

Problem Sheet 6

Deadline: **Monday 21 November, 5:00.**

Hand in to **the drop box** in the undergraduate common room (maths department, room 502).

Hand in the questions marked with an asterisk (*).

One mark will be deducted if you do not **staple your work**.

1) Use integration by parts to find the following:

a) $\int x \sin x \, dx$

d) $\int_0^\pi R^2 \sin R \, dR$

b) $\int x \ln x \, dx$

* e) $\int_1^e \ln x \, dx$

* c) $\int \phi e^\phi \, d\phi$

* f) $\int e^x \sin x \, dx$

2) Use partial fractions to find the following:

* a) $\int \frac{1}{x^2 + 7x + 6} \, dx$

* c) $\int_0^1 \frac{x - 1}{(x + 1)(x^2 + 1)} \, dx$

b) $\int \frac{12 - y}{y^2 + 11y + 18} \, dy$

d) $\int \frac{3x^2 - 19x + 1}{x^2 - 7x - 8} \, dx$

3) Find the following:

a) $\int \frac{8 - 2x}{x^2 - 4x + 3} \, dx$

* d) $\int_0^1 y^e + e^y \, dy$

* b) $\int \frac{\ln b}{b} \, db$

e) $\int (e^x + e^{-x}) \sin(4x) \, dx$

* c) $\int (x - 3) \sin(x^2 - 6x + 12) \, dx$

f) $\int \frac{2 \sin x \cos x}{(\cos x + 3)(\cos x - 3)} \, dx$

* 4a) Use the trapezium rule with $h = \frac{1}{2}$ to approximate the following integral. You may use a calculator or spreadsheet.

$$\int_0^3 e^{x^2} \, dx$$

* b) Give one suggestion of what you could do to improve the accuracy of your answer to (4a).