MATH 1271: CALCULUS I
ANSWERS TO THE SAMPLE FINAL FROM MICHIGAN

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Below are answers, not complete solutions. On the real test, for the hand-graded problems (the last six), you will have to show all work, but not need to simplify your answers.

(1) (a) x_5; (b) x_3 and x_7; (c) x_1, x_2, x_8, x_9.
(2) 2/5
(3) (a) -2.09; (b) $-2.16 \cos 6 + 3 \sin 6$.
(4) Skip this problem.
(5) Skip this problem.
(6) Gene
(7) (a) $y - 4 = \frac{3}{2}(x - 2)$; (b) 3.85.
(8) Maximum.
(9) (a) $x = -3$. At $x = \pm 0.01$ we have local minima, while at $x = 0$ a local maximum. So, the global maximum has to occur at $x = 0$ or an endpoint. By direct computation $f(0) = 0$, $f(-3) = 243 - .0018$, and $f(1) = 1 - 0.0002$.

(b) $x = \pm 0.01$. Since $f'(x) < 0$ for $x < -0.01$, the function $f(x)$ decreases there. Since $f'(x) > 0$ for $x > 0.01$, the function $f(x)$ increases there. Therefore a global minimum may not occur at an endpoint. Must be at a local minimum, which is at $x = \pm 0.01$, where the values of the function are the same, as it is even.
(10) (a) -7.3; (b) An upper estimate is $0.1(11.22 + 10.67 + 10.02 + 9.29)$ and a lower one is $0.1(10.67 + 10.02 + 9.29 + 8.56)$; (c) It is because the distance traveled is the definite integral of the velocity, which is given by a decreasing function. So, the left Riemann sum must approximate but be greater than the integral, while the right Riemann sum must be less than the integral. And these are the two expressions above, respectively.
(11) (a) February 28, as the rate of change of viewership (which shows how fast the viewership is increasing) is minimal there; (b) March 31, as viewership at time t is 5.6 million plus the

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integral of its rate of change from 0 to t, and by computing the net area, the integral from 0 to t on the graph is minimal at $t = 3$, i.e., the borderline between February 28 and March 1. (c) November 15, as this is where the integral from 0 to t becomes equal 0.4, by computing the net area.

(12) (a) $h = 180/w$; (b) $C = 1800 + 3600/w + 16w$; (c) $w = 15$.