1. Suppose $5x^3y - 3xy^2 + y^3 = 6$. $(1,2)$ is a point on this curve. Is the curve concave up or concave down at $(1,2)$?

Explicit way to go y *can* be solved as a function of x.* Then you can differentiate the formula twice and evaluate when $x = 1$.

Implicit way to go Find $\frac{dy}{dx}$ implicitly and then differentiate again *carefully* to get $\frac{d^2y}{dx^2}$. Evaluate everything at $(1,2)$.

2. Suppose that f is a continuous function (defined for all x) and that the values of the following integrals are known:

$$\int_0^1 f(x)\,dx = 5\,; \quad \int_{-1}^1 f(x)\,dx = 3\,; \quad \int_0^2 f(x)\,dx = 8\,; \quad \int_0^4 f(x)\,dx = 11\,.$$

Evaluate these integrals:

a) $\int_0^2 f(2x)\,dx$ b) $\int_0^\pi (\sin x) f(\cos x)\,dx$ c) $\int_2^3 x\,f(8-x^2)\,dx$.

Hint Use substitutions, such as $u = \cos x$ in b).

3. a) Graph $f(x) = x^3 - x$ in the interval $-1 \le x \le 2$. Compute $\int_{-1}^2 f(x)\,dx$.

b) Graph $g(x) = \left|x^3 - x\right|$ in the interval $-1 \le x \le 2$. Compute $\int_{-1}^2 g(x)\,dx$.

b) Graph $h(x) = x^3 - |x|$ in the interval $-1 \le x \le 2$. Compute $\int_{-1}^2 h(x)\,dx$.

4. A radioactive substance A decays at a rate proportional to the amount of the substance present.

a) Suppose that an initial amount of 10 micrograms decays after 8 hours to 7 micrograms. Determine a formula for $A(t)$, the amount of substance A present at time t.

b) In the presence of a certain gamma ray flux, the radioactive decay of the substance is increased. In fact, when an initial amount of 10 micrograms of A is subject to this radiation, after 8 hours only 2 micrograms of A remain. Determine a formula for $B(t)$, the amount of substance A present at time t when the radiation mentioned is present.

c) Suppose we are presented with 10 micrograms of substance A and wish to have 5 micrograms after 8 hours. We are allowed to "turn on" the gamma radiation at some time during the 8 hours (but it must stay on after it is turned on!). At what time should the radiation be introduced in order to obtain 5 micrograms of A after 8 hours?

One problem will be selected for a writeup to be handed in at the next recitation meeting. Please see Professor Greenfield's Math 152 webpage for this semester to learn which problem to hand in.

* Here it is (really!):

$$y = \left(-\tfrac{5}{2}x^4 + 3 + x^3 + \tfrac{1}{18}\sqrt{1500x^9 - 675x^8 - 4860x^4 + 2916 + 1944x^3}\right)^{1/3} - \frac{\frac{5}{3}x^3 - x^2}{\left(-\frac{5}{2}x^4+3+x^3+\frac{1}{18}\sqrt{1500x^9-675x^8-4860x^4+2916+1944x^3}\right)^{1/3}} + x$$