Due Date: **9th January 2017**

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Question 1 (6 marks)
Please submit a table with the values obtained integrating the functions 2, 3, 4, and 5 from Tutorial 9 between 2 and 5. Perform the integration using the 1D rectangle, trapezium and Simpson's rules with 15 intervals.

Function	Rectangle	Trapezium	Simpson's
2	292.51	270.44	—
3	-1.91	-1.77	—
4	1.17	1.10	—
5	16.69	15.66	—

Question 2: (6 marks)
Please submit the following table with the values obtained integrating function 3 from Tutorial 9 between 0 and 1 using the 1D Trapezium rule. Calculate the error between the analytic and the numerical solution. Discuss the relationship between the number of intervals and the error. Real = 1.54954

Intervals	Trapezium rule	Error
4	1.53034	0.0192
8	1.54476	0.0048
16	1.54835	0.0012
32	1.54925	2.9×10^{-4}
64	1.54947	7×10^{-3}

Question 3: (6 marks)
Please submit a table with the values of the mean signal intensity in the RA, RV, LA, and LV regions from Tutorial 10. Use 10 intervals in the x and y direction for the trapezium and rectangle rules and 3x3 gauss points for the Gauss method.
RV = [251 351 151 201]
RA = [201 251 201 251]
LA = [301 351 301 351]
LV = [381 411 220 251]

Region	Rectangle	Trapezium	Gaussian
RA	76·07	76·24	76·59
RV	72·66	72·70	73·05
LA	101·91	102·03	102·42
LV	98·35	98·76	99·38

Question 4: (10 marks)
Please modify the MATLAB files Integrate_image.m and Gauss_2D_tut.m from Tutorial 10 to integrate an analytic function $f(x,y)=x^4e^{y^2}$, instead on an image, using the Gaussian quadrature. You can use the same structure we have seen in Tutorial 9 to integrate 1D functions. Then hand in the code and fill in the table below for the following integral:

$$\int_0^2\int_{-1}^0 x^4e^{y^2}\,dx\,dy$$

Number of Gauss Points in each direction	Gaussian Integration
1	0·3398
3	2·5731
5	3·1910

Question 5: (2 marks)

Please describe in less than 100 words which of the Newton-Cotes methods you would use to integrate function *f(x)=cos(x)+sin(2x)* over [0,2π] and why.

Use Simpson's method

$f(x) = \cos(x) + \sin(2x)$ is a non linear function so we should fit a quadratic to get the most accurate solution