3450:221, Calculus I, Review for Exam 2

1. Find $\dfrac{dy}{dx}$ for $x^2y^3 = \cos(xy)$
2. Valerie is running in the Akron Marathon. A photographer stands 15 feet from the road where the runners pass by a light post. Valerie approaches at a rate of 10.6 feet per second. When she is 20 feet from the light post, **find the rate of change of distance between Valerie and the photographer**. The camera is set so that the photo will be in focus if the image is moving at less than 9.2 feet per second. Will Valerie be in focus?
3. Use a linear approximation to estimate $\sqrt[4]{15.1}$.
4. The side length of a cube is measured as $3 \pm .01$ cm. Estimate the volume, find the error in the volume calculation, and find the relative error.
5. Find the critical points of $f(x) = x^{2/3}(x+1)^{1/5}$.
6. Find the absolute extrema of $f(x) = 2x^3 + 9x^2 - 24x + 1$ on $[0, 2]$.
7. Find the extrema of $f(x) = x^4 - 8x^3 + 22x^2 - 24x$. The critical points are $x = 1, 2, 3$.
8. A cable is attached to a pole at a point 30 feet off the ground and is attached to the ground 40 feet away from the pole. Use the Mean Value Theorem to determine a specific value of the slope at the cable at some point along the cable.
9. Use the first derivative test on $f(x) = x^2 + x - 2$ to see if the critical point $x = 1$ corresponds to a relative maximum or a relative minimum value.
10. Use the second derivative test on $f(x) = x^2 + x - 2$ to see if the critical point $x = 1$ corresponds to a relative maximum or a relative minimum value.
11. Find the intervals where $f(x) = \dfrac{x^2}{x+1}$ is increasing and decreasing.
12. Find the intervals where $f(x) = \dfrac{x^2}{x+1}$ is concave up and concave down.
13. Using the previous two problems, sketch the graph of $f(x) = \dfrac{x^2}{x+1}$.
14. Find the true inflection points of (a) $f(x) = x^4 - 2x^3$ and (b) $f(x) = x^5 + x^4$.
15. Sketch $f(x)$ if the following are true:

    $f(0) = 0$, $f'(x)$ is continuous for all x, $f'(x) > 0$ on $(-1, 2)$, $f'(x) < 0$ on $(-\infty, -1)$ and $(2, \infty)$, $f''(x) > 0$ on $(-\infty, 0)$ and $f''(x) < 0$ on $(0, \infty)$.
16. Use roots, vertical asymptotes and slant asymptotes to draw a rough sketch of $y = \dfrac{x^2(1-x)^3}{(x+2)^2}$
17. Evaluate $\lim\limits_{x \to -\infty} \dfrac{\sqrt{64x^{10} + 9x^9}}{5x^5 + 2}$