C group calculus task:

Edited at 9am 3 April 2017.

1. Explain Heaviside method.

https://en.wikipedia.org/wiki/Heaviside\_cover-up\_method

Differential equations:

2. Solve the differential equation.

y'' + y' + y = cos(x)

http://www.wolframalpha.com/widgets/view.jsp?id=e602dcdecb1843943960b5197efd3f2a

3. Find y in logistic growth for ymin = 2, ymax = 999, R = 0.001.Time x = 0.001.

Catenary:

4. Explain catenary.

https://en.wikipedia.org/wiki/Catenary

5. Find the equation of a massless cord fixed at the height of *100 meters* supporting massive bridge of *1000 meters* in length with the minimum height in the middle of *20 meters*.

Orthogonal polynomials:

6. Find the *10-th* orthogonal polynomials.

**Normal Distribution:**

7. Express the normally distributed random value with the mean of 1 and the standard deviation of 2.

8. Calculate for the normal distribution density function *f(x)*.

**Least squares regression:**

9. Perform the linear least squares fitting of these points (0, 0), (1, 0) and (0, 1). Use vertical offsets and the fitting line in the form y(x) = gx + i. Find the Hessian. Prove the minimum.

Check if for any 3 points (x1,y1), (x2,y2), (x3,y3), which are not on the same straight line,

.

Find the correlation.

Write the expressions for any number of points.

**Correlation:**

10. Find the correlation coefficient for these points.

(5, 8), (2, 3), (6, 4), (1, 7)

**Averages:**

11. Calculate the averages (mean, median and mode) for these numbers.

π, e, ,

Series:

12. Explain series convergence tests.

https://en.wikipedia.org/wiki/Convergence\_tests

13. What are cosh, sinh, tanh?

Parametric curves:

14. Find the length of this curve: x = cos(2t), y = sin(t) + cos(t),

Trigonometry:

15. Give the main trigonometric functions properties.

https://en.wikipedia.org/wiki/Trigonometric\_functions

https://en.wikipedia.org/wiki/List\_of\_trigonometric\_identities

**Vectors:**

16. **R** is the radius-vector on a circumference. Calculate the dot-products and the cross-product.

a. **R.R'** = . . . b. **R'.R''** = . . . c. **R×R''** = . . .

17. Define a conservative vector field **V**.

https://en.wikipedia.org/wiki/Conservative\_vector\_field

18. Work out.

a. div **curl** = . . . b. **curl grad** = . . . c. div **grad** = . . .

, **curl** **V** = , div **V** =. , **grad** S =

**L’Hopital’s rule:**

19. Explain the L’Hopital’s rule.

https://en.wikipedia.org/wiki/L%27H%C3%B4pital%27s\_rule

Creativity questions:

20. Analyze this movie.

https://en.wikipedia.org/wiki/Hidden\_Figures

Deadline: 8 April 2017 Saturday.