## Practice Final Exam solutions

| Problem | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Your answer | A | C | E | E | D | E | B | E | D | D |

- 11.

$$-x^2 + x + \frac{11}{3}\ln|x-8| + \frac{2}{13}\ln|x+5| + c$$

- 12.
  - b. $\begin{bmatrix} 1+3i \\ 2 \end{bmatrix}$
  - c. $\frac{7}{25} + \frac{24}{25}i$.
  - d. $5e^{i38.86}$
  - e. $7 + 24i$.
- 13. $t\begin{bmatrix} -1 \\ 2/3 \\ 1 \end{bmatrix} + \begin{bmatrix} 2 \\ -1 \\ 0 \end{bmatrix}$, $t \in \mathbb{R}$.
- 14.
  - a. $\frac{15}{2}$ (stable) and $\frac{5}{2}$ (unstable)
  - c. $\frac{10 \pm \sqrt{100-20h}}{2}$.
  - d. $h = 5$.
- 15. $\frac{64}{3}$
- 16.
  (a)$\lambda = -2, -4$, corresponding eigenvector respectively $t\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $s\begin{bmatrix} 1 \\ -1 \end{bmatrix}$, $t, s \in$

$\mathbb{R} - \{0\}$.
(b) $(0, 0)$, Stable sink.

- 17.
(a) $(2, 1)$ and $(4, 0)$.
(c) For $(2, 1)$

$$J(2, 1) = \begin{bmatrix} -6 & -6 \\ 3 & 0 \end{bmatrix}$$

$\lambda_{1,2} = -3 \pm 3i$ $Re(\lambda) = -3 < 0, \implies (2, 1)$ is stable spiral.

For $(4, 0)$

$$J(4, 0) = \begin{bmatrix} -3 & -12 \\ 0 & 6 \end{bmatrix}$$

$\lambda_1 = -3 < 0,\ \lambda_2 = 6 > 0 \implies (4, 0)$ is saddle.
(f). 2 susceptible and 1 infected.