MAT 102 SPRING 2008
FEEDBACK ON HOMEWORK 3

1. Some common mistakes.

- Remember to add a general constant C when you compute any indefinite integrals.
- **Q12 of §4.8.** The integral of $1/x$ is
$$\int \frac{1}{x}dx = \ln|x| + C,$$
not $\ln x + C$ (because the latter doesn't work on the negative real axis).
- **Q40 of §4.8.** There is no product rule for integrals: in particular,
$$\int x^{-3}(x+1)dx \neq \left(\int x^{-3}dx\right)\left(\int (x+1)dx\right).$$
You need to expand the brackets before you can compute the integral: the correct way to do it is
$$\int x^{-3}(x+1)dx = \int x^{-2} + x^{-3}dx = -x^{-1} - \frac{1}{2}x^{-2} + C.$$
By the way, be careful when you deal with negative exponents: $-3+1 = -2$, not -4.
- **Q60 of §4.8.**
$$\int \frac{1}{2}dt = \frac{t}{2} + C, \text{ not } \frac{x}{2} + C.$$
- **Q112 of §4.8.** Many of you didn't quite understand there is just one curve that satisfy the conditions in the question. The correct solution is as follows:
$$\frac{d^2y}{dx^2} = 6x$$
so
$$\frac{dy}{dx} = 3x^2 + C_1 \quad \text{for some constant } C_1.$$
Since $\frac{dy}{dx} = 0$ when $x = 0$, we get
$$3(0)^2 + C_1 = 0,$$
so
$$C_1 = 0.$$
Hence $\frac{dy}{dx} = 3x^2$, and
$$y = x^3 + C_2 \quad \text{for some constant } C_2.$$
Since $y = 1$ when $x = 0$, we get
$$0^3 + C_2 = 1,$$
so
$$C_2 = 1$$
and
$$y = x^3 + 1.$$

From the solution we see that the curve is uniquely determined by the conditions $y(0) = 1$ and $y'(0) = 0$.

- **Q62 of §4.6.** The correct reason why (a) is invalid is that it was applying the L'Hospital's rule when it is not allowed: it has to be of the form $0/0$ or ∞/∞ to apply the L'Hospital's rule, but in (a) in the second limit we have $2/1$, so the L'Hospital's rule is not applicable in that situation. (Some of you wrote that the L'Hospital's rule was applied in (a) when it is not *needed*, and therefore the argument is wrong. This argument by itself is not correct: because if one had applied the rule correctly, even though when the rule was not needed, one wouldn't end up in a wrong answer as we saw in the question. It is important for one to use precise wordings when one criticizes others' arguments.)
- **Q50 of §4.6.** Many of you have difficulty with this type of L'Hospital's rule. Make sure that you know how to compute these limits, and talk to us if you have difficulty with them.