Pencil and Paper homework Number 8

This homework concerns 2nd derivatives.
1) Find the 2nd derivatives of the following

a) $f(x) = x^3 - 4x^2 - 3x + 8$

b) $f(x) = \cos(3x)$

c) $f(x) = e^{3x}$

d) $f(x) = e^{-x^2}$

e) $f(x) = xe^{-x}$

f) $f(x) = xe^{-x^2}$

g) $f(x) = x\cos x$

2) In the following problems, find out where the function is increasing, decreasing, concave up, concave down, and where it has maxes and mins and points of inflection and graph the curve showing all those things except increasing and decreasing, which are obvious on the graph.

a) $f(x) = x^3 + x^2 - x - 1$

b) $f(x) = x^4 + 2x^3$

c) $f(x) = \frac{1}{1+x^2}$

d) $f(x) = \frac{x^2}{2} + \frac{1}{x}$

e) $f(x) = xe^{-x}$

f) $f(x) = e^{-\frac{x^2}{2}}$

3) Same as 2, but in this case there is a parameter in the function and you don't have to graph it.

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{x^2}{2\sigma^2}}$$

σ is a constant here. The points of inflection here should come out $\pm\sigma$. This is very important in statistics. It is called the Normal or Bell curve. No matter what the value of σ, 68% of the scores will lie between $-\sigma$ and σ, as we will show when we get to integration.

4) Same as 2, but in this case there are many mins and maxes, including a min at 0. Find two smallest positive values of x which are maxes and the smallest positive x which is a min. Also locate precisely the points of infection near 1 and 3.5. This will all take calculator work; the values are not nice. The function is $f(x) = x\sin x$

5) Allison wishes to fence her horses in a rectangular pasture one side of which is a river. She has 500 meters of fencing and doesn't need to fence along the river, because these horses can't swim. What should the dimensions be so the horses have maximum area to graze in?