Calculus - Chapter 4 Practice Test

Note: This is longer than the actual test and is just meant to give you some good practice so you're more prepared for the real thing. ☺ (but be sure to have done those practice questions!)

1. Determine when $f(x) = x^2 - 3x + 5$ is increasing.
2. For $f(x) = 4x^4 + 16x$, find the a) critical points and b) all extrema (relative and absolute).
3. When does $f(x) = x^4 + 2x - 5$ have a point of inflection?
4. If $f'(2) = f''(2) = 0$, then there must be a point of inflection at x = 2.
5. Where does $f(x) = \sin(x)$ have a point(s) of inflection on the interval $(0, 2\pi)$?
6. For $f(x) = e^{-x}x^4$,
   a) when is it increasing?
   b) what are the relative extrema? (feel free to use a graphing calc here)
7. When is $f(x) = x^3 - 8$ concave down?
8. Find the relative extrema of $f(x) = x^2 - 6x + 4$.
9. Find the absolute extrema (abs. max and min's) of $f(x) = \frac{x^2}{x^2+x+6}$ graphically.
10. Find the absolute extrema of the function $f(x) = x^3 - 12x + 1$ on the interval [-3, 1].
11. Give two positive numbers that have a sum of 50 and have the largest product possible.
12. A company that makes x widgets (in thousands) has the following function for revenue and cost: $r(x) = 5\ln(x + 1)$ and $c(x) = x^2 + 4x + 5$. What production level of x units (in thousands), will maximize profit? (Recall: Profit = Revenue – Cost)
13. A 10 ft ladder is leaning against a wall, and its top is sliding down the wall at 2 ft / sec. At the moment the ladder and the ground form an angle of 30 degrees, how fast is the bottom of the ladder sliding away from the wall?
14. A cone-shaped funnel that is filled with oil is draining at a rate of 4 cm^3 / sec. If the cone is 6 cm tall and has a radius of 5 cm, how fast is the height decreasing at the moment when the oil is half way down, at 3 cm?
15. The distance of an object is given by the function $d(t) = 4\ln(2t + e)$ at any time $t \geq 0$. What is the function's acceleration after 3 seconds?
16. The distance of an object is given by the function $d(t) = x^2 - 5x - 6$ at any time $t \geq 0$.
    a. When is the particle moving to the left?
    b. When is the particle's velocity increasing?
17. If $f(x) = x^2 + 4x$ on the interval [- 3, 1] , what value of "c" satisfies the Mean Value Theorem for Derivatives?
18. If $f(x) = |x + 2|$ on the interval [-2 , 3] , what value of "c" satisfies the Mean Value Theorem for Derivatives?
19. Evaluate $\lim_{x\to 0} \frac{1-\cos(x)}{x^2}$.
20. Evaluate $\lim_{x\to 3} \frac{x-3}{lnx}$.
21. The radius of a sphere is increasing at a constant rate. At a specific moment, the rate of increase of the Surface Area is the same as the rate of increase as the Volume. What is that radius at that moment?