

MATH 251
Exam I
July 8, 2008

ANSWER KEY

1. C

2. C

3. B

4. D

5. $y(t) = -2 - \sqrt{2x^3 + 2 \cos x} + 2$

6. (a) $Q' = 20 - \frac{2}{80-t}Q, \quad Q(0) = 0$

(b) $Q(t) = 20(80-t) - \frac{1}{4}(80-t)^2 = 20t - \frac{1}{4}t^2$

7. (a) $y = -2, 4.5, 8$

(b) $y = -2$ is unstable, $y = 4.5$ is (asymptotically) stable, and $y = 8$ is unstable.

(c) $\lim_{t \rightarrow \infty} y(t) = 4.5$

(d) $\lim_{t \rightarrow \infty} y(t) = 8$

8. (a) $\frac{\partial M}{\partial y} = \pi \cos(\pi x) + 3x^2 = \frac{\partial N}{\partial x}$

(b) $y \sin(\pi x) + x^3 y - 2e^x + 5y = -13 - 2e^2$

9. (a) $y(t) = 3e^{4t} - 2te^{4t}$

(b) $\lim_{t \rightarrow \infty} y(t) = -\infty$

10. $y(t) = C_1 t^2 + C_2 t^2 \ln(t)$

11. (a) $y_c = C_1 e^{-t} + C_2 e^{2t}$

(b) $Y = \frac{3}{20} \cos 2t - \frac{9}{20} \sin 2t$

(c) $Y = (At^4 + Bt^3 + Ct^2 + Dt)e^{-t} + Ee^{2t} \cos 6t + Fe^{2t} \sin 6t$