(ax) for x from 0 to 1.

The indefinite integral of exp(ax) is exp(ax)/a

The integral from 0 to 1 is therefore (exp(a)-exp(0))/a = (exp(a)-1)/a

1. Compute the polar coordinates of the following cartesian points in space

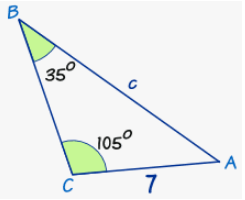
(2,0) , (2, 2) , (-2, 2)

(2,0) that’s an arrow from 0 allong the x axis to 2. The length must be 2 and the angle with the x-axis is 0. Therefore in polar coordinates the point reads (r,phi) = (2,0)

(2,2) points to (2,2) along the main diagional in the first quadrant. Therefore r=sqrt( 22 + 22) = sqrt 8 = 2\* sqrt(2) and the angle is phi=45 (half a right angle)

(-2,2) points to (-2,2) along the main diagional in the third quadrant. The length is the same as for (2,2) but the angle is 180 degrees larger, ie phi = 225

1. Compute all missing angle and sides



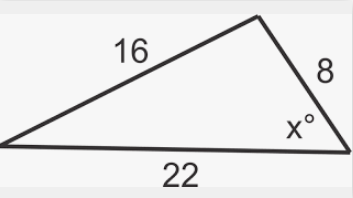
Step 1: 35+105+ angle(A) = 180 🡪 angle A = 180-105-35 = 40

Step 2: Apply the sine law: c/sin(105) = a/sin(40) = 7/sin(35) = 12.204

Step 3: Solve for c …

Step 4: Solve for a

1. Compute all missing angle and sides



Law of cosine: 162 = 82+222 – 2\*8\*22\*cos(x)

Solve for x to get that angle (needs cosine table or calculator)

Compute the height (h) using sin(x) = h/8

Use h to compute the left angle (beta) using sin(beta) = h/16

Compute the last angle, alpha, using alpha+beta+x = 180