

### Problem set 4

Here is your work for final oscillations supervision, in the week of 3 May (lots of stuff to do, but you have lots of time, consider it as revision). Turn in your work to my pigeonhole by 4 May, 5pm. If you have any questions, send me email ([sanjoy@mrao.cam.ac.uk](mailto:sanjoy@mrao.cam.ac.uk)).

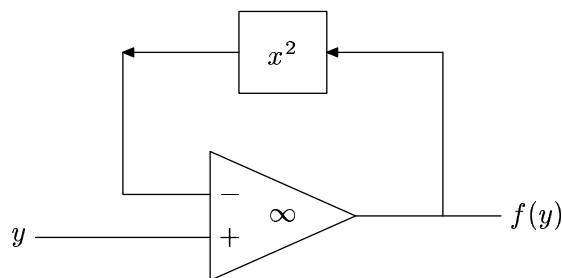
#### 1 *Problems from examples book*

Do problems 17, 18, 22, 23, and 24. In case you do not have a copy of the examples sheet, I've put a PDF version of it on my home page, <http://wol.ra.phy.cam.ac.uk/sanjoy>

#### 2 *Swing sets*

Find a swing set and have a good swing. Estimate the  $Q$  experimentally and, if you can, theoretically. Accuracy is not important here; estimates are. As important practice for the exams: Explain *clearly* how you make your estimates.

#### 3 *Negative feedback*



The input is  $y$ . What is the output  $f(y)$ ? The amplifier (the triangle) has infinite gain – it's an ideal opamp – and the  $x^2$  box spits out the square of its input. What is the output if the amplifier's gain is 10 instead of  $\infty$ ? Describe qualitatively what happens if I swap the – and + connections.

#### 4 *Explaining an important idea*

Pick an important idea in the oscillations course. Write two sides of A4 – or more if you feel inspired – to teach the idea to a friend who knows physics but not much about oscillations. Think how you would like it explained, and then explain it that way! Perhaps think about everyday examples that illustrate the idea, or simple estimates, or ... Use your creativity!